Proceedings

of the Marine Safety Council

Vol. 44, No. 8 *September 1987*

U.S. Department of Transportation

United States Coast Guard

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DIST (SDL No. 123) -- A: abcde(2);fghklmntuv(1). B: n(50); c(16);e(5);f(4);gj(3);r(2);bkiqz(1). C: eglmp(1). D: adgklmw(1). E: mn(1). F: abcdehjklogst(1). List TCG-06.

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Students at the MARAD Firefighting School participate in a training exercise. Story on page 179. (Coast Guard photo by PA1 Rich Muller)

MARAD Firefighting School

PA1 Rich Muller

Coast Guard students take the MARAD classroom outside to a ship mock-up to put theory into practice -- practice that could save their lives and their vessels. *(Official U.S. Coast Guard photo by PA1 Rich Muller)*

You are a crew member aboard a Coast Guard cutter. Your ship has been at sea for 3 weeks when suddenly you hear that dreaded word.

Fire!

As part of the ship's firefighting team, you are responsible for putting out the fire. Smoke, flames, heat, and noise hammer your senses as you get ready. Questions run through your mind: .what's the best way to fight this particular fire?

You realize the dangers to yourself and others. Your answers and how quickly you react are vital. Any delay gives the fire time to spread and endangers your ship and crew members.

Training is important, but fighting fires in a realistic situation is hard to do. That job is done by Mike Romstadt and Steve Parsons, instructors at the U.S. Maritime Administration (MARAD) Fire Training Center near Toledo, Ohio.

Romstadt and Parsons teach a 4-day firefighting course which was originally aimed at providing basic training for merchant seamen

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Petty Officer First Class Rich Muller is a Public Affairs Specialist in the Ninth Coast Guard District, Cleveland, Ohio.

and has been adapted for Coast Guard crews to learn these basic skills. In addition to these courses, the school also offers firefighting instruction for the maritime community.

While many of the Coast Guard classes are from the Great Lakes area, some from other parts of the nation find the MARAD school more convenient for their schedules than the Navy's firefighting school in Norfolk, VA.

The emphasis in Toledo is hands-on experience stressing how to put out shipboard fires. According to MK1 James Jessen, formerly of the Ninth Coast Guard District Training Team, "It's a get-in, put-out-the-fire type of school." One of his jobs at the training team was to assist with each Coast Guard class.

For safety reasons, class sizes at the Fire Training Center range from 10 to 20 students. These students are first taught the chemistry of fire. Then they learn how to use different materials and equipment to fight shipboard fires.

The students learn firefighting lessons in a variety of scenarios. *(Official U.S. Coast Guard photo by PA1 Rich Muller)*

After about a day and a half of classroom work, the training moves outside to a ship mock-up. Here's where all that classroom work is applied to putting out real fires.

The firefighting equipment used at the school is similar to that used on ships. All students have the chance to use water, foam, and portable extinguishers.

While wearing the protective gear and an oxygen breathing apparatus, students are hot and uncomfortable. The students are drenched in sweat and feel like they are in a furnace, but a firefighter learns to determine the difference between being uncomfortable and being in a dangerous situation.

During a fire onboard your ship is not the time to find out how much discomfort you can endure without endangering the team. The firefighting team puts out the fires, and at the school, teamwork and confidence are stressed at all times.

While the fires at school are controlled, they still present many of the problems sailors would encounter in an actual shipboard fire. In putting out the fires, Romstadt reminds his students that "there's a lot of work and a lot of things to consider." He stresses the importance of following the rules when fighting fires. "You can only break so many rules before fouling things up," he says.

Romstadt feels that Coast Guard students are, on the average, younger than most other students, and they seem to enjoy the excitement of the classes. These groups also have had some training in basic firefighting during boot camp and on their ships.

BMC Tom Clemmons, Executive Officer of the Coast Guard cutter **Gasgonade**, says the school is outstanding. Every one who wanted to handle the equipment got the chance. He has been through various Navy courses and says the MARAD school gives more repetition of hands-on drills. "All Coast Guard personnel should go through it," he says. This feeling was echoed by others in the class, which was made up of crew members from various Second District cutters.

Upon completing the course, each student receives a MARAD certificate of completion. In addition, each student takes back to his unit experience and knowledge that may someday be called to the test.

The hands-on training at the Toledo school emphasizes the use of proper equipment to fight a fire. *(Official U.S. Coast Guard photo by PA1 Rich Muller)*

Note

Fire hazards encountered ashore are complicated at sea; heavy seas may contribute to the cause of a fire and then hamper efforts to extinguish it. The officers and crew of a vessel stricken at sea cannot expect a response to a call for help -- they must be able to handle the situation without the assistance of professional firefighters.

The Coast Guard is proposing to require certain applicants for U.S. merchant marine original licenses or raises of grade to have completed Coast Guard-approved training in basic and advanced firefighting beginning October 1, 1988. Those licenses include deck officers serving on vessels over 200 gross tons, deck officers serving on vessels under 200 gross tons on ocean routes, operators of uninspected towing vessels on ocean routes, and all engineers.

A future proposed revision to the regulations governing the certification of seamen is expected to require that all unlicensed U.S. merchant mariners have received at least basic training.

Over the past few years, in anticipation of required firefighting training, a number of organizations submitted requests for the review and approval of their firefighting training programs. Sixteen have been approved to date. The guidelines for submission of a course or program for Coast Guard approval are found in Title 46 of the Code of Federal Regulations, Subpart 10.30. The Merchant Vessel Personnel Division at Coast Guard Headquarters (202-267-0214) will provide more in-depth information upon request. An approved firefighting program (for shipboard application) includes instruction and practical demonstration of the subjects contained in the International Maritime Organization's Resolution A.437(XI) entitled, "Training of Crews in Firefighting."

Capsizing of the Liftboat Dick Sharpe

LCDR J. J. Vallone

At approximately 9:00 p.m. on February 11, 1985, the jackup service vessel **Dick Sharpe** was caught in a major storm in the Gulf of Mexico. It capsized and sank in the Gulf of Mexico oilfield area known as Main Pass (Block 39) approximately 13 miles northeast from Head of Passes, Mississippi River. The operator, deckhand, and a contractor employee abandoned the vessel and took refuge on a life float. The operator subsequently drowned in heavy seas, and the other two men were rescued a day later. The cause and related aspects of this casualty are most important in demonstrating the relationship of vessel operating limitations, owner safety criteria, and weather conditions. This casualty analysis will also serve as a preface to a brief review of jackup vessel operations in the Gulf of Mexico for the past 3 years. This review is completed by the substantial number of serious casualties which have occurred in a relatively short time.

Fleet of liftboats alongside a Mississippi River facility. *(Photo courtesy of the author)*

Particulars of the Dick Sharpe

The **Dick Sharpe** is a self-propelled, uninspected jackup service vessel used primarily in the Gulf of Mexico oilfields. The **Dick Sharpe** was built in 1977, is 137 gross tons, 64 feet in length, with a beam of 50 feet and a 7-foot length. The vessel is of steel construction and is powered by two 325-hp diesel engines. The vessel has three jacking legs, each 96 feet long.

For those not familiar with this peculiar vessel, jackups are also referred to as liftboats. These vessels are essentially self-propelled barges with jackup capabilities; that is, they maintain the capability of independently changing from a seagoing vessel to a stationary, bottom-bearing, elevated work platform. Liftboats are common in the Gulf of Mexico where they routinely move to and from offshore oil structures under their own power. Once alongside a rig, production platform, or wellhead, the vessel lowers its legs to the seabed. It then jacks itself up its legs to a desired height, where it functions as a work platform for operations such as sandblasting, wireline work, fabrication, or structural maintenance.

Warnings Given But Not Heeded

On February 11, 1985, the **Dick Sharpe** was transiting between various offshore structures, carrying miscellaneous equipment and a contractor employee who was performing work on the structures. A small craft advisory was in effect the day before, forecasting 5- to 7-foot seas, increasing to 6 to 9 feet, with northwest winds of 20 to 25 knots. The weather was predicted to worsen on February 11th.

The owner/operator written guidelines provided detailed information and direction regarding emergency procedures, weather-related problems, and vessel maintenance. Specifically, the guidelines required the vessel

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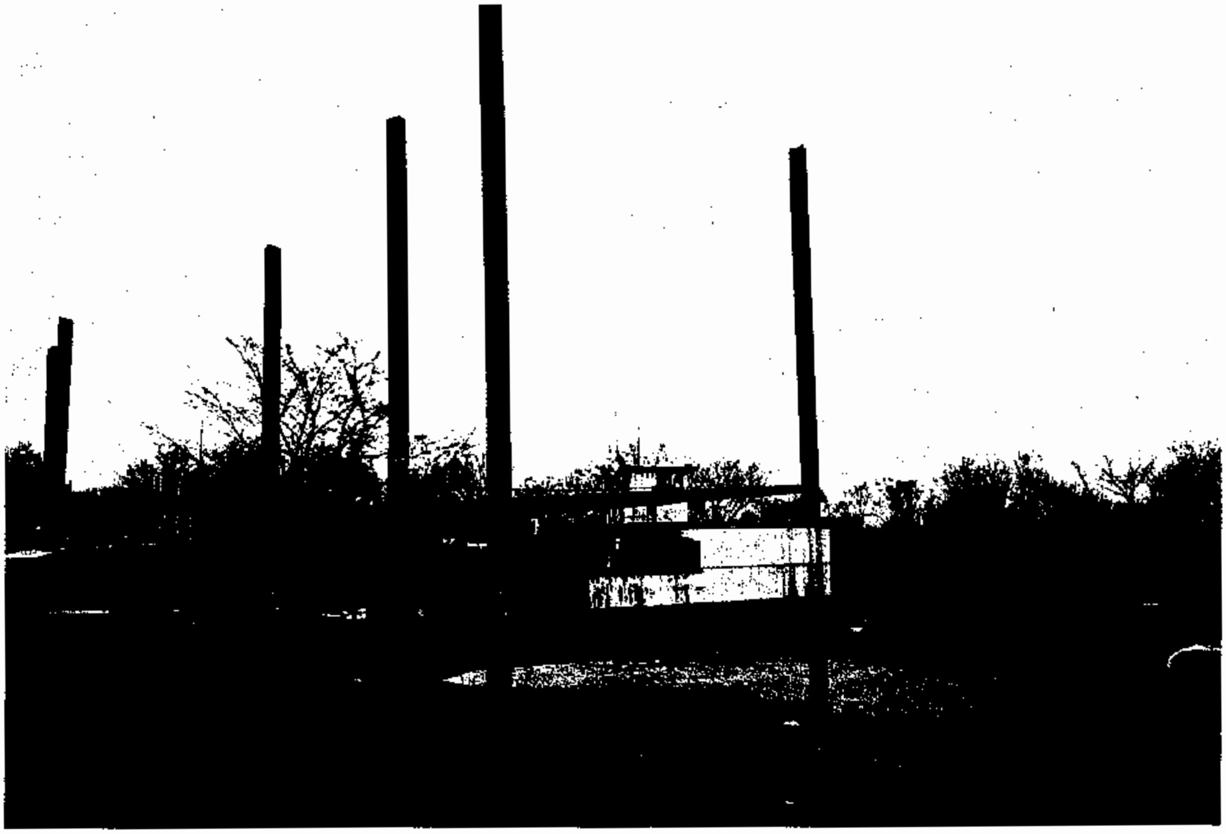


Typical three-leg liftboat shown in a partially jacked-up position. *(Photo courtesy of the author)*

operator to immediately move to a sheltered port whenever seas in excess of 5 feet were anticipated. Furthermore, any decision to move a vessel in heavy seas should be done at a reduced speed, with the legs partially lowered in the water to enhance vessel stability. The owner/operator further advised the vessel operator to obtain approval by radio before commencing any transit in heavy seas. At that time, even more detailed advice could be given by company supervisors.

By early afternoon of February 11, the **Dick Sharpe** encountered winds in excess of 35 knots with 8- to 10-foot seas. This weather was part of a violent storm system passing through southeast Texas and Louisiana. It had been forecast and broadcast for hours preceding the storm's arrival. The operator did not heed the weather forecasts and attempted to ride out the storm. When he realized that the situation was rapidly deteriorating beyond his control, he ignored the company guidelines to lower the vessel legs and instead headed the **Dick Sharpe** northeast at full throttle (9 to 10 knots), hoping to make safe harbor. The 96-foot-long jackup legs were in a full upright position, creating an untenable stability situation in the extreme winds and heavy seas. The weather continued to worsen, with seas reaching 10 to 14 feet and winds in the 50- to 65-knot range. The operator, even realizing that he was making no headway to safety, still neglected to call the vessel owner/operator by radio for guidance or instruction. This situation continued until approximately 9:00 p.m., when the port engine failed. The operator was unable to keep the vessel headed into the seas, and a large wave hit the **Dick Sharpe** full on the starboard side, capsizing it to port.

