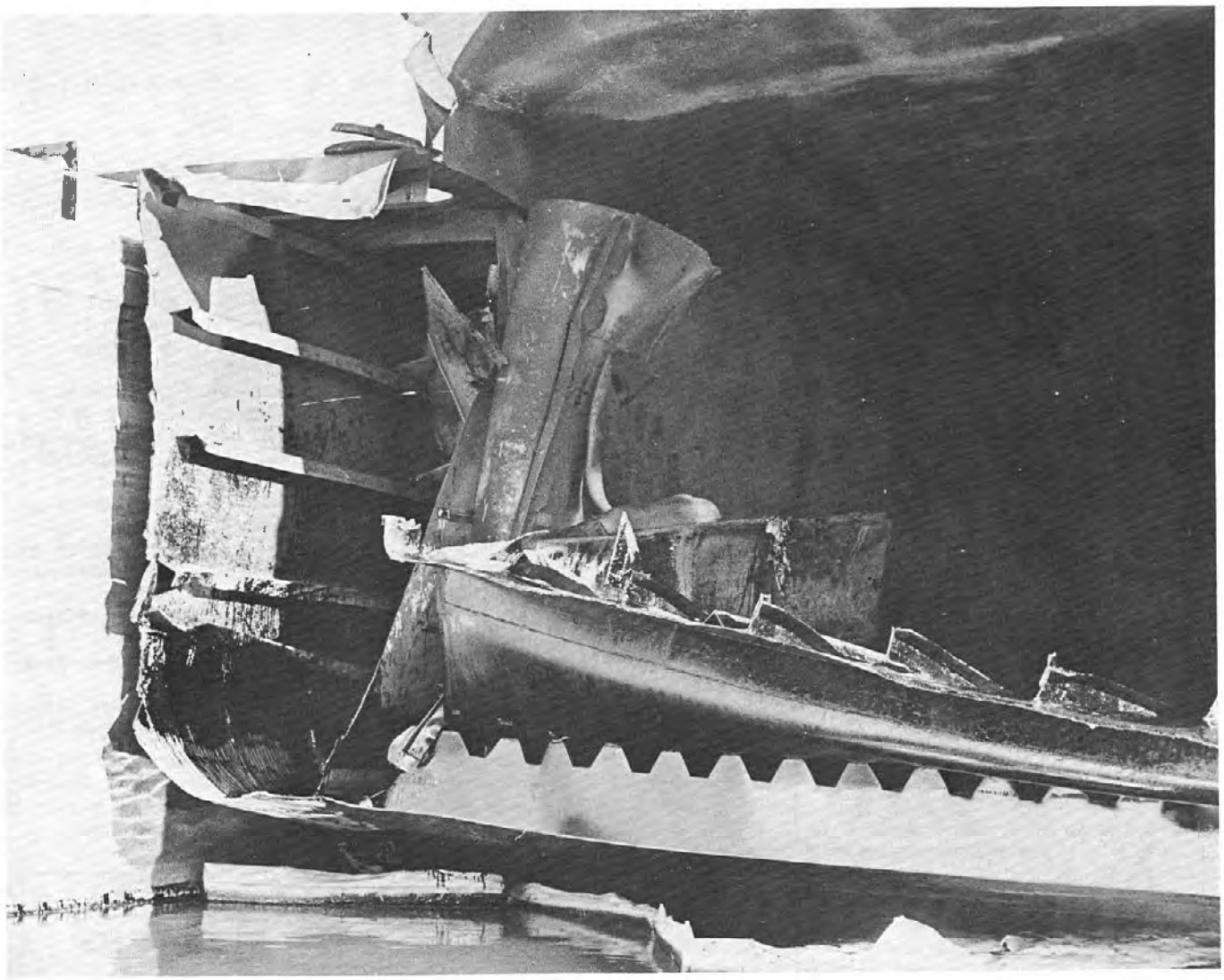
PROCEEDINGS
OF THE MARINE SAFETY COUNCIL



DEPARTMENT OF TRANSPORTATION UNITED STATES COAST GUARD

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PROCEEDINGS

OF THE MARINE SAFETY COUNCIL

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CONTENTS

COVER

The burned-out shell of the double-skin tank barge B-924. Four lives were lost in an explosion and fire 2 years ago at a Mississippi River repair yard where the barge was undergoing welding repairs.

