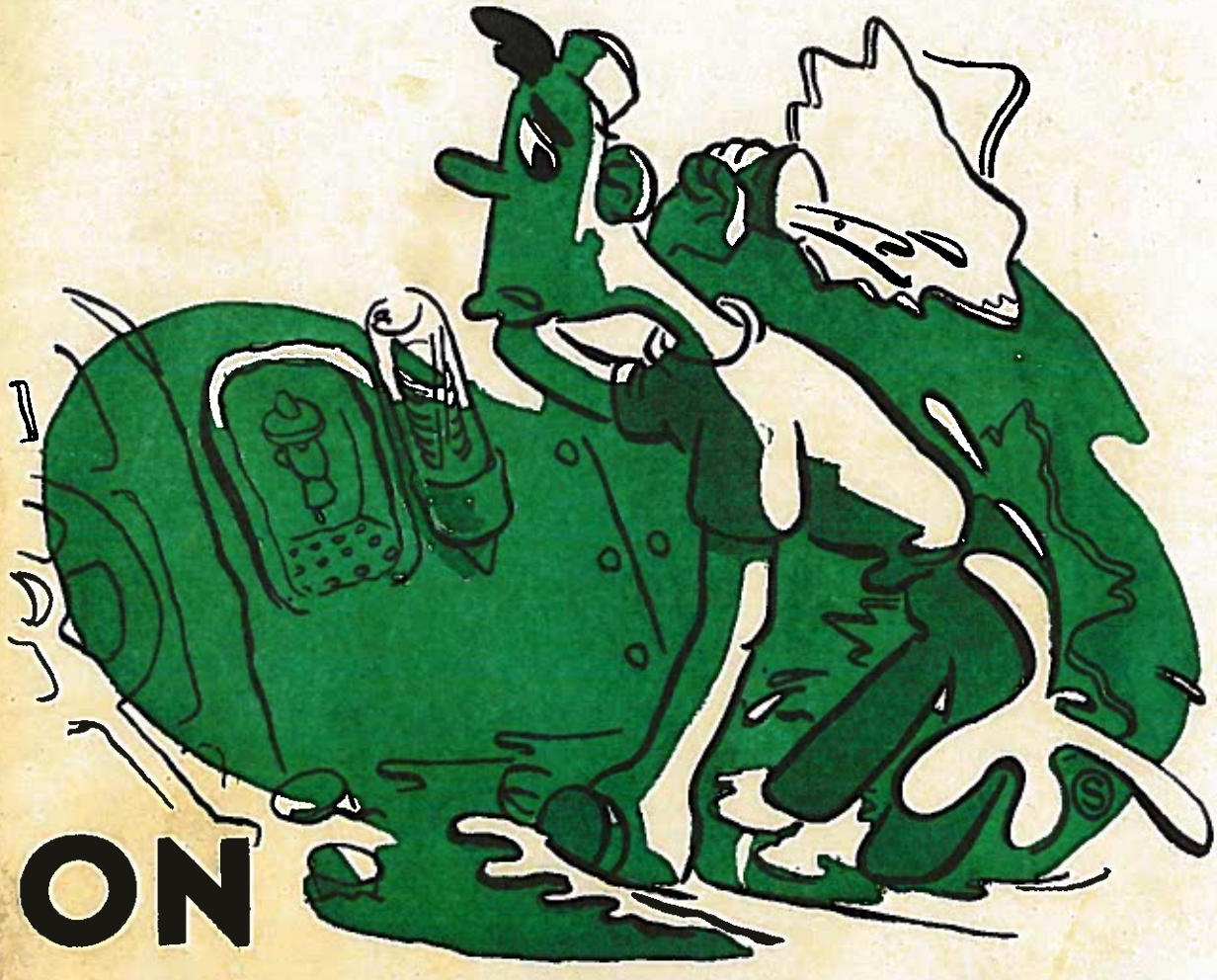
POINTERS



ON DAMAGE CONTROL

NAVY DEPARTMENT
BUREAU OF SHIPS

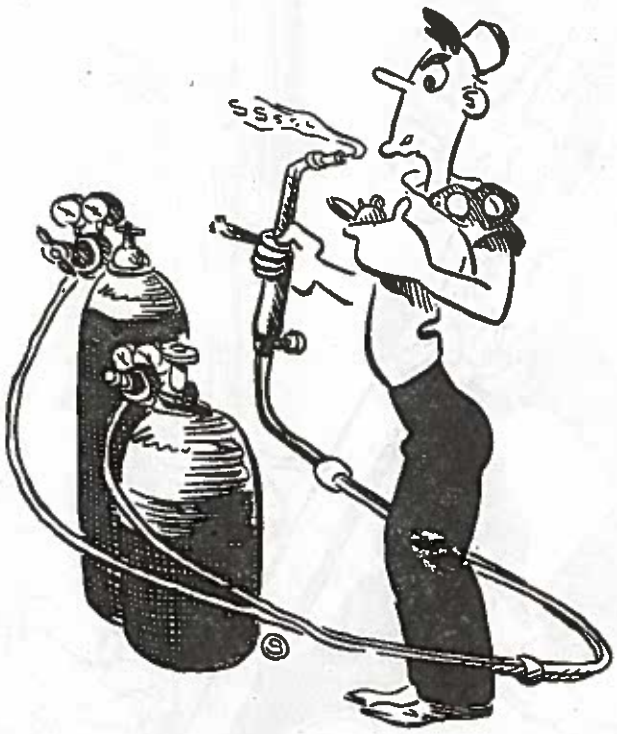
Washington, 1 March 1945

The ships of the Navy are built to take everything the enemy has to give and still come through fighting. To maintain the maximum fighting power of the ship under all conditions is the function of the Damage Control Organization. Every officer and man aboard ship has an individual responsibility to know his part in this organization.

To give general pointers on this subject, TP-8, Pointers on Damage Control, is published for the information and guidance of all concerned.

R. L. COCHRANE,
Rear Admiral, U.S.N.,
Chief, Bureau of Ships.

POINTERS ON DAMAGE CONTROL



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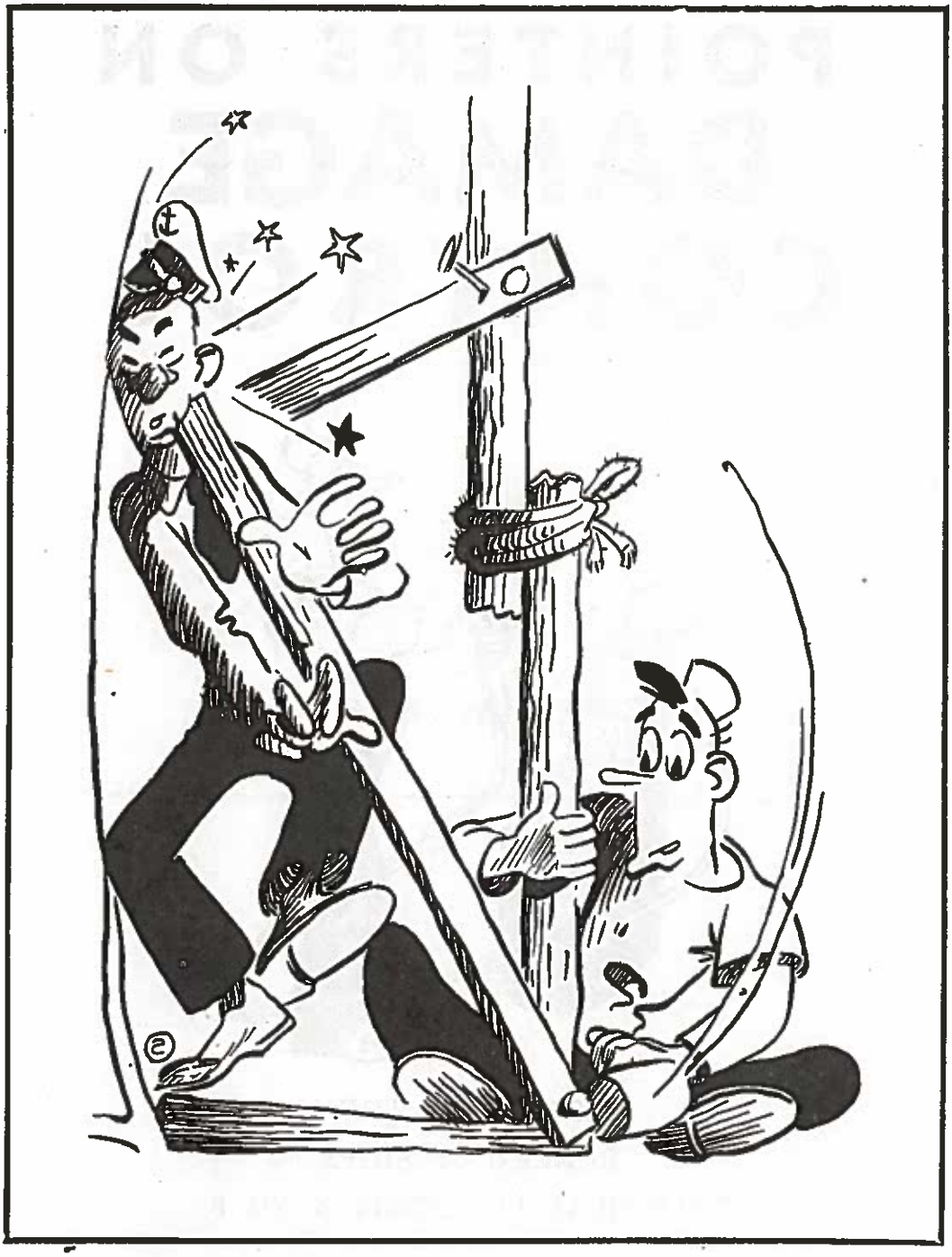


INTRODUCTION

Let's gather 'round and look over POINTERS ON DAMAGE CONTROL. There is some good dope in the following pages which should be of use to you. Don't forget, though, that this material is to be regarded as *general pointers* rather than the last word in Damage Control Instructions.

A few things should be squared away in our minds right now. Damage Control is the use of common sense on your part. Damage Control is 90% PRECAUTION and 10% APPLICATION. A ship, whose crew is trained in Damage Control, has a good chance of weathering severe blows by the enemy.

Have confidence in your ship. It is built to take a tossing around. It will be *able* to do so if you and your mates are on your toes and know your place in the Damage Control Organization.

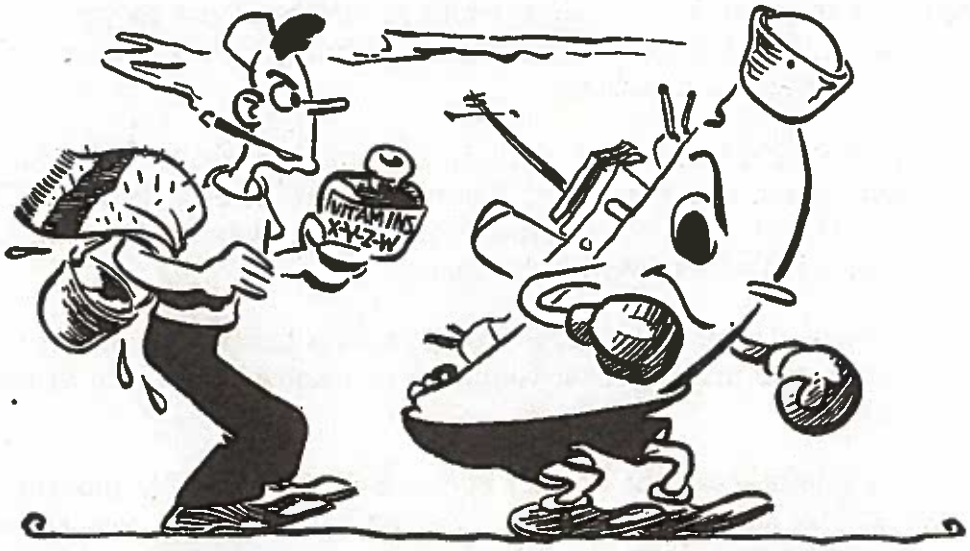
That demon bluejacket of the Pointer Series, SCUTTLEBUM, appears once more in these pages. If you have seen the other "Pointer" publications, you know the guy. If you and he are strangers, here's an introduction:

SCUTTLEBUM is a good egg, but he is all hands and feet. He's the man about ships who is always fouling up the works. There are SCUTTLEBUMS in every branch on shipboard. This time we find him as a member of a Damage Control Repair Party. How do *you* compare with him? Be honest, check yourself.

DON'T BE A SCUTTLEBUM!!

WHAT IT'S ALL ABOUT

The reason for Damage Control is to maintain the maximum fighting power of the ship. Your vessel should be able to take everything the enemy has and still come through fighting. Our naval vessels are designed to withstand damage. Their construction is such that they can weather very severe blows. In other words, friend, your ship is built to do its part. It is up to you and your mates to see that it does.



Have *confidence* in your ship. When you see a Jap torpedo smash through your favorite porthole, don't figure that it's a case of "All hands man the lifeboats." That's foul dope. Remember that fighting ships have been known to take several such blows and *still* keep up a sustained offensive. This is because their Damage Control parties were on the ball and took the necessary steps to:

1. Keep the ship afloat.
2. Keep the ship right side up by removing flooding water.
3. Keep the ship moving and maneuvering.
4. Make rapid repairs to structures, systems, equipment.
5. Fight off effects of fire and the resultant gases.
6. Help speed care of wounded buddies.

In other words, they *practiced effective Damage Control.* While they were doing this, the ships were able to fire their guns and fly off their planes.

Know what the score is *beforehand.* The enemy will not wait for you to learn as you are going into battle. You have an individual responsibility toward Damage Control. Everyone aboard your ship has. It's not a case of "Let George do it," but rather one of, "Let's all lend a hand, mate."

YOUR SHIP AND WATERTIGHT INTEGRITY

"A ship is only a seagoing house built long ways instead of up."

—Scuttlebum

On a ship, walls are called *bulkheads,* ceilings are called *overheads,* and floors are called *decks.* The many rooms are called *compartments.* In most of these compartments the decks, bulkheads and overheads are so tightly joined together that no leakage is possible at the joints. These are known as "watertight" compartments. In a house, we find windows, doors, piping and valves. We find them aboard ship, too. Windows, however, are called *ports.* We also find "doors" in the decks. These are called hatches.