The three men abandoned the liftboat and clung to a 6-person styrofoam life float. At about 0200, February 12, the life float was hit by a large wave, and the vessel operator was lost. His body was never recovered. The deckhand and contract employee were later rescued by an oilfield workboat. Air units (HH52A) of the Coast Guard Air Station New Orleans were dispatched on February 12 and began searching for the lost operator. The search was suspended on February 13.

What Had Gone Wrong?

The proximate cause of this casualty was the failure of the port engine of the **Dick Sharpe**. Major contributing causes in the casualty were the failure of the vessel operator to sufficiently heed the weather forecasts of seas in excess of 5 feet and to immediately move to a sheltered area in accordance with the owner/operator guidelines. In addition, the failure of the operator to lower the jacking legs as required by the owner adversely affected the vessel stability. Had the jacking legs been lowered, the vessel speed may have been reduced, but the overall vessel stability would have been substantially increased, making it feasible to safely ride out the storm.

Company guidelines, operations manuals, and emergency procedures serve no useful purpose (other than ornamental) unless read, understood, and *complied with* by those personnel to whom they are directed. In this case, there were ample warnings and sufficient guidelines available to the vessel operator to have prevented this tragic accident. Unfortunately, the operator chose to take matters into his own hands and ignore defined procedures designed to protect his life and the vessel. This is yet another case study of an attempt to operate a vessel "by the seat of the pants" and hope for the best. Unfortunately, in this case, the best that was hoped for turned out to be the worst that could be expected.

Brief Summary and Analysis of Liftboat Operations in the Gulf of Mexico

The development of liftboats closely parallels the expansion of the offshore oil and gas industry. As the offshore production fields grew in size and moved to deeper waters, the size and complexity of the liftboats increased correspondingly. The first liftboats were small vessels, constructed in southeast Louisiana in 1955. Their lifting mechanism was a mechanical/cable system, designed to operate in shallow waters. The first hydraulic lift systems were developed in the early 1960s. Mammoth liftboats have recently been constructed for service in the Gulf of Mexico. Some of these vessels are capable of operating in water depths of nearly 130 feet and are nearly 300 gross tons. Some have jacking legs of 250 feet in length. These "super liftboats" are capable of operating for extended periods of time and contain heliports, full living quarters for up to 40 contract employees, and mechanical equipment that would rival a small construction company.

Problem Areas

Despite their usefulness and versatility, liftboats pose some serious issues of operational safety. On the average liftboat, the tremendous height of the jacking legs creates serious problems of stability in most sea states that exceed 4 feet. Most liftboat companies require that their operators jack the liftboat into a bottom-bearing mode or promptly return to a safe port whenever seas in excess of 4 feet are anticipated. Depending on the water depth and distance from a safe port, a life-threatening situation can occur if the liftboat is caught in an unanticipated storm and is unable to jack itself into a bottom-bearing mode. Even if a liftboat is able to jack itself into a bottom-bearing mode to ride out a storm, unanticipated winds and seas

Hydraulic gearing mechanism attached to leg housing pontoon/caisson. *(Photo courtesy of the author)* can cause the vessel to capsize unexpectedly. This situation is further aggravated by the relative slow speed of these vessels (generally 8 to 10 knots maximum). The low freeboard, general absence of ballastable compartments, and poor watertight integrity further contribute to a substantial stability problem. Most liftboat hulls are nothing more than standard barge hulls with some modifications for propulsion and jacking gear machinery. The history of casualties involving liftboats indicates that these vessels may be much more sensitive to the effects of weather than most conventional-type vessels.

Since 1983, according to this writer's calculations, there have been 24 serious casualties involving liftboats in the Gulf of Mexico. The months of October-December 1986 alone saw four serious liftboat casualties in the Gulf. Over half of these involved the capsizing of the vessel, and many of these cases involved death or serious injury to the personnel on board. Many of these accidents were weather-related and involved scenarios similar to the **Dick Sharpe** casualty in which the operators were simply not fully aware of the vessel's peculiar characteristics and capabilities in adverse weather conditions.

Several of these casualties involved instances of structural and/or mechanical failure. Under existing regulations, liftboats under 300 gross tons are not inspected by the Coast Guard insofar as they do not carry passengers or freight for hire. Finally, many liftboat companies utilize operators who hold no Coast Guard licenses and who have little or no understanding or knowledge of the basic aspects of vessel trim and stability and the stress effects of jacking a vessel in heavy seas on three or four metal legs. It is not an infrequent industry practice to award liftboat operator status to the old hand with the most seniority, while experienced, licensed personnel serve as mates or deckhands. It is also not uncommon to encounter liftboat operators with little or no commercial vessel experience. One owner bragged to this writer that he had put men in charge of liftboats as novices with only one month of on-the-job training.

Recommended Solutions

The liftboat industry must develop introspective procedures to ensure that the vessels are in seaworthy condition. Some of the Gulf Coast liftboat companies have diligently developed on-the-job training programs, quality control inspection procedures, and have encouraged their personnel to obtain Coast Guard licenses. These companies realize that it is not the status of holding a Coast Guard license that makes the operator more qualified, but the experience, education, and *actual knowledge* behind the license that makes the individual better for the job. However, other companies are virtually run on a "shoestring" with no scheduled maintenance ad inspection programs and poor training for operators. It must be noted that the peculiar aspects of jacking up a liftboat are closely akin to those involved in the operation of offshore jackup drilling rigs. Except on a smaller scale, similar principles of stability, structural stress, and seamanship apply. The owner/operators should be no less diligent in selecting a liftboat operator as they would be in selecting supervisory personnel for an offshore jackup drilling unit. The owner/operators must develop detailed, operable guidelines for their captains to follow in the event of heavy weather, mechanical casualties, or other exigent circumstances. These guidelines must be available to the operators and deckhands and *must be understood and followed*. This point cannot be overstressed. The bottom line is that the owner/operator must know the peculiarities and limitations of these specialized vessels and must in turn ingrain that knowledge in their respective liftboat operators. This writer believes that implementation of these principles will lead to greatly improved operational safety for the liftboat industry.

Editor's Note: *On December 11, 1986, the Coast Guard Marine Safety Council approved a workplan (CGD 86-074) authorizing a regulatory initiative to develop standards which will specifically address the hazards inherent in the operation of these unique vessels. An Advance Notice of Proposed Rulemaking (ANPRM) was reviewed by the Office of the Secretary of Transportation and was published in the Federal Register on April 16, 1987 (52 FR 12439).*

Two Ships Collide; Neighborhood Evacuated

LT Jim Obernesser

A 712-foot container ship collided with an 820-foot container ship during the rush hour in Hampton Roads, Virginia. A toxic cloud from the ships engulfed the Hampton Roads Bridge Tunnel, sending several people to the hospital. Other drivers were forced from their vehicles as irritating vapors escaped from a leaking container. Local authorities evacuated residential areas near the collision site after injuries were reported. Many residents of Hampton were evacuated and could not return to their homes until the local fire chief notified them that the area was clear.

The above scenario was part of a training simulation designed by the Marine Safety School On-Scene Coordinator/Regional Response Team (OSC/RRT) staff at Reserve Training Center Yorktown, Virginia, for Marine Safety Office Hampton Roads. This type of training simulation was developed as a result of major pollution incidents that occurred in the 1970s. The emphasis of the training simulation is placed on the working relationship between the OSC and the RRT. The Yorktown staff initiated and has continued to conduct such training exercises in six different cities throughout the country each year since 1979.

Scenarios are designed for each simulation based upon goals and issues provided by the OSC, the RRT, and the local response community. The Hampton Roads simulation incorporated such issues as funding, trajectory modeling, ecological sensitivity, and disposal of hazardous waste, in addition to other areas of concern.

Members of the OSC/RRT staff visit the community prior to the simulation. All aspects of the incident are thoroughly researched before each simulation. The Hampton Roads OSC/RRT simulation incorporated input from Captain Lloyd C. Burger, the On-Scene Coordinator; Captain Peter C. Lauridsen, the Chief, Marine Safety Division in the Fifth Coast Guard District; and design representatives from industry, local response officials, and state and federal agencies. The local response community had approximately 200 members present for the simulation. These previously identified participants are persons that should have direct involvement in the simulation. Participants are

The control room, nerve center of the collision simulation, buzzes with activity. *(U.S. Coast Guard photo by PA3 Lisa M. Boeve)*

LT Obernesser is a member of the OSC/RRT staff at the Coast Guard Reserve Training Center, Yorktown, Virginia.

asked to respond in a realistic manner. the decisionmaking process is confronted by real-world problems; all decisions are taken as far as can be expected in a training situation.

The realism of the incident, the actual individuals who make the decisions, and the opportunity to discuss a common problem at all levels of government and industry give the simulations a realism exceeded only by the actual event. A debriefing with the response community (Coast Guard, industry, federal, state and local officials) is conducted the day following the simulation. This open forum serves as a form of self-evaluation where perceived problems are discussed by all members of the response community. Issues that arose during the simulation are discussed, and commitments are made to resolve areas of weakness.▮

LT Guy Tetreau (right) relays information to a member of the Environmental Protection Agency. *(U.S. Coast Guard photo by PA3 Lisa M. Boeve)*

Members of the On-Scene Coordination Team plan their strategy. Standing from left: LCDR John Williams, LT Mark Gould, MKCS Peter Kupczyk, BM1 John Knapp. Seated: CAPT Lloyed Burger. *(U.S. Coast Guard phot by PA3 Lisa M. Boeve)*

Statistics of Marine Casualties -- 1985

Annually, the Coast Guard presents a statistical summary of commercial vessel casualties that were investigated by Coast Guard marine investigators during the calendar year. The casualty statistics are presented in two subsets: those that resulted in a total loss of the vessel and those that resulted in a non-total loss of the vessels involved in the accident. In 1985, there were 3,387 marine accidents that involved 5,660 commercial vessels; of these, 401 resulted in a total loss of the vessels involved, and of these, 268 were fishing vessels. There were 5,259 vessels involved in accidents that did not result in a total loss; of these, 1,443 were freight barges.

There were 87 deaths and 56 injuries as a result of vessels involved in a total loss. For those vessels not involved in a total loss, there were 59 deaths and 113 injuries. In 1985, there were 117 deaths and 1,349 injuries onboard commercial vessels not related to a vessel accident.

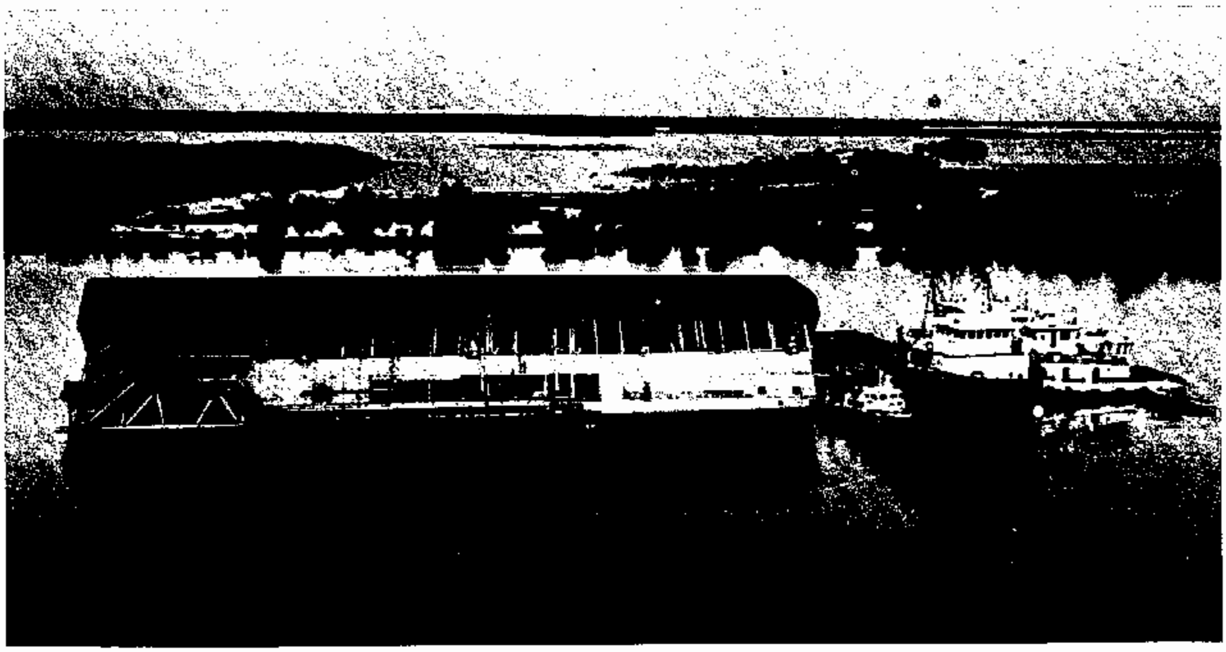
The distribution by vessel type for total losses and non-total losses and the resulting deaths and injuries are shown in figures 1 through 6.