Pictured are the No. 1 starboard cargo tank and starboard wing void. At the time of the explosion, welding was being done to repair a crack in the bulkhead between the tank and the void. The firewatch in the void space escaped when cargo residue ignited, but the four men in the tank - including the marine chemist who had certified the barge safe for hot work - perished.

The initial flames spread quickly and touched off an explosion that ripped away the entire forward rake and blew in the forward bulkheads of both No. 1 cargo tanks. Fire engulfed the barge, and it required the efforts of the local fire department as well as a Coast Guard cutter which was on the scene to extinguish the blaze about 2 hours later.

A summary of the official report of the Coast Guard investigation of the casualty is presented at page 48.

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maritime sidelights

CORRECTION

In the cover caption in the March issue, we said that the casualty statistics for the past year showed a decrease in vessel casualties from the previous year. Unfortunately, we neglected to take into account that the period covered by the 1976 statistics included an extra 3 months. (This was due to the change in the beginning date of the fiscal year from 1 July to 1 October.) Obviously, that's why the statisticians are paid to work with the figures and we're paid to cut and paste.

Actually, if the 1976 figures are adjusted for a 12-month year, the 1977 statistics show an increase in most categories. It should be stressed, however, that year-to-year comparisons are very unreliable indicators, due to a great number of variables that we don't have space to go into here.

As was indicated in the introduction to the statistics in the March issue, specific questions concerning interpretation of the figures are invited, and may be directed to:

Commandant (G-MA/83)
U.S. Coast Guard
Washington, DC 20590.

ONLY LUCK

One of this month's feature articles gives an account of a barge casualty in which a combination of hot work and cargo residue had the predictable tragic consequences. Another incident occurred recently which caused no injury or property damage, but by all rights probably should have.

The tank barge involved was undergoing hot work at a dockside repair facility when a fire broke out in the wing tank below the site of the work. At the time, the vessel had a signed and dated gas-free certificate, 3 days old, stating that Nos. 1 through 5 port and starboard wing tanks were considered gas-free, safe for men and safe for fire.

The proximate cause of the casualty was determined to be molten metal from the welder's torch dropping into and igniting approximately 200 gallons of oil-water mixture that had accumulated in the tank bottom. This accumulation evidently occured between the time of the marine chemist's inspection and the commencing of hot work on the tank top, 3 days later.

Repair yard personnel put out the fire by using dry chemical and then flooding the tank with fresh water to 90 percent of its capacity. Fortunately, this incident resulted in no injuries to crewmen or workers, and no structural damage was sustained by the vessel. However, an informal investigation revealed several factors which deserve further discussion - specifically, numerous improper procedures and apparent ignorance of the role of marine chemists, gas-free certificates, and shipyard "competent persons."

The marine chemist who inspected the tank barge had stipulated in his gas-free certificate that "compartments must be stripped dry and blowers in operation prior to commencing hot work." This requirement had not been met prior to commencing hot work on the day of the fire.

Furthermore, the gas-free certificate stated that all work was to stop and the marine chemist was to be contacted if there were any changes in the gas-free conditions of the space. Even though, on the day of the repairs, a shipyard competent person (so designated in accordance with Deparrmenr of Labor regulations) checked the No. 5 port wing tank and noted an unknown liquid with a distinctive odor at the bottom of the tank, the marine chemist was not informed. Instead, the competent person sampled the tank atmosphere with a combustihle gas indicator (zero reading) and noted the oxygen concentration of the tank as 20.8 percent by volume. The latter figure he arrived at by use of his senses - smell, etc! Based on these observations, the shipyard foreman directed that repair work be commenced.

When a welder smelled a petroleum-like odor in No. 5 port wing tank, another check for combustible gas concentration was made by a shipyard employee who was not even a designated shipyard competent person. He got another zero reading, and, even though he saw the unidentified liquid at the tank bottom, advised the welder that it was safe to proceed. Several hours later, the fire broke out.

Finally, a word about the use of a three day old gas-free certificate. NFPA-306 "Control of Gas Hazards on Vessels to be Repaired - 1975" is the standard governing the inspection and certifying activities of marine chemists. Section 2-4.2 of this standard requires that a marine chemist certificate be issued within the 24 hours preceding hot work on a space. Since 3 days had passed since the original marine chemist inspection of the tank barge, the repair facility was obligated to recall him to reinspect and reissue a new gas-free certificate. If this had been done, the casualty could have been avoided.