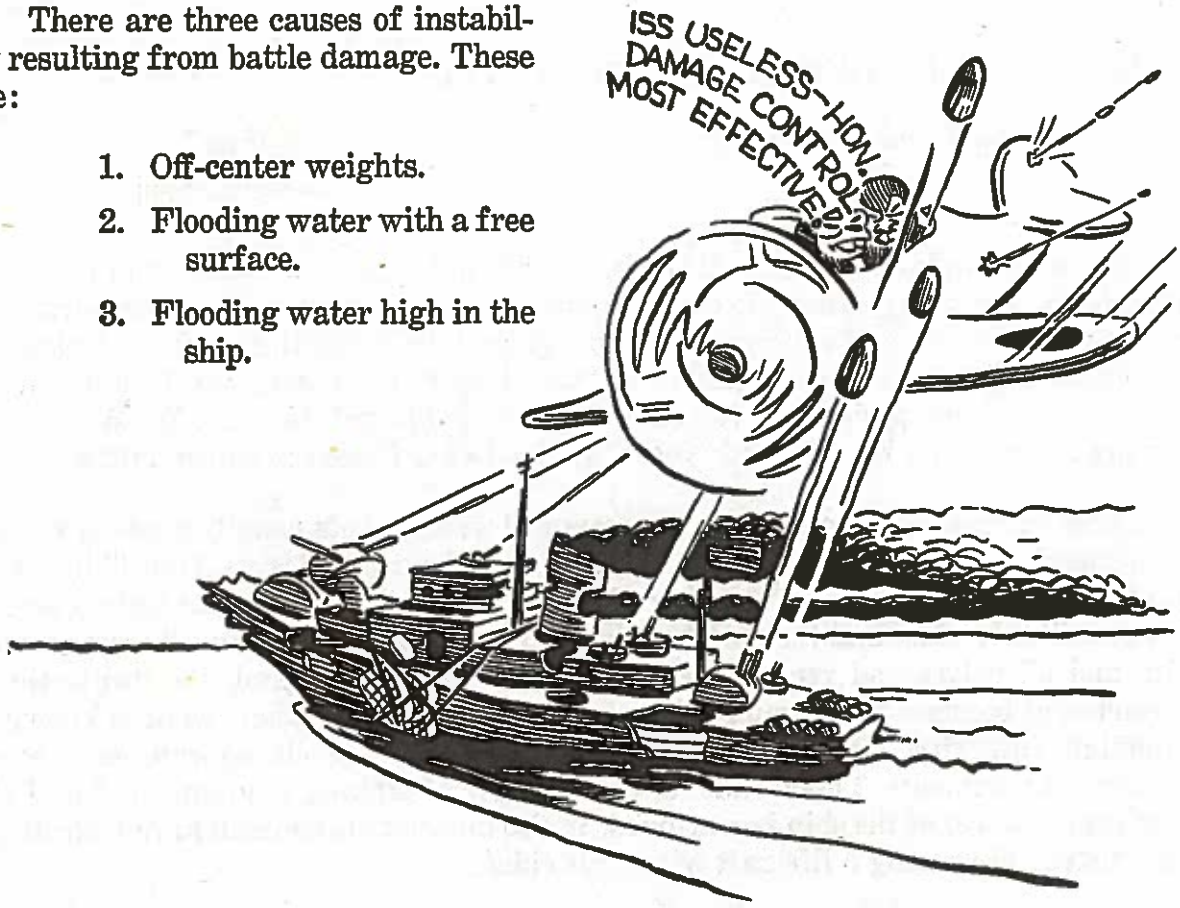
These hatches, doors, and ports, are equipped with gaskets usually made of rubber. When closed properly, they become watertight. It's the same idea as Aunt Tilly's canning jars back home. The jars may *look* closed, but if the covers are not tightly sealed, *leakage will take place* and the tomatoes will spoil. When these openings become watertight, and all valves and ventilation closures are properly secured, the "watertight" compartment becomes truly watertight. No water can get *in.* This is what is known as Watertight Integrity. If the compartment receives a hit and floods, no water can get *out* to other compartments. This means that the danger of sinking is greatly reduced and the offensive power of the ship is continued. It also means that you still have your happy home instead of sharing a life raft with your chief.

YOUR SHIP'S STABILITY

First of all, let's find out what this 75 cent word means. Stability is the ability of a ship to right herself when pushed around. The ship must keep her stability so as to successfully operate her guns and machinery.

There are three causes of instability resulting from battle damage. These are:

1. Off-center weights.
2. Flooding water with a free surface.
3. Flooding water high in the ship.



Distribution of weight aboard ship has a direct bearing on that ship's stability. With lead in your—shoes, you tend to be stable. It's the same with a ship. Weight near the keel (Fuel oil, ammunition, machinery, etc.) increases stability. High weight has the opposite effect. Imagine stowing all your weight in the crow's nest. It does not take a crystal globe to realize what will happen.

Off-center weight causes permanent list. The majority of off-center weight cases are caused by flooding in compartments that do not straddle the center line. In other words, compartments on one side of the ship flood, while the opposite side remains dry. Shifting cargo or machinery can cause the same condition. List is bad because the ship does not have quite so far to go to capsize. List is bad because you have a hard time firing the guns, passing the ammunition, operating machinery, maneuvering, flying

your planes on and off and carrying out many other necessary duties. In fact, you have a helluva job *just getting around.* However, don't get us wrong, ships *have* remained afloat with as much as a 25° list.

You may wonder what "flooding with a free surface" means. Did you ever empty the dishpan under the ice box? Remember how the water sloshed around in the pan? The more it sloshed, the harder it was to handle. If you tried to walk, pretty soon the pan took charge and *you* took a shower. Loose water in a ship has the same effect.

What is your place in your ship's stability? You can help:

1. Stop flooding.
2. Get loose water out of the ship.

Although you may not be the one to decide action on the above, you may be called on to help. Know what to do. Be prepared to assist in an emergency, and don't walk in circles waiting for orders.

COMPARTMENTS AND FITTINGS

You report aboard ship and promptly go on a tour of inspection. Along the way you notice some queer lettering on the bulkhead of the compartment in which you are standing. It says,

A–106–L

All compartments aboard ship are known and located by a system of letters and numbers. If a compartment is numbered A–106–L, you can locate it just as easily as you can locate 106 First Avenue, in your own home town.

On all our latest vessels, the ship is divided into three sections, A, B, and C. The "A" section extends from the *bow* to the *forward bulkhead* of the *forward engineering space*. The "B" section extends from the *forward bulkhead* of the *forward engineering space* to the *after bulkhead* of the *after engineering space*. The rest of the ship from there to the stern is know ı as area "C."

Now, then, that "A" of A–106–L means that the compartment is located in section A of our ship—the forward part. We *still* don't know where we are *in* section A. This is where "–106–" comes in. Decks are identified by numbers. The main deck is known as "1," the next deck *below* is known as "2," and so on *down*. The deck *above* the main deck is known as "01." The deck above that is known as "02," and so on *up*. Therefore,

A–1

of A–106–L means that we are in the forward section of the ship and on the main deck. "06" tells us what compartment we are in. Compartments aboard ship are numbered from the bow aft. Numbering starts all over again in each section. Those compartments on the *port* side have even numbers. Those compartments on the starboard side have odd numbers. Therefore,

A–106

means that we are in the forward section of the ship, main deck, well up toward the bow. (Port side, nacher'ly.)

In addition to all the above, a capital letter is put after the numbers to tell what the compartment is used for. This letter is not necessary for locating a compartment, but if you know what the space is used for, it generally helps you find it. Some of these letters and their meanings are as follows:

A. Storage Space.

M. Ammunition Stowage.

T. Access Trunk.

V. Void Space.

E. Engineering Space.

F. Fuel Oil Tank.

In our case, we have "L," which stands for "living." In other words, it's a living compartment. One we use for eating, bunking. etc. Therefore,

A–106–L

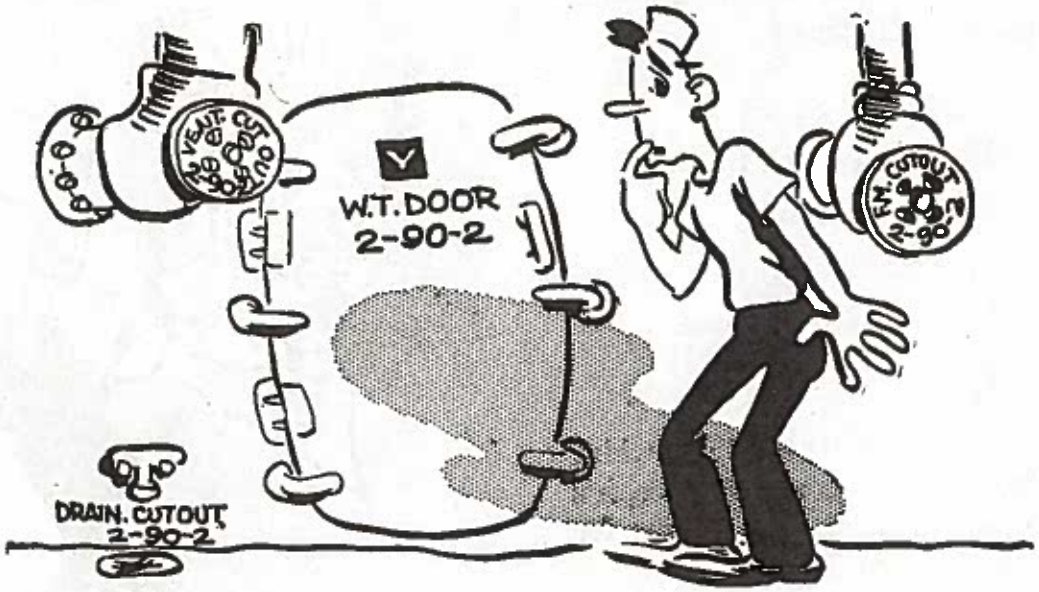
really tells a story and is not just something that "happened."

Doors, hatches, valves, manholes, etc. are classified as fittings. These can be closed to prevent the spread of water through your ship. They also prevent the spread of fire and poison gas.

Every *fitting* has an identifying number. This tells you where the fitting is located, by giving you the deck level, frame number, and whether that fitting is to port or starboard.

For example, your ship is in action. You are in a repair party. The enemy scores a hit, and your Repair Officer tells you to "Close firemain cutout valve 3–117." By noting the number, you know just where the valve is located. 3 means third deck. 117 means the frame location within the ship. Frames are the ribs of a ship and are numbered from forward to aft. Frequently a third numeral is added (3–117–2) to indicate that there is more than one fitting in that system at that frame.

Sometimes valves of different systems will be located side by side, and, therefore, have the same identifying numbers. The valves themselves, however, will be labeled clearly as to the system they are on. There should be no chance of closing or opening the wrong one. BUT—when you get an order, remember what system is specified.



KNOW THE CLASSIFICATION OF YOUR FITTINGS!

You now know that decks and watertight bulkheads divide your ship into many watertight compartments. Many decks and bulkheads are pierced by doors, hatches, ventilation lines, and other closures. Pipe lines also go through the compartments. If you get torpedoed while fittings are open (or if piping is ruptured), there will be nothing to stop the spread of water. Your ship will probably sink, and it will be just you, the sharks, and the mermaids from there on in. For this reason, most doors and hatches are closed during battle. So are many valves in pipe lines.

Naturally, we cannot keep everything closed at all times. Our ship would be useless if we did. Therefore, we keep certain doors and valves open, even in battle. In order that we can know what (and when) fittings should be closed, we mark each one with a letter. This letter determines when the fittings must be closed or left open.

Each fitting aboard ship (with few exceptions) is marked either X, Y, Z or W. These markings let us know which fittings should be closed or left open in the various

material conditions of "closure." By "material conditions" we mean how ready the ship may be to take any blows the enemy can deliver. It is the status of Damage Control fittings, whether they are opened or closed, that we are interested in.

"Geez Chief! Last thing I remember was walkin' away an' leaving the scuttle to C-304-L open—"

We have Two Condition and Three Condition ships in our Navy. Here is the way the system works on a Three Condition ship. There are three material conditions, starting with Condition X-ray, continuing through Condition Yoke (or the War Cruising Condition) to Condition Zebra, which is the final and maximum condition of closing up the ship for battle. The following speaks for itself:

Condition X-ray:

All "X" fittings and systems closed or secured. "Y," "Z," and "W" fittings and systems open or operating.

Condition Yoke:

All "X" and "Y" fittings and systems closed or secured. All "Z" and "W" fittings and systems open or operating. This gives us more closed spaces and, therefore, more protection against damage.

Condition Zebra:

All "X," "Y," and "Z" fittings and systems closed or secured. All "W" fittings and systems open or operating. The ship is now as watertight as it can possibly be and still steam and shoot.

In the above conditions, all "W" fittings are left open. "W" fittings are those doors, hatches, valves, and systems that must be left open in order to "fight the ship."

On a Two Condition Ship:

Condition Baker:

Is the first condition for cruising in dangerous waters. "X" and "Y" fittings are closed. "Z" and "W" are open.

Condition Able:

Is the condition that goes with General Quarters. All "X," "Y," and "Z" fittings are closed. "W" fittings are open.

Compartment check-off lists are very important. There is one in every compartment. Every Damage Control fitting is shown on a check-off list in the compartment

where the fitting is located. The list shows the classification of the fitting and the division which is responsible for its closure. Those fittings that cannot be reached by a division must be closed by repair parties.

Never forget this! When a fitting has once been closed under the above conditions, *don't open that fitting* unless the Damage Control Officer grants permission to do so. It should then be closed as soon as possible. When you have *closed* that fitting, report that fact to the Damage Control Officer. This applies to *all conditions of readiness.*

FITTINGS

"A ship is just as strong as its weakest fitting."

We have already talked about some simple fittings. Let's give 'em the "once over lightly" again, and stress the need for proper opening, closing, and the keeping of fittings in good working condition.

You wouldn't take your car out of the garage with a leaking tire, 'cause you know you couldn't trust it. It's the same way with a leaking fitting—*only more so*!! The sea and the Japs play for keeps. Give the sea the smallest opening and it will move in on you. Give the little Sons of ——er—— Nippon the smallest spot of light at night, and they can blast you out of this world. Remember, it takes only one strike in this league and you're out.

"Hon. Scuttlebum make nice marker for stinkey boys to shoot at, yiss!"

WATERTIGHT DOORS should be closed by securing the dog furthest away from the hinge first. Then secure the two dogs nearest the hinged side. After this, secure the rest of the dogs. Don't secure a dog *tightly* until all dogs are in place. Pressure on all dogs should be equal, so that the knife edge pressing into the gasket will be uniform. Uneven pressure will warp your door and cut your gaskets.

