Proceedings
of the Marine Safety Council

Vol. 43, No. 3

United States Coast Guard

March 1986

Proceedings

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Automated propulsion throttle runaways have resulted in damage similar to that sustained by this vessel. The article on page 43 presents some of the Coast Guard's findings on this safety problem. (Official U.S. Coast Guard photo)

More on Propulsion Throttles

LT Peter L. Randall
Marine Technical and Hazardous Materials Division
U.S. Coast Guard

The April 1985 edition of **Proceedings** included a brief article on automated propulsion throttle runaways. It warned of a potential safety problem caused by the failure of propulsion throttle controls and stated that the Coast Guard was trying to identify a specific common cause or causes for the problem. About the same time, early 1985, the Coast Guard's Office of Merchant Marine Safety issued a "safety advisory" on throttle runaways to the industry and to Coast Guard marine inspectors.

Why These Actions Were Taken

In late 1984, the Office of Merchant Marine Safety learned of a nearly disastrous throttle runaway on a foreign flag tanker that was offloading overseas. At the same time, details of implementing the new SOLAS Regulation II-1/31.2.7 were under consideration. This regulation requires propulsion controls on new vessels in international service to maintain the preset speed and direction of thrust upon failure and to sound an alarm. As a result of the reported runaway and the new regulation, the Coast Guard looked more closely at past casualty information. Some definite trends were noticed, and the safety advisory was issued.

The Seriousness of the Problem

To date, there have not been any injuries, but there has been substantial property damage. The following examples occurred between 1972 and 1985, and speak for themselves.

- A steam vessel's throttles failed and ran away while moored. Lines parted, and the gangway was destroyed.
- A steam vessel's throttles ran away while locked in the Panama Canal. Quick closure of the main steam stop by the crew avoided major damage.
- A steam tanker's throttles ran away while discharging oily ballast while moored. Substantial pollution resulted.
- A steam tanker's throttles ran away while moored and preparing to offload cargo. Mooring lines parted, and the loading arms were destroyed.
- The controllable pitch propeller (CPP) control system on a large passenger vessel failed while mooring, resulting in full propeller pitch and the ramming of another passenger vessel.
- A Navy auxiliary's steam throttles ran away while moored. The lines parted, and another vessel was rammed.
- A vessel's CPP propulsion control system failed while mooring. The vessel's stem was laid open when it rammed the pier.
- A diesel tanker's throttles ran away while picking up the pilot. No injuries or damages were reported.

The list goes on, and the Coast Guard is presently evaluating casualties that occurred in 1985. Casualties have occurred to steam, diesel, and CPP propulsion systems, and both electronic and non-electronic propulsion control systems have failed.

Causes

Based on the information available from the casualty reports, some common causes have been identified.

One particularly dangerous cause is the failure of feedback components in automatic shaft speed control systems. In this type of system, the operator's throttle setting is compared to either the shaft speed and direction, or to the throttle's position, and the difference is automatically amplified and used to open or close the throttle. Such governing systems are common for automated steam throttles in the "maneuvering mode" and on both steam and diesel throttles having acceleration/deceleration programs. Unfortunately, some systems may be what control system engineers call "open-loop unstable," i.e., failure of the speed feedback signal results in maximum throttle. One manufacturer found that when a fuse supplying power to the feedback device opened, the throttle opened fully. Some operators have found that throttle valve position feedback potentiometers are unreliable on their vessels and have installed comparator circuits to detect and trip throttle runaways.

This vessel collided with the pier, damaging both. The captain ordered "stop," but the propulsion control system failed to "full ahead." (Official U.S. Coast Guard photo)

Controllable pitch propeller systems appear to have an "Achilles heel" similar to loss of feedback. These systems often establish propeller pitch setting by comparing the operator's throttle setting to a reference spring pressure, pneumatic pressure, or voltage. When the reference component or source fails, maximum propeller pitch is frequently the result, and the propulsion diesel eventually stalls.

Both of the above are examples of design flaws, i.e., they can be corrected by redesign. Problems of another sort, such as improper installation and break-in failures, usually manifest themselves at an early stage in a vessel's life. For this reason, regulatory bodies, owners, operators, shipyards, and system manufacturers scrutinize system performance during trial periods. As a result, few of the casualties reported to the Coast Guard have occurred to new vessels.

Unfortunately, lack of **proper** maintenance frequently appears to result in propulsion control casualties. In electrical control systems, common causes are dirty contacts, loose printed circuit cards, and improper handling of components. In pneumatic control systems, control air that is wet, dirty, and lacks proper lubrication can be the culprit.

The following is a list of causes that have led to throttle runaways:

Diode failure.
Limit switch failure.
Circuit card failure.
Sticking of control air valves.
Control air seal failure.
Speed feedback circuit failure.
Control air valve failure.
Feedback sensor failure.
Fuse failure.
Dirty contacts.
Synchro failure.
Partial or complete loss of power, air pressure, or hydraulic pressure to the throttle control system.

Runaway Prevention

The Coast Guard has initiated several actions in an attempt to prevent future propulsion runaways. The first action is to make industry aware of the problem through the safety advisory, mailouts, and articles such as this one. Second, the Coast Guard is stepping up its efforts to identify casualty trends at an early stage so that pre-emptive action can be taken. Third, a Notice of Proposed Rulemaking (NPRM) on Vital Systems Automation was published in the September 23, 1985, Federal Register. In it, the Coast Guard proposes to extend the failsafe propulsion control criteria of SOLAS to most new installations, and to require a failure analysis to ensure that obvious design flaws are not overlooked. For existing vessels, much of the burden rests with the operator to detect and correct design flaws. An operator who experienced a throttle runaway, and who responded to the Coast Guard's safety advisory, offered the following recommendations:

Operators should:

carry out a failure analysis of the propulsion control system. Find out what happens when components fail.

- institute operator training of all mates and engineers on automated vessels, reviewing operation of the throttle controls, protective devices, and trip systems.

- install a bypass line and orifice around the main steam stop on steam vessels so that the turbine can be warmed up with the main stop closed and steam limited by the orifice.

install a separate circuit to monitor shaft RPM versus operator setting.

Some additional recommendations from the Coast Guard include:

- confirming proper operation of local and remote emergency propulsion trip devices on a regular basis.

- following the manufacturer's recommended maintenance procedures closely.

- ensuring that local alternate propulsion controls are readily available, operable, and the engineers are familiar with them. Don't wait until the automatic controls fail in congested waters.

- sharing automated propulsion control problems, experiences, and recommendations with the Coast Guard and the rest of the maritime community.

There's no guarantee that we can prevent all casualties resulting from propulsion control failures. However, by having a better understanding of the problem, we can certainly minimize their occurrence and their effects, making navigation safer for everyone. For more information, call LT Peter Randall, U.S. Coast Guard, at (202) 426-2206.

Know Your HazMat Transportation Regulations

"...A shipment that is not prepared in accordance with the hazardous materials transportation regulations may not be offered for transportation by air, highway, rail or water. It is the duty of each person who offers hazardous materials for transportation to instruct each of his officers, agents and employees having any responsibility for preparing hazardous materials for shipment as to the applicable regulations..."

The above excerpt is from Title 49, Code of Federal Regulations (49 CFR), Hazardous Materials Regulations Section 173.1(b). To assist you in meeting your 49 CFR requirements, the Captain of the Port, New York, Hazardous Materials Office, will be holding a seminar on proper use of the regulations on March 20, 1986, on Governor's Island, New York. For further details, call the Captain of the Port, New York, Hazardous Materials Office at (212) 668-7909. Those interested in an in-depth, comprehensive presentation on the 49 CFR Hazardous Materials Regulations should contact Mr. David B. Goodman, Program Manager, Hazardous Materials Safety, Transportation Safety Institute, 6500 South MacArthur Boulevard, Oklahoma City, OK 73125; (405) 686-4824.

