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To the expanding Port of Tacoma and its commercial and industrial interests, the new fireboats and firefighting techniques will augment the existing high level of fire and security protection, providing advantageous insurance ratings which in turn will secure new investment interest. Story begins on page 87. Cover photo courtesy of the Fire Department, City of Tacoma.

A Ten-Year Dream Fulfilled: Tacoma's New Fireboats

Tony F. Mitchell
Chief, Fire Department
City of Tacoma, Washington

After a decade of effort, the second of two surface effect ships -- multi-purpose harbor service crafts — arrived in Tacoma, Washington, in 1983. Conceived and developed by the City of Tacoma, the fireboats (named the "Defiance" and the "Commencement") are the first of their kind in the world and are considered to be the state of the art.

This venture is the epitome of how a local jurisdiction, in concert with an agency of the federal government and private enterprise, can successfully achieve the goal of a unique undertaking. The City of Tacoma, the U.S. Department of Transportation's Maritime Administration, and Vosper Hovermarine cooperated to make this program possible.

Fireboats in the Past

For almost a century, the fireboat concept has remained relatively the same. Earlier vessels have been large and plodding, with displacement-type hulls that generally require large crews and even larger amounts of fuel. These boats also create a damaging wake when underway.

Historically, fireboats have been built to **design specification,** and often they have not performed as expected. Let me offer a few examples:

- A few years ago one city ordered a planing hull fireboat that would not plane as specified.
- About 5 years ago another city paid close to $2 million for a new fireboat that was supposed to travel approximately 25 knots; it actually travels 17 knots and creats a wake in excess of 6 feet.
- In 1981 the Hong Kong Fire Department added a fireboat to its fleet of six. It cost $10 million and has a 51-member crew to cover three shifts.

Specifications for the New Fireboats

The new multi-purpose fireboats have been constructed against a **performance characteristics specification.**

The typical method of having a desired product built or manufactured is to develop a **design specification** and then award a contract to the lowest bidder. With this method, what you tell the builder you want is generally what

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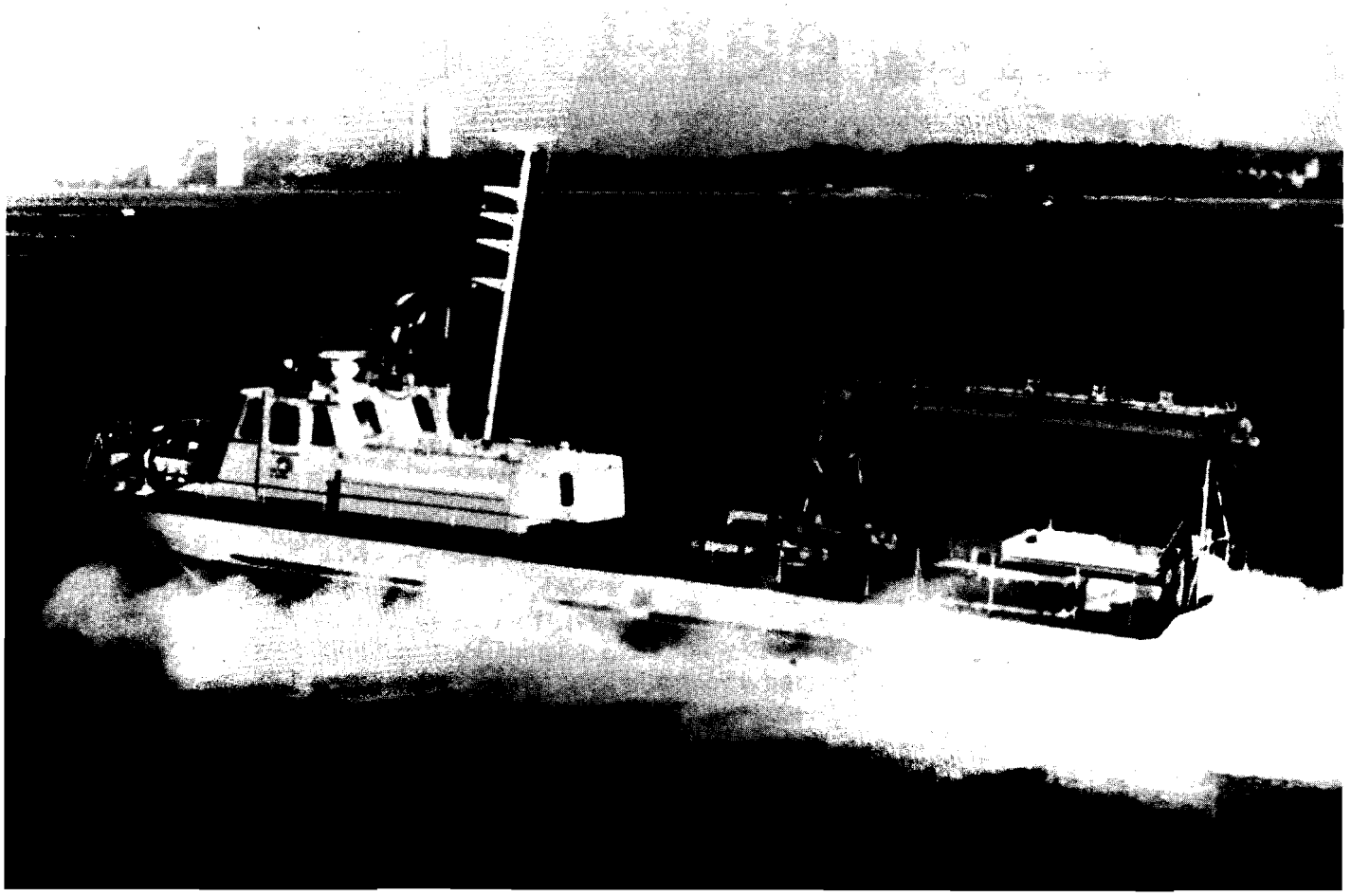
Chief Tony F. Mitchell has been the head of the Fire Department, City of Tacoma, since April 1976. He has been actively involved in fire administration for the last 12 years. Chief Mitchell, as head of the Fire Department, also serves as Tacoma's Harbormaster.