WATERTIGHT HATCHES are really nothing more than doors that never learned to stand upright. They are found in the deck, and are operated in the same manner as the doors. SCUTTLES are really small hatches, and are operated the same way. Some doors, hatches, and scuttles are operated by a hand wheel rather than by dogs. These are the "quick closing" type.

VENT DUCT COVERS are used on ventilation duct terminals. The ventilation system is an excellent water or poison gas carrier. Properly secured vent duct covers can prevent flooding and keep out suffocating smoke.

MANHOLE COVERS are found in double bottoms, tank tops, and similar places. They are nothing but steel plates covering access holes in the deck. They are bolted and have a gasket sandwiched in between. Always be sure that the plate is firmly in place and that the gasket is in good condition.

VALVES are important in Damage Control. A faulty valve may allow water to leak in through the piping. Sometimes a Scuttlebum just plainly forgets to *close* a valve that should be secured. It's the same deal as the vent system. Leaking valves allow piping to carry water to areas where there should be no water. If the piping should be *broken* because of a hit, the old water will just spurt out and flood the compartment.

This brings us to PROGRESSIVE FLOODING. This term means just what it says—the flooding of the ship in progressive stages from one compartment to another. Flooding *progresses* because watertight fittings are not properly maintained. Valves

may be corroded or not fully closed. Gaskets may be rotted or cut. Hatches may be warped and dogs may be loose. You boys on the security patrol are responsible for catching these things. In fact, everybody *aboard ship* is responsible. There is no passing the buck. Don't try to. You sink or swim *together*.

There are more advanced types of fittings. Let's go over them just to see what they are.

STUFFING TUBES are watertight fittings that allow us to run electric cables through watertight bulkheads or decks without losing Watertight Integrity. After the cable is drawn through, packing is put around it so as to "plug" or make the area inside the tube watertight. Sometimes the packing shrinks, has been left out or has been inserted improperly. This is one of the most frequent causes of progressive flooding. *Report such conditions!* PACKING GLANDS are very similar to stuffing tubes.

GLOBE VALVES are common aboard ship. They are used in many piping systems, and are seated with a metal to metal fit. Here is where YOU come in. Don't bang or force this fitting. A dent or gouge at the seat may develop into a leak. The pressure on the line will work against you. Don't paint valve stems. Clean and inspect valves regularly. It is surprising how many sea shells and how much marine growth can be found within. If left there, clogging will result.

A GATE VALVE is just a gate in the line. It is operated by a valve stem. Close only hand tight, and don't use a wrench.

CHECK VALVES are installed in drainage lines to prevent the fluid in the lines from "backing up." They allow flow in one direction *only*. Watch out that these valves are not stuck. A stuck valve is worse than no valve at all.

DECK DRAIN VALVES are found on deck drains. Keep 'em closed when not in use. Inspect each strainer at intervals and *keep them clean.*

PLUG COCKS are placed in gravity drains to prevent sea water backing up into compartments. They work like the spigots on the old vinegar barrels, and require only one quarter of a turn from "Full Open" to "Full Close."

Regular inspections and examinations of all valves and fittings are part of the ship's routine. They can well be the means of saving your ship. Follow your ship's inspection schedules faithfully. It's so easy, when in a safe area, to slide over inspections. What are you going to do a few days later when faulty fittings give way while hell is being pounded out of you by the enemy?

KEEP VALVES AND FITTINGS IN FIRST CLASS OPERATING CONDITION AND IN THEIR PROPER STATE OF CLOSURE!!

Maintenance has A–1 priority aboard ship. The regular inspection schedules we keep yapping about, plus a wee bit of common sense on your part, will show you where the trouble lies. Here is a list of conditions that allow leakage.

1. Worn gaskets on doors, hatches, etc.
2. Distorted knife edges on doors, hatches, etc.
3. Leakage where dog spindles pass through the frames.
4. General looseness of fittings.
5. Poorly packed stuffing tubes and packing glands.
6. Bent, burred and missing bolts.
7. Small shells in salt water lines getting into valve seats.
8. General corrosion and rusting of fittings and bulkheads.
9. Holes in bulkheads and decks.

Rust on bulkheads should be attended to at the first available opportunity, if directed by the First Lieutenant. Scrape it down to solid metal. Clean the metal of dirt and grease. Wipe it dry. Paint it with a preservative paint. Rust spots are like fleas on a dog. They keep popping up all the time. Beat 'em to the punch.

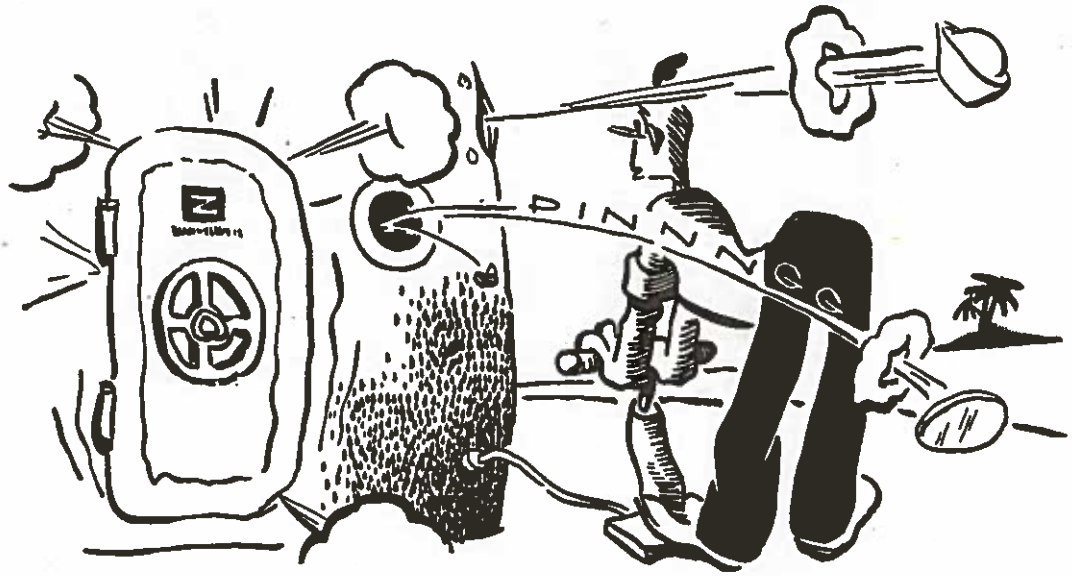
AIR TESTING

Certain compartments aboard ship have to be tested regularly to see just how watertight they are. They may be tested by the following methods:

1. Visual Inspection.
2. Checks for Leakage.
3. Air Pressure Testing.

The air test is the only *sure* way to determine the compartment's watertightness.

Few compartments are absolutely watertight. Due to the ships getting knocked around by the sea, certain minor leaks may develop. These leaks may be so small that, for all practical purposes, the compartment may be regarded as "watertight." However, it must pass the Air Test to be considered safe. The Air Test shows if the compartment has any "leaks," and if so, how bad they are.



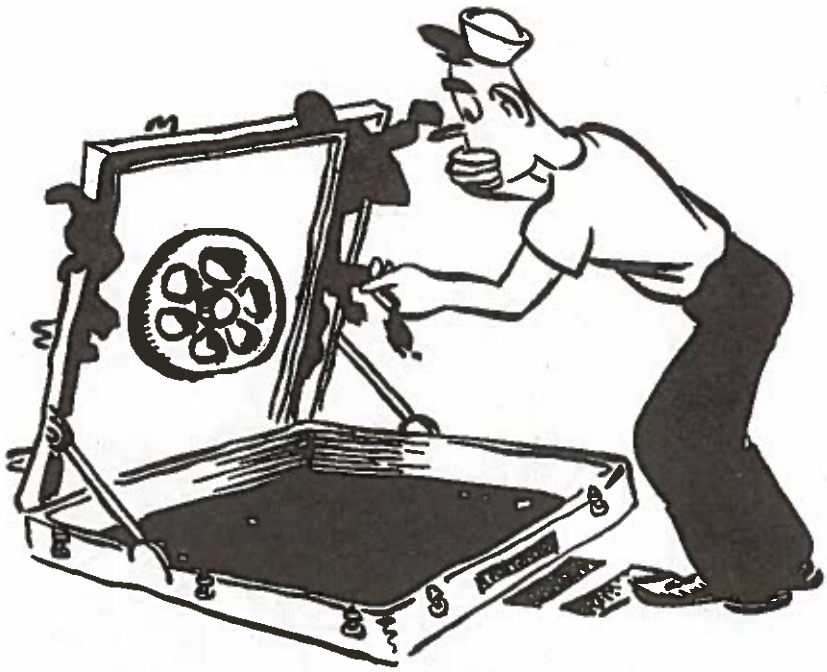
An unsatisfactory compartment means that the boys in the Air Test gang had better get on the ball and find out where the trouble is. Here are some common causes of leakage.

1. Improperly closed or faulty fittings.
2. Corrosion or holes. (Some jerk is always drilling a hole without permission.)
3. Improperly packed electric cable stuffing boxes.
4. Leaks around "structural members," due to the working of the ship in heavy seas, faulty welding, neglect in repairs, etc.

When trouble is found, don't think about it for hours.

REPORT IT TO THE DAMAGE CONTROL OFFICER!

Watertight Integrity aboard ship is everybody's responsibility. When the bow of the ship goes down, the stern often follows. All hands, from the skipper on down, get their feet wet. Anything that you discover aboard ship that will hurt Watertight Integrity—the ripped rubber gasket, the "weeping" rivet, or the loose dog—should be *reported to your Damage Control officer immediately*!!



LET'S LOOK BACK

So, here we are. We have covered some ground and mebbe you have learned something about Damage Control. Remember that if you are to come through in that important pinch, you must:

1. Have confidence in your ship.
2. Know its construction.
3. Know your numbering system of compartments and fittings.
4. Know the classification of fittings.
5. Set material conditions properly.
6. Know how to *maintain and operate* your ship's fittings.
7. Keep your compartments watertight.

PUMPS AND DAMAGE CONTROL

Most pumps aboard ship are directly connected with Damage Control. Pointers of a general nature on rotary, reciprocating and centrifugal pumps will be found in "POINTERS ON STEAM SYSTEMS AND THEIR AUXILIARIES." Right now, we shall take up four pumps that are used in emergencies.

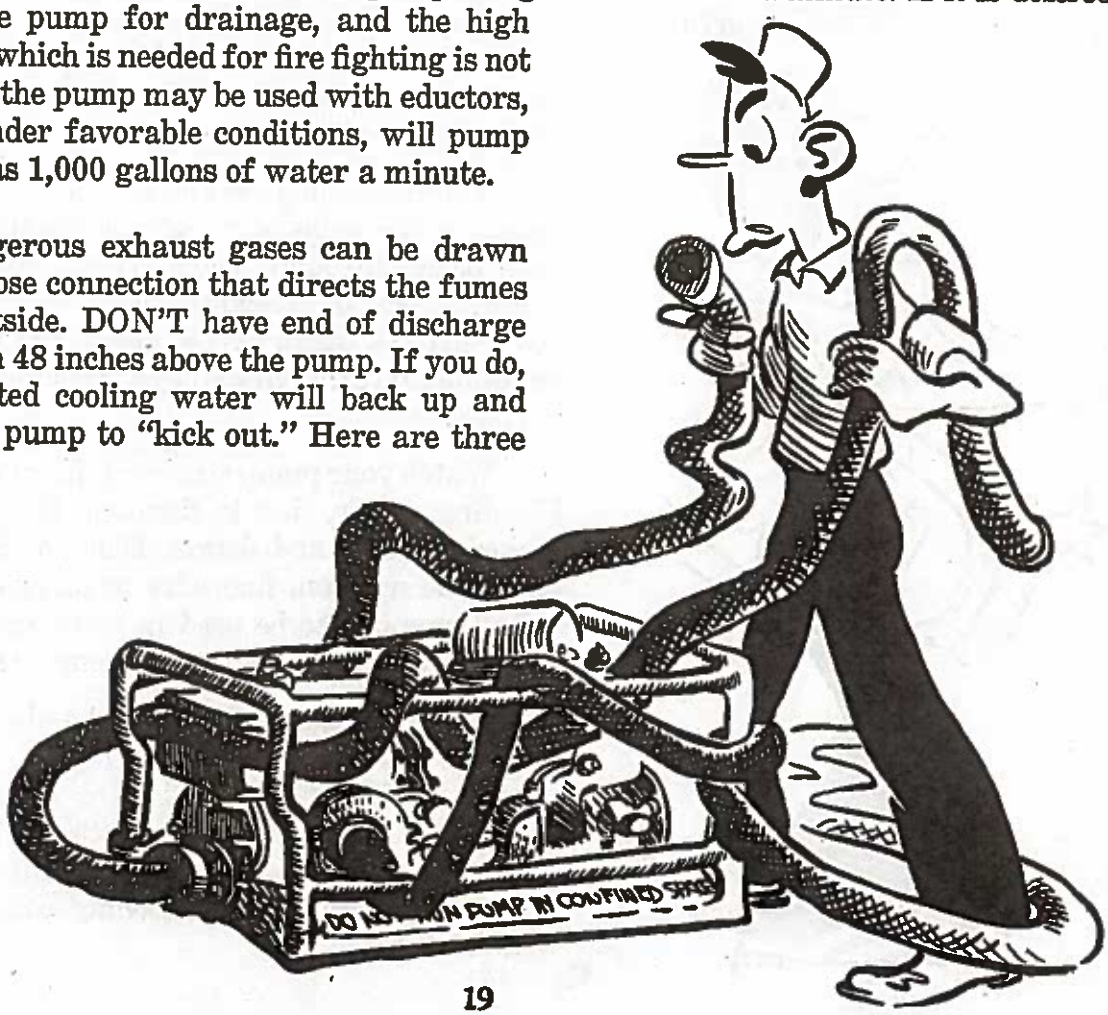
THE GASOLINE HANDYBILLY

is a portable gasoline-driven rotary pump. It is used in Damage Control for either fire fighting or drainage, and has a capacity to pump 60 gallons of water a minute. It should not be used to pump oil or gasoline unless an eductor is used to perform the actual handling of these liquids.

THE GASOLINE-DRIVEN P-500 PUMP

is a larger model of the handybilly, but uses a centrifugal pump instead of the rotary rotary pump and has a capacity to pump 500 gallons of water a minute. If it is desired to use the pump for drainage, and the high pressure which is needed for fire fighting is not required, the pump may be used with eductors, which, under favorable conditions, will pump as much as 1,000 gallons of water a minute.