National Recreational Boating Safety Program

The Coast Guard has fiscal year 1986 funds available to provide financial assistance to national, nonprofit, public service organizations to help them conduct boating safety activities. This announcement seeks proposals for all types of projects that will promote boating safety on a national level. Innovative approaches are welcome.

Specific information on organization eligibility, proposal requirements, award procedures, and application forms (Standard Form 424) can be obtained by writing to Commandant (G-BP/42), U.S. Coast Guard, 2100 Second Street, SW, Washington, DC 20593 or by calling Mr. Ladd Hakes at (202) 426-1062.

Proposals for boating safety projects must be received by April 25, 1986.

The WHISKEY RUNNER

About 11:00 p.m. on October 27, 1984, the operator of the recreational motorboat WHISKEY RUNNER met some friends in Huntington Harbor, California, and launched the boat, which had been borrowed from Sundown Marine Company of Huntington Beach, California. The operator stated that after launching the WHISKEY RUNNER, they proceeded onboard the boat to a restaurant in Huntington Harbor and docked the boat at the restaurant about midnight. The operator said that he stayed at the restaurant until about 1:45 a.m. on October 28. Outside the restaurant, the operator met some other friends and invited them and their companions to join him on a cruise to the QUEEN MARY, a floating hotel in Long Beach, California. The operator and eight passengers, all of whom were in their twenties, boarded the WHISKEY RUNNER. None of the persons who had accompanied the operator to the restaurant earlier were onboard. Two of the passengers said that they all had been drinking alcohol.

The WHISKEY RUNNER proceeded out of Huntington Harbor, past the U.S. Naval Weapons Station, and through the waters of Anaheim Bay to the open waters of San Pedro Bay. The operator said that it was a calm, clear night, with no moon, but that he saw the North Star. He said that there was about a 1-foot chop. The WHISKEY RUNNER did not stop at the QUEEN MARY, and passengers said that they were not drinking alcohol while they were onboard the boat. The operator said that, during the voyage back from the QUEEN MARY, the eight passengers were all awake and sitting in the passenger area of the boat. He said that he was using the shore lights as reference markers for navigation and that the boat was making about 30 mph (26 knots) as it turned into the entrance to Anaheim Bay. He said that, as he made the turn into Anaheim Bay close to the west jetty, the shore lights were obscured by the west jetty rocks, and he did not see a 12-foot-diameter concrete mooring buoy in the U.S. Navy anchorage until the boat was nearly 5 to 10 feet from it. About 2:50 a.m., the WHISKEY RUNNER struck buoy 0-8 nearly head-on, demolishing the port bow. The WHISKEY RUNNER sank moments later.

Three passengers who had been sitting directly behind the operator (all facing aft) were thrown clear of the boat and survived. The other five passengers, who were sitting on the other side of the boat, did not escape from the boat and died. One survivor, who suffered a broken pelvis, swam to shore, climbed onto the west jetty, and attracted the attention of some persons fishing on the jetty. Meanwhile, another survivor put a survivor on top of the buoy and clung to the operator, who was seriously injured, and awaited rescue.

About 3:00 a.m., the Seal Beach, California, police were notified that someone was screaming for help on the west jetty. After arriving at the jetty, the Seal Beach police talked with the survivor and, about 3:30 a.m., notified the Orange County Sheriff's Department Harbor Patrol, the U.S. Coast Guard, the Orange County Fire Department, and the Long Beach Lifeguard Department of the accident. The Orange County Fire Department boat was the first rescue vessel to arrive at the buoy, and by 4:00 a.m., the crew had rescued the operator and the other two survivors near the buoy. All four survivors were taken to a local hospital by ambulance.

Also responding to the accident were a Coast Guard 41-foot utility boat, a Coast Guard helicopter, and two Orange County Harbor Patrol boats. At 4:30, the Orange County Harbor Patrol began diving operations to recover the other passengers, and by 8:30 a.m., their bodies had been recovered. The Harbor Patrol then recovered the boat and its engine, which had broken free of the boat.

Vessel Information

The WHISKEY RUNNER was a 20.4-foot-long fiberglass ski boat built by North Star Marine Company of Anaheim, California, in

This article is taken from the National Transportation Safety Board's marine accident report number NTSB/MAR-85/01/SUM. The Editor wishes to thank Mr. Ralph Johnson, NTSB, for his assistance in obtaining the text and photographs.

1983. The boat had a 454 cc, 350 hp, V8 Chevrolet inboard engine with a Berkley jet drive capable of propelling the boat at a maximum speed of about 55 mph (48 knots). The passenger area had six seats. Two seats faced forward, with the operator's seat on the port side. Behind the two forward-facing seats were four seats, two facing aft and two (on either side of the engine) facing forward. Since the WHISKEY RUNNER was more than 20 feet in length, it was not required by the Coast Guard to meet flotation requirements for small vessels nor was it required to have its maximum capacity (number of persons and maximum weight in pounds) marked on the hull.

The WHISKEY RUNNER was owned by a resident of Anaheim who had left it with Sundown Marine Company (Sundown) to sell. The operator of the WHISKEY RUNNER stated that he had arranged with Sundown to borrow the boat on October 27. Sundown did not provide the boat with any lifesaving or firefighting equipment, nor were they required by Coast Guard regulations to provide such equipment, as is the case for rental craft.

The operator of the WHISKEY RUNNER stated that he put six lifejackets into the boat, but none of the surviving passengers remembered seeing any lifejackets, and none was recovered by the Orange County Harbor Patrol or the Coast Guard. Coast Guard regulations (33 CFR 175.15) state that no person may use a recreational boat 16 feet or more in length unless there is a Coast Guard-approved personal flotation device aboard for each person plus one buoyant cushion.

Bow view (top) and stern view (bottom) of the WHISKEY RUNNER. (Photo courtesy of NTSB)

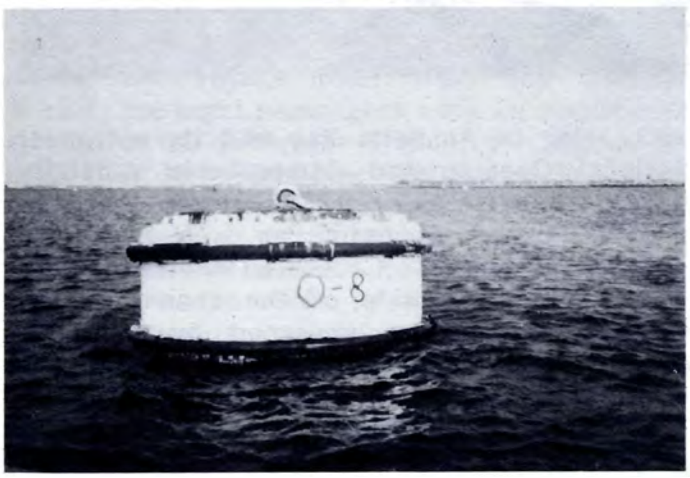
Waterway Information

The waters of Anaheim Bay constitute a danger zone (33 CFR 204.195). The recreational boater has a number of sources of information available that state the restrictions on boating in Anaheim Bay and its entrance. National Oceanic and Atmospheric Administration (NOAA) chart 18749 shows that the channel through Anaheim Bay is a restricted area regulated by 33 CFR 204.195 and that the area on the east side of the channel is an explosives anchorage governed by 33 CFR 110.215. The NOAA chart clearly shows the location of each mooring buoy located in the anchorage areas on either side of the channel.