This incident should emphasize the importance to all concerned personnel - repairyard management, supervisors, workers, and Coast Guard marine inspectors - of understanding the work site conditions requiring a marine chemist. In addition, all persons involved in such repair work should be familiar with and be able understand the contents and limitations of the gas-free certificate, including any qualifying instructions written on the certificate by the marine chemist. From this incident, it is evident that a continous education program is necessary so that maritime repair facility workers will obtain the knowledge necessary for them to insist that proper aafeguards and safe procedures he utilized on the job.

Barge Blast Kills Four

The following is a summary of the official marine casualty report on the explosion of the tank barge B-924. A copy of the complete report may be obtained without charge by writing to the Commandant (G-MMI), U. S. Coast Guard, Washington, DC 20590.

On 13 November 1975, the tank barge B-924 exploded and burned during welding repair work at the Brent Towing Company repair facility, Greenville, Mississippi. Four people were killed and two others injured as a result of this casualty. The B-924 sustained approximately $230,000 damage, and another barge moored next to it an additional $38,000. Oil pollution and damage to power and telephone lines accounted for another $20,000 in damage.

The B-924 was a double-skin tank barge with wing voids, double bottoms, and rake ends surrounding six cargo tanks, three along each side of the centerline. The 1,698-gross-ton barge was built in 1973 and measured 290 feet long, 52.5 feet beam, and 10.5 feet in depth. It was certified to carry 24,400 barrels of Grade A and other specified chemical cargoes. The barge had been loaded with No. 6 fuel oil on the last trip before the casualty and with crude oil on the three previous trips.

On 3 November 1975, while the B-924 was in general service, a break in the steam coil in the No. 1 port cargo tank was discovered. The problem was brought to the attention of the Brent Towing Company on 5 November, whereupon the B-924 was ordered to be returned to Greenville for repairs. Early in the morning of 12 November, the barge was moored port side to the company dock alongside a permanently moored

vessel used for stripping and cleaning tanks. Another tank barge, the B-428, was moored port side to the B-924, since both vessels were scheduled for repairs the next morning. During the day, the tanks on both barges were opened and blowers placed over the ullage openings.

On the morning of the 13th a certified marine chemist arrived to determine that the two vessels were safe for men and fire and to issue gas free certificates to the Brent Towing Company to allow welding repair work to be done.

Company employees were under instructions never to perform any hot work on a vessel unless there was a gas free certificate posted on the vessel. Additionally, they had been told to follow the instructions of the marine chemist at all times when he was on scene and when work was being performed. This policy of the company, with regard to the relationship with the marine chemist, led employees to believe that safe working conditions were ensured by the mere presence of the chemist.

Around 11 a.m. work was begun on the steam line fracture, located approximately 2 feet forward of the after bulkhead of the No. 1 port cargo tank. Cargo residue around the fracture was cleaned up with rags and the welding repair begun without the use of a sand blanket or asbestos sheeting. The adjacent tank, No.2 port, contained cargo at the time, and there was some cargo residue in the adjacent void spaces and in the No. 1 starboard cargo tank.

Around 11:30 the repair was completed and preparations were made to weld a crack in the No. 1 starboard cargo tank. This repair was not started immediately because the marine chemist felt that the oil was too close to the crack and he wanted it pumped away from the working area. He also said that there was an odor in the tank that he did not like, but that he thought the blowers could handle it. During the lunch break, two blowers were in operation on the Butterworth openings to the No. 1 starboard cargo compartment. There was also a blower on the opening into the No. 1 port wing void, but none on the No. 1 starboard wing void adjoining the area that was to undergo repairs.

Around 12:30 rhe marine chemist, a leaderman, a welder, and a laborer entered the No. 1 starboard cargo tank to begin repairing the fracture. About the same time, two men entered the No. 1 starboard wing void as firewatch on the opposite side of the bulkhead where the welding was to be performed. Neither of these men was familiar with the duties of a firewatch.