Dangerous exhaust gases can be drawn off by a hose connection that directs the fumes to the outside. DON'T have end of discharge more than 48 inches above the pump. If you do, accumulated cooling water will back up and cause the pump to "kick out." Here are three



ways of eliminating the exhaust gas problem. With the exhaust hose leading overboard,

1. Disconnect cooling water line to exhaust manifold. Let water run down engine base.
2. Drill hole in bottom of exhaust gas discharge line and install pet cock. Let water drain.
3. Take exhaust gas discharge hose to portable vent blower. Gas will be drawn up. Water will run on deck.

When not in use, the gasoline-driven pumps should be stowed where they can be easily reached. Wipe and lubricate them. Conduct routine tests to insure that they are in proper working order.

ELECTRICAL SUBMERSIBLE PUMPS

Are designed for use as drainage pumps. In an emergency they can be used as fire pumps. Usually they are used by just putting two or three of them into the water of a flooded compartment.

These pumps are powerful enough to pump water that is as much as 20 feet below them, provided, of course, that hose connections reach down into the water. In this case, the pump must be primed to start.

Test the pumps weekly. A weak spot of these pumps is the point at which the electric lead or cable passes through the watertight casing to the motor. Check the packing gland carefully, and never lift the pump by the electric cable. Rig a handling line through the "eye" provided for that purpose.

Watch your pump strainers. *Keep 'em clean.* Flooding water, due to damage, is filled with soaked clothing and debris. Home-made strainers, made up from fine wire mesh or expanded metal have had to be used in many cases. Keep extra strainers on board to prevent this.

Too much emphasis cannot be placed on the care and upkeep of submersible pumps. These are usually the first pumps called for when damage occurs. Many times they are the only pumps available to handle flooding. Remember, friend, you can't empty a *badly* flooding compartment with buckets.

EDUCTORS

"Educt" means to *draw out.* This is just what an eductor does to water in compartments. Our Navy uses this simple unit of equipment known as the WATER JET EDUCTOR. Some of these are portable.

Ever see a guy swiping gas out of an automobile? He will put one end of a hose into the tank and suck on the other end in the same manner he would a straw. This starts a flow of the liquid gold out of the tank, through the hose, and into a waiting container. An eductor works in a similar way.

Generally speaking, eductors are installed where severe service or simplicity of operation is desired. On some ships, eductors have been installed as independent drainage systems for compartments close to or below the water line. They are operated by pressure from the firemain.

NOW THEN

We have touched upon three kinds of pumps. The points covered will give you an *idea* of what they are and how they operate. The surest way to *learn how* to run these pumps is to:

1. Study the instruction plates installed on the pumps.
2. Study the manufacturer's instruction books.
3. *Run the pumps* and learn from experience.
4. Study the pamphlet "USES AND APPLICATIONS OF PORTABLE EMERGENCY PUMPING EQUIPMENT."

TOOLS AND EQUIPMENT

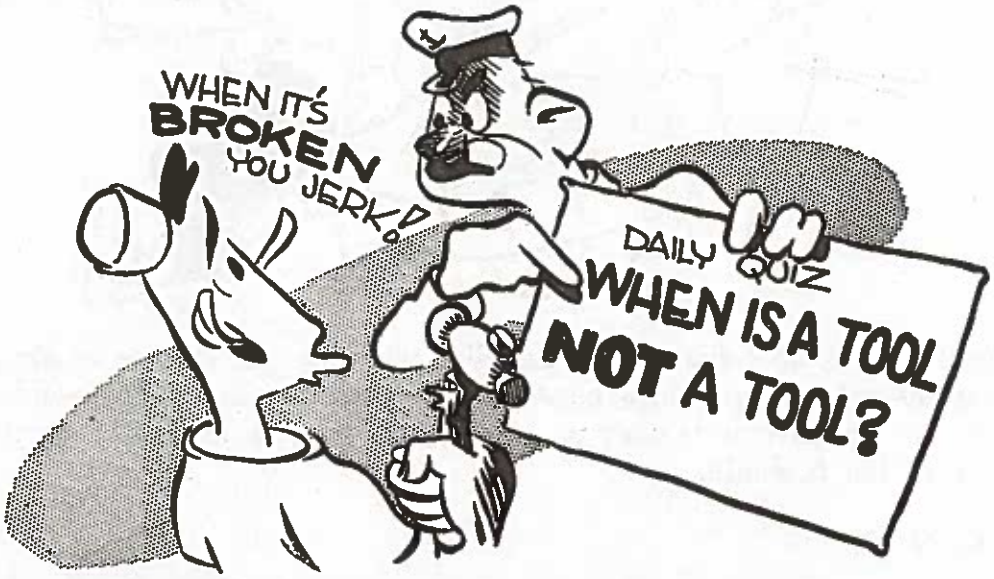
Let's take a breather for a minute and go up to Maine for some hunting. You are walking along an old logging road. Suddenly, a nice, big, juicy bear appears broadside to you. You sound G. Q. and immediately begin maneuvering. Several factors will determine whether or not you accomplish your mission.

1. *You* must know what the score is.
2. *Your* gun must be the "right size" for the work at hand.
3. *You* must know *how to use* your gun.

It's the same way with Damage Control:

U + TOOLS = TEAM

One member of the team is no good without the other. Tools aboard ship are the repairman's weapons. Naturally, if we attempted to list all shipboard tools and their uses, we'd be here all night.



Your ship's Damage Control Lockers contain those tools that are necessary for battle damage repairs. These lockers also contain *equipment* that is necessary for the work. Booklets on the care and use of tools are being widely distributed throughout the fleet. Grab hold of one of these and look it over. You will find that it contains most valuable information. *Make it your business* to *know* the tools and their uses. Remember that there are *right* and *wrong* ways to use any tool. Practice. Know the correct way *before* you get into a jam.

Some of the tools and equipment, particularly items infrequently used, should be kept in the locker provided at the Repair Party Headquarters. The greater part, how-

ever, should be distributed throughout the section of the ship for which the repair party is responsible. They should be kept at these locations at *all times*. This distribution insures that important tools and equipment will always be close at hand, and also prevents all the equipment from being destroyed in the event that the large repair locker near the Repair Party Headquarters is damaged.

Many large ships provide each member of a repair party with a small pocket size notebook which indexes this distributed equipment by type and notes its location by deck and frame number.

Each member of a repair party should be provided with a flashlight attached to a lanyard. Small tool belts and carpenter aprons save time and trouble. A complete suit of clothing should be worn to protect against flash burns. Steel helmets should be worn by all members of repair parties.

"A good workman is known by his tools." Keep the tools in the Damage Control Locker *clean* at all times. Keep a bit of oil on working parts. This cuts down wear and prevents rusting.

PIPING SYSTEMS

FIREMAIN SYSTEM

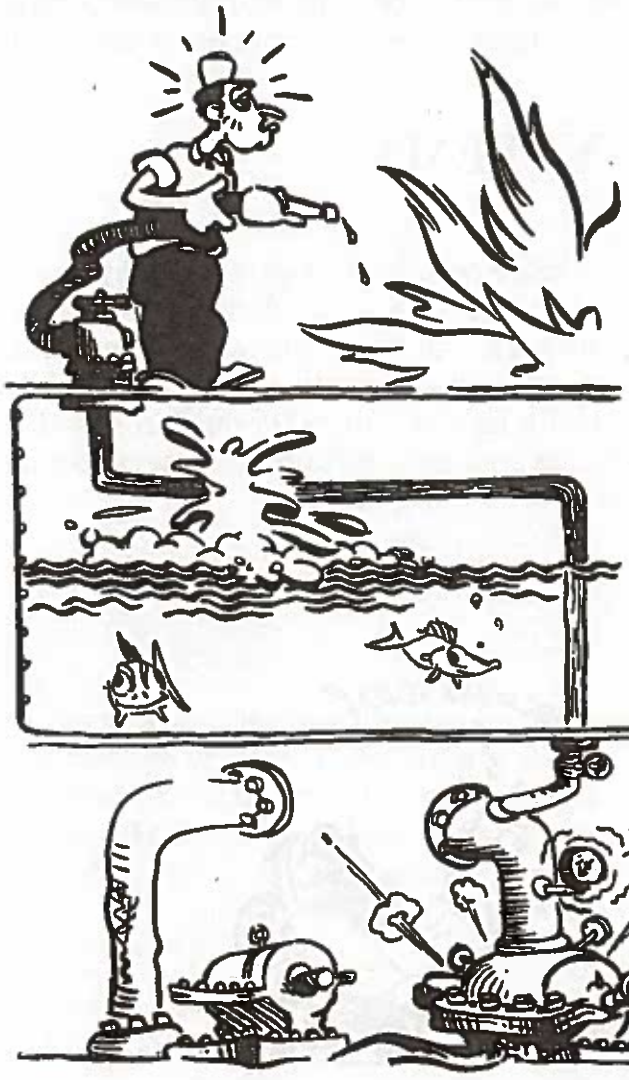
The Firemain System aboard ship is like the fire system of pipes and hydrants back in the old home town. The Firemain System provides water under pressure for the fire plugs, sprinkling systems, fixed fog systems, and water curtains. In general, all connections aboard ship used for fire fighting or fire protection are either solidly joined to the Firemain System or are provided with hose couplings for quick connection to fire plugs. Connections to the flushing system as well as to certain machinery cooling systems also branch from the firemain.

The piping may be installed as either:

1. A single line system, or
2. A loop system.

The "single line" system consists of a line of piping running fore and aft through the ship. Water is pumped into this main from pumps located, usually, in the machinery spaces. Pipes ("risers") extend from pumps to the firemain and from the firemain to upper deck levels. From these risers, pipes lead to fire plugs. Connections to flushing and sprinkling systems come off the firemain. (Also to certain machinery cooling systems.)

The "loop" system has the firemain forming a loop around the main machinery spaces. Two separate lines of firemain piping run through the machinery spaces, one down the port side, the other down the starboard side. Cross connecting pipes at the forward and after ends of the machinery spaces complete the main loop. Vertical loops sometimes extend upward from the main loops. Secondary horizontal loops on upper levels have also been used.



Cut-out valves, located in the fire main proper and its cross connections serve to close off any part of the Firemain System that may be damaged. The arrangement of pumps, piping, and cut-out valves is such that by closing certain valves and running certain pumps, we can have a number of separate and independent Firemain Systems. This saves the rest of the system and does not rob it of water pressure in the event of damage to one section.

Valves in the Firemain System are classified (X, Y, Z, or W). Acquaint yourself as to "which is which." If you need more dope, read your check-off lists.

The firemain piping is so arranged that sections of piping and valves may be dismantled for repairs. If a section of piping is damaged, the cut-out valves on either side of the break can be closed and the damaged section removed by unbolting the proper flanges. Temporary service can be restored by connecting a length of firehose between the open flanges. These temporary connections are known as "jumpers," and are secured to the flanges through hose-flange adapters that, in turn, are bolted in place or secured with C clamps. Jumpers can also be run between fire plugs. These are very handy in an emergency.

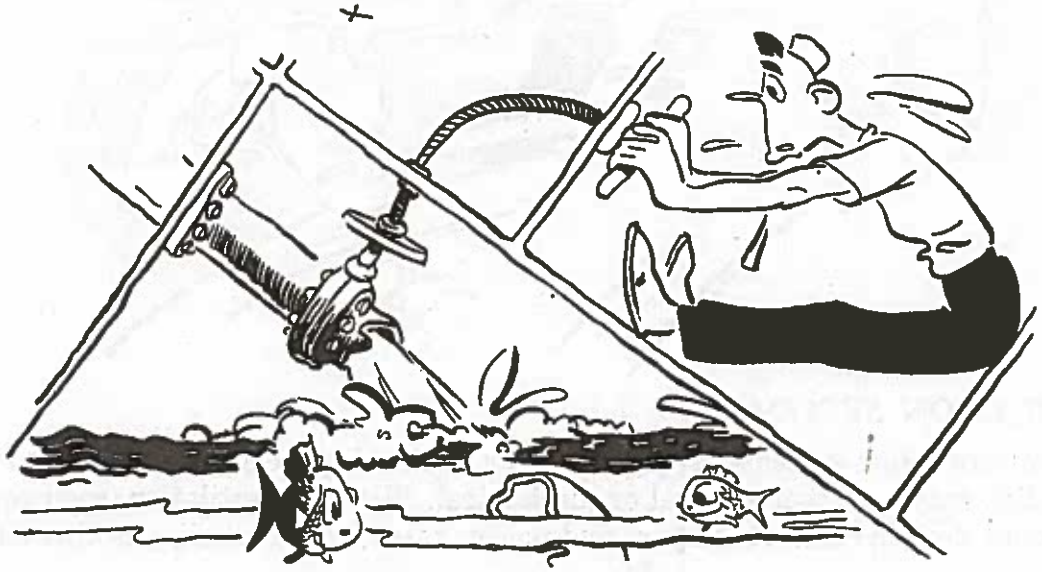
In conclusion, don't forget that both Engineering and Damage Control personnel *must know and understand their Firemain System.* War experience had demonstrated that a ship can be lost because of fire through unnecessary failure of the Firemain System.

DRAINAGE SYSTEMS

Aboard most ships we have the MAIN DRAINAGE SYSTEM and the SECONDARY DRAINAGE SYSTEMS. In addition, some compartments are drained by gravity.

In general, a drainage system consists of:

1. A length of suction piping (drainage main).
2. Branches from the above, leading into spaces to be drained.
3. Pumps (or eductors) to take suction from the drainage main.
4. Discharge piping from the pumps.
5. Necessary valves, manifolds and strainers.



Flexible cables and reach rods allow remote operation of some of these valve
Remote operation may also be accomplished electrically, pneumatically or hydraulicall

The Main Drainage System usually runs through main engineering spaces onl
It may be of the single line or loop variety, as described in the Firemain System.

The Secondary Drainage Systems are usually smaller than the Main Drainag
System. So are their pipes and pumps. These systems are used to drain spaces forwar
and aft of the main engineering spaces.

Separate independent systems, serving limited spaces, are also found aboard som
ships.

Portable eductors, submersible pumps, and gasoline-driven pumps (handy billies
are brought into play for emergency draining. These are described in the Pumps an
Damage Control section of this booklet.

All valves in drainage piping must be classified for the same reasons as state
under the Firemain System. Pumps installed to take suction may be either reciprocatin
or centrifugal.

The first thing to do is to restrict or stop the inflow of water caused by underwate
damage. The next thing is to remove the water that has entered—or is *still* enterin
Hold drills in flooding control. Know what tools you have to work with. The reason fc
drainage systems is to *take away unwanted water*. A group of alert, well-informed me
can operate these systems with maximum efficiency. This will go far in keeping
severely damaged ship *afloat* and *fighting*.