Fireboat 5, the "Defiance," in action. Photo courtesy Fire Department, City of Tacoma.

you will receive, but it may not measure up to all your expectations. Because the product we were pursuing was unique and nonexistent, and because we had limited resources which did not include developmental cost, we opted for primarily a **performance specification.** Simply put, if the craft did not perform according to our stringent standards, then we would not pay the builder for them.

We are pleased and feel very fortunate that the Vosper Hovermarine Company "hung in there" and delivered its product. Otherwise, no doubt we would have ended up with a more traditional-style fireboat and would have "suffered the immeasurable loss of what might have been."

While our new fireboats are generically referred to as a hovercraft, the surface effect ship, or Hovermarine, is totally different in design concept from the amphibious hovercraft. The surface effect ship (SES) is basically a ship, while the amphibious hovercraft is basically an airplane. As a ship, the SES compares more favorably with similar displacement and planing hulls in terms of performance and handling characteristics, and it considerably improves economy.

Originally developed for its characteristics as a high-speed marine platform, the boat's designers gradually became aware of a unique advantage of the SES at "zero speed." In effect, the flat bottom of the SES makes for the most stable of marine platforms; at rest, the boat is a flat-bottom barge. Although the virtue of a fireboat's speed in reaching the scene of an

incident cannot be denied, once reached, the boat itself is nothing more than a platform upon which personnel and machinery must function. The more stable the platform, the better they function.

How Did the Dream Begin?

The new fireboat program started as early as 1959, when preliminary discussions were held to determine what might be done to replace the City's aging 1929 Fireboat #1, bought in 1929 at a cost of $148,000. It was not until 1973, though, that positive, productive action began to take place.

In May 1982, the first multi-purpose fireboat arrived and was placed in service on December 24, 1982 — a Christmas present to our taxpayers.

Before 6 months had passed, a 19-year-old female was successfully rescued after she jumped from approximately the 200-foot level of the Tacoma Narrows Bridge. The fireboat "Defiance," with trained and properly equipped firefighters aboard, arrived on the scene within 14 minutes. This had never before been achieved in the 34-year history of the bridge and its 49 known jumping incidents.

The Final Phase

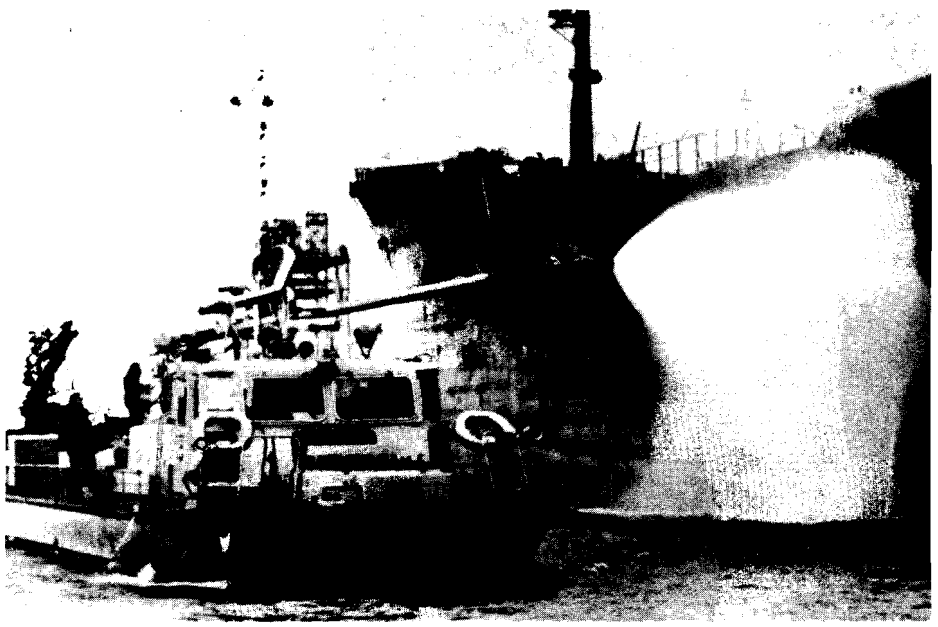
It is now time for the final phase of the developmental aspects of the project: publication of the "Tacoma Harbor Service Craft Mission and Craft Evaluation Report."

As the publication title suggests, the test agenda was divided into two types: **mission,** which relates to the missions the craft will perform, and **craft,** which were conducted to verify the performance of the craft. Logically, most of the tests performed related to the original 42 requirements identified in the 1974 U.S. Maritime Administration's three-volume "MPHSC Requirements Study."