Before starting the welding repair, no attempt had been made to completely clean the tank of oil residue. The No. 1 starboard cargo rank had an estimated 1 to 2 inches of oil on the bottom for a radius of approximately 6 feet from the opening of the cargo discharge line, and the entire tank was covered with oil residue. The bottom and internals of the wing voids and double bottoms in way of the No. 1 cargo tanks were coated with oil. The No. 1 starboard wing void contained several inches of oil increasing in depth to approximately 6 inches toward the after bulkhead.

There was no fire protective material such as a sand blanket or asbestos sheeting on either side of the bulkhead. No cleaning or preparation of any kind had been done in the area of the crack in the No. 1 starboard wing void and there is no evidence that combustible gas readings were taken in the void space prior to commencing welding. The two men standing the firewatch in the wing void had no method of direct communication to the repair party in the starboard cargo tank.

The firewatch had been standing in the wing compartment for about 5 to 10 minutes when they saw the area around the crack start to glow and sparks began spitting through into the void. Within a few seconds the sparks started to flare, and the two men immediately discharged the fire extinguisher, but without effect. As the void became engulfed in flames, the men dropped the fire extinguisher and ran for the ladder to escape through the manhole. Once on deck, they had begun running aft when the forward part of the barge exploded, knocking one man to the deck and the other into the water.

Three other men who had been standing on the forward rake end, seeing flames coming out of the openings to the cargo tank and wing void, also had begun running aft before the explosion. Two of these men also were knocked into the water by the force of the blast.

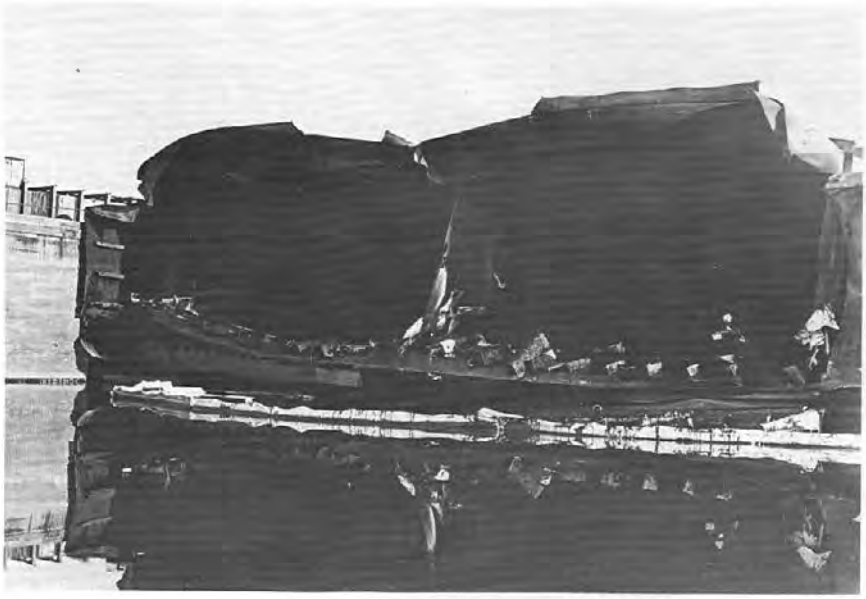
Although the men on firewatch were severely burned, all who were on deck at the time of the explosion were able to get to safety. The four men in the cargo tank had no chance to escape.

The blast ripped away most of the rake in three sections, one of which was deposited on a roadway more than 500 yards from the site. Both forward No. 1 wing bulkheads were forced forward, and both cargo tank forward bulkheads were forced aft by the explosion. The forward section of the B-924 was immediately engulfed in flames.

The Coast Guard Cutter Patoka was passing the Brent Towing Company facility at the time, enroute to service aids to navigation. When the barge exploded, the officer in charge of the Patoka sounded the general alarm, launched a small boat to look for survivors, and proceeded to the scene.

The Patoka nosed against the B-428 and began spraying foam, while the crew severed the forward lines to the barge. The Patoka then pulled the B-428 away from the burning B-924, and, being underpowered for the size of the barge, held the B-428 away until the tug Miss Kathy arrived and took it in tow. The cutter then was assisted in firefighting by the Miss Kathy, the Corps of Engineers harbor workboat MV Roche, and the Greenville, Miss., Fire Department. By around 2:30 in the afternoon the fire was completely extinguished.