Title 33 CFR 204.195 states that the waters between the east and west jetties and the contiguous basin and tidal channel are a danger zone and that no craft is authorized to transit the area without registering with and obtaining a decal from the Weapons Station. However, in fact, the decals are no longer issued or required. The U.S. Navy regularly patrols Anaheim Bay to keep vessels out of the anchorage. Speed limits in the channel are specified by 33 CFR 204.195, which states that vessels shall not exceed 8 knots (9.2 mph) in the outer harbor and 3 knots (3.5 mph) in the inner harbor. A 5-mph (4.3 knots) speed limit in both the inner and outer harbors actually is enforced. The U.S. Coast Pilot states that all the waters inside the jetties of Anaheim Bay are within a danger zone and that an explosives anchorage has been established.

The Orange County Harbor Patrol has posted a large sign at the launching ramp in Huntington Harbor indicating a maximum speed of 5 mph (4.3 knots) through the channel (restricted area) and regularly patrols Anaheim Bay for violations of the speed limits or other regulations. There also is a smaller, unlighted sign in the inner harbor showing the speed and other restrictions. However, there are no signs posted on the jetties to alert occasional visitors entering Anaheim Bay to the speed and other restrictions.

The U.S. Navy mooring buoy which the WHISKEY RUNNER struck was about 12 feet in diameter and rose about 5 feet out of the water. It was not lighted. The mooring buoy and others like it in Anaheim Bay are not lighted because the large chains used to moor ammunition vessels would destroy any lights as the vessels swung around the buoy. Furthermore, the buoys are in waters not open to public navigation. The channel is well-marked by various aids to navigation, both lighted and unlighted. There was a green lighted buoy and a fixed red light marking the ends of the jetties, two unlighted buoys about halfway to the inner harbor, and a fixed red light and an unlighted buoy at the entrance to the inner harbor. The channel is also provided with a lighted range[1] to navigate down the center of the channel.



Daytime photograph of U.S. Navy buoy 0-8. (Photo courtesty of NTSB)

Operator Information

The 28-year-old operator was from Seal Beach. He stated that he had worked on a commercial fishing vessel in Alaska for 3 years and had been in and out of Anaheim Bay approximately 10 times before the accident. He said that he did not know there were U.S. Navy mooring buoys outside the channel and that he had never looked at a chart of Anaheim Bay. The operator stated that he did not know what range lights were.

A test of a blood sample taken from the operator 3-1/2 hours after the accident by the Orange County Sheriff's Department showed that he had a blood alcohol concentration (BAC) of 0.11 percent. California's motor vehcle laws set a blood alcohol concentration of 0.10 percent as the lower threshold to be considered legally drunk.

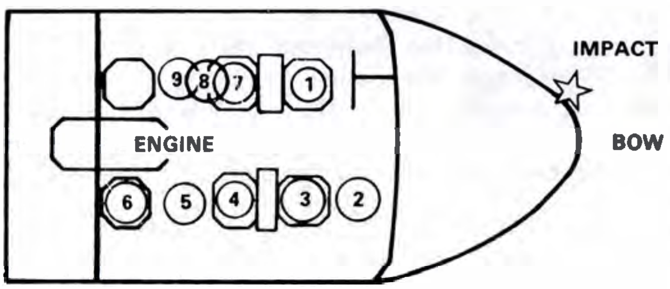
Injuries

The operator was in the left-front, forward-facing seat at the time of the accident. The location of the eight passengers at the time is not precisely known. However, it is believed that two passengers were in the right-front, forward-facing passenger seat (with one person on the lap of the other); three passengers were behind the operator, with one person in the aft-facing seat and the others on the deck facing aft; two passengers were behind the two passengers in the right-front forward-facing seat either in the aft-facing seat or on the deck facing aft; and a passenger was in the right-rear, forward-facing seat. The operator incurred a ruptured lower intestine, a fracture of the right femur, a fracture of the left humerus, and a fracture of the left ankle. Three passengers were thrown from the boat. One passenger had a broken pelvis, a concussion, multiple head and

[1] *Range lights are two fixed lights placed in line as an aid to navigation to indicate a safe track to steer. The rear light is placed higher but in the same vertical plane as the front light. Because of their fixed nature and the accuracy with which a vessel can be positioned by keeping the lights aligned, ranges are among the best aids to navigation.*

facial lacerations, bruised kidneys, and a ruptured spleen. One passenger incurred numerous muscle contusions and a torn tendon. The other passenger's injuries could not be determined. Divers found the fatalities in the following locations:

Passenger 2:	pinned between right-front seat and dashboard.
Passenger 3:	below deck in forward section, feet toward bow.
Passenger 4:	below deck in forward section, feet toward stern.
Passenger 5:	below deck in forward section, feet toward stern.
Passenger 6:	outside boat with legs through hole in port bow.



This diagram of the WHISKEY RUNNER shows probable seating positions of the operator and the passengers. The operator (1) and passengers 7, 8, and 9 survived.

According to the medical examiner's report, three of the fatalities were due to drowning; these three persons had head and facial injuries as well as other minor injuries to the body. The other two fatalities received more traumatic injuries as a result of the collision and died from loss of blood. Blood, urine, stomach content, and tissue samples from the deceased passengers were analyzed for alcohol and drugs.

Analysis

The operator of the WHISKEY RUNNER had a BAC of 0.11 percent 3-1/2 hours after the accident. In the postabsorptive state, the average or normal rate of metabolism and elimination of alcohol from the human body is approximately 0.015 percent per hour. Assuming that the operator consumed no alcohol between the time of the accident and the time the blood sample was taken, assuming that he was in a postabsorptive state, and assuming that his metabolism and elimination of alcohol follows the normal distribution curve, the operator had a BAC of about 0.16 percent at the time of the accident. A BAC as low as 0.03 percent decreases the ability to distinguish close but separate moving objects. Reaction time and coordination are affected at the 0.05 percent concentration. Reaction time to optical and acoustical stimuli decreases at about 0.08 percent, and at a BAC of 0.10 percent, there is deterioration in judgment, sensory response, and muscular coordination. A 1975 Coast Guard study indicates that when a recreational boat operator's BAC reaches 0.035 percent, the operator is impaired in normal boating operations.[2] With an approximate BAC of 0.16 percent at the time of the accident, the operator of the WHISKEY RUNNER was impaired significantly by his use of alcohol.

The operator probably was experiencing fatigue from the combined effects of alcohol, the partying activities, and the time of day. (It is known that major decrements in performance occur regardless of activity when body temper-

[2] *Wyle Laboratories, "Alcohol and Pleasure Boat Operators," prepared for the U.S. Coast Guard, Report No. CG-D-134-75, Washington, DC, June 1975.*

Passenger	Alcohol percentage	Drugs (Ng/ml) 9 THC */	COOH **/
2	0.08	0	0.0
3	0.00	0	0.0
4	0.09	2	19.0
5	0.14	0	0.0
6	0.10	0	3.6

*/ Delta 9-tetrahydrocannabinol, one of the psychoactive components of marijuana.
**/ Nonpsychoactive carboxy acid metabolite (an indication of alcohol in the bloodstream).

ature is lowest, which is typical between midnight and 7:00 a.m.[3])

On November 7 1983, as a result of its safety study, "Recreational Boating Safety and Alcohol,"[4] the National Transportation Safety Board issued two Safety Recommendations to several states, including the State of California:

M-83-76

Adopt legislation to clearly define the level of legal intoxication for recreational boat operators in order to strengthen your State's enforcement program for reducing accidents, fatalities, injuries, and property damage caused by the use of alcohol.

M-83-77

Adopt legislation to allow a chemical test of blood, breath, or urine if a recreational boating operator is suspected of being intoxicated and toxicological tests in the event of a recreational boating accident fatality.

On November 29, 1983, the California Department of Boating and Waterways replied:

Following a cursory study in 1980 of coroner's reports involving persons who died in boating accidents, we were able to determine that alcohol, indeed, does play a role in fatal boating accidents. For that year, approximately 35 percent of the persons who died (where data was available) were at the legal level of intoxication for persons operating vehicles on the highway. There were a few reports where persons were also under the influence of controlled substances (drugs).