This final report certainly lends a high degree of credibility to the project and will be a very useful resource to other port areas that may be interested in the multi-purpose fireboat concept. The information contained in the report is not predicated on an engineer's projection or on builder or Fire Department claims. It was accomplished with scientific testing of our SES fireboats, utilizing two highly qualified consultants and the facilities of the U.S. Naval Testing Range in our area.

A New Era

The era of the high-speed, multi-purpose fireboat is here. The traditional-style fireboats with their slow speeds, larger crews, damaging wakes, minimal services, and high costs of operation are history. The United States Maritime Administration, the Vosper Hovermarine



The flat bottom of the fireboat makes it a stable platform for firefighting equipment. Photo courtesy Fire Department, City of Tacoma.

Company, and the City of Tacoma have taken the lead and shown the way. And out in the Pacific Northwest, the fireboats "Defiance" and "Commencement" are providing total services to our harbor area and stand ready for review and demonstrations. During the latter part of 1982, both the U.S. Navy and Coast Guard received SES vessels and have more on order, so we are in good company.

To my knowledge, there is no fireboat in existence or available in the world today that can outperform the overall characteristics of the surface effect ship multi-purpose Harbor Service Craft and the purposes for which it was designed. We have shed the traditional fireboat concept — exceeded the sound barrier, so to speak -- and we will, and already have, significantly influenced the development of others.

To the expanding Port of Tacoma and its commercial and industrial interests, the new fireboat and firefighting techniques will augment the existing high level of fire and security protection, providing advantageous insurance rating which in turn will secure new investment interest.

The City of Tacoma is proud of this completely new and unique mutli-purpose fireboat...we welcome further inquiry. ⚓

Because the new fireboats are quick and efficient when responding to emergencies, insurance rates in and around the Port of Tacoma have improved. Photo courtesy Fire Department, City of Tacoma.

SPECIFICATIONS

Hull

Length - 70 feet
Beam: 20 feet
Draft:
on air cushion - 3' 6"
off cushion - 5' 4"
height off cushion - 25' 7"
Gross weight (fully loaded): 7800 lbs.
Hull life expectancy: 20 years

Power

G.M. diesels 2-435 SHP, 1-400 SHP, 1-570 SHP (fire pump)

Rated pumping capacity: 7075 gpm at 100 psip at pumps

Performance

Speed of 30 knots, 20 knots in 6-foot waves

Wake minimal at all speeds

Range of 60 nautical miles plus 8 hours full capacity pumping, 2.5 gallons of fuel per minute.

Stopping distance: three craft lengths

Fully operational with a crew of two

Firefighting Equipment

Monitors: one 7075 GPM, two 2500 GPM, two 2500 GPM under dock nozzles. All wheelhouse controlled.

35' telescoping Hi-Access ladder with 1500 GPM with foam

Foam tank and 2300 lbs. firefighting tools

Rescue Equipment

- Ladder lifting capability: 2880 lbs. at 15' radius
- Divers' ladder and rescue platform
- Resuscitator, aspirator, stretcher, and medical supplies
- Extrication tools
- Portable de-watering systems to 500 GPM and Floto Pump

Navigational and Communication

- Fire, police, CB, and bridge-to-bridge marine radios
- Loud hailer, 1/4-mile range directional listening device

Equipment Identification

- 1500 GPM remote conrol F/S* nozzle
- Foam tank
- Propulsion engine compartment hatches
- 35' telescoping ladder and waterway on crane with 2800-lb. lifting capacity
- 7075 GPM manifolds with 2-1/2" and 5" hose connections
- Main fire pump engine compartment hatch
- Rescue platform (detachable)
- Divers' ladder (detachable)
- 7075 GPM remote conntrol nozzle: 90^{o} rotation, -15^{o} to $+70^{o}$ elevation
- High definition radar
- Searchlight and loudhailer with quarter-mile listening device
- 2500 GPM remote control F/S* nozzle: 270^{o} rotation with stops
- Forward lift and forward fire pump engine compartment hatch
- 2500 GPM remote control under dock F/S* nozzle: -5^{o} to $+10^{o}$ elevation
- Bow skirt

**F/S = 90^{o} fog to straight stream.*

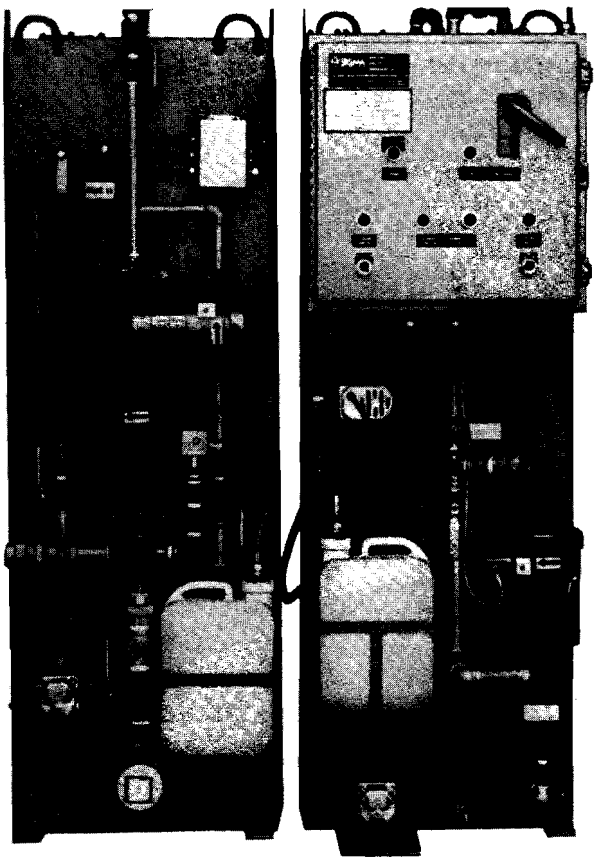
NOTE: Foam delivered through 1-1/2" deck hydrants at base of ladder and through ladder nozzle.