The Commandant, in his review of the casualty, concurred with the Marine Board in their determination that the proximate cause of the casualty was welding re-



pairs being undertaken on a tank barge that was not gas free. This resulted in the ignition of vapors from cargo and cargo residue in the No. 1 starboard wing void which spread fire throughout the forward section of the vessel and ignited volatile vapors causing an explosion. The disregard for federal regulations and unsafe practices on the part of the marine chemist and the owners of the vessel resulted in this fatal accident.

The Coast Guard, under the authority of 46 CFR 30.01-10, requires repair work on inspected vessels to be accomplished under the direction of the Officer in Charge, Marine Inspection. The Coast Guard Marine Inspector, acting within the scope of this regulation, shall inspect a vessel with regard to the repair work to be accomplished and grant his approval or disapproval as appropriate. If upon this inspection any unsafe conditions are noted, the inspector shall require that they be eliminated prior to commencing rapair work.

In this case the owners of the barge did not notify the Coast Guard of any repair work to be undertaken on the B-924 or the B-428. Had this requirement been adhered to, the casualty would have been prevented. Attempting hot work within a space where there is cargo residue and free oil is inherently dangerous and would not be allowed by a Coast Guard Marine Inspector.

Testimony received by the Board revealed that on a previous occasion a Coast Guard inspector at Greenville had required the cleaning of a tank barge owned by the Brent Towing Company when he found it to be in similar condition to the B-924. This requirement was imposed by the Coast Guard inspector even though the barge had been certified gas free. The gas free certificate had been issued by the same marine chemist who perished aboard the B-924.

The owner of the repair facility and barge had the ultimate responsibility to its employees to insure that a safe working environment was maintained. Regardless of the fact that a marine chemist was on scene, the presence of a volatile carge residue in the tank to be repaired and in all adjacent tanks should have alarted the company to the inherent dangers present. These dangers were magnified in that no attempt was made to clean the areas to be welded. That the employees were allowed to proceed with hot work in those spaces was a major contributing factor to the cause of this casualty.

At no time during the search for cargo leakage, preparation, or repair work on the B-924 was a gas free certificate issued to the barge owners, nor was there any attempt made by the senior officer present to secure copies of a gas free certificate as required by 46 CFR 35.01-1. In addition, employees of the repair facility were allowed to enter cargo spaces and adjacent void compartments on the day prior to the casualty without a test conducted by a competent person as required by 29 CFR 1915.11.

The Commandant concurred with the Marine Board's recommendation that the Coast Guard review standards relating to detailed procedures and responsibilities for the completion and handling of marine chemists' certificates. The Coast Guard will also conduct a complete review of the certification of marine chemists and their equipment, and the maintenance of related records.

The Board concluded that there was evidence of violation of law on the part of the repair facility in that the welding on the B-924 was not done under the direction of the Officer in Charge, Marine Inspection. This violation is a matter to be investigated under criminal penalty procedures, and the Commandant directed that the case be forwarded to the Department of Justice.

The Commandant concurred with the Marine Board recommendation that further investigation under civil penalty procedures be initiated against the barge owners regarding the evidence that no gas free certificate was issued or obtained prior to commencing hot work on the B-924. The investigation also developed evidence of violation of law in that the repair facility, through its agents, knowingly and willfully caused or allowed such fraud, neglect, conuivance, misconduct, or violation of law by which the lives of four persons were lost. This evidence was forwarded to the Departmeut of Justice.

A copy of the investigative report also has been forwarded to the Occupational Safety and Health Administration, in light of evidence of violation of that agency's regulations.

Helicopter Evacuation at Sea

This article and checkoff list was prepared for use in evacuations carried out by U.S. Coast Guard helicopters. In general, these procedures are applicable to helicopter operations conducted by other rescue agencies. It is a resourceful solution to a difficult problem, and one that cannot always be used. Even a so-called "routine" evacuation demands much effort and planning, and the key to success is preparation.

When a merchant vessel is faced with a medical evacuation at sea, lives depend on knowing the right procedures and on planing well in advance. An oversight or poor planning on the ship can imperil the helicopter, its crew, and even the patient's shipmates helping on deck. Knowing the right way makes everyone safer.