VENTILATION SYSTEMS

The ventilation systems supply fresh air to the ship's compartments and space
Ventilation may be either natural or mechanical. Without ventilation, men could nc
work below deck in comfort. Vapors and poison gases from fuel oil, gasoline and suc

may collect in voids and bilges. There they could cause trouble by igniting. Personnel breathing these gases have been seriously affected; in fact, they've been killed!

Because of the long ducts and openings in bulkheads, ventilation systems are very dangerous. The ducts are potential carriers of *flooding water* from one compartment to others. Fire and gas can be carried in the same manner. This is why most ventilation fittings are closed in action.

In Condition Zebra all ventilation systems except those supplying machinery and battle air compressors must be closed because of watertight integrity. During lulls in battle, sections of the ship may be "flushed out" by opening up the ventilation system concerned. Permission for this must be obtained from Damage Control.

If you have to go into a void, be sure to ventilate the area with a portable blower. The air is undoubtedly full of paint fumes and other poisons. Men have been lost because of this neglect. Safety lamps and explosimeters should be brought along.

Many ventilation motors have control switches in more than one location. These make the securing of groups of vent blowers easy in case of fire or damage. Know the locations of these switches. Rapid securing of systems can prevent feeding of oxygen to flames. It also prevents spread of smoke throughout the ship.

Ventilation systems should be cleaned on a regular schedule. The main enemies are dust, dirt, and rubbish that collect in screens and along ducts. This condition is a serious fire hazard. It can also promote explosions. Again, we drag out that old and ancient saying,

KEEP IT CLEAN!!

If you get a chance, secure a copy of POINTERS ON SHIPBOARD VENTILATION. This little wheeze lays the facts on the line about ventilation aboard ship. Don't miss the chance to read it.

DAMAGE CONTROL ORGANIZATION

The Damage Control Officer is the head of the damage control organization and is responsible for:

1. Coordinating the efforts of all departments in the ship for Damage Control.
2. Placing the ship in the proper material condition for battle which includes not only the proper material condition for battle and the proper setting of the material conditions but also the day-to-day maintenance of the material and equipment which preserves watertight integrity.
3. Repairing damage during and after battle.
4. Supervising exercises and training in Damage Control.

During battle, the Damage Control Officer is normally located in the Damage Control Station. This station is the headquarters of the Damage Control Organization and has communication with:

1. The bridge.
2. All repair stations.
3. Control engine room.
4. Battle dressing stations.

Sound-powered telephones are generally used for this communication. Ship's Service phones are also sometimes used. There are also several types of loud speakers.

However, ships don't provide carrier pigeons or crystal globes, so if these electrical systems are shot away, it's a good idea to know how to carry written or verbal messages to any part of the ship.

Information concerning the location, type, and extent of damage sustained is transmitted to the Damage Control Station by means of these communications. There, this information is assembled and analyzed. The Damage Control Officer then transmits the orders and information necessary to neutralize or reduce the effect of this damage on the ship's fighting power.

REPAIR PARTIES AND REPAIR STATIONS

On larger vessels, the Damage Control Officer has one or more assistants who act as Repair Party Officers, etc. Each has charge of a group of men that performs specific duties, both before and during battle. These men have a daily routine of periodic inspections to keep the ship watertight and its machinery (including Damage Control Emergency Gear) in good operating condition.

For battle work, however, these men are in the Damage Control Repair Parties. They are joined by other men of various ratings from various departments to make up the complete battle Damage Control Organization. These men, plus equipment, must be on hand to overcome whatever damage the enemy may inflict on the vessel. Each party is assigned a certain section of a ship. This section is "their baby," so to speak, and they are responsible for its safety. Watches are established, so that the area can be under control at all hours during wartime cruising.

Repair Party Stations are the headquarters for the various repair parties during battle. These parties are responsible for patroling and making actual repairs to damage. All hands should know the location of these stations and the areas for which each party is responsible. If you end up in a repair party, keep your head and realize your responsibility. You don't need a batch of stripes on your sleeves to make decisions. If you discover leaks and such, report the condition to your station, and take whatever steps you can to remedy the situation immediately.

Each repair party is known by a number. The larger a ship, the more repair parties. On a destroyer escort you will find three parties: Repair I, Repair II and Repair III. On a carrier they go up to VIII.

Few of the members of these repair parties are stationed at the Repair Party Headquarters. The majority are stationed singly or in small groups throughout the section of the ship for which their party is responsible. This procedure:

1. Makes easier the early location of damage for the information of the Repair Party Officer and Damage Control Officer.
2. Insures that trained men will be stationed near the scene of damage in order that they may take prompt action.
3. Insures that local damage near the Repair Party Headquarters will not put all members of the party out of action.

Each repair party includes skilled mechanics, carpenter's mates, shipfitters, electrician's mates, metalsmiths and machinist's mates. Most of them will be from the Hull and Engineering Groups that kept the ship ready before battle. There may also be a considerable number of non-technical men, such as bandsmen, seamen, and steward's mates. The more these men know about Damage Control and how to use tools, the better

the ship will be prepared to handle damage. As far as you are concerned, study your Damage Control. Ask questions on anything you don't understand. On the other hand, help others who may not know as much as you do.

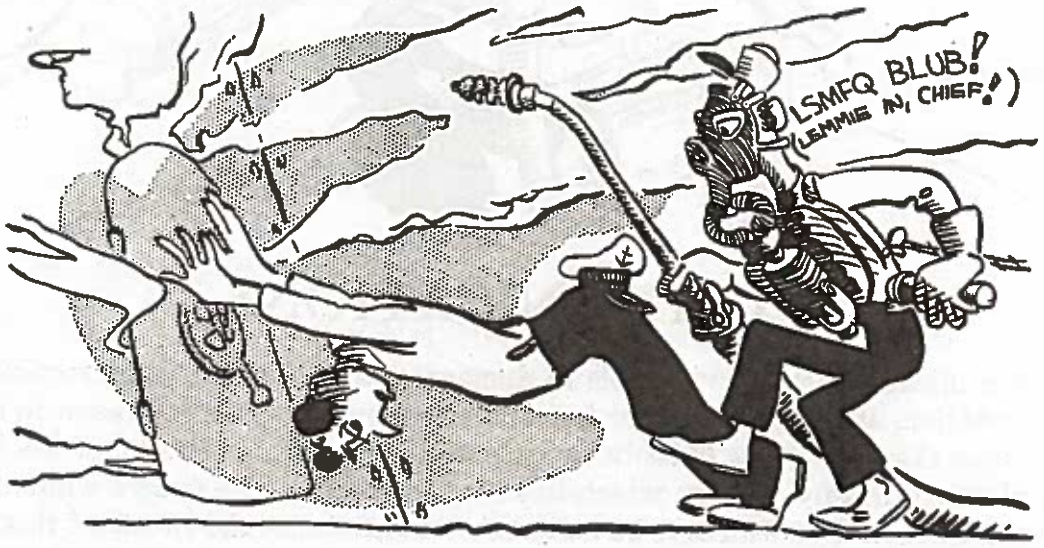
As we mentioned before, the headquarters of each repair party is in constant communication with the Damage Control Station, and with all other repair parties. If the Damage Control Station gets knocked out, the next designated repair station takes over, and so on down the line. This is known as the "chain of control."

It is very important to keep a record of what happens, not only at the Damage Control Station, but at Repair Party Stations as well. This record is known as a Damage Control Log.

REPAIR PARTY EQUIPMENT

Know where your Damage Control Lockers are. Know what Damage Control tools they contain. Each ship has an Allowance List which tells how many and what kinds of tools you are supposed to have aboard. Know what these tools are, where they should be and how to use them. In addition to those mentioned in the "Tools and Damage Control" section of this booklet, we are provided with flashproof helmets, gloves, and goggles. These can come in mighty handy at times. Leather and asbestos gloves are good, too. Asbestos slippers over shoes can prevent super "hotfoots."

Wear a complete suit of clothing when in action; sleeves down and buttoned, collar up and buttoned. Uncovered portions of the anatomy just beg for flash burns. If you have a gas mask, keep it with you. See that rescue breathing apparatus and hose masks are available at each station.



Remember what we said about tool belts saving you time and trouble. The carpenter aprons are helpful, too. Both of these tool carriers can be made by hand. And don't forget emergency lighting equipment. A miner's head lamp allows both hands to be free for work.

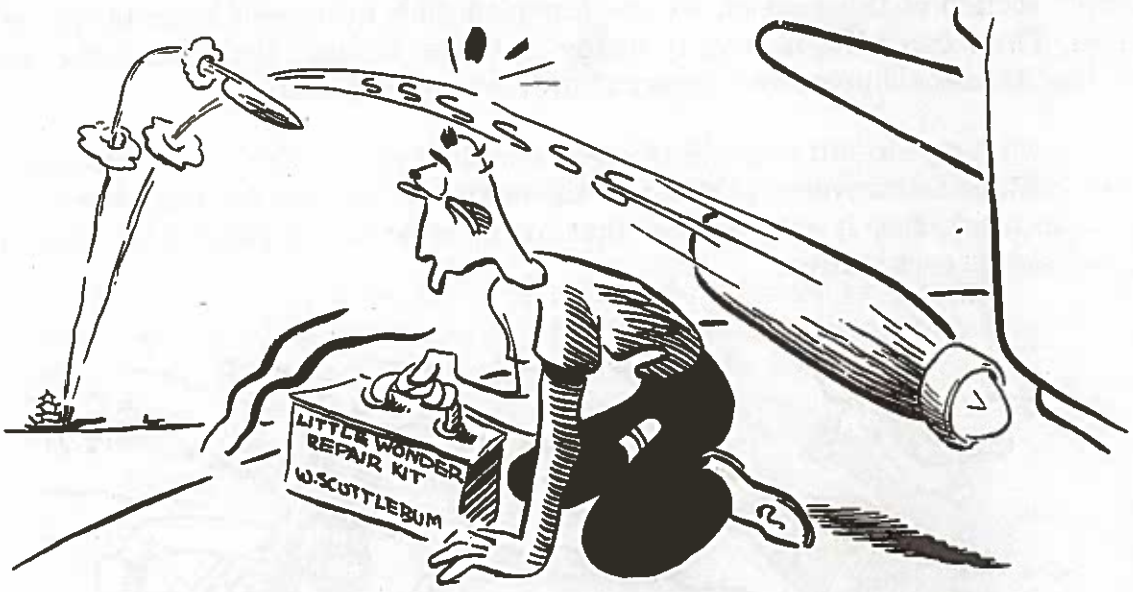
The slogan "Don't put all your eggs into one basket," is a good one. It applies to Damage Control. Spread your tools and tool lockers around. This will prevent their all being lost by one hit.

SOMETHING TO REMEMBER

In war zones you will be going to battle stations repeatedly. You will remain there for long hours at a time. There will be many drills and classes. Cooperate 100% with all of this. You may not appreciate it when you first go aboard ship in a safe harbor, but you will appreciate it a bit more when you stick your bow outside the torpedo nets.

And, mister—you will really be thankful for it when the hardware begins to fall. Remember,

YOUR BEST DAMAGE CONTROL WORK IS DONE BEFORE THE BATTLE!



COMMUNICATIONS

Communications play a vital role in damage control. Lack of information, incorrect information, and orders incorrectly transmitted and received can result in disaster. The Damage Control Officer must be quickly and accurately informed of the location, type, and extent of any damage which has been sustained. The orders which he gives concerning corrective measures to be undertaken to minimize the effects of this damage

must, in turn, be quickly and accurately transmitted to the repair parties. The effect of damage can be increased and the ship lost through the misdirected efforts of repair parties. This unfortunate and avoidable circumstance can often be attributed to faulty communications. Imagine what a rat race it would be if the only way of communication was by yelling back and forth. Every ship would sound and look like Saturday afternoon at Ebbets Field.

TYPES ABOARD SHIP

Yes, interior communication must be fast and "clean." By clean we mean that it must be complete in form and clear in voice. There are several forms of normal communication aboard naval ships. These are:

1. Battle telephone circuits.
2. Intercommunicating systems. (Inter-station)
3. Ship's Service telephones.
4. General Announcing System. (Ship's Broadcast)
5. Voice tubes.
6. Messengers.

THE BATTLE TELEPHONE CIRCUITS require no outside electrical power. Power is produced by the sound of the voice vibrating against a thin metal disk in the phone. Individual phones can be "plugged in" all over the ship wherever there is a telephone jackbox (plug). In order to designate these different "party lines" aboard ship, numerals are used. Practically every battle telephone circuit has its designation starting with "j." Some of these circuits are used primarily to pass Damage Control information and orders.

Sound-powered phones with long extensions should be made up ready for use. These will prove to be of great value if your ship is damaged.

THE INTERSTATION TWO-WAY SYSTEMS have the advantage of broadcasting orders or information at a repair station, so that all hands, instead of the telephone talker only, can hear. This allows a fast and wide range of communication. Don't emphasize this means of communication to the neglect of training in the battle telephone. Know both and know them well. Your interstation system may be ruined by damage.

THE SHIP'S SERVICE TELEPHONES are generally available for use and are normally installed at all Repair Stations. This system is not as rugged as others aboard ship and may go out of commission early in action.

THE SHIP'S BROADCAST SYSTEM is a means of communication, but so many stations other than Damage Control are affected that it should probably never be used unless all other methods fail. However, it should be kept in mind as a possible means of communication.

Remember, mate, that the last three systems are dependent upon the ship's generators. When electric power goes off, so do these circuits.

VOICE TUBES are rapidly disappearing, though some ships have 'em. The tubes run short distances from one area to another, and communication is established by calling through them.