The public, industry, and the Coast Guard have used the finding of the investigations to establish standards and determine the need for legislation to improve the protection of safety of life and property at sea. 46 CFR 4.05-10 states, "In addition to the notice required by paragraph 4.05-1, the person in charge of the vessel shall, as soon as possible, report in writing to the Officer in Charge, Marine Inspection, at the port in which the casualty occurred or nearest the port of first arrival." The following summary represents casualties for which reports were received at Coast Guard Headquarters during calendar year 1985. These casualties, involving commercial vessels, were required to be reported to the Coast Guard whenever the casualty resulted in any of the following:

- an accidental grounding or an intentional grounding which also meets any of the other reporting criteria or creates a hazard to navigation, the environment, or the safety of the vessel.
- loss of main propulsion or primary steering, or any associated component or control system, the loss of which causes a reduction of the maneuvering capabilities of the vessel. Loss means that systems, component parts, subsystems, or control systems do not perform the specified or required function.
- an occurrence materially and adversely affecting the vessel's seaworthiness or fitness for service or route, including but not limited to fire, flooding, or failure of or damage to fixed fire extinguishing systems, lifesaving equipment, auxiliary power generating equipment, or bilge pumping systems.
- loss of life.
- injury causing a person to remain incapacitated for a period in excess of 72 hours.
- an occurrence not meeting any of the above criteria but resulting in damage to property in excess of $25,000. Damage includes the cost of restoring the property to the service condition which existed prior to the casualty, but excludes the cost of salvage, gas freeing, and drydocking. It also does not include such items as demurrage.

Every event involving a vessel or its personnel which meets any of the conditions of a reportable casualty is of great concern to the Coast Guard. A number of reportable casualties are not investigated by the Coast Guard simply because they are not reported. Thus, it is of the utmost importance that the masters of all vessels ensure that all casualties are reported.

The statistical tabulation presented below is intended to summarize the casualty experience of the entire commercial fleet.



The capsizing of the liftboat Tonkawa in a Louisiana bayou was a major casualty in 1985. *(Coast Guard file photo)*

Because the summary is so all-encompassing, use of the statistics may lead to erroneous conclusions if the limitations of the data are not well understood. The Marine Safety Evaluation Branch of the Marine Investigation Division will gladly assist in quantifying those limitations for each specific need.

Comments and recommendation for changes or improvements in the statistics should be addressed to Commandant (G-MMI-3), U.S. Coast Guard, 2100 Second Street, SW, Washington, DC 20593-0001.

Major Casualties That Occurred in 1985

Uninspected Drilling Barge
Tonkawa

At approximately 2330 on May 20, 1985, the uninspected posted drilling barge **Tonkawa** capsized and sank to starboard while under tow by three vessels: **Sioux** (O.N. 633697), **Comanche** (O.N. 615367) and **Choctaw** (O.N. 641018) while enroute from Turtle Bayou, Louisiana, to West Lake Verette, Louisiana. The capsizing occurred at approximately 0.5 miles north of Avoca Island Cutoff Daybeacon #10, Bayou Chene, Louisiana. As a direct result of this casualty, 11 persons aboard the **Tonkawa** were killed. Oil pollution of Bayou Chene also resulted.

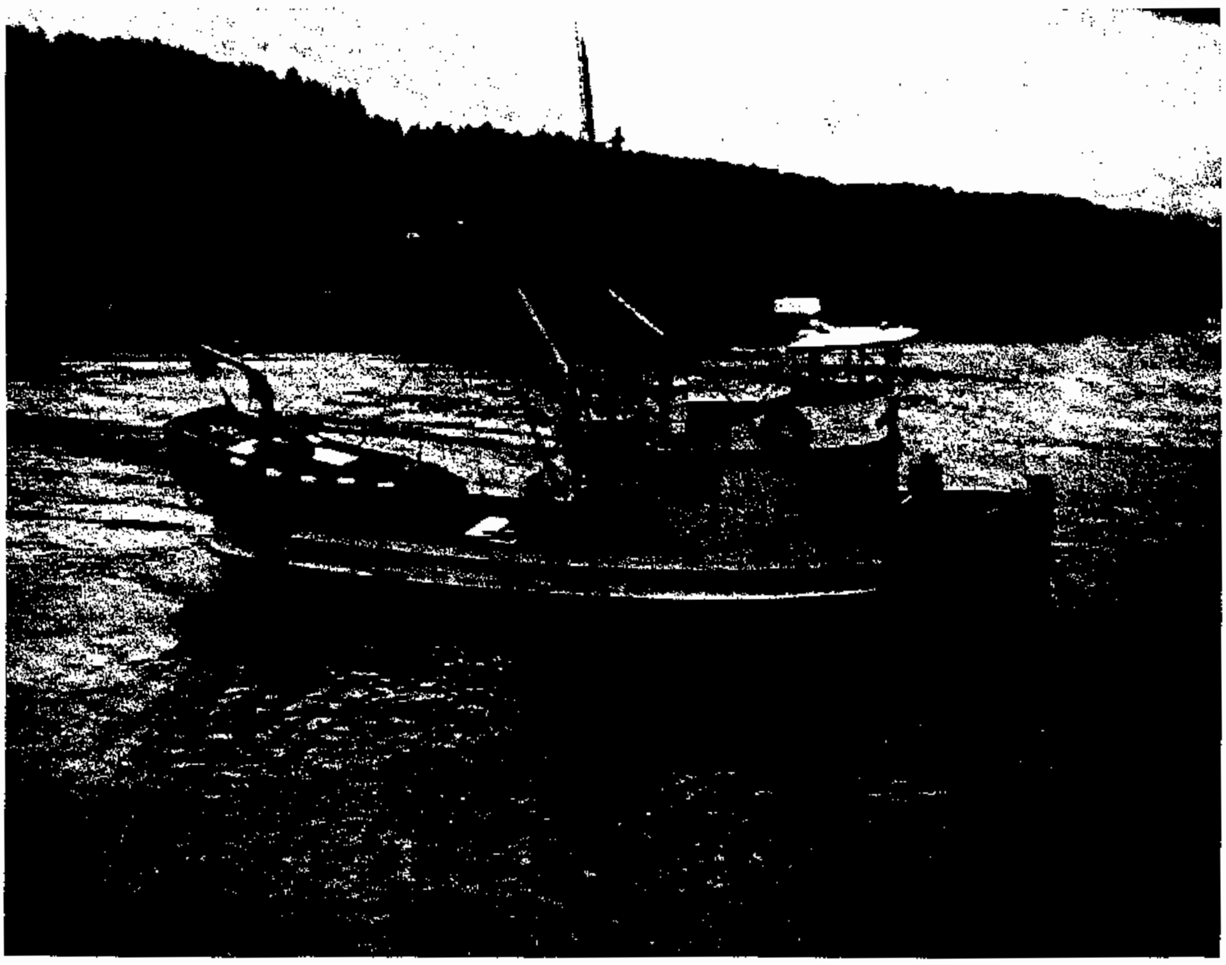
Corrections

Tables 6 and 7 of "Statistics of Marine Casualties -- 1984" published in the March 1987 issue of this magazine contained some errors. The corrected tables are shown at the conclusion of this article.

Uninspected Fishing Vessel
Western Sea

On August 20, 1985, the fishing vessel **Dusk** recovered a body wearing a life preserver floating at 57°-57' north latitude, 151°-56' west longitude. This body was turned over to the Alaska State Troopers in Kodiak, Alaska. Information in a letter found on the body led the Alaska State Troopers to conclude that the deceased was a crew member of the fishingvessel **Western Sea**, O.N. 213251. The **Western Sea** had departed Kodiak on the evening of August 15, 1985, apparently enroute to Izhut Bay, Afognak Island, Alaska, with six people on board (POB) to fish for salmon. Izhut Bay is approximately 25 miles north-northeast of Kodiak, via Marmot Bay. U.S. Coast Guard Air

Station, Kodiak, Alaska, and the U.S. Coast Guard cutter **Rush** were notified of the recovered body, and a search for the vessel and the POB began. On the evening of August 20, a lifering with the name **Western Sea** painted on it and part of the vessel's flying bridge bulwark identified by the Alaska Fish and Game number plate attached to it, were located by a helicopter from Air Station Kodiak. These items were located at 57°-58' north latitude, 152°-02' west longitude. A fish hold hatch cover identified as coming from the **Western Sea** was subsequently recovered. The body found on August 20 was shipped to the coroner's office in Anchorage, Alaska, where a positive identification was later made by the victim's father. The search for the vessel and POB continued with negative results. The search was suspended, pending further developments by the North Pacific Search and Rescue Coordinator in Juneau, Alaska, on August 24, 1985. On September 10, 1985, two bodies were recovered off Cape Chiniak, Kodiak Island, Alaska. One was recovered by the U.S. Coast Guard cutter **Munro** at 57°-28' north latitude, 151°-19' west longitude. Both bodies were wearing life preservers. These bodies were turned over to the Alaska State Troopers who shipped them to the coroner in Anchorage, Alaska for identification and autopsy. One body was identified by Dr. Michael T. Propst, a forensic pathologist in Anchorage, as that of Jerald W. Bouchard, the captain of the **Western Sea**, and the other has not yet been positively identified. The remainder of the persons known to have been aboard the **Western Sea** and any additional identifiable wreckage have not been located as of this date.



This photo of the Western Sea was taken just weeks prior to the casualty. *(Photo by Davona Burno)*

TABLE 1

SUMMARY OF COMMERCIAL VESSEL TOTAL LOSSES
BY NATURE OF CASUALTY AND VESSEL SIZE FOR 1985

	FOUNDERED	FIRE/EXPLOSION	COLLISION	GROUNDING	HULL/MACHINERY DAMAGE	MISSING	OTHER	TOTAL
	No.	No.	No.	No.	No.	No.	No.	
FREIGHTSHIP								
Less than 100 GT	1				1			2
100-199								
200-299								
300-499								
500-1599								
1600-4999								
5000-9999				1				1
10,000-19,999								
20,000 and Above								
SUBTOTAL	1			1	1			3
TANKSHIP								
Less than 100 GT								
100-1599								
1600-4999								
5000-9999								
10,000-19,999								
20,000-39,999								
40,000-99,999								
100,000 and Above								
SUBTOTAL								
PASSENGER VESSEL (inc. ferries)								
Less than 100 GT	7	4	1	3				15
100-1599								
1600-4999				1				1
5000 and Above								
SUBTOTAL	7	4	1	4				16

TABLE 1 Cont'd:

SUMMARY OF COMMERCIAL VESSEL TOTAL LOSSES
BY NATURE OF CASUALTY AND VESSEL SIZE FOR 1985

	FOUNDERED	FIRE/EXPLOSION	COLLISION	GROUNDING	HULL/MACHINERY DAMAGE	MISSING	OTHER	TOTAL
	No.	No.	No.	No.	No.	No.	No.	
TUG/TOWBOAT								
Less than 100 GT	9	3	3	1				16
100-199	4	2	1		1			8
200-299			1	1				2
300-999			1					1
1000 and Above								
SUBTOTAL	13	5	6	2	1			27
OFFSHORE SUPPLY								
Less than 100 GT	4			1			2	7
100-199					1			1
200-499				1	1			2
500 and Above								
SUBTOTAL	4			2	2		2	10
MODU								
Less than 300 GT	2							2
300 GT and over		1	1					2
SUBTOTAL	2	1	1					4
PLATFORM							2	2
SUBTOTAL							2	2
FISHING VESSEL								
Less than 100 GT	76	52	19	29	20	4	8	208
100-199	12	5	3	2	1		1	24
200-499	2			1				3
500-999			1					1
1000 and Above								
State Numbered	16	8	3	2	1	2		32
SUBTOTAL	106	65	26	34	22	6	9	268

TABLE 1 Cont'd:

SUMMARY OF COMMERCIAL VESSEL TOTAL LOSSES
BY NATURE OF CASUALTY AND VESSEL SIZE FOR 1985

	FOUNDERED	FIRE/EXPLOSION	COLLISION	GROUNDING	HULL/MACHINERY DAMAGE	MISSING	OTHER	TOTAL
	No.	No.	No.	No.	No.	No.	No.	
TANK BARGE								
Less than 500 GT								
500-999	1	1	1					3
1000 and Above		1	3		1			5
SUBTOTAL	1	2	4		1			8
FREIGHT BARGE								
Less than 100 GT								
100-999	6		7	3	2		23	41
1000 and Above	1							1
Unknown								
SUBTOTAL	7		7	3	2		23	42
MISCELLANEOUS								
Less than 100 GT	6	2	8				1	17
100 and Above (SP)	3				1			4
100 and Above (NSP)								
SUBTOTAL	9	2	8		1		1	21
TOTAL	150	79	53	46	30	6	37	401
FOREIGN FLAG *								
Freight				1				
Tank								
Other		1		2				
SUBTOTAL		1		3				

* These vessels have been included in the above total.