The Editor wishes to thank Mr. Carl Sobremisana, U.S. Maritime Administration, for his assistance in bringing this article to publication.

Marine Sanitation Device Hazards

LT T.M. Keegan
Survival Systems Branch
Merchant Vessel Inspection Division
U.S. Coast Guard

As of January 30, 1980, no person may operate a vessel equipped with an installed toilet in the navigable waters of the United States unless the vessel is equipped with a U.S. Coast Guard Certified Marine Sanitation Device (MSD). People who repair these devices, and those who work on vessels equipped with these devices, could be exposed to hazards peculiar to this equipment. There is at present no record of casualties resulting from the use or misuse of U.S. Coast Guard Certified MSDs. However, most of this equipment is getting older (many were installed before January 30, 1980) and may be falling into disrepair.



This physical/chemical marine sanitation device has a design flow rate of 7.5 gallons per minute.

Types of MSDs

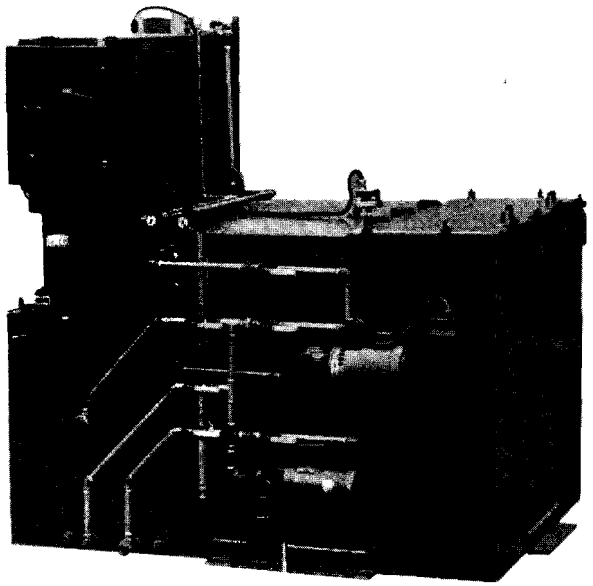
There are two major groups of marine sanitation devices. One group retains waste water onboard until it can be discharged at sea or to a shoreside reception facility. The Coast Guard refers to this as a Type III device. The second group treats the waste water and discharges the effluent into the sea. The Coast Guard refers to these as Type I or Type II devices.

The "retain onboard" devices are composed of holding tanks and may also have recirculating devices. The holding tank is just a container or space properly ventilated that is used to retain the human waste and the transport medium on board the vessel until it can be

properly discharged. The recirculating type are very similar to the ones employed on commercial aircraft. They are primarily composed of a pump to recirculate the transport medium (possibly by vacuum), and a holding tank to retain the waste. The transport medium is composed of water, disinfectant, and deodorizers.

The "treat and discharge" devices employ treatment processes that are either physical/chemical, macerator/chlorinator, or biological. The human waste water (or black water) enters the system and is tranported to a holding or staging area where solid particles, such as rocks or jewelry, are settled or screened out. The treatment for physical/chemical devices begins by further separating out the solid waste and then adds disinfectant. This device can readily handle large quantities and surges of black water. However, it produces a lot of sludge which must be removed. Macerator/chlorinator devices first mechanically grind the solid waste and then chemically treat the effluent. This type of device requires more chemical disinfectant than the others and may not be as effective.

Biological units differ in that they first aerate the sewage to expedite the growth of microorganisms which will break down the waste paricles naturally during this aerobic action. The effluent is then chemically treated. The biological units create less sludge than the physical/chemical type and employ less disinfectant than the macerator/chlorinator device but have difficulty handling surges of sewage in the inital operating stages.



This marine sanitation device is a biological unit with a capacity of 1,000 gallons per day.

Health Hazards

The primary hazard to your health and safety generated by all these devices is biological. Human waste decays aerobically and anaerobically. (Aerobic waste treatment employs the action of microorganisms in the presence of oxygen. Anaerobic treatment is the action of microorganisms in the absence of oxygen.) Human waste will support the growth of microorganisms, and some of these will cause serious diseases. Pathogenic organisms such as Salmonella, Escherici Coli, and Vibrio Cholerae have been found in waters containing human waste. These organisms will cause dysentery and cholera. Methane, a highly volatile and explosive gas, is another product of anaerobic decay. Disease and gas hazards will most likely occur in a holding tank or inoperative treatment tank containing black water which is allowed to sit without being completely flushed or adequately ventilated.

Marine sanitation devices which employ chemical treatment may present a chemical hazard. The owner's manual for this type of MSD will specify by brand name the type of chemical to be used and will also state the proper amount. Chlorine, in one form or another, is specified by most companies for use in MSDs. Large amounts of this substance can be hazardous, particularly if the liquid changes to a gas. When mixed with certain solvents, chlorine will form a poisonous gas that can cause painful death or (in low quantity) painful sores to the skin, lungs, and nasal passages.

Experimenting with a chemical treatment tank is risky and should not be done. The safest method of treating the black water is described in the owner's manual supplied by the manufacturer. This manual should be followed to the letter.