As a result, the Department sponsored legislation to increase the penalty for operators who are involved in a serious or fatal boating accident and under the influence. The legislation was successful, and now the penalties prescribed in law for such offenses parallel those for operators of vehicles. The legislation did not, however, contain a blood alcohol level as suggested in your letter.

More recently new legislation was enacted that requires the Department to undertake a comprehensive study of the relationship between alcohol and motorboat accidents. The study will span two boating seasons. We are to report back to the Legislature on or before January 1, 1986, with our findings and recommendations.

Safety Recommendations M-83-76 and -77 have been classified "Open — Acceptable Action" pending the outcome of California's special study and legislative initiatives. As a result of this accident, the Safety Board reiterates Safety Recommendations M-83-76 and -77 to further indicate its concern that the State of California act to enhance its ability to address alcohol-related recreational boating accidents.

Passengers 3 through 6 probably were thrown under the bow section of the WHISKEY RUNNER upon impact with the buoy. There was no correlation between the seating of the passengers and the cause of death, other than that all passengers on the starboard side died. While the boat was carrying more passengers than it had seats, passengers in seats and passengers seated on the deck survived.

When the operator of the WHISKEY RUNNER turned into Anaheim Bay channel, he probably became disoriented because he lost sight of the shore lights and ran out of the marked channel where he collided with the mooring buoy. However, when the shore lights were obscured, the various lighted aids to navigation should have become even more discernible. The channel was well-marked for both daytime and nighttime operation, but the operator had never looked at a chart and was not familiar with the aids to navigation generally, much less the lighted range, an important aid to navigation. By observing the range, an experienced operator would know immediately that he was heading out of the channel.

The WHISKEY RUNNER struck an unlighted buoy. Although a light on the mooring buoy might have warned the operator of the buoy in time to prevent the accident, it is not practical to put lights on mooring buoys of this type. The buoys are well-marked on charts and are located in a reserved anchorage; further, the entire Anaheim Bay has been designated a danger zone where every boat operator must observe specified restrictions. If the operator had been operating the boat at or below the enforced 5-mph (9.2 mph by federal regulation) speed when it hit the buoy, the damage to the boat and the personal injuries probably would have been minor. If the operator of the WHISKEY RUNNER had slowed the boat to 5 mph (or

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[3] *Akerstedt, T., Torsvall, L., and Gillberg, M., "Sleepiness and Shift Work: Field Studies,"* **Sleep**, *5S95-106, Raven Press, New York.*

[4] *National Transportation Safety Board Report SS-83-3.*

even to 9.2 mph) as he entered the channel, he would have had more time to orient himself in the channel and probably would have remained in the channel. The operator stated that he had operated boats through Anaheim Bay a number of times. He should have been aware of both the speed limit and buoys, but the effects of alcohol apparently impaired his judgment.

Although federal regulations are explicit in stating that Anaheim Bay is a danger zone, and nautical charts clearly show it is a restricted area, there is a need for a lighted sign on the end of one or both jetties to warn infrequent visitors of the speed limit and that they should proceed with caution. The Orange County Harbor Patrol and U.S. Navy, through education and enforcement, provide adequate warnings to local users of the restricted nature of the waterway. However, the infrequent visitor entering the channel from San Pedro Bay might not become aware of the restrictions unless a Harbor Patrol or U.S. Navy patrol vessel was present at the time.

Recommendations

As a result of its investigation, the National Transportation Safety Board made the following recommendation to the U.S. Naval Weapons Station, Seal Beach, California:

> *Erect a lighted sign on at least one jetty at the entrance to Anaheim Bay indicating the existence of a danger zone and the maximum speed limit. (Class II, Priority Action) (M-85-66)*

Coast Guard Marine Inspectors Complete Engineering Course

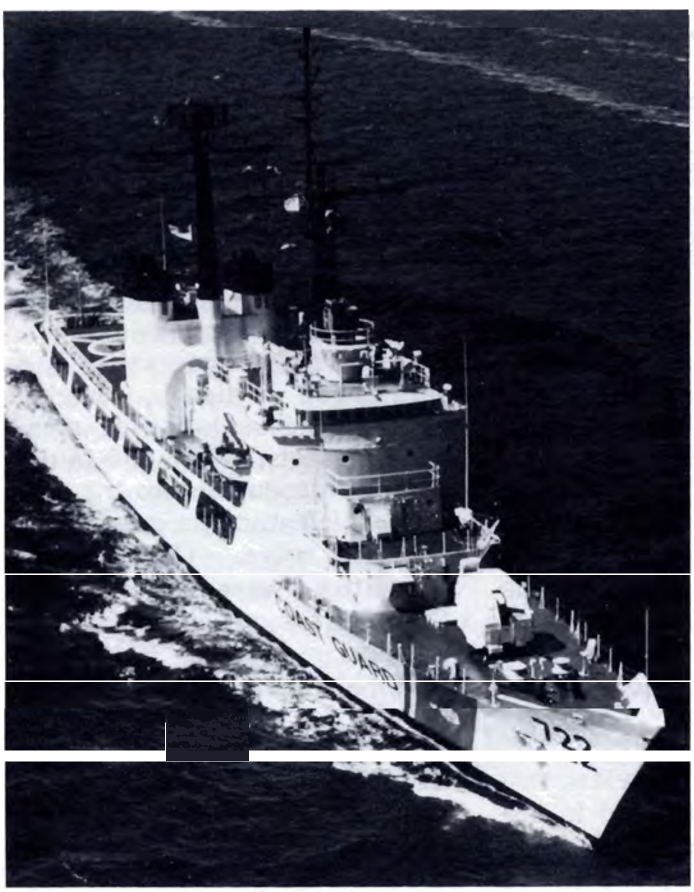
Nineteen Coast Guard Marine Inspectors from Marine Safety Office, San Francisco Bay, CA, recently completed the 5-week "Marine Engineering for USCG Inspectors" class conducted by the California Maritime Academy of Vallejo, CA. The course consisted of 30 hours of instruction held at the Coast Guard Marine Safety Office on Coast Guard Island in Alameda, CA. Various engineering instructors from the California Maritime Academy gave classes in engineroom systems, steam turbines, boilers, pumps, diesel engines, shipboard electrical systems, steering gear, and automated enginerooms. The course was developed by the California Maritime Academy at the request of Coast Guard Marine Safety Office, San Francisco Bay.

The exchange of ideas by the Coast Guard Inspectors who enforce the regulations and experienced marine personnel who have had to abide by the regulations in operating the merchant vessels was one of the high points of each class. The course included a session at the Engineering Lab of California Maritime Academy. The diesel engineroom simulator was the focal point of this trip and provided an opportunity for the Coast Guard inspectors to view this specialized training aid in action. The diesel engineroom simulator is one of two in the United States and can simulate the actual operation of a slow-speed diesel engine aboard various types of merchant vessels. Over 500 faults can be introduced into the system, which students must identify and solve. Coast Guard inspectors were given their Certificates of Training by Captain David Zawadzki, Commanding Officer, Marine Safety Office, San Francisco Bay, and by Mr. Gale Kubli, Assistant Director, Department of Continuing Maritime Education, California Maritime Academy.

The Coast Guard's Search

As an interesting sidenote in this issue of ***Proceedings****, we'd like to show you some of the vessels and aircraft used by the Coast Guard in accomplishing its many missions. The equipment shown on these pages is employed mainly for search and rescue operations. In a future issue, we will include photos of the Coast Guard's work boats. (Official Coast Guard photos)*

This medium-range HH-3F helicopter, used in search and rescue missions, is distinguished by its "nose." In reality, the nose is the antenna for the weather radar.