TABLE 2A

TOTAL LOSSES DURING 1985
TYPE OF VESSEL BY AGE OF VESSEL

Type vessel Age	0-4	5-9	10-14	15-19	20-24	25-29	30 & Above	UNKNOWN	TOTAL
FREIGHTSHIP	1			1			1		3
TANKSHIP									
PASSENGER VESSEL (inc. ferries)	3	2	2	3	1	2	3		16
TUG/TOWBOAT	4	3	2	7	2	5	2	2	27
OFFSHORE SUPPLY	1	4	2	2	1				10
MODU	1	1	1	1					4
PLATFORM	1							1	2
FISHING VESSEL	11	51	31	28	18	21	68	8	236
STATE NUMBERED	1	6	4	5	1	2	6	7	32
TANK BARGE	1	3			2		2		8
FREIGHT BARGE	2	4	6	9	7	1	1	12	42
MISCELLANEOUS	4	4	4		2		1	6	21
TOTAL	30	78	51	57	34	31	84	36	401

TABLE 2B

TOTAL LOSSES DURING 1985
NATURE OF CASUALTY BY AGE OF VESSEL

Casualty Age	0-4	5-9	10-14	15-19	20-24	25-29	30 & Above	UNKNOWN	TOTAL
FOUNDERED	11	29	21	21	6	13	31	18	150
FIRE/EXPLOSION	9	23	11	6	7	4	11	8	79
COLLISION	3	10	7	8	5	2	11	7	53
GROUNDING	1	7	2	6	7	6	17		46
HULL/MACHINERY DAMAGE	3	4	3	7	5	3	5		30
MISSING	1			1	1		3		6
OTHER	2	1	5	6	3	3	4	13	37
TOTALS	30	74	49	55	34	31	82	46	401

TABLE 3

SUMMARY OF COMMERCIAL VESSELS NOT INVOLVED IN A TOTAL LOSS
BY NATURE OF CASUALTY AND VESSEL SIZE FOR 1985

	FOUNDERED	FIRE/EXPLOSION	COLLISION	GROUNDING	HULL/MACHINERY DAMAGE	WEATHER DAMAGE	OTHER	TOTAL
	No.	No.	No.	No.	No.	No.	No.	
FREIGHTSHIP								
Less than 15 GT				2	1			3
15-99	1			4	4			9
100-199								
200-299			2		2	1		5
300-499	1		1		2			4
500-1599			6	8	3		1	18
1600-4999		1	3	6	2			12
5000-9999		2	19	10	18		1	50
10,000-19999		5	44	27	51		5	132
20,000 and Above	1	3	27	57	32	4	9	133
SUBTOTALS	3	11	102	114	115	5	16	366
TANKSHIP								
Less than 100 GT	1		1		2		2	6
100-1599		1	4	4	5		1	15
1600-4999			7	3	7		1	18
5000-9999			2	2	3			7
10,000-19,999		3	13	12	18	1	1	48
20,000-39,999	1	3	12	31	19		1	67
40,000-99,999		1	6	7	13			27
100,000 and Above								
SUBTOTALS	2	8	45	59	67	1	6	188
PASSENGER VESSEL (inc. ferries)								
Less than 100 GT	12	12	37	48	47	2	10	168
100-1599	1	3	4	9	12		3	32
1600-4999	1	1	5	1	9			17
5000 and Above		1	2	6	6			15
SUBTOTALS	14	17	48	64	74	2	13	232

Table 3 Cont'd:

SUMMARY OF COMMERCIAL VESSELS NOT INVOLVED IN A TOTAL LOSS
BY NATURE OF CASUALTY AND VESSEL SIZE FOR 1985

	FOUNDERED	FIRE/EXPLOSION	COLLISION	GROUNDING	HULL/MACHINERY DAMAGE	WEATHER DAMAGE	OTHER	TOTAL
	No.	No.	No.	No.	No.	No.	No.	
TUG/TOWBOAT								
Less than 100 GT	41	12	89	71	44	1	19	277
100-199	17	5	134	123	59	4	14	356
200-299	3	2	33	34	16	2	3	93
300-999	5	2	74	193	23		11	308
1000 and Above			14	29	6			49
SUBTOTAL	66	21	344	450	148	7	47	1083
OFFSHORE SUPPLY								
Less than 15 GT								
15-99	1		10	4	4	3		22
100-199		1	4	1	2			8
200-499			17	6	6	1		30
500 and Above			1					1
SUBTOTAL	1	1	32	11	12	4		61
MODU								
Less than 100 GT		1	1			1		3
100-299			1					1
300 GT and Above	3	2	15	1	11	2	2	36
SUBTOTAL	3	3	17	1	11	3	2	40
PLATFORM		2	6		2		2	12
SUBTOTAL		2	6		2		2	12
FISHING VESSEL								
Less than 100 GT	90	24	68	93	376		102	753
100-199	19	11	30	44	79	1	20	204
200-499	1	1	1	1	1			5
500-999			2		5			7
1000 and Above		2	1	2	3			8
State Numbered	26	10	16	11	75	1	17	156
SUBTOTAL	136	48	118	151	539	2	139	1133

Table 3 Cont'd:

SUMMARY OF COMMERCIAL VESSELS NOT INVOLVED IN A TOTAL LOSS
BY NATURE OF CASUALTY AND VESSEL SIZE FOR 1985

	FOUNDERED	FIRE/EXPLOSION	COLLISION	GROUNDING	HULL/MACHINERY DAMAGE	WEATHER DAMAGE	OTHER	TOTAL
	No.	No.	No.	No.	No.	No.	No.	
TANK BARGE								
Less than 100 GT			1		1			2
100-499	1		3	1	2		1	8
500-999	4	1	33	69	12	1	4	124
1000 and Above	3	3	120	169	33	1	10	339
SUBTOTAL	8	4	157	239	48	2	15	473
FREIGHT BARGE								
Less than 100 GT	3							3
100-999	61	4	230	406	62	2	255	1020
1000 and Above	4	1	92	167	25	1	12	302
Unknown	8		25	36	7		42	118
SUBTOTAL	76	5	347	609	94	3	309	1443
MISCELLANEOUS								
Less than 100 GT	22	5	47	12	17	2	9	114
100 and Above (SP)	8	8	12	14	19	6	6	73
100 and Above (NSP)	2		31		8			41
SUBTOTAL	32	13	90	26	44	8	15	228
TOTALS	341	133	1306	1724	1154	37	564	5259
FOREIGN FLAG								
Freight	4	7	60	75	45		11	202
Tank		1	19	22	15		2	59
Other	2	3	14	7	7		2	35
SUBTOTAL	6	11	93	104	67		15	296

TABLE 4A:

VESSELS NOT INVOLVED IN A TOTAL LOSS DURING 1985
TYPE OF VESSEL BY AGE OF VESSEL

Type vessel Age	0-4	5-9	10-14	15-19	20-24	25-29	30 & Above	UNKNOWN	TOTAL
FREIGHTSHIP	57	79	93	71	19	4	37	6	366
TANKSHIP	32	34	41	30	8	19	22	2	188
PASSENGER VESSEL (inc. ferries)	47	45	32	25	23	15	43	2	232
TUG/TOWBOAT	187	222	219	139	71	89	132	24	1083
OFFSHORE SUPPLY	18	30	7	4	2				61
MODU	21	8	6	2		2	1		40
PLATFORM	2					2		8	12
FISHING VESSEL	79	251	135	111	53	41	265	42	977
STATE NUMBERED	16	27	24	25	16	7	12	29	156
TANK BARGE	52	103	118	89	37	27	21	26	473
FREIGHT BARGE	263	291	256	148	92	56	31	306	1443
MISCELLANEOUS	34	36	31	15	10	10	30	62	228
TOTAL	808	1126	962	659	331	272	594	507	5259

TABLE 4B:

VESSELS NOT INVOLVED IN A TOTAL LOSS DURING 1985
NATURE OF CASUALTY BY AGE OF VESSEL

Casualty Age	0-4	5-9	10-14	15-19	20-24	25-29	30 & Above	UNKNOWN	TOTAL
FOUNDERED	52	47	42	42	24	25	66	43	341
FIRE/EXPLOSION	19	24	23	17	13	7	20	10	133
COLLISION	223	298	242	150	74	75	114	130	1306
GROUNDING	318	377	372	225	110	79	109	134	1724
HULL/MACHINERY DAMAGE	137	260	187	161	74	51	228	56	1154
WEATHER DAMAGE	5	9	7	3	3	2	1	7	37
OTHER	54	111	89	61	33	33	56	127	564
TOTAL	808	1126	962	659	331	272	594	507	5259

TABLE 5A

SUMMARY OF COMMERCIAL VESSEL CASUALTIES
BY CAUSE* AND NATURE OF CASUALTY - 1985

PERSONNEL	FOUNDERED No.	FIRE/EXPLOSION No.	COLLISION No.	GROUNDING No.	HULL/MACHINERY DAMAGE No.	MISSING No.	OTHER No.	TOTAL
Inatt. to duty	2		15	17	2		4	40
Judgmental error	8		134	262	3		8	415
Carelessness	11	13	8	9	1		1	43
Lack of knowledge	2		1	4	1			9
Relied on floating ATON				1				1
Failed to								
Account wind/current	5		31	25	1		1	63
Use nav. equip/charts			3	2				5
Use radiotelephone							1	1
Ascertain position			8	51	1		1	61
Establish Pass Agreement			8	1				9
Keep Proper Lookout			20	8				28
Keep Right of Channel			6	1				7
Comply w/Rule, Reg, Procedure			6	1				7
Proceed at Safe Speed			6	2			1	9
Yield Right of Way			8	2				10
Stress								
Fatigue			5	4				9
Physical impair.			1	1				2
Intoxication				2				2
Improper Loading	9		1	2	3		1	16
Improper Maintenance	16	13	1		46		2	78
Improper Mooring/Tow	10		8	4	1			23
Improper Securing/Rigging	21		2		1		1	25
Improper safety Precaut	8	10	3	7	2		2	32
Operator Error	12		103	145	6		7	273
Other	12	7	27	47	10		5	108
SUBTOTAL	116	43	405	598	78		36	1276

TABLE 5B

SUMMARY OF COMMERCIAL VESSEL CASUALTIES
BY CAUSE* AND NATURE OF CASUALTY - 1985

ENVIRONMENT	FOUNDERED No.	FIRE/EXPLOSION No.	COLLISION No.	GROUNDING No.	HULL/MACHINERY DAMAGE No.	MISSING No.	OTHER No.	TOTAL
Adverse weather	35	1	25	32	8		23	124
Adverse current	8		10	9	5		4	36
Debris	2	3	3	1	13		20	42
Ice	1		4	12	3			20
Lightning		1						1
Shoaling	1		2	162				165
Submerged object	1		63	7	1			72
Channel hazard	1		9	18				28
Inadequate AtoN								
Other			8	5				13
SUBTOTAL	49	5	124	246	30		47	501

* Cause is first one listed in each record

TABLE 5C

SUMMARY OF COMMERCIAL VESSEL CASUALTIES
BY CAUSE* AND NATURE OF CASUALTY - 1985

MATERIAL RELATED	FOUNDERED No.	FIRE/EXPLOSION No.	COLLISION No.	GROUNDING No.	HULL/MACHINERY DAMAGE No.	MISSING No.	OTHER No.	TOTAL
Failed Materials:								
Structural	92	11	12	9	252		2	378
Mechanical	19	9	5		388		5	426
Electrical	2	32		1	114		14	163
Corrosion					10			10
Normal wear					16		1	17
Improper welding					2			2
Improper riveting								
Steering failure					3			3
Fouled propeller	1				4		61	66
Inadequate:								
Lighting								
Stability	5				1			6
Lifesaving equip								
Firefighting equip								
Controls							1	1
Lubrication					1			1
Maintenance								
Insufficient fuel							7	7
Propulsion Failure	1				1			2
Fatigue Failure			4		5		52	61
Other	5		6	15	8		2	36
SUBTOTAL	125	52	27	25	805		145	1179
NEC	7	8	2	3	7		1	28
CAUSE UNKNOWN	119	94	31	30	107	6	16	403
TOTAL	416	202	589	902	1027	6	245	3387

TABLE 6

DEATHS/INJURIES RESULTING FROM TOTAL LOSS OF
COMMERCIAL VESSELS DURING 1985

	FOUNDERED	FIRE/EXPLOSION	COLLISION	GROUNDING	HULL/MACHINERY	MISSING	OTHER	TOTAL
FREIGHTSHIP				1/0				1/0
TANKSHIP								
PASSENGER VESSEL			1/2					1/2
TUG/TOWBOAT	2/0		2/1					4/1
OFFSHORE SUPPLY				0/1			0/1	0/2
FISHING VESSEL	37/9	3/6	2/6	4/7		8/0	3/0	57/28
STATE NUMBERED	4/2	0/1	0/2			5/0		9/5
MODU	2/3		2/2					4/5
PLATFORM								
FREIGHT BARGE								
TANK BARGE		3/8	0/1					3/9
MISCELLANEOUS	5/0		3/4					8/4
LICENSED OFFICER	1/0			1/1				2/1
CREW	48/14	4/8	7/13	4/6		13/0	3/1	79/42
PASSENGER	1/0	1/0	3/5					5/5
OTHER		1/7		0/1				1/8
TOTAL	50/14	6/15	10/18	5/8		13/0	3/1	87/56