Maintenance and Repair

As with everything mechanical, marine sanitation devices require maintenance and repair to operate properly and safely. Trouble-shooting and maintenance information will also appear in the owner's manual. In addition to performing equipment examinations recommended by the manufacturer, the following steps will provide a good monthly maintenance check:

- Examine for leaks all soil and waste drains, discharge lines, flanges, joints, access plates, and clean out plugs.
- Examine for leaks all valves in the system, and check for free operation.
- Examine for leaks all impellor casings, and operate all motors.
- Operate controls, including automatic pump starters.
- Examine for leaks all tank penetrations and manholes.

Some leaks may be very small, but they can be detected by using the paper towel test: while the MSD is in operation, simply follow the piping system and hold a paper towel about 2 inches from the joint valve covers or flanges. If the towel shows moisture, the piping system is leaking and should be repaired.

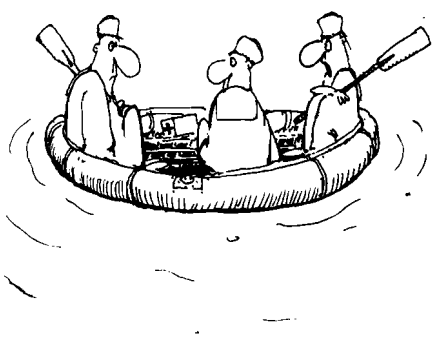
In all cases when working on these devices, you should be properly attired in rubber boots, overalls, rubber gloves, and hair covering. No one working on these devices should be allowed free movement about the vessel until protective clothing has been removed and placed in plastic bags. The used clothing should be either discarded or washed immediately.

Before entering large holding or treatment tanks or even spaces containing these tanks, make sure the space has been adequately ventilated and that the tanks are safe for workers. Use explosion-proof lights. Smoking should not be allowed in or near these areas. Cigarettes not only have the potential to ignite gases, but they also can collect microogranisms during the trip from the pocket to the lips. Diseases such as cholera, dysentery, and typhoid fever are usually transmitted from hand to mouth.

Remember, it is your health and safety that are of concern here. If you are responsible for the maintenance of a marine sanitation device, you should

- Follow the manufacturer's guidelines.
- Maintain your MSD in good working order.
- Examine the MSD regularly to make sure it operates properly.
- Make certain that the treatment and holding tanks are taken care of properly when shutting down.

As in most cases, good common sense and proper maintenance of your equipment will prevent accidents and injury. ‡



"OK, knock off the 'Rub-A-Dub-Dub' rhyme, Farnsworth!"

Ship and Equipment Design

How well are mariners' requirements taken into account when ships are designed and fitted out? On the premise that feedback from professionals could forestall future problems, a London-based organization solicited the views of its seafaring members.

Part VIII
Navigation

Compiled by E.J. Riley
from responses to the
Nautical Institute questionnaire

Many complaints were made about the lack of systematic layout on the bridge deck. It was frequently emphasized that the bridge/wheelhouse should be designed as a central control for navigation, communications, mooring operations, and emergency operations. Instruments, repeaters, vital for navigating and piloting a vessel, should be easily visible from the conning position with adequate repeaters on the bridge wings. All equipment should be designed for onboard, at-sea servicing by unskilled technicians.

1. Anchor daytime signals

Problem: Netting-type anchor balls are difficult to see by day.

Remedy. The design of daytime signals should be improved.

2. Azimuth rings/mirrors

Problem: During frequent use, azimuth mirrors/rings are left on repeaters and suffer from weathering. Also, certain makes are designed poorly.

Remedy. Azimuth mirrors/rings should be designed for robust use. Also, gyro repeaters (see number 9) should be better designed to protect the mirrors/rings.

3. Chart fittings/drawings

Problem: Folio drawers are too weak and shallow. They are insufficient for the vast quantities (3,000 charts are now in the world catalog). The chart table is too small for U.S. charts.

Remedy. Drawers should be of stronger construction to hold large quantities of charts. Chart tables should be large enough to accommodate two charts.

4. Clock

Problem: Clocks on vessels are usually sited where it is inconvenient for personnel to consult them.

Remedy. It is essential to have a clock sited on the for'd bulkhead visible at the conning position by day and night, and it should be easily visible for most personnel on the bridge.

5. Digital readouts

Problem: Digital readouts are prone to frequent failure and are difficult to maintain.

Remedy. These should be designed for the marine environment and for onboard, at-sea maintenance.

6. Echo sounder

Problem: Illumination of the echo sounder is poor. Transducers are often inaccessible; they can be inoperative at times when the vessel is in ballast. Maintenance on digital readouts is more difficult.

Remedy. When the echo sounder is sited on the chart table bulkhead, a digital repeater should be placed close to the conning position. There should be adequate illumination for both with individual dimmer control. Echo sounder ought to be operable for all conditions of the ship, with both imperial and metric readout facilities.

7. Electronic equipment

Problem: Frequently electronic equipment is subject to performance failure, with insufficient information for maintenance.

Remedy. The equipment should be designed for the marine environment. Accompanying manuals ought to provide more comprehensive information, easily understood by unskilled personnel.

8. Gyro

Problem: Some main gyros are inaccessible.

Remedy. The thermometer should be sited for easy reading without disturbing the gyro when housed. The follow-up switch for repeaters on some ships needs to be more accessible.