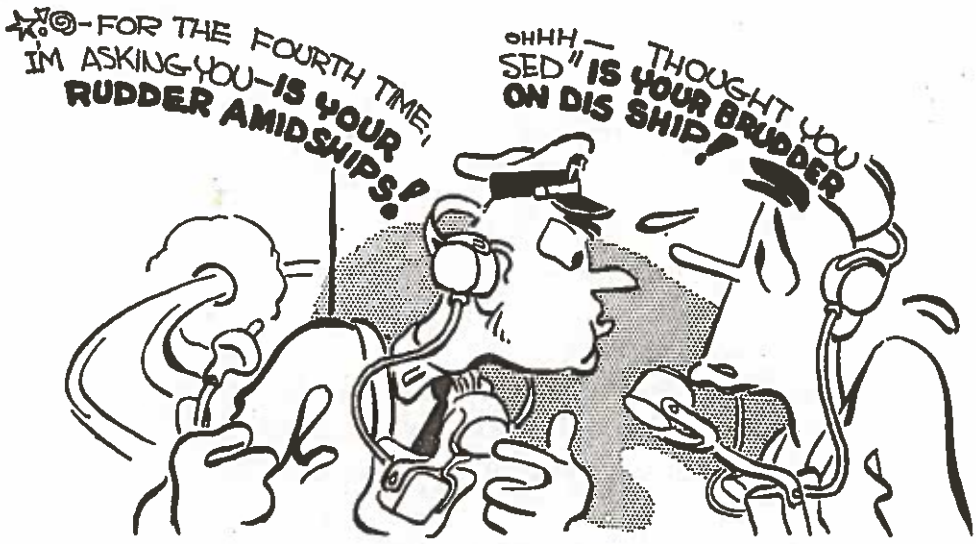
MESSENGERS are used for relaying orders and information. If you should find yourself made a messenger, your duty will be similar to old Buffalo Bill's. You will

"He's been that way ever since we made him a messenger!"

"take mail through," so to speak, by personally relaying spoken and written messages from one place to another. Yours will be a very important job. There have been actual cases where all other means of communication have failed, and messengers had to take over until some emergency circuits could be rigged. Know how to get around the ship. Know the Senior Officer at all departments, the Repair Party Officers, and the Petty Officers both by name and by sight. It is also a good idea to secure a canvas pouch for lengthy messages.

TRAINING TALKERS

Good telephones with poor talkers are often worse than no telephones at all. On one ship we know of, some 8-inch powder magazines were flooded because someone got the wrong word over the phone.



If you're a Damage Control man you should know how to talk over a phone. It's not just speaking English; it's talking it so the guy on the other end knows what you're saying.

1. Talk clearly *without slurring* your words.
2. Talk slow enough so as to avoid bunching your words.
3. Give your words *clear endings*.
4. If you're from the deep south, remember that the guy on the other end may be from Boston—and vice versa. Give your mates a break and avoid local dialect.

Besides being able to talk correctly, you must learn the standard phrases that are used on all ships. Know when to use them.

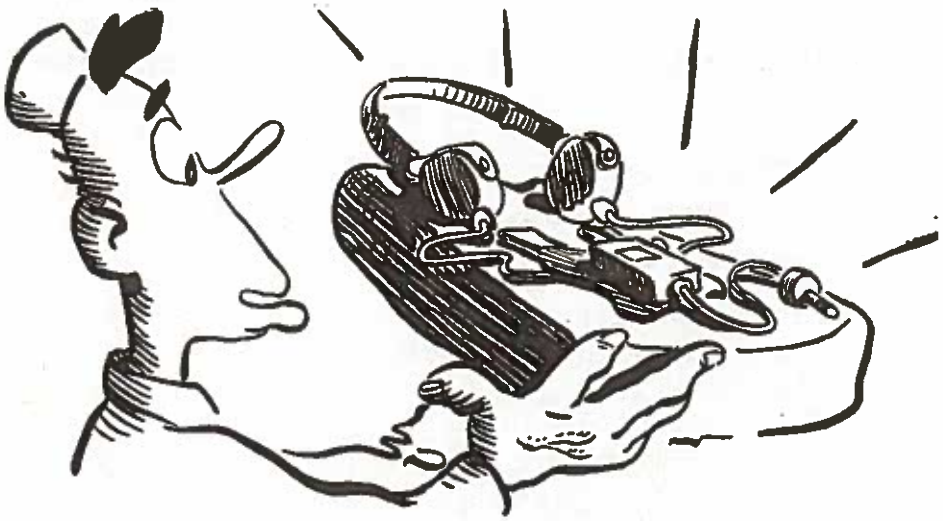
In general, messages are divided into three parts.

1. Name of station called.
2. Name of station calling.
3. The message.

If you are calling, don't wait for an acknowledgment, but give your message. When the message has been received and *understood* the station called will acknowledge it.

Here are some general rules for sound powered phones:

1. Be alert to what is said over the phone.
2. Repeat all messages sent and received word for word.
3. Understand clearly the message received. If the message is not understood always request a repeat.
4. Don't play, skylark or make funny noises over the systems.
5. Speak loudly and clearly.
6. *Hold the button down* while talking and only while talking.
7. Hold the transmitter about ½ inch from the mouth.
8. If the transmitter goes out, use the earpiece as a transmitter (or vice versa).
9. Test your circuit regularly.
10. Avoid use of alphabetical letters as references. This may lead to confusion. Use phonetics instead. For example, instead of "B" use "BAKER."
11. Never secure from your station until released by the officer in charge of your station.
12. *Try to be the best talker in your circuit!*



CARE OF PHONES

Telephones are the primary means of communication during drills, battle, or whenever the ship is engaged in any activity. Because of this, take care of your phones. Observe the printed instructions on the care and handling of phones. Suppose your phone "went out" because of carelessness on your part? How could you carry on in case of emergency?

DAMAGE CONTROL COMMUNICATION BILL

A Damage Control Communication Bill aboard any ship lists the circuits alphabetically, with the location of their outlets. The systems are then cross-indexed by listing individual stations and showing the various circuits installed at those stations. This information shows the ship's communication systems at a glance and lets you know how they are arranged.

SUMMARY

We have shown you the importance of communication aboard ship. We have outlined how it works. Frankly what you are most concerned about is *you*. Your talking can be the deciding factor between victory and defeat. Even if you are only remotely concerned with communications, you, as a member of the Damage Control Organization, should take it upon yourself to *know how*, just in case. Practice clear speech and correct procedure. Don't be like the guy who said, "We're being gassed down here and are about to pass out." He didn't identify his station. By the time the rescue party found out where he was calling from, he and his buddies were dead. Lack of information, incorrect information and orders incorrectly transmitted and received may result in disaster.

EFFECT OF PLUGGING SHELL HOLES

THE AMOUNT OF WATER ENTERING A SHIP THROUGH A HOLE VARIES DIRECTLY AS THE AREA OF THE HOLE AND THE SQUARE ROOT OF ITS DEPTH. "PUMPS" ARE THE NUMBER OF ELECTRIC SUBMERSIBLE PUMPS REQUIRED TO HANDLE THE FLOODING.

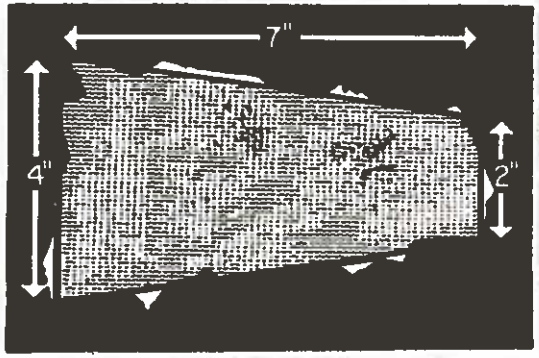
UNPLUGGED HOLES

DEPTH IN FT.	GALLONS PER MINUTE	PUMPS
1	301	③
2	425	④
3	512	⑤
4	603	⑥
5	676	
6	739	
7	794	⑦
8	853	
9	904	

DEPTH IN FT.	GALLONS PER MINUTE	PUMPS
1	114	①
2	160	
3	192	②
4	227	
5	254	
6	277	
7	286	③
8	320	
9	339	

SAME HOLES, PARTLY PLUGGED

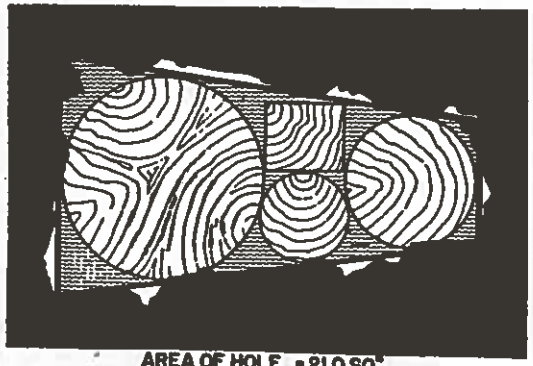
AREA OF HOLE = 19.65 SQ."
AREA OF PLUG = 12.25 SQ."
AREA OF LEAK = 7.40 SQ."



DEPTH IN FT.	GALLONS PER MINUTE	PUMPS
1	319	③
2	451	④
3	552	⑤
4	638	⑥
5	713	
6	782	
7	844	⑦
8	902	
9	957	⑧

DEPTH IN FT.	GALLONS PER MINUTE	PUMPS
1	91	①
2	129	
3	158	
4	182	②
5	204	
6	224	
7	241	
8	258	
9	273	③

THESE FIGURES SHOW HOW IMPORTANT IT IS TO PUT SOME KIND OF PLUG INTO A SHELL HOLE RIGHT AWAY.



AREA OF HOLE = 21.0 SQ."
AREA OF PLUGS = 15.0 SQ."
AREA OF LEAK = 6.0 SQ."

REPAIRING DAMAGE IN ACTION

What you and your mates know about repairing damage during and immediately after action may be the means of keeping your ship afloat and fighting. You are not then concerned with what a Navy Yard or a tender can do for you; you *are* concerned with what you can do for your ship.

Here is some battle damage that you may be called upon to help with:

1. Holes and cracks in the hull.
2. Punctured, weakened or distorted bulkheads and decks.
3. Warped or sprung doors and hatches.
4. Ruptured or cracked pipe lines and cables.
5. Clearing away of wreckage.
6. Damaged electric circuits.
7. Fire.

You should prepare yourself to use Damage Control repair equipment in squaring away the effects of the above mentioned damage. The following require immediate attention:

1. Flooding.
2. Electric power and light.
3. Air pressure to guns.
4. Damaged sections of the Firemain and Drainage Systems.
5. Ventilation to vital operating spaces.

And don't kid yourself on this point; the most important "tools" that you have are your own brains. Many ships have been *saved* by someone's using readily available tools and materials, combined with a little headwork. Don't worry about how the damage was inflicted, but concern yourself with the unhappy *results* and what *you can do to correct them.*

SMALL HOLES AND CRACKS IN THE HULL

Temporary repairs can often be made by driving wooden plugs or wedges into small holes. The wood must NOT be painted, because bare softwood will absorb water and swell, thus tending to hold the plug in place. Combinations of conical and square-ended plugs and tapered wedges may be used to get a good fit. Wrapping the plugs with lightweight cloth, or laying a cloth over the hole before driving in a plug, will help the plug to grip. The cloth will also act as a caulking material to fill spaces between plugs. Additional watertightness may be gained by driving oakum into the blank spaces. The important thing is to *plug those holes at once*!

Don't drive a hard wedge into a crack. This may possibly widen it. Try driving oakum or an undershirt into the crack. An hour or so after you have made such a repair you may note that the crack is growing progressively longer. Find the extreme ends of the crack and drill small holes there. Plug those holes with wooden plugs, or by tapping and inserting a machine screw.

Another effective method is to lay a flat piece of rubber packing or heavy canvas over the crack, back it up with a piece of board, and brace the patch in place with shoring. Inspect frequently.

Holes of fairly large size may sometimes be plugged with mattresses and shoring. The difficulty is that a hole large enough to require such a patch has probably admitted enough water to flood the compartment. However, a shallow water diving outfit can, in many cases, be employed to advantage. You will have to weight a mattress to submerge it.

Holes in the hull at or above the waterline may not appear to be very dangerous, but they are. If your ship rolls in a heavy sea or loses freeboard, those holes become submerged and admit water at a very dangerous level—*above* the center of gravity. Stability and reserve buoyancy are lost. The water also presents a free surface.

For an outside patch, take a pillow (or mattress) and punch a hole in the middle. Take a plank slightly longer than the pillow and bore a large hole through the middle of it. Knot one end of a stout line and run the other end through the plank and the pillow, and pulling the unknotted end of the line through the shell hole, draw the patch tight against the hull. Make the inboard end of the line fast to a stanchion. Draw it tight with a Spanish windlass.

Almost any available material may be used for such patches; pillows, mattresses, mess tables, floor plates, gratings, etc. Additional holding lines, on the inside and outside, may be needed with large outside patches.

Prefabricated patches may be made from steel plates with holes drilled through the center. A gasket is permanently installed near the edges of the inner face of the plate. Fasten a line to a wooden block, push the block through the hole. Float the line to the surface, where men can secure the messenger to the line on the patch.

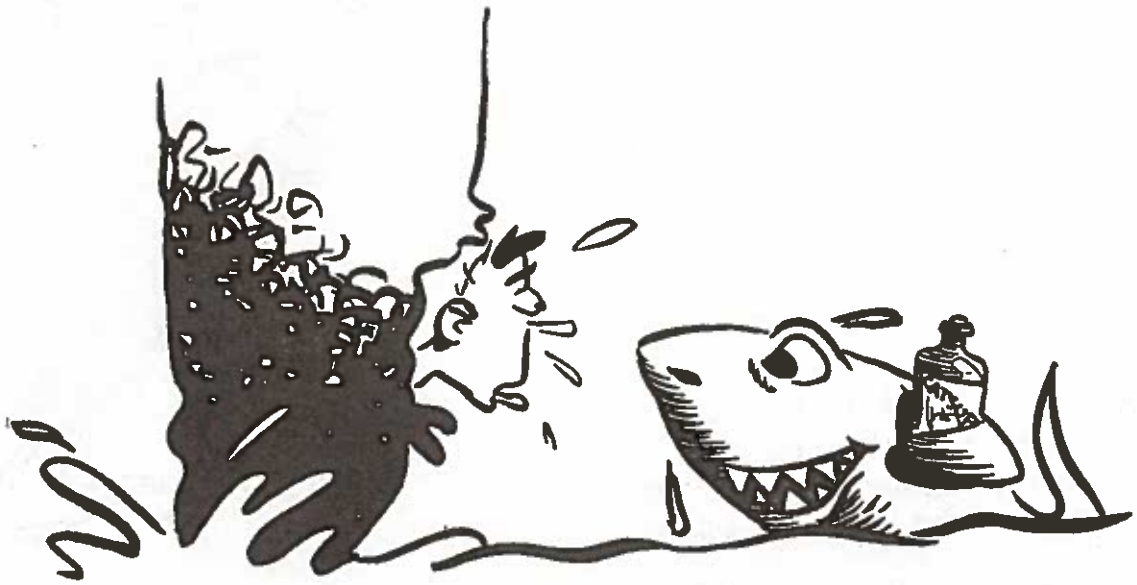
Another patch, which is highly suitable for use over holes having jagged edges protruding inboard, is a box running in sizes up to 18 inches square and 6 inches deep.