TABLE 7

DEATHS/INJURIES RESULTING FROM A COMMERCIAL VESSEL
NOT INVOLVED IN A TOTAL LOSS DURING 1985

	FOUNDERED	FIRE/EXPLOSION	COLLISION	GROUNDING	HULL/MACHINERY	WEATHER DAMAGE	OTHER	TOTAL
FREIGHTSHIP		3/1	1/4	0/1				4/6
TANKSHIP		0/2	0/5		0/1			0/8
PASSENGER VESSEL	1/2	1/4	1/14	0/2	0/2			3/24
TUG/TOWBOAT	0/2	0/1	2/12	0/1		0/1		2/17
OFFSHORE SUPPLY		1/0						1/0
FISHING VESSEL	3/1	0/2	1/6		2/2			6/11
STATE NUMBERED	4/1	1/7	1/3		0/1		1/0	7/12
MODU	11/0	2/4	2/2		2/0			17/6
PLATFORM		0/3			0/5		2/7	2/15
FREIGHT BARGE	2/0		2/1		0/1	0/1		4/3
TANK BARGE		2/0						2/0
MISCELLANEOUS	1/1	1/4	4/6	3/0	1/0		1/0	11/11
LICENSED OFFICER	1/0	1/2	0/1	0/1				2/4
CREW	16/6	7/19	9/25	0/2	5/8	0/2	1/0	38/62
PASSENGER	1/0		5/23	3/1			2/7	11/31
OTHER	4/1	3/7	0/4		0/4		1/0	8/16
TOTAL	22/7	11/28	14/53	3/4	5/12	0/2	4/7	59/113

TABLE 8

OTHER DEATHS/INJURIES ONBOARD COMMERCIAL VESSELS DURING 1985
(NOT RELATED TO A VESSEL CASUALTY)

	SLIP/ FALL ONBOARD	FALL OVER BOARD	DISAPPEAR	STRUCK BY OBJECT	PINCH OR CRUSH	BURN SCALD	ELECTRIC BURN/ SHOCK	CUT	CAUGHT IN LINES	ASPHYXIA	SPRAIN OR STRAIN	DIVING	UNKOWN OR NOC	TOTAL
FREIGHTSHIP	2/86	5/1	4/0	4/32	2/8	0/3		0/5	0/3	1/0	0/26		2/4	20/168
TANKSHIP	2/34	1/0		0/17	0/10	0/4			0/1		0/6		0/2	3/74
PASS. VSL.	0/31	2/0	1/0	1/10	0/9		1/0	0/1	0/2	1/0	0/7	12/6	0/3	18/69
TUG/TOWBOAT	1/16	14/0	2/0	1/9	0/8		0/1	0/1	0/1		0/3		1/4	19/43
OFFSHORE SPLY	0/19	0/1		2/17	0/6	0/1	0/1	0/1	0/2	0/2	0/6	0/1	0/1	2/58
FISHING VSL.	0/15	13/0	2/0	2/15	0/11	0/3	0/1	0/4	0/10	1/0		2/0-	1/5	21/64
STATE NUMBERED		3/0		1/0						0/1				4/1
MODU	3/111	1/6		9/104	2/61	0/4	0/2	0/8	0/3		0/103	0/1	0/7	15/410
PLATFORM	0/142	2/5	1/0	1/104	0/49	0/14	1/1	0/9			0/84	0/2	0/14	5/424
FREIGHT BARGE		2/1		1/0						2/0				5/1
TANK BARGE	0/1													0/1
MISCELLANEOUS	0/13	1/0		2/8	1/3			0/2				1/4	0/6	5/36
LICENSED OFFICER	2/23	3/2	1/0	1/17	0/6	0/1		0/3		2/2	0/5			9/59
CREW	6/412	36/12	7/0	21/292	3/155	0/28	2/6	0/25	0/22	1/1	0/225	0/3	3/39	79/1220
PASSENGER	0/21	2/0	1/0	1/4	0/2			0/1		1/0	0/2	13/3	1/5	19/38
OTHER	0/12	3/0	1/0	1/3	2/2			0/2		1/0	0/3	2/8	0/2	10/32
TOTAL	8/468	44/14	10/0	24/316	5/165	0/29	2/6	0/31	0/22	5/3	0/235	15/14	4/46	117/1349

Corrected Table 6 from 1984 Statistics

TABLE 6

DEATHS/INJURIES RESULTING FROM TOTAL LOSS OF
COMMERCIAL VESSELS DURING 1984

	FOUNDERED	FIRE/EXPLOSION	COLLISION	GROUNDING	HULL/MACHINERY	MISSING	OTHER	TOTAL
FREIGHTSHIP								
TANKSHIP		8/11						8/11
PASSENGER VESSEL					1/1			1/1
TUG/TOWBOAT	6/2							6/2
OFFSHORE SUPPLY								
FISHING VESSEL	22/3	5/2	2/2	6/0		6/0	1/0	42/7
STATE NUMBERED	3/0			0/1		6/0		9/1
MODU								
PLATFORM								
FREIGHT BARGE								
TANK BARGE								
MISCELLANEOUS	11/2		5/2					16/4
LICENSED OFFICER	1/0	2/7						3/7
CREW	29/7	11/5	6/2	6/1	1/1	12/0	1/0	66/16
PASSENGER	11/0		1/2					12/2
OTHER	1/0	0/1						1/1
TOTAL	42/7	13/13	7/4	6/1	1/1	12/0	1/0	82/26

Corrected Table 7 from 1984 Statistics

TABLE 7

DEATHS/INJURIES RESULTING FROM A COMMERCIAL VESSEL
NOT INVOLVED IN A TOTAL LOSS DURING 1984

	FOUNDERED	FIRE/EXPLOSION	COLLISION	GROUNDING	HULL/MACHINERY	WEATHER DAMAGE	OTHER	TOTAL
FREIGHTSHIP		3/2	0/3		1/2		1/0	5/7
TANKSHIP			2/0		0/2			2/2
PASSENGER VESSEL			0/7	0/1	0/1		4/2	4/11
TUG/TOWBOAT		0/2	2/11		0/4		3/3	5/20
OFFSHORE SUPPLY	1/1	1/0	3/4		0/1			5/6
FISHING VESSEL	1/0		1/4		1/2		4/3	7/9
STATE NUMBERED		0/2			0/2		6/0	6/4
MODU		0/2	0/3		0/2		4/5	4/12
PLATFORM		5/11	0/4		1/0			6/15
FREIGHT BARGE			3/7		0/1		2/1	5/9
TANK BARGE		3/4	1/4				0/1	4/9
MISCELLANEOUS	1/1	0/1	1/6		2/1		2/1	6/10
LICENSED OFFICER		0/1	0/2		0/2		2/0	2/5
CREW	3/2	8/22	12/43		4/15		21/16	48/98
PASSENGER			1/8	0/1			1/0	2/9
OTHER		4/1			1/1		2/0	7/2
TOTAL	3/2	12/24	13/53	0/1	5/18		26/16	59/114

A Bad Solenoid Can Ruin Your Whole Day

LT Peter L. Randall

Note: *Solenoids are wound, cylindrical electric coils that act as an electromagnet to move a plunger when the coil is energized. The term is sometimes improperly used to refer to the valve, switch, or other device that the solenoid coil operates.*

Electric solenoids are commonplace on today's vessels. They serve as the interface between remote controls and the pneumatic, hydraulic, or electric systems that the controls operate. Small, numerous, and generally reliable, their importance is frequently overlooked, even in critically important systems such as electrohydraulic steering gear.

Background

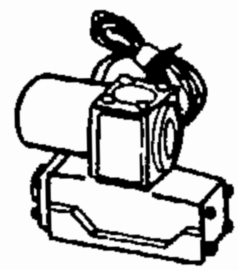
In 1985, the Coast Guard began specific tracking of solenoid-related steering gear casualties. Part of the motivation for this effort has been recurring reports of solenoid failures on inspected vessels. Part of the motivation has also been jamming of a solenoid-controlled steering gear valve on a foreign tanker that resulted in a collision, explosion, fire and *at least* $7.3 million in damage. While the solenoids themselves didn't cause *that* casualty, they had the same potential.

Results to Date

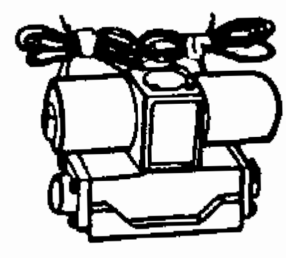
In tracking these casualties, the Coast Guard has found the following:

- Many of reported solenoid failures do not result in damage because the condition is detected during the pre-arrival and pre-departure tests required by Coast Guard regulations.
- Many reported failures don't result in damage because the crew is able to shift to a backup steering control required by the regulations.
- The use of solenoids in some existing designs can result in complete loss of steering, in spite of redundancy.
- Most solenoid failures can be avoided by simple *maintenance* and *periodic replacement* of the coil.

The comments below discuss the operation and maintenance of solenoids in



SINGLE SOLENOID



DOUBLE SOLENOID

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LT Randall is a Staff Engineer in the Coast Guard's Marine Technical and Hazardous Materials Division, Office of Marine Safety, Security and Environmental Protection.

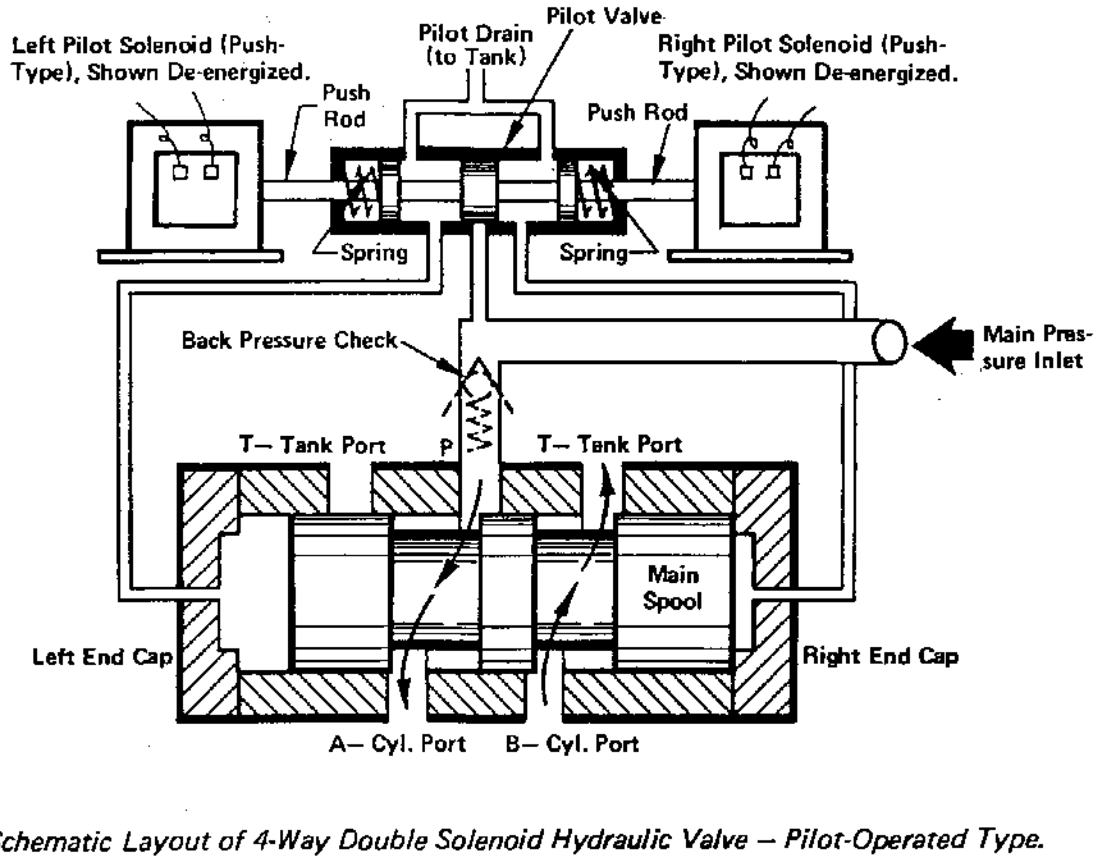
steering gear. While alternating current (AC) solenoids for directional control valves in electrohydraulic systems are specifically discussed, the comments also apply to electropneumatic systems and direct current (DC) solenoids. All possible modes of failure are not covered. Instead, emphasis is placed on reasonably well-documented failures. If you have comments or suggestions on this topic, call the Coast Guard's Marine Technical and Hazardous Materials Division at (202) 267-2206 or the Merchant Vessel Inspection Division at (202) 267-1464.

The Care and Feeding of Solenoids

Most solenoids are designed to operate for millions of cycles, and usually do. Solenoid failures can be divided into two groups: electrically related and mechanically (or hydraulically) related. Being electro-mechanical devices, solenoids may fail due to an open winding, shorted winding, armature binding, or other mechanical failure.