9. Gyro repeaters

Problem: A common complaint was poor illumination, either too bright or dim, brightness being a distraction in the conning position. Lift-on/off lids for protection of azimuth rings were awkward and cumbersome, so personnel did not use them often.

Remedy. It is necessary for finer illumination control on all repeaters. Design of repeater hoods should be improved for easy use, e.g., a concertina lid. An additional repeater should be placed on the for'd bulkhead by the conning position, clearly visible.

10. Heat generated by equipment

Problem: There can be a large amount of heat generated by electrical equipment.

Remedy. Arrangements should be made to ensure adequate heat dispersion from electrical units.

11. Illumination

Problem: General illumination of equipment is very bad. Frequently it is too bright or too dim, and often no individual control for the instruments. Frequently, instruments are read and controls are negotiated by flashlight.

Remedy. Individual illumination control should be designed for all instruments and equipment, with fine dimmer control to cope with all aspects of daytime and night-time visibility so that the illumination should not cause distraction.

12. Log

Problem: Some electric magnets were found to be unreliable and certain types to be inoperative.

Remedy. The ship's log should be designed to cope with the various frequent changes of the ship's condition.

13. Movement book

Problem: Frequently this is balanced on the main console, with entries written by flashlight. Invariably, the time of loggings is as accurate as one's wristwatch.

Remedy. Facilities need to be designed to accommodate the movement book close to the telegraph and should be adequately illuminated so as not to distract from ship operations/ navigation. It should be sited with full view of wheelhouse clock.

14. Navigation lights

Problem: The siting of some sidelights are so low that they frequently become extinguished from heavy seas. Reserve navigation lights often run off a battery and are frequently not individually controlled. "All around" lights are often sited where funnel and radar mast obscure part of the light.

Remedy. Regulation to lowest siting of sidelights "...shall not be so low as to be interfered with by deck lights." They should be sited at a height clear of being extinguished by seas. Each light should have individual emergency control, and backup power should come by the mains-battery if all generators fail. "All around" lights should be sited as the name implies.

15. Radar

Problem: There were a number of comments relating to radar, particularly the use of non-standard controls. Radar sets are frequently too low and sited in unsuitable places. There is a lack of spares; maintenance is difficult, and equipment is prone to failure.

Remedy. Standardize controls. Provide adequate spares with equipment. At least one radar should be sited at the front of the wheelhouse where it would be convenient and easily accessible.

16. Wheelhouse design

Problem: Additional items supplied to the vessel after construction/fitting-out tend to end up sited in any available space. Chart tables are generally the first to suffer and frequently become cluttered with additional equipment. The various instruments, e.g., barometer, are frequently sited with little regard to the average height of personnel.

Remedy. A suitable amount of space should be left at the design stage for additional items likely to be acquired during the life of a vessel. All instruments should be sited conveniently and easily accessible for reading.

Keynotes

Advance Notice of Proposed Rulemaking

CGD 84-088	Certification of Seamen	(4 Feb)

Abstract: The Coast Guard is calling for comments on the proposed total revision of 46 CFR Part 12, Certification of Seamen. This proposal contemplates additional requirements, such as physical examinations, mandatory training, and drug/alcohol screening for initial certification and retention of Merchant Mariners Documents. In addition, this revision will incorporate changes in the statutes, clarify policy and procedures, and improve the overall readability of the regulations.

Notice of Proposed Rulemaking

CGD 84-027	Documentation of Vessels	(4 Feb)

Abstract: The Coast Guard published a notice of proposed rulemaking (49 FR 45623) on November 19, 1984, concerning changes pertaining to the marking of vessels documented under the laws of the United States. Public comments were invited by February 19, 1985. A request has been received for an extension of the comment period. In consideration of the request, the closing date for comments is extended to the close of business on April 19, 1985.

Notice of Meeting

CGD 85-006	Towing Safety Advisory Committee Meeting	(11 Feb)

Final Rule

CGD 84-089	Great Lakes pilotage; Rates increase	(21 Feb)

Abstract: This rule amends the Great Lakes Pilotage Regulations. These amendments increase the basic pilotage rates by 4 percent in the U. S. Great Lakes pilotage system. These changes are made in order to increase the revenue received by the pilot organizations so that they may meet their operating costs.

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.

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. If sea feed temperature in a flash evaporator falls below 160° Farenheit,

A. the distillate should be directed to the contaminated drain tank.
B. the automatic solenoid dump valve should direct distillate to the bilge.
C. the demisters will become scaled.
D. priming will occur in the first effect.

Reference: Harrington, Marine Engineering

2. To charge a bladder-type hydraulic accumulator,

A. remove all hydraulic system pressure and bring the pneumatic pressure to the accumulator preload pressure.
B. remove all hydraulic system pressure and bring the pneumatic pressure to the system's design pressure.
C. increase the pneumatic pressure until the hydraulic system reaches its design pressure.
D. allow the accumulator to completely fill with gas charge at atmospheric pressure, shut off the air chamber, and add hydraulic fluid until the hydraulic system reaches its design pressure.

Reference: Oster, Basic Applied Fluid Power

3. Water hammer in steam lines can be prevented by

A. keeping lines drained and insulated.
B. replacing all 90° elbows with capped tees.
C. opening the steam supply valve wide to prevent pressure drop.
D. keeping steam temperature below the saturation point.