The box is put over a hole from inside the ship, and is held in place by shoring. A gasket along the facing edge of the box insures a better fit to the hull.

If your patch does not fit close to the hull, you can use oakum or wedges to fill up the cracks. No temporary plug or patch will be 100% leakproof, but if you can reduce the flow of flooding water, you can control flooding with your pumps, and thus save your ship.

DECKING

Ruptures in decks have to be repaired, not only to prevent the spread of water, but to make the decks safe for personnel. Remember that while a ruptured deck may not, for the moment, seriously endanger the ship, you cannot be sure that progressive flooding or further damage will not make that deck the only barrier between yourself and the sharks.

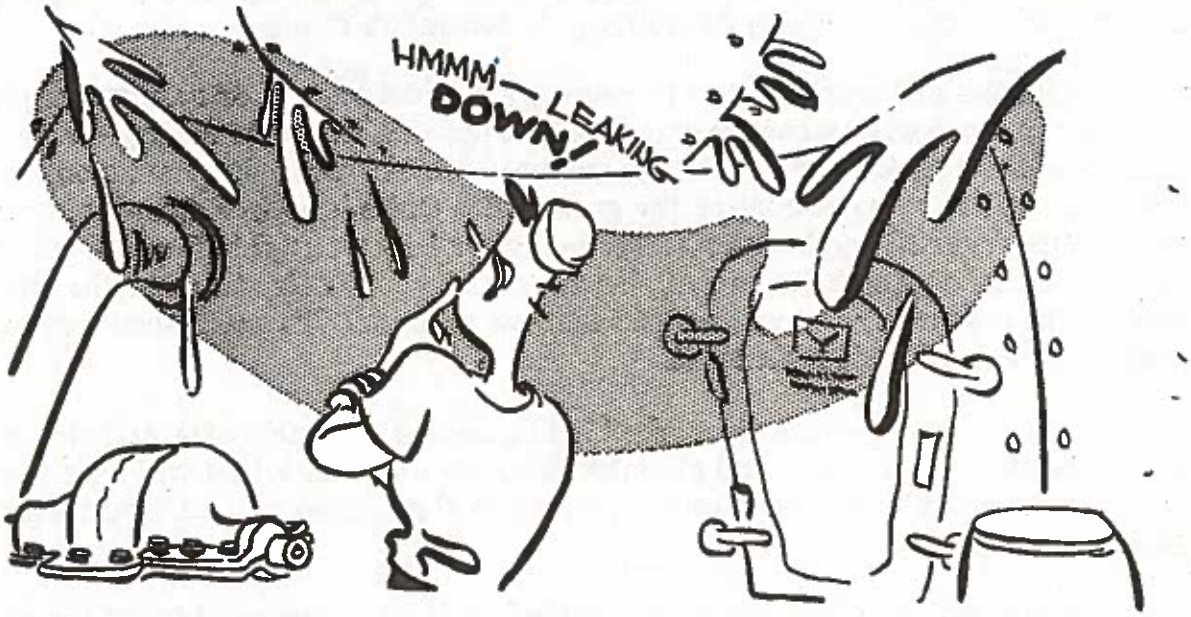


MISCELLANEOUS LEAKS

Other dangerous leaks are those in stuffing tubes, around reach rods and cables, cracks where angle irons are bent away from decks and bulkheads, loose rivets, holes left where rivets have been pulled through plating, holes made by flying metal fragments, and many others.

Such holes or leaks may occur in compartments far from the scene of major damage. Many of them may not be obvious at a casual inspection. However, because of the possibility of sustaining further damage, and the danger of progressive flooding as a

result of other leaks or collapsing bulkheads, those minor leaks must be repaired as early as possible.



WRECKAGE REMOVAL

In battle, the removal of wreckage has often been found to be of utmost importance. Wreckage may foul guns and directors so that they cannot be trained, may hold hatches and doors shut when they must be opened, and will certainly block passageways. The wreckage may be fallen radio and radar antennae, pipe lines, bulkheads, electric cables, lockers, bunks, and dislocated deck and bulkhead plating.

Before clearing away wreckage, isolate damaged systems in the area. This prevents fire, flooding, and injuries to personnel. Isolate electric systems in the damaged area as a fire prevention measure. *Do this quickly*!

Loose wreckage may be removed by hand. (Don't forget those gloves!) Most wreckage is metal, and may have to be cut away. Acetylene torches and pneumatic chisels are the best tools for that purpose. Axes, cold chisels, mauls, rivet busters, and other hand-operated tools will also be found useful.

ALWAYS HAVE A CO_2 FIRE EXTINGUISHER AND A FIRE HOSE READILY AVAILABLE WHEN YOU ARE CLEARING AWAY WRECKAGE. REMEMBER, A SPARK OR FLAME MAY SET OFF EXPLOSIVE GASES!

If you enter a gas-filled compartment, wear a rescue breathing apparatus (or hose mask), and a rescue line. Be sure someone is on the other end to haul you out if anything goes haywire.

PIPE LINES

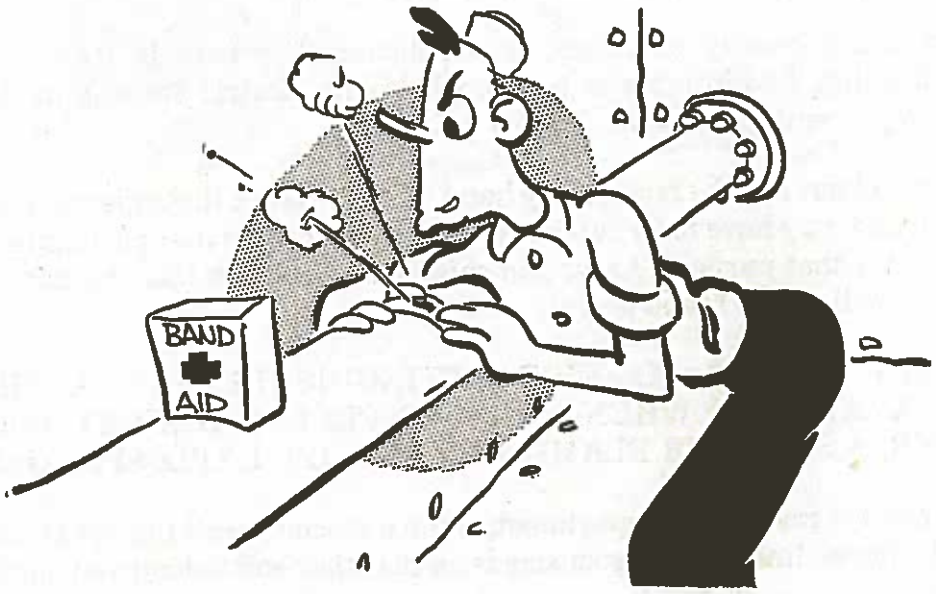
Before commencing repairs to any pipe line, it is necessary to remove pressure from the line, and to provide the same service by some other means.

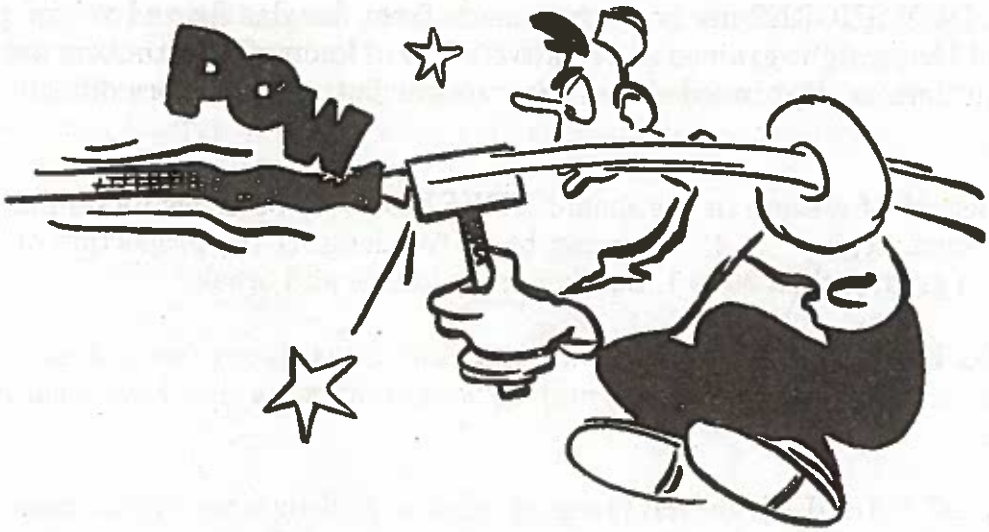
Small holes and cracks in low pressure water, fuel oil, air, or even steam piping can often be repaired by what are known as soft patches. Wrap the damaged area with a gasket of sheet packing and secure the gasket in place by wrapping it with one or two layers of marline or wire. Coating the gasket with white lead or red lead putty often gives a tighter seal. Sometimes a soft wood plug can be jammed into the hole, cutting it off flush with the pipe, and then applying the gasket over it. Do not make the plug too long, as the protruding end will restrict the flow of liquid. The patch should extend at least an inch on either side of the hole.

For low-pressure steam lines, the binding should be tough wire and the facing compound should be litharge and glycerine, or other compounds that will bake into the crack. If the patch leaks steam, cover it with a burlap bag to prevent injuries to personnel.

No patch will be 100% perfect, and if the hole is large, the repair may not be able to stand all the pressure you would like to put on it. Adjust your pressures accordingly, and remember that half pressure may be enough to save your ship.

If the pipe has been badly holed or ruptured, a patch may not suffice. You may have to renew a section. It is advisable to have spare sections of the smaller sizes of pipe aboard.





The open end of a pipe can often be closed off by driving in a wooden plug. However, the plug cannot stand much pressure.

If the pipe line is fitted with bolted flanges, break the line at a flange joint and install a blank flange. Most ships carry a number of blank flanges, even for lines as large as the main steam line. Small lines can be blanked off with pipe caps.

There is a special portable flange that can be used for running jumpers. It is drilled like the blank flange, but in the center is a large hole fitted with a screw coupling to which you can attach a hose or a pipe. C-clamps are valuable for joining flanges and for other purposes.

SHORING

Shoring is the process of placing props against the side of a structure, or beneath or above it. to strengthen it and to prevent its collapse.

Ships often have to support ruptured decks, strengthen weakened bulkheads, build up temporary bulkheads against the sea, support hatches and doors, and provide props for equipment that has broken loose. This is done largely by shoring.

A SHORE is a portable beam.

A WEDGE is a block, triangular on the sides and rectangular on the butt end.

A SHOLE is a flat piece which may be placed under the end of a shore to distribute weight or pressure.

A STRONGBACK is a beam used to distribute pressure across a deck or bulkhead.

WOODEN SHORES are best when made from douglas fir and yellow pine. The wood should be straight-grained and relatively free of knots. Cured timbers are stronger than green timbers. Hardwood shores are stronger but are also more difficult to cut or nail.

The length of a shore in use should NEVER be over 30 times its minimum thickness. For example, a 4″ × 4″ shore can be 10 feet long. If the proportion of length to thickness is greater than 30 to 1, the shore may buckle and break.

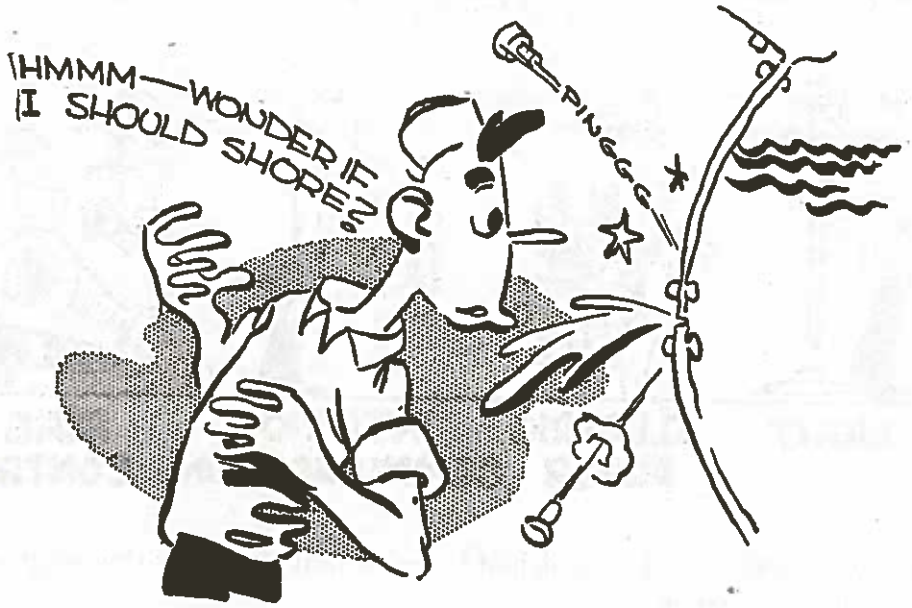
WOODEN WEDGES should be made of *soft wood.* Leave 'em coarse, rough and unpainted. A few hardwood wedges may be kept on hand as they have good resistance to crushing.

WOODEN SHOLES are flat pieces of wood an inch or more in thickness and from 8 to 12 inches wide.

Various kinds of rigging gear, such as chainfalls, wire hawsers, blocks and tackle, and manila line will be found useful during shoring operations, especially for clearing away wreckage and restoring equipment to its original position.

When stowing shores, spread them well about the ship in accessible compartments. The pockets between frames and girders are good places to stow shores. Secure them with lines or metal clips, so that they cannot break loose, *but* so that they can be removed easily when required. Wooden wedges can be made up into compact blocks. Plugs may be kept in canvas bags tied to a beam or stanchion.

Deep bulges in plating, bent frames and stanchions, loose rivets, cracks in seams, and panting of bulkheads are indications of the need for shoring. "Panting" is the most dangerous condition, because it indicates weakness against recurring pressures. It may cause metal fatigue, which in time will lead to cracks, splits, or even collapse.



There is a tendency to shore when it is not necessary. Unless pressure must be resisted, shoring will not be needed. However, if there is any question in your mind, always shore. It is better to be safe than sorry.

When a compartment is flooded, the deck and all bulkheads around it *are* subject to some pressure. Therefore, all containing structure *may* have to be shored. Priority should be given to any deck or bulkhead that may have been weakened or is subject to great pressures.

If we attempted to tell you all about *how* to shore it would take many pages. Your best bet is to investigate available reading material on shoring. Just reading this information will not make you a shoring expert. Drill and experience are the best teachers.