First, distance will determine whether an evacuation is even possible. The maximum range of the types of helicopters now used by the U.S. Coast Guard, the HH-52A amphibious single-turbine-powered and the HH3F amphibious double-turbine-powered, is 150 and 300 nautical miles respectively. This is in ideal weather, with ideal weight aboard, and includes going out, hovering for 10 minutes, and returning. Bad weather or extra weight shorten these distances.

Obviously, then, if a merchant vessel is 500 miles at sea and needs a helicopter evacuation, she will have to divert and steam for a point where a helicoprer can reach her. Normally, the Rescue Coordination Center working the case will tell the ship if a diversion is necessary, and a rendezvous point will be established. If the vessel is already within helicopter range, a diversion in the direction of the helicopter's base may still be beneficial to speed the removal of the patient.

For planning the evacuation and discussing the patient's condition, good sbip-helicopter communication is crucial. A fixed-wing aircraft often escorts a helicopter during an offshore evacuation, both to guide the helicopter to the scene, and to help with communications. Therefore, it is not unusual for a fixed-wing aircraft to circle the vessel and communicate with it before the helicopter arrives, relaying information until the helicopter is within communications range.

Voice communications between ship and aircraft are normally conducted on international distress and/or calling frequencies such as 2182 kHz and 156.8 MHz. Other frequencies common to both helicopter and vessel may be used, but once good communications have been established, frequency changes should be avoided. Helicopters can transmit and receive voice - Double Side Band and Single Side Band - on high frequencies between 2,000 kHz and 30,000 kHz if necessary. Homing capabilities for the helicopter are often available on many frequencies.

But if voice communications cannot be established, the helicopter will attempt to set up communications through other means when it arrives on scene. These may be: lowering a portable radio; using a loud hailer; dropping message blocks; lowering a handset connected to the aircraft intercom; using a chalk board; or using hand signals. As a last resort, if there is no practical way to communicate, the pilot may move right into position and begin the hoist.

Whatever the communication method on scene, the vessel should have earlier provided the Rescue Coordination Center with as accurate a position as possible, including course, speed, weather and sea conditions, and wind direction and velocity. Medical information on the patient should include whether or not he is ambulatory since Coast Guard helicopters do not normally carry stretchers.

After the helicopter has taken off, the vessel will be told its estimated time of arrival (ETA). Most probably, communications will first be established with the fixed wing aircraft, and later with the helicoprer as it gets closer. Frequent transmissions may be requested from the ship for homing purposes, so she should maintain a continuous watch on the assigned frequency.

With or without ship-to-aircraft communications, however, the Master can prepare for the hoist prior to the helicopter's arrival. Most merchant vessels have a clear area from which the hoist can be made safely - usually on the fantail. The more space made available, the easier and less hazardous the hoist. (A horizontal distance of 50 feet in

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Reprinted from AMVER Bulletin, 5/6:77.

all directions from the aircraft body is a minimum safe clearance.) Although Coast Guard helicopters can hoist from a substantial height, the operation becomes more difficult and dangerous with increased altitude.

If the hoist is to be from the fantail and an awning covers it, it should be removed and tied up securely along with any other items that may be blown about by the rotor downwash. Booms extending aft near the fantail should he raised as vertically as possible alongside the king posts. Aft flagstaffs should be taken down and antenna wires or cables extending to the stern removed if possible. Any reduction of obstructions on the stern, or wherever the hoist is to be made, will mean a lower and easier hoist. Except in unusual circumstances, the hoist will be made from the port side of the vessel since the helicopter hoist and hatch are on its starboard side.

Shortly before the helicopter arrives, and if the weather and his condition permit, the patient should be brought up from below and placed under cover near, but not in, the hoist area. Wrap any blankets securely around him so the rotor downwash doesn't blow them away.

As the helicopter arrives, change course into the wind, ideally with it about 20 degrees on the port bow. It is not only unnecessary to slow or stop, but is actually preferable to maintain normal speed since the helicopter can make the hoist with better control at a forward speed of 10 to 15 knots.

Final instructions for the hoist will be given by the pilot after seeing the ship and its obstructions. The pilot may not want to use the planned position, but will lower the basket or stretcher to another section of the vessel if it appears safer. During its flight, the aircraft builds up a static electricity charge. Anyone who reaches up to take hold of the basket or stretcher will most certainly get a shock. Therefore, always let the basket or stretcher touch the deck before handling it. If a high hoist is involved or if the hoist is from a confined space, the helicopter may lower a trail line. Deck personnel can guide the basket to the deck with this line as long as they do not touch the basket itself.