Reference: Osbourne, Modern Marine Engineering Manual, Vol. I

4. To properly seat brushes on a commutator, you should use

A. emery cloth.
B. heavy paper.
C. a file.
D. sandpaper.

Reference: Hubert, Preventive Maintenance of Electrical Equipment

5. In a diesel engine, blow-by is generally the result of worn

A. valve guides.
B. oil control rings.
C. valve seats.
D. compression rings.

Reference: Stinson, Diesel Engineering Handbook

DECK

1. The signal employed in connection with the use of shore lifesaving apparatus to signify, in general, "affirmative," is

A. vertical motion of the arms.
B. code signal "C" sent by light or sound signaling apparatus.
C. firing of a red star signal.
D. none of the above.

Reference: HO.102

2. Which of the following is the lifesaving signal for, "You are seen. Assistance will be given as soon as possible."?

A. Red star rocket
B. Orange smoke signal
C. Green star rocket
D. Vertical motion of a flag

Reference: HO.102

3. The point in a vessel at which all the vertically downward forces of weight can be considered to act is the

A. center of buoyancy.
B. center of gravity.
C. metacenter.
D. pivot point.

Reference: Ladage, Stability and Trim for the Ship's Officer

4. Intact buoyancy is a term used to describe

A. the volume of all intact spaces above the waterline.
B. an intact space below the surface of a flooded area.
C. an intact space which can be flooded without causing a ship to sink.
D. the space at which all the vertically upward forces of buoyancy are considered to be concentrated.

Reference: Ladage, Stability and Trim for the Ship's Officer

5. Fresh air breathing apparatus is used to

A. make underwater repairs to barges.
B. determine if the air in a tank is safe for men.
C. enter areas that may contain dangerous fumes or lack oxygen.
D. resuscitate someone who has stopped breathing.

Reference: CG-174

ANSWERS

1-A;2-B;3-B;4-B;5-C
DECK

1-B;2-A;3-A;4-D;5-D
ENGINEER

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.

Barge Fleeting Report Released by MARAD

The Maritime Administration recently announced the completion of a study on barge fleeting in the Deep River Corridor on the Lower Mississippi River.

Barge fleeting involves the assembly, mooring, shifting, and breaking out of non-self-propelled barges and provides safe, secure, and accessible temporary storage for waterborne cargoes in transit between domestic and foreign origins and destinations.

The study focused on Louisiana's 235-mile-long corridor from Baton rouge to the Gulf of Mexico. The report notes that this stretch of the Mississippi annually records more than 125,000 barge movements and, with some 8,000 designated barge fleeting spaces and 470 miles of navigable deep-river frontage, has the largest, densest, and most complex barge traffic in the world.

Volume 1 of the three-volume report discusses fleeting sites, current fleeting practices, capacity and throughput limitation, and new intermodal technologies. Volume 2 is a handbook guide to the components of a barge fleeting plan, including a methodology for site evaluation and testing.

Copies of the report are available from the National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22161. The order numbers and prices are as follows:

Volume 1, "The Barge Fleeting Industry and Port Competitiveness," #PB85-163517, price $26.50.

Volume 2, "Barge Fleeting Handbook Guide and Site-Evaluation Methodology," #PB85-163525, price $20.50.

Volume 3, "Executive Summary," #PB85-16353, price $11.50.

Chemical of the Month

Richard W. Sanders

Caustic Potash

Editor's Note: Readers may be interested in comparing this month's chemical, caustic potash, with January's chemical, caustic soda.

Caustic potash is a descriptive term for this month's chemical, potassium hydroxide. "Caustic" refers to any chemical that can burn or destroy flesh. The word comes from the Greek "kaustos," meaning "burning." Potash is a material that was originally obtained by running water through the ashes of burned wood and boiling the solution in open kettles. This residue, used to make a crude soap, was called potash because it was made from "ashes" in "pots." Today the term has been extended and is the commercial name for a number of compounds containg potassium.

In its pure form, caustic potash is a white solid with a waxy appearance. It is commonly put into flake or pellet form and may be dissolved in water to form a solution. Caustic potash deliquiesces (dissolves by absorbing moisture) very rapidly on exposure to air and is extremely soluble in water.

Potassium hydroxide is used extensively in manufacturing a variety of products. It is a common ingredient in household detergents and drain cleaners. It is also used in making ceramics, glass, drugs, adhesives, fertilizers, soaps, and textile dyes.

Richard W. Sanders was a Third-Class Cadet at the time he wrote this article. It was written under the direction of LCDR Thomas Haas for a class on hazardous materials transportation. Technical assistance was provided by the Cargo and Hazards Branch, U.S. Coast Guard Headquarters.

Potassium hydroxide was produced in early times by extracting alkali (potash) from wood ashes and adding quicklime to it. Chemically, the production is caused by reaction of potassium carbonate (potash) with calcium hydroxide (quicklime) in water. The resulting solution is then separated from solid materials and evaporated. Obtaining potassium hydroxide by this lime process was the standard method of manufacture until the end of the 19th century, when production through electrolysis of potassium salt (KCl) was discovered. This process involves running an electric current through a solution of potassium chloride and water. Chlorine gas is formed and bubbles off. The remaining solution is then evaporated, leaving potassium hydroxide. This is the standard industrial method of production for this chemical today.

Caustic potash is a strong **base** (opposite of **acid**) that should be handled with extreme caution. Like caustic soda (see "Chemical of the Month," January 1985 issue), it can cause severe burns. It is especially dangerous to delicate tissues. Concentrated caustic potash will also damage clothing and dissolve metals such as aluminum, zinc, and tin. When added to water, a significant amount of heat is liberated. Although potassium hydroxide is reactive, it is not flammable.