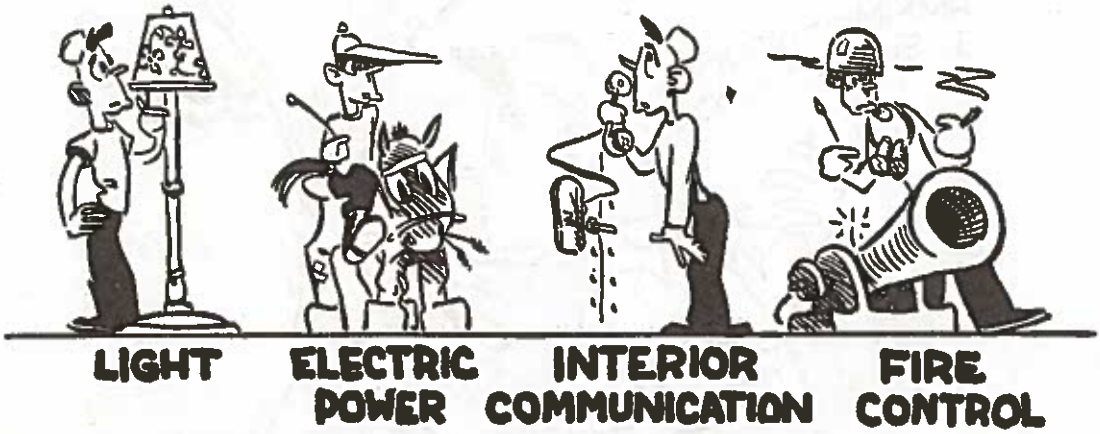
Know the details of shoring operations whether you are in the repair party or not. Know the tools; their possibilities and limitations.

It's the same here as with the rest of Damage Control. The man who has the correct equipment and judgment, and knows how and when to use it, is the man who may one day be of the greatest help in bringing his damaged ship back home.

ELECTRICITY AND DAMAGE CONTROL

ELECTRIC CIRCUITS

Generally speaking, electrical circuits found aboard ship can be divided into:



The electric cables are distinguished by color markings for the purpose of making identification and emergency repair.

Light and power:.....RED, Vital. YELLOW, Semi-vital.

Interior Communication and Fire Control: BLUE, Vital, GREEN, Semi-vital.

Non-vital circuits are not marked with a color code. Naturally, the red and blue vital circuits should be repaired first, after sustaining battle damage.

THE CASUALTY POWER SYSTEM

is a feature that has been built into all recent ships. It is a semi-portable electric circuit used to provide for power distribution after battle damage has ruined the main distribution circuits.

Power is fed through vertical *risers* which are permanently installed cables. These may be energized by connecting the lower ends to switchboards or distribution panels. *Jumpers* are available for this purpose. The upper ends of the risers are in various compartments. On the forward and after bulkheads of compartments are *terminals* or connectors. These go through the bulkhead and are watertight. The terminals are fitted with clamps or sockets and set-screws for securing the ends of *cables*. These cables are coiled up and hung in each compartment. The large ones are for connecting one terminal

to another so as to extend power along the ship. Smaller cables are for operating electrical tools within the compartment.

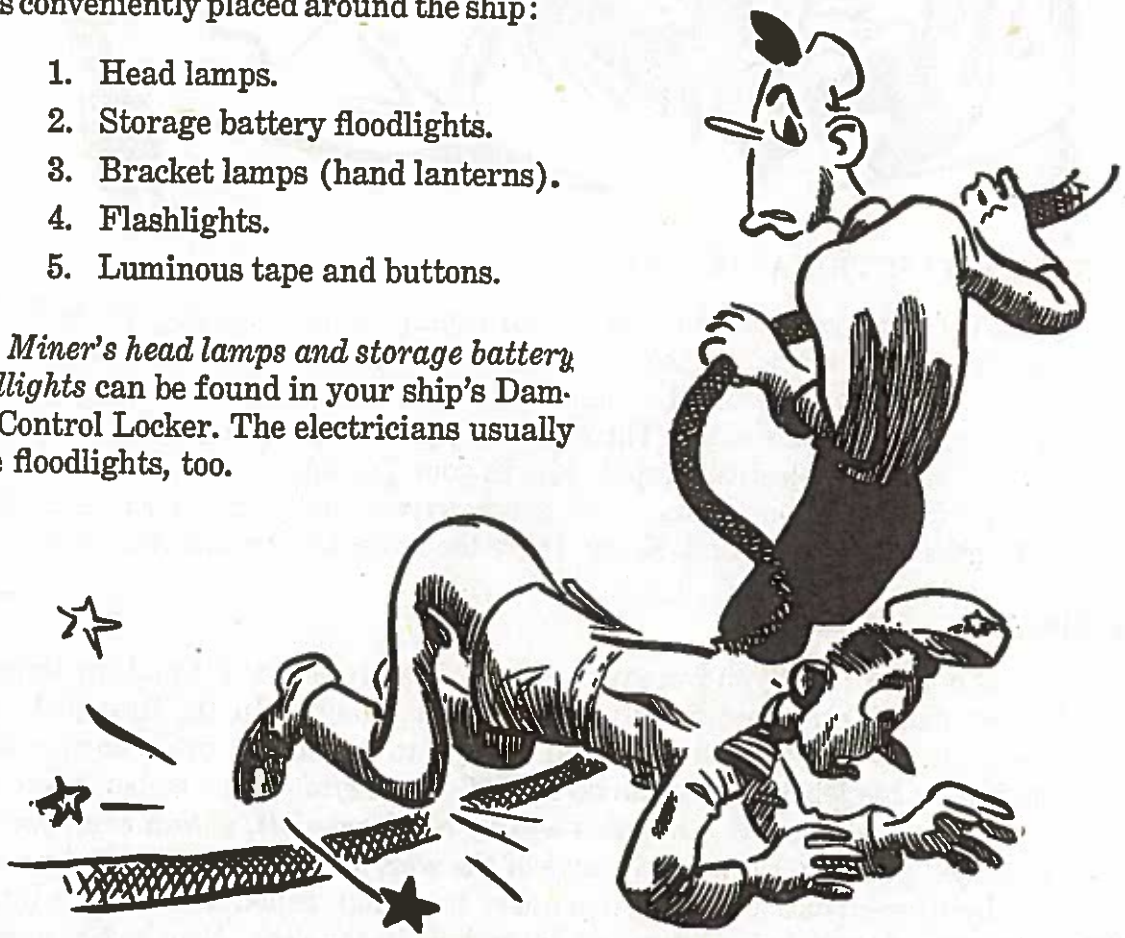
On direct current ships, the terminals are in pairs, with the *positive* leads marked *red* and the negative leads marked *green*. On alternating current ships there is only one terminal on each bulkhead. Each terminal has sets of slots marked A, B, and C, to allow for "three-phase" current. *Be sure to connect terminals properly*. The wrong wire in the wrong hole can short circuit the system and cause the loss of your only source of power. Don't let the cables flop around the deck. Secure them along the overhead and out of the way.

EMERGENCY LIGHTING

Now then, suppose that the regular electric circuits and the casualty power system have *both* been put out of commission. You should have the following emergency substitutes conveniently placed around the ship:

1. Head lamps.
2. Storage battery floodlights.
3. Bracket lamps (hand lanterns).
4. Flashlights.
5. Luminous tape and buttons.

Miner's head lamps and storage battery floodlights can be found in your ship's Damage Control Locker. The electricians usually have floodlights, too.



Bracket lamps should be found hanging on the bulkheads in convenient locations. Many times, hand flashlights are issued to all repair men aboard ship. *Luminous tape* and buttons should be mounted in handy places around the ship. Luminous tape is

"energized" by the electric lights of the compartments shining on it. When the lights go out, the tape continues to glow. The tape and buttons are very valuable for indicating ladders, doors, men, etc., in the dark. The buttons, on the other hand, are radioactive.

EMERGENCY ELECTRICAL REPAIRS

Your ability to make emergency electrical repairs during battle will depend on training and frequent drills *before* the battle is joined. You must know how to make the best use of what you have left after the ship has been hit. Know where switches, junction boxes, and other devices are located. Through *drill*, get to *do* and know *by habit* what will have to be done. Keep electrical repair kits in your Damage Control Lockers. These kits contain pliers, cable connectors, tape, screwdrivers, and other such equipment. Keep short lengths of cable on hand. Know where the material *is* when you *want* it.

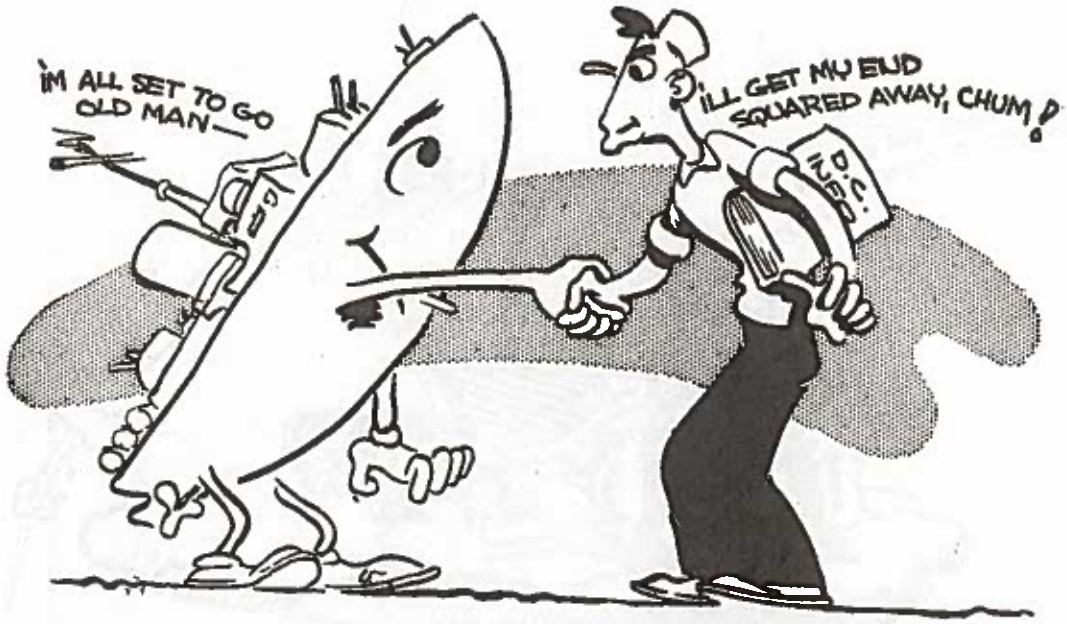
WARNING!

"Leave us not say" that you were not warned. If your ship is hit and the lights go out, don't start running around blindly and without thought. In the first place, you should know your job and your station well enough to operate in utter darkness. No man is qualified for his job unless he can do this. *Walk carefully!* Remember, there may be no deck where there was one 5 minutes ago. *If at all possible, obtain some form of lighting.* Don't get panicky. In the early days of the war, an allied naval vessel received a bad hit. All lights went out. The crew, in a hurry to get out, failed to wait for a light to show the safe way. Along their path was a large hole in the deck. *Nearly 300 men fell through and were drowned or crushed to death.* If the leaders had walked carefully or had taken a moment to get a flashlight, they could have discovered the hole and walked around it. Take a lesson from history. Keep your head and think straight!

SO—

We have finally come to the end of our story. As was stated in the introduction, this booklet is not to be regarded as a complete manual on Damage Control. There is much more to learn than has been covered here. Men who have spent the last few years trading blows with the enemy know this. You have seen or heard of the totally unpleasant consequences of not taking the correct precautions. You are also aware of what a tough job it is to repair damage in action *even if you know the score* and have the correct *equipment* available.

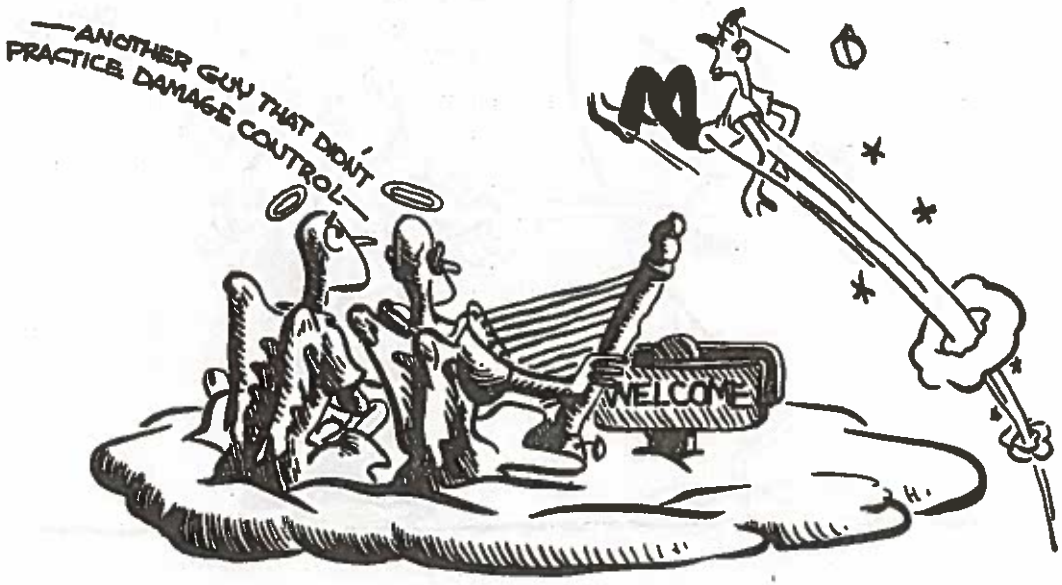
You fellows who have not had a damaged ship under foot *take heed.* Your knowledge of and ability to apply the corrective measures of Damage Control, permits your ship to realize the reliability and toughness that has been built into it. Our ships are the best in the world, BUT they are only as good as the men who man them.



In closing, let the following be your

Ten Commandments of Damage Control

1. Keep your ship watertight.
2. Do not violate material conditions.
3. Have confidence in your ship's ability to withstand severe damage.
4. Know your way around—even in the dark!
5. Know how to *use* and *maintain* your Damage Control equipment.
6. Report damage to the nearest Damage Control Station.
7. Keep personal articles properly secured at all times.
8. Practice *personal* Damage Control. Protect yourself so you can protect *your ship*!
9. Take every possible step to save the ship as long as a bit of hope remains.
10. Keep cool; DON'T GIVE UP THE SHIP!



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"DARLING, WE OWE IT ALL TO SCUTTLEBUM NOT FOLLOWING HIS **DAMAGE CONTROL CHECK-OFF LIST!**"