Since we are considering AC solenoid-controlled directional valves, it is obvious that the first possible failure is that of the solenoid coil itself. The wire size and insulation are capable of very long life so long as the solenoid is not abused. The inrush current of a solenoid when it is first energized is typically 6 times the hold-in current. Any condition which prolongs or magnifies this situation, or otherwise causes the solenoid to draw too much current, will severely overheat the solenoid. Overheating causes the wire insulation to deteriorate and eventually allows adjacent turns in the solenoid to partially short. This shorting causes the solenoid to draw even more current with the end result being a destroyed solenoid.

To compensate for the heating that occurs with high cycling rates (6-10 operations per



Schematic Layout of 4-Way Double Solenoid Hydraulic Valve — Pilot-Operated Type.

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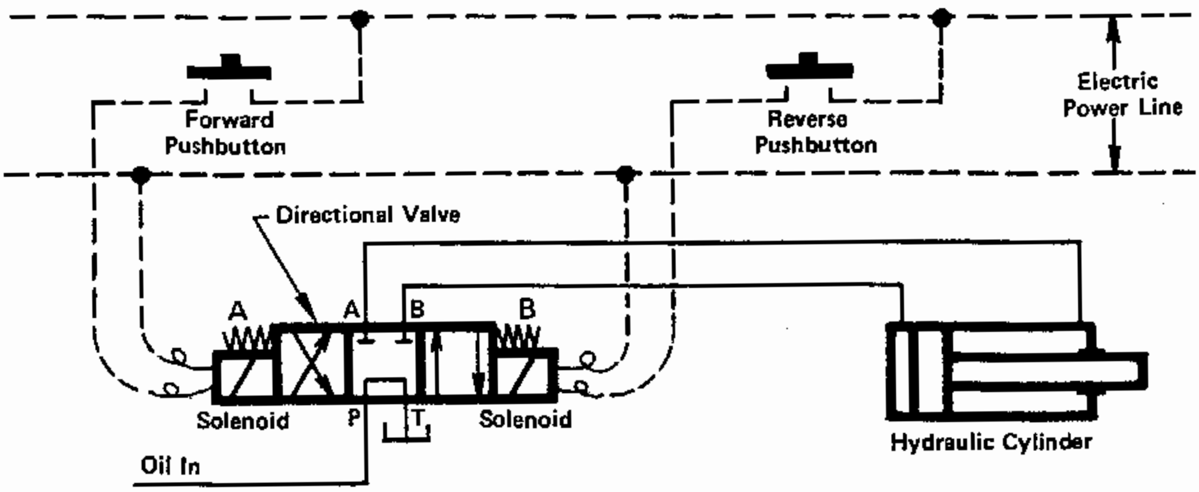

Basic Solenoid Valve Control of Double-Acting Hydraulic Cylinder.

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minute in a steering gear, with associated inrush current heating), many solenoids are oil immersed. A light mineral oil is used to evenly dissipate heat from the coil and lubricate moving components. Loss of this oil may also result in overheating.

Excessive voltage to the solenoid allows the solenoid to work properly but will cause it to draw too much current in the energized state. Undervoltage, binding of the armature shaft, or foreign matter beneath the armature can prevent the solenoid from seating properly, again causing it to draw too much current. Any of these conditions will lead to eventual failure of the coil. Extreme overvoltage or overcurrent, on the other hand, will cause a wire to burn open which produces a rapid and complete failure.

In a directional valve, two solenoids shift the hydraulic control valve spool back and forth. If for some reason both solenoids are energized at the same time, only one will pull in properly and the other will proceed to overheat. This condition can result from a faulty control device which, among other reasons, may be damaged by overvoltage transients on the ship's power system. These spikes are of very low energy content, but may be sufficient to damage electronic control devices, particularly those not partially protected by isolation transformers. Spike clippers such as zener diodes, varistors, or transient suppressors may be used to reduce the likelihood of damage from high voltage transients. The short circuit protection required by the Coast Guard, the International Maritime Organization, and classification societies in steering control circuits should not be relied upon to protect these circuits from overvoltages, transients, and gradual solenoid burning.

On the hydraulic side of the directional control valves, there are several factors which can affect the proper performance of the valve. Any mechanical binding in the solenoids or of the valve spool can cause improper operation and possible solenoid damage. The valve spool is pushed one way or the other by the action of the solenoids, thus directing the hydraulic oil to the actuators to steer the vessel. The small mechanical clearances in the valve spool require use of clean, noncontaminated oil to ensure proper operation. Dirty oil or oil that has deteriorated to a point that sludge or varnish is forming can cause binding of the valve spool, as well as possible damage to other parts of the hydraulic system. Valve spools that are not operated frequently, such as dump valves or bypass valves, may have a tendency to "stick" because of minor contamination or varnish buildup. Clean oil is even more important in servo valve systems due to the even smaller clearances and low forces available in these valves.

Preventive maintenance is the key to long and trouble-free system performance. Clean oil of the proper type should be maintained in the system. Filters and strainers should be checked, cleaned, or replaced at regular intervals. Oil should be changed periodically because of deterioration of the oil and additives therein, and to remove particle contamination. Any oil added to the system later should be the same type as the original and of a type recommended by the steering gear manufacturer. After repair which involves breaking any lines and performing tasks such as welding, grinding, or other contaminant producing activities, the appropriate portion of the system should be flushed and refilled with clean oil of the proper type. Valve spools should be checked at regular intervals for free operation and evidence of sticking due to varnish buildup or scoring. Solenoids should be replaced at 12- to 24-month intervals. After any failure associated with a possible overvoltage condition, all transient suppression devices should be checked or replaced. As with any shipboard system, regular inspections should be made and any leaks or loose mechanical or electrical connections investigated and corrected at the earliest opportunity. *All* valves, particularly dump valves or bypass valves, should be exercised *regularly*.

Steering gear is typically of a heavy-duty design and is capable of years of satisfactory service. Regular preventive maintenance can help to protect a large financial investment in steering equipment, the vessel, and the cargo, and to prolong the safe and efficient service life of the system.

"We may be tossed upon an ocean where we can see no land—nor, perhaps, the sun or stars. But there is a chart and a compass for study, to consult and to obey. The chart is the Constitution."

—Daniel Webster

Chemical Transportation Advisory Committee Gears Up

R. H. Trainor

The Chemical Transportation Advisory Committee (CTAC), organized in 1949, advises the Coast Guard on water transportation of hazardous materials in bulk. Over the years, CTAC has been active in developing existing water transportation regulations, including those for chemical tankships, liquefied gas ships, and waterfront facilities.

Organization

The Secretary of Transportation renewed CTAC's charter in April 1987 and approved the list of new members in May 1987. Under the charter, CTAC is composed of not more than 25 regular members who are appointed by the Commandant of the Coast Guard, subject to the approval of the Secretary of Transportation. CTAC members serve for a term of 3 years or until replaced by the Commandant. The terms are staggered with approximately one-third of the terms expiring each year. Since CTAC is now gearing up after a period of inactivity, the new members have been appointed for terms of either 1, 2, or 3 years to reestablish the proper rotation.

CTAC members nominate a Chairman who is responsible for conducting the meetings and preparing CTAC's reports to the Coast Guard. The members may also nominate a Vice-Chairman who assists the Chairman as necessary.

CTAC reports to the Chief, Office of Marine Safety, Security and Environmental Protection, who acts as CTAC's sponsor. The Chief of the Marine Technical and Hazardous

Mr. Trainor is a Chemical Engineer in the Hazardous Materials Branch, Office of Marine Safety, Security and Environmental Protection, U.S. Coast Guard.

Materials Division, as CTAC's Executive Director, oversees the management of CTAC.

Organization of Subcommittees

The Chairman, with the approval of the sponsor, may establish subcommittees to work on specific projects. The subcommittees typically will conduct studies, discuss proposals, and recommend regulatory standards to the main committee. Even though the chairman of each subcommittee must be a member of CTAC, anyone with an interest and willingness to serve can volunteer as a member of a CTAC subcommittee. The CTAC subcommittees provide interested members of the public with a very effective way to participate in the various CTAC projects.

First Meeting Held in June

After the charter was renewed, CTAC held its first meeting on June 16, 1987, at Coast Guard Headquarters in Washington, DC. Mr. Alexander Delli Paoli of Exxon Company International was nominated as Chairman and Mr. Robert Conn of Shell Oil Company as Vice-Chairman. The primary goal of this first meeting was to discuss upcoming CTAC projects. To that end, Coast Guard personnel made short presentations on relevant topics:

- vapor recovery systems for tank barges and ships;
- an occupational health and safety program for marine personnel;
- venting and gas freeing of cargo tanks;
- revision of 46 CFR Part 151, regulations for unmanned barges carrying bulk chemicals;
- carriage of coal in bulk;
- carriage of bulk chemicals on offshore supply vessels;
- filling requirements for liquefied gas vessels;
- revision of 33 CFR Part 126, regulations for waterfront facilities;
- implementation of MARPOL Annex II for vessels and facilities; and
- implementation of MARPOL Annex II for packaged materials.

CTAC decided to look more closely at the first three topics and requested that the Coast Guard provide detailed task statements for each of the three. CTAC will review these statements and agree upon the organization of subcommittees by the fall of 1987. Remaining topics will be discussed at a later date.

Public Participation Encouraged

All meetings of CTAC and its subcommittees are open to the public. Notices of all committee and subcommittee meetings are published in the Federal Register. The Coast Guard encourages interested members of the public not only to attend, but also to actively participate, particularly on the subcommittees. Again, subcommittee membership is open to anyone with the interest, expertise, or willingness to serve.

For those who would like additional information about serving on CTAC or its subcommittees, please contact Commander R. W. Tanner or Mr. R. H. Trainor, Commandant (G-MTH-1), U.S. Coast Guard, 2100 Second Street, SW, Washington, DC 20593-0001; telephone (202) 267-1577.

Lessons from Casualties

Confined Space Hazards

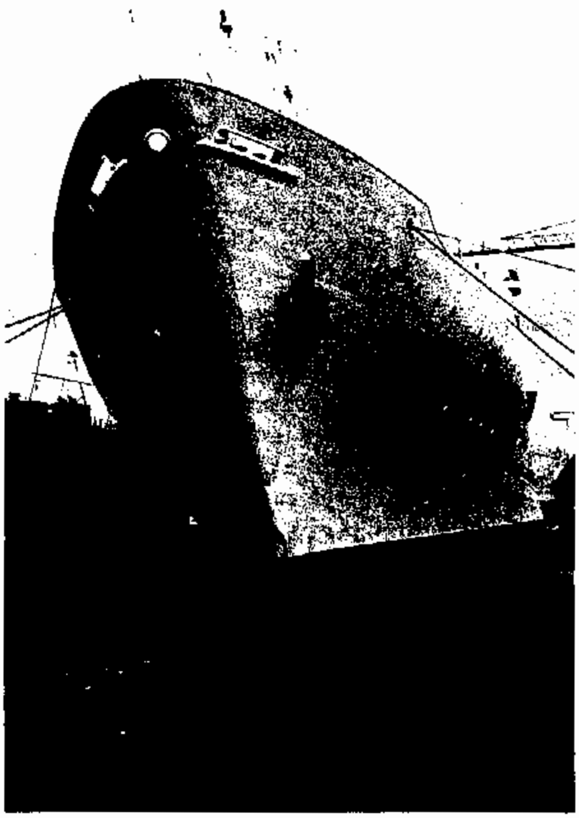
LCDR Christopher Walter

September 1984, Norfolk, Virginia: A dockworker climbed into a barge that was loaded with corn, passed out, and died. One after another, five would-be rescuers went to his assistance and passed out or were affected and had to be hospitalized. Nitrogen dioxide, a deadly gas formed by fermenting grain, and lack of oxygen were suspected of causing the death and injuries.

A person being overcome and his would-be rescuers also falling victim is unfortunately an oft-repeated scenario. In November 1972, a review of Coast Guard casualty files found that the Chief Mate of the **SS William T. Steele** was working in a cargo tank when benzene began leaking into the tank. Instead of leaving the tank, the Chief Mate tried to stop the leak and was overcome by benzene fumes. The Master and Second Mate attempted to rescue him; all three men died. The Second Mate did not use any respiratory protection. The Master used a fresh-air breathing apparatus with a safety line; he took it off and tried to pass it to the Second Mate. Both men were overcome by the benzene fumes and fell to the bottom of the tank, where they died.

Despite experience, training, and safety programs, the dead men on the **SS William T. Steele** failed to fully observe several basic safety precautions and took actions which became irreversible.

September 1984, Norfolk, Virginia: The **Veracruz I**, a passenger liner on the blocks in drydock, capsized when the drydock failed. As a result of the capsizing, sewage from a treatment tank back-flooded into the crew quarters and sewage gases killed one man. The dead man was trapped in his room when several crates fell against his door. He escaped from the room by kicking out a door panel, only to be overcome. Hydrogen sulfide was the suspected killer. For more information on this incident, see the March 1985 issue of *Proceedings*, page 67.



The capsized Veracruz I. *(Photo courtesy of the author)*

LCDR Walter is Chief of the Investigations Department, U.S. Coast Guard Marine Safety Office, Hampton Roads, Virginia.