This 378-ft., high-endurance cutter, the MORGENTHAU, is homeported in San Francisco. The Coast Guard's 12 high-endurance cutters are situated at various installations nationwide and are employed mainly in law enforcement and fishery patrols.

and Rescue Equipment

This C-130 aircraft has a long-range, low-flying capability for drug interdiction and search and rescue efforts. It pinpoints the location of suspicious vessels or casualty survivors so that cutters or helicopters know where to direct their efforts.

The HH-52A helicopter is used for short-range search and rescue missions. The HH-52A will soon be phased out and replaced by the HH-65A, which is outfitted with more sophisticated search and rescue equipment.

Search and Rescue at Sea

The International Maritime Organization's most important task is the adoption of measures to improve the safety of life at sea. Many of its conventions are concerned with this subject and the majority are intended to stop accidents from happening in the first place.

But although these instruments have proved their value, accidents do still occur and may result in the loss of life.

As a result, IMO has adopted a number of measures which are designed to mitigate the effects of an accident at sea and ensure that those involved are rescued as quickly as possible. The Organization's work can be divided into four main areas:

1. Improving lifesaving techniques and equipment on board ships.
2. Distress alerting and signaling.
3. Survival after abandoning ship.
4. Search and rescue operations.

Improving Lifesaving Techniques and Equipment on Board Ships

Requirements concerning lifesaving appliances and related subjects are contained in Chapter III of the International Convention for the Safety of Life at Sea (SOLAS). The current version of this instrument was adopted under the auspices of IMO in 1974 and entered into force in 1981.

It is important that ships should not only be provided with sufficient lifesaving equipment and survival craft, but also that such appliances are readily available, can be boarded quickly, and launched safely and rapidly, even in adverse conditions. The regulations contained in the chapter take all of these factors into account. It is divided into three sections. Part A deals with general subjects, Part B with requirements for passenger ships, and Part C with requirements for cargo ships.

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*This article was originally published in the No. 2, 1985, issue of the **IMO News**.*

Chapter III of the 1974 Convention was completely revised in amendments adopted by IMO in 1983. These are expected to enter into force on July 1, 1986.

The amendments not only take account of recent developments but also are designed to expedite the evaluation and introduction of further improvements.

Like the existing chapter, the amended version also contains three parts, but the arrangement is very different. Part A deals with such matters as application, exemptions, definitions, evaluation and testing, and production tests. Part B is concerned with ship requirements, and Part C with lifesaving appliance requirements.

Among the most important changes introduced are those involving lifeboats and liferafts.

Generally speaking, the lifeboats required by the current Chapter III of SOLAS 1974 are of the traditional open design, most of them without power. The revised chapter requires that **all** lifeboats be equipped with an engine. They must be partially or totally enclosed, and the latter must be self-righting.

Cargo ships must carry sufficient totally enclosed lifeboats or, in certain instances, self-righting, partially enclosed lifeboats to accommodate all on board. Chemical and oil tankers must carry boats equipped with a self-contained air support system (if the cargo emits toxic gases) or which can afford protection against fire for at least 8 minutes (where the cargo is flammable).

A specified number of the boats carried on board ships should be designed to rescue persons in distress and to marshal survival craft.

The requirements for inflatable and rigid liferafts have also been amended and expanded.

The new chapter requires that survival craft be capable of being launched when the ship has a list of 20 degrees in either direction; the 1974 Convention refers to a 15 degree list.

The new chapter also includes a requirement that lifeboats on ships of 20,000 gross tons and above be capable of being launched when the ship is making headway at speeds of up to 5 knots. This is a new requirement and is in response to the fact that ships have increased greatly in size since the original chapter was drafted and would take much longer to stop.

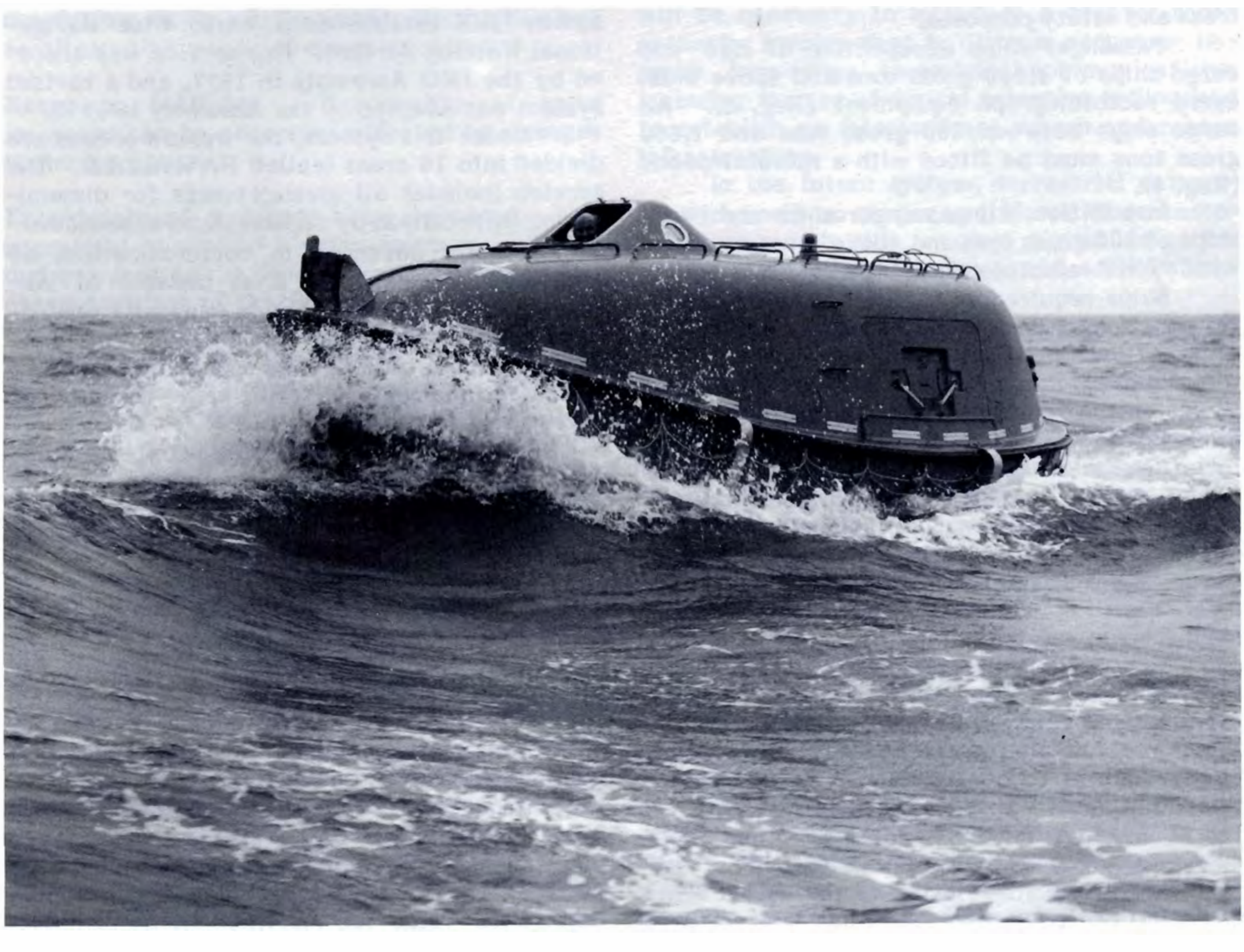
Other requirements are designed to make the stowing, boarding, and launching of survival craft and rescue boats safer.