If the patient is so ill that the stretcher must be brought to him, it will have to be unhooked from the hoist cable. Don't try to take the stretcher away from the hoist point without unhooking the cable and letting it go free. Don't hook the hoist cable to any part of the vessel. Normally, the pilot will retrieve the cable, then pull away from the ship until he sees the patient aboard the stretcher and ready to be hoisted.

Instinctively, the patient will want to grasp the side of the basket. Instruct him not to, because of the possibility of injuring his fingers if it hits the side of the helicopter as it is being brought aboard. When the patient is ready for hoist he nods his head, deck personnel signal the hoist operator in the helicopter by indicating thumbs up, and the hoist begins. Steady the basket or stretcher to minimize swinging, use steadying lines if the hoist is so equipped, but for safety do not stand under it.

Special lighting precautions will be necessary if the hoist takes place at night. Because of visibility and depth-perception problems, the pilot will probably make an instrument approach to the ship. Lighting of the ship and the hoist area is necessary, but it is important not to shine any lights into the cockpit of the aircraft, nor to shine any lights pointing up toward the helicopter. Such lights can disorient or blind the pilot. If a searchlight is used to help the aircraft locate the vessel, shine it vertically and secure it once the helicopter has reached the area. Any boom lights used to light the deck should be directed downward.

Every helicopter evacuation at sea is different, and each presents its own problems. Communications between pilot and ship may be impossible. Operations at night, or under poor weather conditions require the utmost caution and capability of the pilot. But in each case knowing what to expect aud how to prepare, and what the accepted precedure is, can save time, effort--and a life.

Helicopter Evacuation Checklist

When Requesting Helicopter Assistance:

1. Give accurate position, time, speed, course, weather conditions, wind direction and velocity, voice and CW frequencies.

2. If not already provided, give complete medical information, including whether or not the patient is ambulatory.

3. If you are beyond helicopter range, advise your diversion intentions so that a rendezvous point may be arranged.

4. If there are any changes, advise immediately. Should the patient expire prior to arrival of the helicopter, be sure to advise. Remember, the flight crew are risking their lives attempting to help you.

Preparations Prior to Arrival of the Helicopter:

1. Provide continuous radio guard on 2182 kHz, or specified VOICE frequency if possible. The helicopter cannot operate CW.

2. Select and clear the hoist area, preferably aft, with a minimum 50-foot radius. This must include the securing of loose gear, awnings, and antenna wires. Trice up running rigging and booms. If the hoist is aft, lower flagstaff.

3. If hoist is at night, light pickup area as well as possible. BE SURE YOU DO NOT SHINE ANY LIGHTS ON THE HELICOPTER so the pilot is not blinded. If there are obstructions in the vicinity, put a light on them so the pilot will be aware of their positions.

4. Point searchlight vertically to aid in locating the ship, and secure them when helicopter is on scene.

5. Advise location of pickup area BEFORE the helicopter arrives so that he may make his approach aft, amidships or forward, as required.

6. There will be a high noise level under the helicopter, making voice communication almost impossible. Arrange a set of hand signals among the crew who will assist.

Hoist Operations:

1. If possible, move the patient to a position as close to the hoist area as his condition permits - TIME IS IMPORTANT.

2. Normally, if a litter is required, it will be necessary to move the patient to the special litter which will be lowered by the helicopter. Be prepared to do this as quickly as possible. Be sure patient is strapped in, face up, WITH LIFE JACKET, IF HIS CONDITION PERMITS.

3. Be sure patient is tagged to indicate what medication, if any, was administered, and when.

4. Have patient's medical record and necessary papers in envelope or package ready for transfer WITH him.

5. Change course so the ship rides as easily as possible with the wind on the bow, preferably on the port bow. Try to choose a course to keep stack gases clear of the hoist area. Once established, maintain course and speed.

6. Reduce speed if necessary to ease ship's motion, but maintain steerageway.

7. If you do not have radio contact with the helicopter, when you are in all respects ready for the hoist, signal the helicopter in with a "come on" by hand, or at night by flashlight.