September 1985, Cambridge, Maryland: A company supervisor entered a barge compartment and passed out. A second man called for help before going to his rescue and losing consciousness. A third man yelled for help before he tried a rescue. He passed out, too. Rescue workers pulled all three men out and revived them. They were treated and released from a hospital. The compartment had been sealed for 4 years, and the internal surfaces had rusted. The rusting process used up oxygen in the space until there was not enough left to support life.

November 1986, Jacksonville, Florida: Methane and hydrogen sulfide gas were released and four crewmen were killed on the **Scandinavian Sky**, another cruise ship in drydock. All four crewmen were working on a sewage holding tank when one of them apparently opened a valve, allowing deadly hydrogen sulfide gas to escape.

Every time you enter a tank or other confined space, you take the risk that you will not come out alive. Every time tanks or other spaces are opened, there is a chance that fumes will spill out -- fumes that are explosive, poisonous, or that displace enough oxygen to disable and kill. The experienced mariner and dockworker are also at great risk when their familiarity with barges, tanks, and holds dulls them to the dangers of confined space entry.

Also, just because a tank is not carrying chemicals or fuel does not mean that it is safe. Many organic materials release poisonous gases when they oxidize. Some tank coatings and paints give off noxious or poisonous fumes. Fumigants collect in low spots in cargo holds. Rusting can remove enough oxygen from a space's atmosphere to kill the unprotected, unsuspecting mariner, especially in spaces that are small in volume and large in surface area. Spaces which can harbor deadly gases or are lacking in oxygen include tanks of all descriptions: cofferdams, condensers, idle boilers, fish holds with ammonia refrigeration systems, large sumps, stacks and sewage treatment systems. All confined spaces should be treated as dangerous.

To enter a confined space safely, it must be checked for oxygen deficiency, poisonous gases, and residues that might produce toxic materials under existing atmospheric conditions. If work will be done that involves welding, flames, or spark production, additional precautions must be taken to prevent fire and/or explosion. These checks are done by certified marine chemists following the provisions of the National Fire Protection Association pamphlet No. 306, "Standard for the Control of Gas Hazards on Vessels To Be Repaired." On vessels which are at sea with no marine chemist available, the senior officer present is required to make these inspections. If the space has not been tested and certified as safe for workers, it is simply not safe to enter unless protective equipment is used, with trained and properly equipped persons standing by to assist.

Be careful when you enter any confined space.▪

Maritime Notes

Naval Essay Contest Announced

The U.S. Naval Institute (USNI), based in Annapolis, Maryland, has announced the prize list for its upcoming annual Arleigh Burke Essay Contest. The first prize will be $2,000, a gold medal, and a life membership in the USNI, the 113-year-old association for naval professionals. Two honorable mention winners will also receive prizes. The first honorable mention winner will be awarded $1,000 and a silver medal, and the second honorable mention winner will be awarded $750 and a bronze medal.

The essays must be on a subject which furthers the Naval Institute mission, "The advancement of professional, literary, and scientific knowledge in the naval and maritime services, and the advancement of the knowledge of sea power." Anyone who wishes to enter may do so. Entries must be original, unpublished essays. They must be typed, double-spaced, and should not exceed 4,000 words.

Entries should be mailed to Publisher (ABEC), U.S. Naval Institute, Annapolis, MD 21402, and must be received no later than December 1, 1987.

Winning essays will be published in the USNI's monthly magazine, Proceedings. Essays that are not selected for prized may be purchased for future use.

For more information, contact the Naval Institute at (301) 268-6110, extension 247, or send a self-addressed, stamped envelope to ABEC Rules, Membership Department, Annapolis, MD 21402.

New Device to See Through Smoke Evaluated

The scene: a Navy ship in dock undergoing overhaul. The situation: a fire has broken out in an unmanned space. The watch sees smoke, sounds the alarm, and the fire party arrives to find the space filled with smoke. The fire is still small and could be relatively easy to fight, if found quickly. However, due to the dense smoke, time is lost in finding the fire and, by the time that it is located and extinguished, considerable damage has been done.

Recently, a similar situation occurred aboard an aircraft carrier, but with one major difference -- a new infrared imaging device permitted the fire party to see through the thick smoke. Within seconds, the fire was located and, before it had a chance to grow, it was extinguished.

The device used in this incident was the Naval Firefighter's Thermal Imager (NFTI). Navy combatant ships are now receiving NFTIs as a result of a 4-year evaluation and testing program by a team of scientists at the Naval Research Laboratory (NRL). The first units have already been delivered to aircraft carriers homeported on the East Coast.

The NFTI consists of a hand-held imager, which is operated similar to a video or move camera, and a small power unit, which is slung around the neck or over the shoulder. The imager looks somewhat like a one-gallon can with a pistol grip. It has a TV-type viewing screen that shows black and white images of everything in the smoke-filled compartment. Instead of ordinary light, the imager uses heat emitted by fires, people, or objects so that these can be seen in total darkness or through thick smoke.

The imager contains an infrared sensitive TV camera tube (called a pyroelectric vidicon) and a small television display that is viewed by the operator. The power supply, about the size of a thick paperback book, uses common AA batteries. The device is enclosed in a polycarbonate plastic case and measures 6-1/2 inches in diameter by 10-1/2 inches long. The images weighs about 7 pounds, and the battery power unit adds approximately 2 more pounds.

For more information, contact Mr. R. Fulper, Code 1005.4, Naval Research Laboratory, Washington, DC 20375; telephone (202) 767-3744.

(Reprinted from Navy Domestic Technology Transfer Fact Sheet, *April 1987.)*

Coast Guard Cutters Become Artificial Reefs

The Maritime Administration has authorized the transfer of three vessels to the State of Florida for use as an offshore artificial reef for the conservation of marine life.

The vessels are the ex-USS **Rankin**, located at the James River Reserve Fleet, Fort Eustis, Virginia, and Coast Guard cutters **Bibb 9** and **Duane**, located in Boston, Massachusetts.

Florida has certified that the vessels will be properly prepared before sinking; that they will be accepted at their present location in "as is, where is" condition; and that the state will secure all licenses and permits which may be required under other applicable federal and state laws.

The use of surplus ships for artificial reefs is authorized by Public Law 92-402, as amended.

Production Begins on Safety and Survival at Sea Videotape Series

The North Pacific Fishing Vessel Owner's Association (NPFVOA) has entered show business. The Seattle-based association of Bering Sea crab and trawl fishermen began production of a series of cold water safety and survival videotapes in mid-July.

The videotape series represents the third phase of the NPFVOA's Vessel Safety Program. Slated for completion in mid-October 1987, the videotapes will address four subject areas: Safety Equipment and Survival Procedures, Fire Prevention and Control, Medical Emergencies at Sea, and Fishing Vessel Stability.

Undertaken with the funding and support of the National Marine Fisheries Service and the U.S. Coast Guard, the Vessel Safety Program represents an industry-government collaboration aimed at reducing fishing vessel casualties. The program began with publication of the Vessel Safety Manual, a 300-page document that comprises the operational half of the Voluntary Safety Standards for U.S. commercial fishing vessels.

The program's second phase was the establishment of the Crew Training Program, a series of hands-on safety and survival courses for commercial fishermen and other mariners. The videotapes, which will parallel the NPFVOA manual and training program, are intended to provide refresher training for those who have completed the other phases of the program, or to serve as stand-alone training aids for those who haven't.

For information about the videotapes or the other components of the Vessel Safety Program, write the NPFVOA Safety Office at Building C-3, Room 207, Fisherman's Terminal, Seattle, WA 98119; telephone (206) 283-0861.

Ship Values for War Risk Insurance

The Maritime Administration published in the Federal Register its biannual notice of determination of ship values for War Risk Insurance.

These values, effective January 1, 1987, constitute compensation for specific vessels listed. They were computed in accordance with sections 902(b) and 1209(a)(2) of the Merchant Marine Act, 1916, as amended.

MARAD's war risk insurance program insures operators and mariners against losses resulting from war or warlike actions during periods when commercial insurance is not available on reasonable terms and conditions. The authority to issue such war-risk insurance expires on June 30, 1990, under Public Law 99-59.

MARAD Reports Available

Report on Automatic Marine Telephone System

The Maritime Administration has announced the availability of the final report, "Testing of the Prototype Automatic Marine Telephone System." The system was designed to provide inland waterways communications along the Mississippi, Ohio, and Illinois Rivers, as well as the inland canal of the Gulf Coast. The project was jointly funded by MARAD and Waterway Communications Systems, Inc.

Copies of the report may be obtained from the National Technical Information Service, 5285 Port Royal Road, Springfield, Virginia 22152. The order number is PB87-207270/AS; the price is $13.95.

Arctic Deployment of the Coast Guard Cutter Polar Sea

"Arctic Deployment of the Coast Guard Cutter Polar Sea -- Winter 1983," conducted by ARCTEC Offshore, Inc., is a four-volume report on arctic marine transportation describing the voyages of the U.S. Coast Guard cutter **Polar Sea** from the ice edge to Wainwright, Alaska, from March to May 1983. The voyage of the **Polar Sea** was the fifth phase of an assessment program on the feasibility of a year-round transportation system, including offshore structures, serving Alaska.

Between 1979 and 1987, MARAD and other sponsors conducted an Arctic Marine Transportation Program to reduce the risks associated with arctic marine transportation. Full-scale deployments on the Coast Guard's Polar Class icebreakers were planned to define arctic environmental conditions, to obtain data to improve design and operating criteria, and to demonstrate the operational feasibility of commercial icebreaking ships along possible future arctic marine routes.

Copies of the four-volume report, or copies of individual volumes, may be ordered from the National Technical Information Service, 5285 Port Royal Road, Springfield, Virginia 22152. Order numbers are as follows: Executive Summary, number PB87-185286/AS, price $13.95. Environmental Data, number PB87-185294/AS, price $30.95. Trafficability Tests, number PB87-185302/AS, price $42.95.

Instrumentation and Computer Software Documentation, number PB87-185310/AS, price $11.95. The full four-volume set, order number PB87-185278/AS, can be obtained for $85.00.

Vessel Inventory Report

The Maritime Administration has updated its semi-annual report, "Vessel Inventory Report as of January 1, 1987." The report contains information on all United States-registered oceangoing merchant ships of 1,000 gross tons and over. The report is in five parts.

Part I contains an alphabetical listing by vessel name of all merchant ships in the U.S. merchant fleet, whether privately or government owned, showing each vessel's type, owner or operator, design type, deadweight tonnage, and year built.

Part II provides an alphabetical listing by owner or operator, together with their respective vessels, of all merchant ships in the U.S. fleet, whether privately owned or government owned, showing each vessel's type, design type, deadweight tonnage, and year built. The total number of vessels and total deadweight for each owner/operator is also listed.

Part III lists merchant and military vessels in lay-up at each Reserve Fleet Site maintained by MARAD, with the design type summaries for each site, and for the Reserve Fleet as a whole.

Part IV lists military vessels currently in the National Defense Reserve Fleet by name, type, reserve fleet site, and design type.

Part V lists military and privately owned vessels currently in custody of the National Defense Reserve Fleet by vessel, type, reserve fleet site, and design type.

Copies of the report may be obtained from the Maritime Administration, Office of External Affairs, Room 7219, 400 Seventh Street, SW, Washington, DC 20590.

Stern Design

"Stern Design of Fine-Formed Single-Screw Ships," prepared by Webb Institute of Naval Architecture under MARAD's University Research Program, describes practical procedures to satisfy stern design requirements of efficient propulsion, minimal vibrations, good steering control and direction stability, seakeeping, adequate structural strength, and deck space.

The report includes early design equations for propulsive efficiency, characteristics of the propeller and rudder, cavitation avoidance criteria, blade-frequency pressure forces, and blade tip clearance. The report offers advice on choices of stern section shapes.

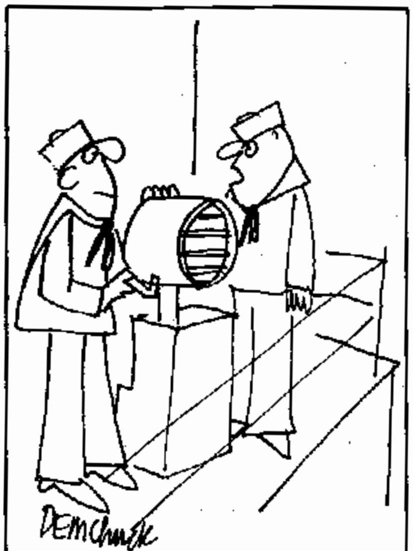
This document may be ordered from the National Technical Information Service, 5285 Port Royal Road, Springfield, Virginia 22152. The order number is PB87-184180/AS; the price is $13.95.

Ship Hull Ultimate Strength

"Experimental Investigation of Ship Hull Ultimate-Strength Using Large Scale Models," prepared by the University of California, Berkeley, under MARAD's University Research Program, summarized result of an experimental study to determine the ultimate strength of ship hull box girders using two large-scale models.

Test results indicated that an effective sectional modulus concept would be a simple but effective method to estimate hull strength. They also indicate that the main longitudinal strength girders control hull strength.