Although SOLAS is the most important instrument concerned with lifesaving appliances, IMO has also adopted a number of recommendations over the years which have also contributed greatly to improvements in this area. The IMO Assembly in 1983, for example, adopted a recommendation on the testing of lifesaving appliances which is designed to assist the implementation of the revised Chapter III when it enters into force. It also adopted a code of practice for the evaluation, testing, and acceptance of prototype novel lifesaving appliances and arrangements.

Some other recommendations which have been adopted by the IMO Assembly on the subject of lifesaving appliances over the last few years have dealt with the approval of servicing stations for inflatable liferafts (adopted in 1975), fitting of retro-reflective tapes to lifesaving appliances (1973), survival instructions for liferafts (1969), etc. Many of these recommendations have been incorporated as requirements into the revised Chapter III.

Distress Alerting and Signaling

One of the greatest contributions to rescue at sea was the invention of radio. Before that, the most a ship in distress could do to summon help was to fire flares and hope that



The revised Chapter III of SOLAS 1974 requires, among other things, that all lifeboats be partially or totally enclosed. This enclosed unit can carry 33 persons. (Photo by Malcolm Pendrill, Ltd., Surrey, England, from the collection of Robert Markle, Survival Systems Branch, U.S. Coast Guard) another ship was near enough to see them. Radio enabled ships to send distress messages over a distance of hundreds and later thousands of miles.

The advantages of radio for maritime purposes were appreciated from the very early days: the first rescue at sea resulting from a radio message was in 1899, when the lightship on the Goodwin Sands in the Straits of Dover sent a message ashore when the steamship ELBE ran aground, enabling a lifeboat to be launched in time to rescue the ship's crew. It soon became obvious that the use of radio would have to be regulated on an international basis if the new medium was to be properly developed, and the first international conference on radio was held as early as 1906.

Requirements covering radio on ships have formed part of SOLAS ever since the first version was adopted in 1914. In the 1974 Convention, they appear in Chapter IV. This deals mainly with facilities intended for distress and safety purposes.

Passenger ships irrespective of size and cargo ships of 1,600 gross tons and above must carry radiotelegraph equipment (Reg. 3). All cargo ships between 300 gross tons and 1,600 gross tons must be fitted with a radiotelephone (Reg. 4).

In addition, all passenger ships and cargo ships of 300 gross tons and above must be fitted with a VHF radiotelephone installation.

Ships required to be fitted with a radiotelegraph installation must carry at least one radio officer and, if not fitted with a radiotelegraph automatic alarm, must listen continuously on the radiotelegraph distress frequency. For passenger ships, radio watch must be kept for at least 8 hours every day, while ships carrying more than 250 passengers must listen on the distress frequency for at least 16 hours a day (and must carry at least two radio officers). Cargo ships fitted with an automatic alarm must listen on the distress frequency for at least 8 hours a day.

Ships required to be fitted with radiotelephone must keep a continuous watch (which can be by means of automatic alarm) on the radiotelephone distress frequency (2182 kHz). Ships required to be fitted with a VHF radiotelephone must keep a continuous watch on 156.8 MHz (channel 16) and/or on other channels as required by their administration.

Requirements relating to the use of radio in rescue craft are contained in Chapter III of SOLAS. An approved portable radio apparatus must be carried in all ships, except those equipped with a motor lifeboat on each side containing a radiotelegraph installation (Reg. 13). Where more that 199 persons are carried, at least one lifeboat must be equipped with a radiotelegraph station, and where the total number of persons on board is 1,500 or more, every motor lifeboat must be so equipped.

Several additional requirements regarding radio apparatus were introduced into this chapter in the 1983 amendments. They include the carriage of manually activated emergency position-indicating radio beacons (EPIRBs).

While the rapid transmission and reception of distress messages is the most important task of radio at sea, it is essential that warnings be given to ships on matters which can affect their safety. These include the establishment and malfunction of lights, sound signals, buoys and other aids to navigation; the location of wrecks and other hazards; and the establishment of offshore structures.

To ensure such information will be received by all ships likely to be affected by it, IMO and the International Hydrographic Organization (HO) established a World Wide Navigational Warning Service. This service was adopted by the IMO Assembly in 1977, and a revised system was adopted by the Assembly in 1979.

Under this system, the world's oceans are divided into 16 areas (called NAVAREAS). The service includes all arrangements for disseminating information by regular radio broadcasts.

Despite advances in communications at sea, confusion can still arise because of language difficulties. English is generally regarded as the international "language of the sea," but even when both parties speak the language, misunderstandings can still arise because of imprecision in its use.

In 1977 the IMO Assembly adopted a Standard Marine Navigational Vocabulary to overcome some of these problems by standardizing the English terms used in communications at sea.

It is not intended that the Vocabulary be made mandatory, but rather that through constant repetition the phrases and terms used will become those normally used by seafarers for communications between and on board ships.

The most important development in telecommunications in the last 30 years has been the introduction of satellite communications. They enable both radio and printed messages to be transmitted instantly from one place on earth to another, and IMO was quick to appreciate their value for maritime purposes. Research was begun in the 1960s, and in 1976, a conference convened by IMO adopted a convention establishing the International Maritime Satellite Organization (INMARSAT).

The establishment of INMARSAT as an independent organization marked a great step forward for maritime radiocommunications. For the first time, shipping had a communications system reserved solely for its own use and designed for its own purposes, and the INMARSAT system offers advantages which cannot be provided by terrestrial radiocommunications.

The Future Global Maritime Distress and Safety System

Despite its widespread use and proven success, there are some disadvantages with the present maritime radiocommunication system. They include the following:

Congestion. The number of terrestrial radio frequencies available for maritime communications is physically limited and cannot be increased. In certain instances this results in congestion, which can be serious since a ship has no alternative means of communication.

Reception facilities. The quality of some messages can be adversely affected by changes in the ionosphere.

Uncertainty of messages being received. The successful receipt of a radio message -- even a distress message — depends on the propagation characteristics of the frequency on which it is transmitted, the geographical location of ships, and the time of day and season. In many parts of the world, the density of shipping is light, and the number of coastal radio stations limited. As a result, it may under certain conditions be impossible for a ship in distress to alert other ships or coast radio stations, or assistance may be delayed for several hours.

These factors could result in a serious delay in a distress message being received and a search and rescue operation being initiated.

However, recent advances in communications technology and the establishment of INMARSAT have provided an opportunity to overcome these difficulties, and IMO is currently working a completely new martime distress and safety system which is expected to be introduced in the early 1990s.

The basic concept of the FGMDSS is that shore search and rescue authorities as well as shipping in the vicinity of a distress will be rapidly alerted to the distress and be capable of being involved in a coordinated rescue operation. The concept applies to all cargo ships and passenger ships on international voyages regardless of their geographical location. Additionally, the system will provide for urgency and safety communications, as well as the dissemination of navigational and meteorological information to ships.

The system will use both satellite and terrestrial communications. Satellite communications will be provided by INMARSAT. A distress capability for alerting by satellite EPIRBs will be provided by INMARSAT geostationary satellites as well as by polar orbiting satellites.

Recent advances in communication technology and the establishment of the INMARSAT system have been the catalysts in planning for a future system. A reliable, long-range communication link continuously available will significantly improve the probability of a distress alert being received, and equipment currently being developed will provide automatic alerting in the case of a sudden disaster at sea.

To use this system to its full potential, it will be necessary to introduce a greater shore authority involvement in distress response; improve long-range terrestrial communications, including the use of digital selective calling; and to establish an international search and rescue infrastructure.

In the future system, terrestrial communications will no longer use Morse Code radiotelegraphy but will employ digital selective calling (DSC), radiotelephony, and narrow band direct printing (NBDP).

The equipment to be carried on ships will be designed for simple operation and will be largely automated. The type of equipment will depend on a ship's area of operation.