8. ALLOW BASKET OR STRETCHER TO TOUCH DECK PRIOR TO HANDLING TO AVOID STATIC SHOCK.

9. If a trail line is dropped by the helicopter, guide the basket or stretcher to deck with line - keep line clear at all times.

10. Place patient in basket, sitting with hands clear of sides, or in the litter as described above. Signal hoist operator when ready for hoist. Patient signals by nodding head if he is able. Deck personnel give thumbs up.

11. If necessary to take litter away from hoist point, unhook hoist cable and keep free for helicopter to haul in. DO NOT SECURE CABLE TO VESSEL OR ATTEMPT TO MOVE STRETCHER WITHOUT UNHOOKING.

12. When patient is strapped in stretcher, signal helicopter to lower cable, hook up, and signal hoist operator when ready to hoist. Steady stretcher from turning or swinging.

13. If trail line is attached to basket or stretcher, use to steady. Keep feet clear of line.

SAVE THIS CHECKLIST -- THE INFORMATION CONTAINED HERE IS ESSENTIAL!

Nautical Queries

The following items are examples of questions included in the Third Assistant Engineer examination and the Second and Third Mate examinations.

ENGINEER

1. In a diesel engine, the spring force required for proper valve operation is determined by

A. cam contour.
B. spring length.
C. minimum firing pressure.
D. maximum firing pressnre.

2. Which supercharging method creates the least back pressure in a diesel engine exhaust system?

A. A pulse-pressure turbocharger
B. An engine driven reciprocating blower
C. A constant pressure turbocharger
D. An engine driven rotary blower

3. When there is a flame failure in an automatically fired auxiliary boiler, the

A. fuel supply is shut off.
B. air supply is shut off.
C. water supply is shut off.
D. safety valve lifts.

4. In most solid state electronic circuits the current and voltage are

A. D.C. regulated low voltage.
B. A.C. variable voltage.
C. D.C. variable voltage.
D. A.D. regulated high voltage.

5. Superheating of a refrigerant takes place in which refrigeration system component?

A. Evaporator
B. Expansion valve
C. Compressor
D. Receiver

DECK

1. Which of the following is the chief problem encountered when surging synthetic mooring lines on the gypsy head during mooring operations?

A. The lines may jam and jump off the gypsy head.
B. If there is a sudden strain on the line, the man tending the line may be pulled into the gypsy head.
C. The line's surging may cause the vessel to surge.
D. The heat generated may cause the lines to temporarily fnse to the gypsy head.

2. All of the following are parts of the sensitive element of a Sperry Gyrocompass EXCEPT the

A. wire suspension.
B. phantom ring.
C. rotor and rotor case.
D. vertical ring.

3. Structural members that fit between the floors of a vessel and stiffen the double bottom are called

A. buckler plates.
B. intercostals.
C. boss plates.
D. floor stiffeners.

4. Which of the following groups should be used to send the signal longitude 10° 34' west?

A. D 0934
B. Lo 10934W
C. G 0934
D. L 10934

5. Quadrantal error in a gyrocompass has its greatest effect

A. in high latitudes.
B. near the equator.
C. on north or south headings.
D. on inter-cardinal headings.

ANSWERS

Engineers
1. A 2. A 3. A 4. A 5. A

Deck
1. D 2. B 3. B 4. C 5. D

MERCHANT MARINE SAFETY PUBLICATIONS

The following publications may be obtained from the nearest marine safety office or marine inspection office of U.S. Coast Guard. Because changes to the rules and regulations are made from time to time, these publications can be kept current between revisions only by referring to the Federal Register. (Official changes to all federal regulations are published in the Federal Register, printed daily except Saturday, Sunday, and holidays.) Following the title of each publication in the table below are the date of the most recent edition and the dates of the Federal Registers affecting each.

The Federal Register may be obtained by subscription ($5 per month or $50 per year) or by individual copy (75 cents each) from SupDocs, U.S. Government Printing Office, Washington D.C. 20402.

CG No.	TITLE OF PUBLICATION
101-1	Specimen Examinations for Merchant Marine Deck Officers (2d and 3d Mate) (4-1-77).
101-2	Specimen Examinations for Merchant Marine Deck Officers (Master and Chief Mate) (4-1-76).
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