This document may be ordered from the National Technical Information Service, 5285 Port Royal Road, Springfield, Virginia 22152. The order number is PB87-184404/AS; the price is $18.95.



"Maybe what you're trying to say, Joe, just can't be said in this medium."

Chemical of the Month

Brett Alexander

Dichloropropane

At the length of 15 letters, "dichloropropane" is rarely used in day-to-day conversations. But if you've ever used antiknock fluid in your automobile or used an industrial-strength spot remover to get the mustard out of your shorts, then you've used dichloropropane. A member of the halogenated hydrocarbon family, dichloropropane is a colorless, water-insoluble liquid with a chloroform aroma.

In addition to being used as a lead scavenger in antiknock fluids, dichloropropane is used as a soil fumigant for the protection of fruit and nut crops, field crops, beets and tobacco against nemotodes; during rubber compounding and vulcanizing operations; and in the extraction processing of fats, oils, lactic acid, and petroleum waxes. Apart from being able to take the mustard out of your shorts, dichloropropane can take the paint and varnish off your walls, can be used in cleaning and degreasing, and is used in manufacturing tetrachloroethylene and propylene oxide.

The first step in controlling a spill or leak of dichloropropane is to remove all ignition sources. Second, the area of the spill must be ventilated. Anyone working in a vapor concentration over 75 ppm of dichloropropane is required to wear some form of respiratory protection, such as a self-contained breathing apparatus. In a concentration greater than 2000 ppm, a self-contained breathing apparatus with a full facepiece, operated in pressure-demand or another positive pressure mode, is required. Rubber gloves and protective clothing should be worn to prevent contact with the liquid. For a small spill, the chemical can be absorbed with paper towels and evaporated in a safe place, such as a fume hood. A larger spill can be collected and atomized in a suitable combustion chamber equipped with an effluent gas cleaning device. Dichloropropane should not be allowed to enter a confined space, such as a sewer, because of the risk of explosion. If a spill does occur, the National Response Center must be contacted at 1-800-424-8802.

Overexposure to dichloropropane causes eye and skin irritation and may cause drowsiness or lightheadedness. If the chemical gets on your skin, promptly wash the contaminated area with soap and water. Any clothing that becomes wet with the liquid should be removed immediately. If the chemical gets into your eyes, flush them with large amounts of water, lifting the upper and lower lids occasionally. If irritation persists in either of these two cases, get medical help. If large amounts of the vapors are inhaled, move the exposed person to fresh air immediately, perform artificial respiration if breathing has stopped, and get medical help as soon as possible. Lastly, if the chemical is swallowed, get the afflicted person to vomit. Administering syrup of ipecac, as directed on the package, may be helpful in this procedure.

Fires involving dichloropropane can be extinguished by using CO_2, dry chemical, foam, or a water fog. As highly toxic hydrogen chloride gas is a combustion product of dichloropropane, fire parties should wear body and respiratory protection.

Dichloropropane is generally stable; however, it does corrode aluminum and can react vigorously with oxidizing agents such as chlorine and oxygen. Therefore, it is stored and shipped in sealed containers and is regulated by the Coast Guard as a Subchapter O commodity for shipment under Title 46 of the Code of Federal Regulations. The Department of Transportation assigns dichloropropane a

Brett Alexander was a Third-Class Cadet at the Coast Guard Academy at the time this article was written. It was written under the direction of LCDR J. J. Kichner for a class in hazardous materials transportation.

hazard rating of 3.2, meaning that it is an inflammable liquid.

Chemical Name
Dichloropropane

Formula
$CH_3CHClCH_2Cl$

Synonyms
propylene chloride
propylene dichloride
propylidene chloride

Physical Properties
boiling point: 96°C (205°F)
freezing point: -80°C (-112°F)
vapor pressure: 46°C (115°F), 2.5 psia

Threshold Limit Value
75 ppm

Flammability Limits in Air
3.4 - 14.5 percent

Combustion Properties
flash point: 65°F
autoignition temperature: 1035°F

Densities
vapor (air = 1): 3.89

U.N. Number: 1279

CHRIS Code: DPP

Cargo Compatibility Group: 36
(Halogenated Hydrocarbons)

Nautical Queries

The following items are examples of questions included in the Third Mate through Master examinations and the Third Assistant Engineer through Chief Engineer examinations:

Engineer

1. A common-emitter circuit has an input voltage of 0.1 volt, an output voltage of 2.0 volts, an input current of 0.5 milliamps, and an output current of 10 milliamps. What is the power gain?

A. 20
B. 40
C. 400
D. 4,000

Reference: Grob, *Basic Electronics*, 3rd Ed.

2. The aftercooler on a particular crosshead engine had to be secured due to excessive leakage. What should be done to permit continued engine operation with this condition?

A. Bypass the aftercooler and run normally.
B. Run at the reduced speed until the cooler can be repaired or renewed.
C. Switch to diesel fuel (light oil) and run at normal speed.
D. Nothing special need be done since the heating value of heavy fuel is sufficiently low.

Reference: Pounder, *Marine Diesel Engines*, 5th Ed.

3. Where do you purge air from a refrigeration system?

A. Expansion valve
B. Filter/drier
C. Evaporator
D. Condenser

Reference: NAVSHIPS, Bureau of Ships Technical Manual, Sections 59-115 & 59-152

4. In accordance with Coast Guard regulations, each electric cable for an intrinsically safe system must be _________.

A. 2 inches (50 mm) or more from other intrinsically safe circuits
B. partitioned by a non-grounded, non-ferrous barrier from other non-intrinsically safe electric cables
C. a shielded cable
D. all of the above

Reference: 46 CFR 105-11

5. The type of boiler fuel oil system, in which a portion of the oil supplied to the burners is normally returned to the suction side of the fuel oil pump while steaming, would be termed _________.

A. direct mechanical
B. steam atomized
C. return flow
D. all of the above

Reference: NAVPERS 10535-F, Boiler Technician 3 & 2

Deck

1. When using a buoy as an aid to navigation, which of the following should be considered?

A. The buoy should be considered to always be in the charted location.
B. If the light is flashing, the buoy should be considered to be in the charted location.
C. The buoy may not be in the charted position.
D. The buoy should be considered to be in the charted position if it has been freshly painted.

Reference: Chapman, *Piloting, Seamanship, and Small Boat Handling*

2. Which of the following is a proper size block to use with a 3-inch circumference manila line?

A. 6-inch cheek, 4-inch sheave
B. 8-inch cheek, any size sheave
C. 9-inch cheek, 6-inch sheave
D. at least 12-inch sheave

Reference: Cornell and Hoffman, *American Merchant Seaman's Manual*

3. The dumping of refuse in a lock is permitted _________.

A. when approved by the lockmaster
B. when locking downbound
C. at no time
D. during high water only

Reference: 46 CFR 207.300

4. Shell plating is _________.

A. galvanizing the steel
B. hatch covers
C. outer plating of a vessel
D. synonymous with decking

Reference: Baker, *Introduction to Steel Shipbuilding*

5. What dayshape should a vessel being towed exhibit if the tow *exceeds* 200 meters?

A. Two balls
B. Two diamonds
C. One ball
D. One diamond

Reference: International Rules, Rule 24; COMDTINST M16672.2A

Answers

Engineer
1-C; 2-B; 3-D; 4-C; 5-C
Deck
1-C; 2-C; 3-C; 4-C; 5-D

If you have any questions concerning "Nautical Queries," please contact Commanding Officer, U.S. Coast Guard Institute (mvp), P.O. Substation 18, Oklahoma City, Oklahoma 73169; telephone (405) 686-4417.

Keynotes

Final Rules

CGD 86-100, Compatibility of Cargoes (June 4)

This rule amends the requirements for compatible stowage of bulk liquid hazardous materials on tank vessels by adding materials recently authorized by the Coast Guard for carriage and by making minor technical changes. This action updates the current regulations and better informs persons loading bulk liquid chemical cargoes of their compatibility.

The effective date of this rule is July 6, 1987. For further information, contact Dr. Michael C. Parnarouskis, Hazardous Materials Branch, Office of Marine Safety, Security and Environmental Protection, (202) 267-1577.

CGD 86-032, Financial Responsibility for Offshore Facilities; Change of Address (June 18)

This final rule changes the filing address for applications for Outer Continental Shelf (OCS) offshore facility Certificates of Financial Responsibility (COFR). This action results from the recent Coast Guard reorganization of the program which transfers the application processing responsibilities from the Eighth Coast Guard District Office in New Orleans, Louisiana, to U.S. Coast Guard Headquarters, Washington, DC. The intended effect of the reorganization is to improve efficiency and service to the offshore industry in the processing of applications for OCS offshore facility COFRs, and provide centralized management of all correspondence pertaining to administration of the Offshore Oil Pollution Compensation Fund.

This rule is effective August 3, 1987. For further information, contact Frank A. Martin, Jr. (202) 267-0518.

Notice of Proposed Rulemaking

CGD 84-098a, Self-Inspection of Fixed OCS Facilities (July 7)

The Coast Guard is proposing to issue regulations concerning the inspection of fixed facilities on the Outer Continental Shelf (OCS). Presently the regulations state that each OCS facility is subject to an annual on-site inspection by the Coast Guard. This rulemaking proposes to require the owner or operator of fixed OCS facilities to conduct an inspection at intervals not to exceed 12 months and report the results of that inspection to the Coast Guard. This proposal would allow the required annual inspection to be conducted incident to other owner/operator inspections, maintenance, or operations. The Coast Guard would focus the efforts of available marine inspectors on inspections of manned fixed facilities, particularly those which have a poor safety record and would perform additional inspections of other fixed OCS facilities sufficient to provide oversight of the self-inspection program.

Comments on the proposed rulemaking were due on August 21, 1987. For further information, contact LCDR Alan J. Cross, Office of Marine Safety, Security and Environmental Protection, (202) 267-2307.

CGD 84-044, Hazardous Materials Used as Ships' Stores On Board Vessels (July 7)

The Coast Guard is proposing to revise the rules for hazardous materials used as ships' stores on board vessels. Except for minor amendments, the present rules have remained unchanged since January 18, 1941. Many of the citations, terms, and definitions have become outdated. This revision would update the text. Also, it would cross-reference existing Department of Transportation hazardous materials regulations and Consumer Product

Safety Commission labeling regulations to reduce the paperwork burden for industry and the Coast Guard, while maintaining the current level of safety. Materials presently listed which are no longer used as ships' stores would be removed.

Comments must be received on or before October 5, 1987. For further information, contact Mr. C. Rivkin, Hazardous Materials Branch, Office of Marine Safety, Security and Environmental Protection, (202) 267-1217.

Advance Notice of Proposed Rulemaking

CGD 86-025, Equipment Standards for Uninspected Fish Processing Vessels (July 9)

This rulemaking will implement the provisions of the Commercial Fishing Industry Vessel Act which requires development of regulations for uninspected fish processing vessels that enter into service after December 31, 1987, and carry more than 16 persons who are primarily employed in the preparation of fish or fish products. The response to this advance notice will help the Coast Guard determine the appropriate standards to propose for this class of vessels.

Comments must be received on or before September 8, 1987. For further information, contact LCDR William J. Morani, Jr., Standards Development Branch, Office of Marine Safety, Security and Environmental Protection, (202) 267-1055, between the hours of 7:00 a.m. and 3:30 p.m.

Notice of Meeting

CGD 87-050, Lower Mississippi River Waterway Safety Advisory Committee Meeting (July 29)

A meeting of the Lower Mississippi River Waterway Safety Advisory Committee was held on Tuesday, August 18, 1987, in the World Trade Center, 2 Canal Street, New Orleans, Louisiana.

The purpose of this Advisory Committee is to provide consultation and advice to the Commander, Eighth Coast Guard District, on all areas of maritime safety affecting this waterway.

Additional information may be obtain from Commander V. O. Eschenberg, Executive Secretary, Lower Mississippi River Waterway Safety Advisory Committee, c/o Commander, Eighth Coast Guard District, Room 1341 Hale Boggs Federal Building, 500 Camp Street, New Orleans, LA 70130-3396; telephone (504) 589-6901.

Final Rule - Correction

CGD -83-039, Vessel Financial Responsibility for Pollution Liability, Correction (July 30)

On October 11, 1983, the Coast Guard published a rule which requires vessels to prove financial responsibility in case there is a pollution incident. The appendix shows various forms, one of which, CG-5358-2 (6-83), appearing at 48 FR 46214 contains an error.

The first paragraph of Form CG-5358-2 (6-83) appearing at 48 FR 46214 reads, "The amount of liability insured herein is $300 per gross ton or $25,000, whichever is greater, per vessel, in any one incident." It is clear elsewhere in the rule and in the form itself that the liability amount is $250,000, not $25,000. This error has only recently been recognized.

Accordingly, this notice corrects that $25,000 figure to read $250,000. The figure appears on page 518 of 33 CFR Parts 1 to 199 (33 CFR Part 132) in the first column, 14 lines down in the first paragraph of the form.

For more information, contact Bruce P. Novak, U.S. Coast Guard (G-CMC), 2100 Second Street, SW, Washington, DC 20593-0001; telephone (202) 267-1477.

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