The introduction of the FGMDSS will greatly improve radiocommunications at sea, especially for distress purposes, but electromagnetic technology has several other applications which are relevant to rescue at sea. Radio direction-finding, radar, electronic navigation systems such as Omega, Decca, and Loran C, and satellite navigation systems are all based on these principles. Although primarily used for navigation, these devices are also useful for search and rescue purposes, and requirements for their carriage are contained in the SOLAS Convention.

The invention of radio and the tremendous advances made in telecommunications technology during this century have been of immense value to rescue operations at sea. The measures introduced by IMO referred to earlier in this article have similarly improved the chances of survival following an accident at sea. But rescue ultimately depends upon help arriving in time.

Survival After Abandoning Ship

The greatest danger to life following the sinking or abandoning of a ship is not drowning, but hypothermia — death from cold.

The sinking of the TITANIC in 1912 provided a dramatic example of the effects of cold-water immersion. Partially due to a lack of preparedness with protective clothing, adequate flotation equipment, and a knowledge of survival procedures, none of the 1,489 persons immersed in the $0^{\circ}C$ water was alive when rescue vessels arrived 1 hour and 50 minutes after the sinking. Countless lives could have been saved had they known more of how to cope with cold water; almost all of the people in lifeboats were alive.

During World War II, the Royal Navy of the United Kingdom alone lost about 45,000 men at sea, of whom it is estimated 30,000 died from drowning and hypothermia. Many of those who drowned were incapacitated due to cold.

Many of the improvements introduced into the revised Chapter III of the SOLAS Convention are designed to improve chances of survival by reducing the threat of hypothermia. Most lifeboats, for example, must be totally or partially enclosed. The latter must have rigid covers extending over 20 percent of the lifeboat's length and be equipped with a folding canopy to cover the rest.

While such boats do not offer the same degree of protection as totally enclosed lifeboats, they are easier to board in an emergency, especially on passenger ships where large numbers of untrained persons are involved. And they certainly offer much greater protection against the cold than the traditional open boat. The revised Chapter III requires that totally enclosed boats and some partially enclosed boats must also be capable of righting themselves automatically if they capsize.

As a further protection against the cold, the revised Chapter III introduces a number of requirements regarding the carriage of personal aids against hypothermia. These include immersion suits, which protect the body against heat loss, and thermal protective aids, which perform the same function but do not allow the same freedom of movement.

Further guidance on combating hypothermia at sea was given in 1981 when IMO published **A Pocket Guide to Cold Water Survival.** The guide states:

> *It is important to realize that you are not helpless to effect your own survival in cold water. Body heat loss is a gradual process, and research shows that in calm water at $5^{\circ}C$ a normally dressed person has only a 50-percent chance of surviving 1 hour. Simple self-help techniques can extend this time, particularly if the person is wearing a lifejacket. You can make the difference.*

It then goes on to give practical advice on how to combat cold and how to treat victims.

To be continued in the next issue of *Proceedings*.

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. The most inefficient method of voltage reduction from the standpoint of power loss is a (an)

A. capacitor in series with the load.
B. inductor in series with the load.
C. capacitor and inductor in series with the load.
D. resistor in series with the load.

Reference: Hubert, Preventive Maintenance of Electrical Equipment

2. Although accurate tests of boiler water for dissolved oxygen are difficult on board ship, you can be fairly sure of proper oxygen removal by

A. testing frequently for total dissolved solids.
B. maintaining low boiler water pH.
C. giving the boiler frequent surface blows.
D. testing boiler water for excess scavenging agents.

Reference: Pincus, Practical Boiler Water Treatment

3. Which type of bearing is designed to limit end movement and to carry loads applied in the same direction as the shaft axis?

A. Rigidly mounted reduction gear bearing
B. Segmental, pivoted-shore thrust bearing

C. Self-aligning radial bearing
D. Spherically seated, radial bearing

Reference: Osbourne, Modern Marine Engineer's Manual, Vol. 1

4. When using a flame safety lamp to detect low levels of oxygen, you should

A. fuel with a light fuel, i.e., white gas.
B. allow 2 minutes to warm up.
C. light with the igniter.
D. all of the above.

Reference: MARAD. Marine Fire Prevention, Firefighting and Fire Safety

5. A properly adjusted thermostatic expansion valve will have a constant valve opening under a condition of constant

A. supply pressure.
B. suction pressure.
C. refrigerant superheat.
D. compressor speed.

Reference: Nelson, Commercial and Industrial Refrigeration

DECK

1. When rigging a bos'n's chair on a stay with a shackle,

A. secure the shackle to the stay with small stuff.
B. never allow the shackle pin to ride on the stay.
C. seize the end of the shackle.
D. mouse the shackle to the chair.

Reference: American Merchant Seaman's Manual

2. Which statement is true concerning an "inverting type" sextant telescope?

A. It is also known as the "erect image" type.
B. It has one lens less than the erect type.
C. It absorbs more light than the erect type.
D. When only one telescope is provided with a sextant, it is usually of this type.

Reference: American Practical Navigator

3. A marine sextant has the index arm set at zero and the reflected image of the horizon forms a continuous line with the actual image. When the sextant is rotated about the line of sight, the images separate. The sextant has

A. error of perpendicularity.
B. side error.
C. prismatic error.
D. centering error.

Reference: American Practical Navigator

4. Temporary seizings on wire rope are made with

A. marlin.
B. tape.
C. sail twine.
D. wire.

Reference: Knight's Modern Seamanship

5. Which molten substance is poured into the basket of a wire rope socket being fitted to the end of a wire rope?

A. Babbit
B. Bronze
C. Lead
D. Zinc

Reference: Knight's Modern Seamanship

ANSWERS

ENGINEER
1-D;2-D;3-B;4-C;5-C
DECK
1-B;2-B;3-B;4-D;5-D

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

"Preparation of Fire Control Plans" - Paper Available

On October 29, 1985, LCDR William Riley of the Survival Systems Branch, Office of Merchant Marine Safety, presented a paper at the National Safety Congress on the subject "Notes on the Preparation of Fire Control Plans." Copies of the paper are available to interested parties by writing to Commandant (G-MVI-3), U.S. Coast Guard, 2100 Second Street, SW, Washington, DC 20593.

Richard W. Sanders

Styrene Monomer (Inhibited)

Styrene is one of the most important chemicals in the plastic and rubber industries. Although it is not used in its own form, styrene is used in the production of a vast amount of everyday materials. Polystyrene (styrofoam) and SBR (a synthetic rubber used in tires and tire products) are two examples.

Also called vinyl benzene, phenylethylene, cinnamol, or styrol, this chemical was first isolated in the 1800s. It was distilled from a natural resin of certain trees growing in the Americas and Asia. This resin, called storax, was of no industrial significance at the time. Styrene first became important during World War II in the manufacture of synthetic rubber. Later, peacetime uses, especially in high-impact plastics, accounted for its rapid growth.

Styrene is a colorless, flammable liquid. It boils at 145°C (293°F) and has an aromatic odor. Styrene consists of a two-carbon chain (ethene) bonded to a carbon ring (benzene). When reacted, the chemical forms long chains of molecules, called polymers. These polymers are then combined with other materials or themselves to make a desired product. In its own right, there is no industrial use for styrene.

The most important method of production for this chemical is alkylation (chemical addition) of benzene with ethylene to produce ethylbenzene, which is then dehydrogenated (chemical removal of hydrogen) to form styrene. Dow Chemical Company, BASF, Shell Chemical Company, Monsanto, and Union Carbide each developed variations of this method. Styrene production in 1980 was nearly 2,600 metric tons.