A spill of caustic potash, whether in solution or solid form, should be diluted with water. Damage is minimized by lowering the concentration of the chemical as quickly as possible. If washed into the environment, caustic potash should be introduced slowly and with large volumes of water to minimize the pH (acid-base) change. Workers involved in a cleanup are required to wear protective clothing, including a face shield or goggles, and gloves.

Potassium hydroxide is a health hazard. If inhaled, the dust can cause severe lung damage. If the chemical comes into contact with the eyes, it can cause blindness. The eyes should be flushed with water for 15 minutes, and a physician should be notified. If spilled on the skin, flush the affected area for the same amount of time.

If products containing potassium hydroxide are swallowed, a counterdose must be taken immediately. For products containing high concentrations of potassium hydroxide, such as drain cleaner, two tablespoons of vinegar in two glasses of water should be administered, followed by the whites of two raw eggs or two ounces of vegetable oil. If low-concentration products, such as detergents containing caustic potash, have been swallowed, one or two glasses of milk should be administered. For each case, vomiting should **not** be induced. Contact a physician or poison control center immediately.

Caustic potash is shipped as a solid containing 83 to 86 percent potassium hydroxide with 10 to 13 percent water and 2 to 3 percent carbonate. It is also shipped in tank vessels as a 50-percent solution. For bulk shipment, caustic potash is regulated by the U.S. Coast Guard as a corrosive material in Subchapter C (Subpart F) of the Code of Federal Regulations. Tank construction for containment and transport of potassium hydroxide is also regulated in Subchapter C (Subpart L) of the CFR. Regulations concerning bulk shipment are also found in Subchapter O (Shipping) of Title 46. The International Maritime Organization includes it in Chapter 8 of the IMO Chemical Code (Corrosive Materials). For package shipment, caustic potash is regulated by the U.S. Department of Transportation as a corrosive material, and containers used to transport it are required to bear the "Corrosive" label. The International Maritime Dangerous Goods Code entries for caustic potash can be found on page 8124 of that manual. ‡

Chemical name:	Caustic Potash	
Formula:	KOH	
Synonyms:	potassium hydroxide potassium hydrate lye	
Physical Properties:	**solid**	**50% solution**
boiling point:	1320-1324°C (2408-2415°F)	145°C (293°F)
melting point:	360°C (680°F)	-43°C (-45°F)
Threshold Limit Values (TLV)		
time weighted average:	2 mg/m^3	not established
short term exposure limit:	not established	not established
Flammability Limits in Air	not flammable	not flammable
Combustion Properties	not combustible	not combustible
Densities		
crystal (water=1):	2.044	1.514 (at 15°C, 60°F)
vapor (air=1):	0.62	not applicable
Identifiers		
U.N. Number:	1813	1814
CHRIS Code:	PTH	CPS
Cargo compatibility group:		5 (Caustics)

Automated Propulsion Throttle Runaways

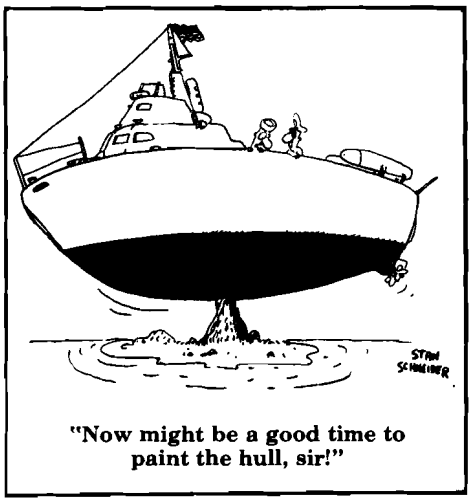
Several recent casualties indicate a potential safety problem caused by the failure of electronic propulsion throttle controls. These failures are characterized by erratic throttle response or a sudden uncontrolled increase in engine or turbine speed. Reported runaways are more prevalent on steam vessels and have resulted in the ramming of moored vessels, surging and breaking of mooring lines, and broken loading arms and gangways.

All mariners should be aware of the potential for any automated throttle control to fail without warning and should be prepared to take appropriate action. All vessel operators should regularly confirm proper operation of remote and local emergency propulsion trip devices. Steam vessel operators who regularly "roll" the turbine with steam while in port should continuously monitor for possible runaway and should trip the turbine, if necessary.

The Coast Guard is trying to identify a common cause or causes for this serious problem. If you have information on past automated propulsion throttle runaways, either in port or at sea, contact your nearest Coast Guard Officer in Charge, Marine Inspection.

Consumers should know

NATIONAL CONSUMERS WEEK
APRIL 22-28, 1985



"Now might be a good time to paint the hull, sir!"

Correction

Please note that Dr. Alan L. Schneider, Marine Technical and Hazardous Materials Division, U.S. Coast Guard, was omitted as the author of "Inerted Product Carrier Tanks — A Newly Discovered Problem" in the February 1985 issue (page 35).

Please note also that "New Marine Fire Training Facilities in Washington State," page 53 of the same issue, contained incorrect telephone numbers. Mr. John Anderson, Director of the Training Center, can be reached on (206) 888-4523. Persons interested in donating material or equipment to the program should contact Mr. Hal Schuyler at (206) 431-3502. These are not toll-free numbers as originally stated.

We apologize for the errors and inconvenience.

U.S. Department
of Transportation

**United States
Coast Guard**

2100 Second St., S.W.
Washington, D.C. 20593

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