Although styrene is mildly toxic, it is considered a relatively safe organic chemical. The reported odor threshold is 0.05-0.15 ppm (parts per million). At concentrations of 200-400 ppm, styrene vapor has transient irritant effects on the eyes. At 400-500 ppm, irritation to the respiratory tract occurs. Still higher vapor concentrations cause depression of the central nervous system. Effects range from drowsiness and stupor to unconsciousness. Prolonged contact with the skin (1 hour or more) causes swelling and blistering. Repeated contact causes cracking and inflammation, which results from deoiling of the skin. Styrene is commonly stored and transported containing 4-*tert*-butylcatechol (TBC) as an inhibitor to self-polymerization. TBC is also a skin sensitizer. Very small quantities of TBC can produce a rash in sensitive individuals.

The current permissible exposure limit set by the Occupational Safety and Health Administration is 100 ppm of styrene per million parts of air averaged over an 8-hour work shift, and an acceptable peak of 600 ppm for 5 minutes in any 3-hour period. Work involving styrene should proceed in areas of adequate ventilation. In areas where this is not possible, or for operations requiring entry into tanks or closed vessels, respirators must be supplied. Employees should use impervious clothing, gloves, face shields (8-inch minimum), and other protective clothing to prevent repeated or prolonged skin contact with liquid styrene. In the event of a spill, contaminated clothing should be placed in closed containers for storage until it can be discarded or the chemical is removed. In no case should the clothing be reworn while still contaminated with styrene.

In case of skin contact with the chemical, the affected area should be washed with soap and water. If sytrene gets into the eyes, they should be washed immediately with large amounts of water, lifting the lower and upper eyelids occasionally. A person who has breathed large amounts of the vapor should be exposed to fresh air. If breathing has stopped, artificial respiration should be performed. Finally, if styrene has been swallowed, do not induce vomiting. In all cases, medical attention should be sought immediately.

Richard W. Sanders was a Second-Class Cadet at the Coast Guard Academy when this article was written. It was written under the direction of LCDR J.J. Kichner for a class on hazardous materials transportation.

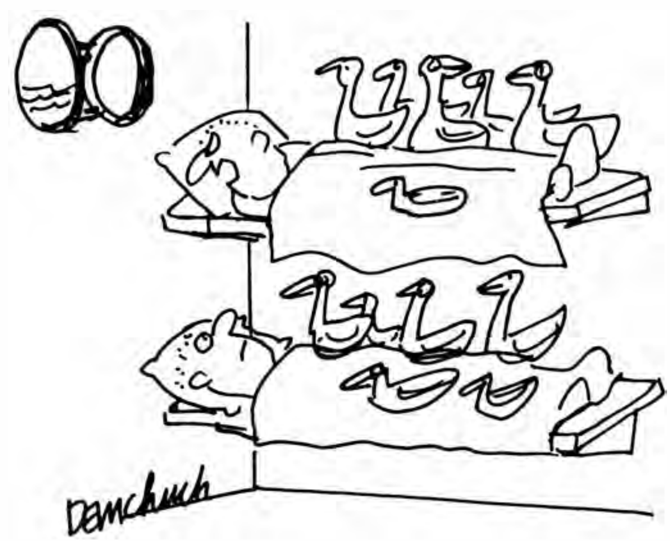
In the event of a spill or leak, a series of steps should be followed for cleanup. First, all ignition sources should be removed, and the area of the spill should be ventilated. For small quantities, styrene can be absorbed on paper towels and then evaporated or burned. Large quantities may be absorbed in dry sand or earth and secured in a sanitary landfill. Persons involved in cleanup should wear protective equipment and clothing. If the spill ignites, firefighting should be done from a safe distance using dry chemicals, foam, or carbon dioxide. Water may not be effective, but it should be used to cool fire-exposed containers, protect firefighters, and flush spills away from the burning source.

Styrene is shipped in a variety of containers. Glass bottles and 1- to 5-gallon cans are used for small quantities. Fifty-five-gallon metal drums are also used. For large amounts, tank trucks, tank cars, and tank barges are employed.

The U.S. Coast Guard lists styrene as a Grade D combustible liquid in its Subchapter O regulations of Title 46, Code of Federal Regulations. The International Maritime Organization includes it in Chapter 6 of its Chemical Code. The U.S. Environmental Protection Agency regulates styrene as a Hazardous Waste under Title 40, Subchapter D, and the Department of Transportation regulations are found in Subchapter C of Title 49 of the CFR. Styrene is listed in the International Maritime Dangerous Goods Code as a Class 3 chemical.

With this issue of ***Proceedings****, we are pleased to welcome LCDR J.J. Kichner as our new liaison for "Chemical of the Month" articles.*

Chemical name:	Styrene (monomer)
Formula:	$C_6H_5CHCH_2$
Synonyms:	vinyl benzene phenylethylene cinnamol styrol
Physical Properties:	
boiling point:	145°C (293°F)
freezing point:	-30°C (-23°F)
vapor pressure:	
20°C (68°F)	6.0 mm Hg
46°C (115°F)	304 mm Hg
Threshold Limit Values (TLV)	
time weighted average:	50 ppm
short term exposure limit:	100 ppm
Flammability Limits in Air	
lower flammability limit:	1.1% by volume
upper flammability limit:	6.1% by volume
Combustion Properties	
flash point:	37.8°C (100°F)
autoignition temperature:	490°C (914°F)
Densities	
liquid (water=1):	0.9060
vapor (air=1):	3.6
U.N. Number:	2055
CHRIS Code:	STY
Cargo compatibility group:	30 (Olefins)



"Well, the porthole's open. . .I hope you're satisfied!"

Notice of Proposed Rulemaking

CGD 85-060	Inland Waterways Navigation Regulations; Connecting Waters from Lake Huron to Lake Erie	(January 6)

The Coast Guard is proposing to amend the existing Inland Waterway Navigation Regulations for connecting waters between Lake Huron and Lake Erie. Comments on this proposal must be received on or before February 20, 1986.

Final Rule Correction

CGD 83-005	Sailing School Vessel Regulations	(January 9)

The Coast Guard is establishing a new set of regulations which will establish minimum inspection standards necessary for safe operation of sailing school vessels. These regulations become effective on January 9, 1986.

Notice

CGD 86-001	Rules of the Road Advisory Council; Meeting	(January 16)

The Rules of the Road Advisory Council will meet on Thursday and Friday, March 6 and 7, 1986, at the Lincoln Hotel, 4860 West Kennedy Blvd. at Urban Center, Tampa, Florida. On both days the meetings will begin at 8:30 a.m. and end at 4:30 p.m.

CGD 86-007	Information Concerning the Availability of Voluntary Uninspected U.S. Commercial Fishing Vessel Safety Standards	(January 27)

The Coast Guard has developed a series of Navigation and Vessel Inspection Circulars (NVICs) establishing proposed voluntary vessel safety standards for U.S. uninspected commercial fishing vessels. These standards are advisory in nature and do not modify or supersede any existing or future laws or regulations. The NVICs, which are technical in nature and written for fishing vessel designers, builders, naval architects, marine surveyors, insurance underwriters and vessel owners, are available through the Government Printing Office. Comments and recommendations concerning these standards from interested parties are encouraged. The NVICs will be consolidated into a final NVIC in June 1986 after time has elapsed for the Coast Guard to consider comments. Comments are requested by March 15, 1986.

CGD 86-010	Aquatic Resources Trust Fund; Availability of Financial Assistance	(January 30)

The Coast Guard is seeking to enter into financial assistance agreements with national nonprofit public service organizations for national boating safety activities. This announcement seeks proposals for all types of projects that will promote boating safety on a national level. All proposals must be submitted by April 25, 1986.

Requests for copies of NPRMs should be directed to the Marine Safety Council. The address is Commandant (G-CMC), U.S. Coast Guard, 2100 Second Street SW, Washington, DC 20593; telephone (202) 426-1477. The office, Room 2110, is open between the hours of 9:00 a.m. and 4:00 p.m. Monday through Friday. Comments are available for inspection or copying during those hours.