NOT TO PASS OUT OF THE HANDS OF OFFICERS OF THE NAVY OR OFFICERS OF THE NAVAL RESERVE FORCE

Confidential

NOTES ON INSHORE PATROL SERVICE

NAVY DEPARTMENT
OFFICE OF NAVAL INTELLIGENCE
MAY, 1917

WASHINGTON
GOVERNMENT PRINTING OFFICE
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OFFICE OF NAVAL INTELLIGENCE,
May 3, 1917.

This pamphlet contains four lectures delivered at the Naval War College in April, 1917. They are published because the information in them may be of interest to members of the inner patrol service. Nothing in them is to be considered as an order; they are to be regarded solely as circulars containing information that may be of use.

1. Proposed Method of Searching for Inshore Patrol Boats, by Commander L. McNamee, United States Navy.

2. Inner Patrol, by Commander R. W. McNeely, United States Navy.

3. Handling Boats Underway—Care and Equipment of Boats—Stationing of Crew, by Commander F. N. Freeman, United States Navy.

4. Care of Battery—Training of Crew—Principles of Gunnery, by Commander W. L. Littlefield, United States Navy.

ROGER WELLES,
Captain, United States Navy,
Director of Naval Intelligence.

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PROPOSED METHOD OF SEARCH FOR INSHORE PATROL BOATS

By

COMMANDER L. McNAMEE, U. S. N.

APRIL, 1917

SEARCH METHOD FOR INSHORE PATROL BOATS.

Search for submarines will be conducted in strict accordance with standard diagrams, copies of which are appended. They prescribe the speeds, times, and courses to be assumed for all conditions. The center of the diagram, or point of origin of the search curves, is invariably to be taken as the point at which the submarine was seen to disappear.

It is assumed that the U-boat will be of the usual type, tonnage 850, surface speed 16 knots. Submerged speeds and radii are as follows:

Speed, 10 knots; radius, 70 miles.
Speed, 5 knots; radius, 120 miles.
Speed, 2 knots; radius, 130 miles.

Four standard diagrams are used for the following conditions, which are considered all that would normally arise in practice:

No. 1. Patrol boat speed, 20 knots; submarine, 10 knots.
No. 2. Patrol boat speed, 15 knots; submarine, 10 knots.
No. 3. Patrol boat speed, 15 knots; submarine, 5 knots.
No. 4. Patrol boat speed, 6 knots; submarine, 2 knots.

Boats start from the origin at the assumed speed of the submarine. At the end of the first leg they change course and take up the speed assigned on the standard diagram.

Let us assume a force of 19 boats—some on patrol station, some en route to or from harbor, and some in port with the tender.

The nearest boat sighting the submarine, if equipped with radio, will signal by that means the location in which it is seen to submerge, in the meantime proceeding at top speed to that point, and opening fire when in range. If not equipped with radio she gives the alarm at once by firing guns, hoisting a shape, blowing whistle, and firing rockets or smoke bombs.

The first boat that has radio sends out the alarm, followed by the location of the submarine as soon as learned.

The boat arriving first at the spot where the submarine was seen to disappear anchors, hoists a flag at the masthead, and remains in the position as marker until the submarine has been relocated in another vicinity. Should the water be too deep to anchor, she drops a buoy and remains herself as near as possible to it.

Boats will search in three groups, the number available being so divided in accordance with their order of arrival at the marker. In

the case under consideration the first six boats to arrive will be assigned each a spiral of the standard diagram for an assumption of submerged speed of 10 knots, and will be promptly dispatched in the order of their arrival. It is assumed that these boats can make a speed of 15 or 20 knots. Ordinarily the first boats would search toward deep water as being the most probable course of the submarine.

When six have been dispatched the next six would in order take spirals on the assumption of 5 knots submerged speed.

Similarly the third group to arrive would take up the search on the assumption of 2 knots speed.

It is the duty of the marker to keep track of the spirals taken by each boat and to assign spirals to each arriving boat.

If the chase starts at 6 a. m. and there is 12 hours of daylight, it will be seen that the first group would finish its search in seven hours at a distance of 70 miles from the start. They could then utilize the remaining hours of daylight for any special search prescribed by the flag boat. They should in the absence of instructions return at best speed to the point of origin of the search.

The second group could in 12 hours of daylight reach a distance of 60 miles from the origin, but as the submarine has a radius of 120 miles at 5 knots, it can be seen that if not discovered, he may still be proceeding submerged and will escape.

The third group would likewise finish at a distance of 24 miles.

Should the submarine be relocated by any boat she will proceed at once to the spot and take up the position as marker, all boats will assemble as before, and a new search started. Boats unprovided with radio will give the alarm by firing guns, blowing whistle, and using smoke bombs on arriving at the point where the submarine was last seen; the boat should circle rapidly over the position to further attract attention.

The chase will, in any case, in the absence of instructions, continue until dark.

Boats should then assemble, as they proceed toward the base, into groups of three or four, get into a V-shaped formation, and the leader show the running lights of a steamer. Others should remain darkened.

A submarine sighting the lights might think that he had a merchant steamer to deal with, and when he came to the surface to attack find himself in a nest of patrol boats.

The area to be patrolled by each division will be divided into squares, each square to be designated by a letter and number.

Boats on patrol will be assigned a number of squares to be kept under observation, and the boat should habitually cruise over this area at reduced speed and never leave it except when called away to chase. The officer on watch must keep himself constantly informed

of the position of his boat in regard to these squares and be prepared to signal instantly the location of any submarine sighted. But three words should be needed in any case to report the position of a submarine. For instance "Sm—B—22" would mean to all hands that a submarine was sighted in square B—22. These squares could conveniently be assigned code words which would still further shorten the message and prevent U boats from sending confusing messages to mislead patrols.

STANDARD SEARCH DIAGRAMS.

Four diagrams are provided covering submerged speeds of 10, 5, and 2 knots with patrol speeds of 20, 15, and 6 knots.

These diagrams are designed to be placed and oriented with their centers over the position where the submarine was seen to disappear. They are constructed on the scale of Coast Survey Chart No. 113. Courses and distances are laid off correctly for this chart and the boat need only apply the corrections for the deviation of the compass. All courses are magnetic and are given in degrees and nearest quarter point.

In order that boats will not be crowded or confused, the initial courses all radiate from the center to a convenient distance before the retiring search spiral begins. This first leg should be run at approximately the assumed speed of the submarine, though this point is not important. The diagrams, however, are so constructed.

In following the diagram boats should note when the next change of course is to be made and be ready to change promptly at the end of the prescribed time.

Land, buoys, or marks of any kind should be noted and their position with reference to different points on the spiral used to check the course and position of the boat.

If the spiral runs into danger, note the next course on the same spiral that can be safely steered and skirt the land or danger till the next safe point on the spiral is reached.

As the chase should continue until darkness or until the limit of submerged radius is reached, it is important that officers understand how to extend the diagram beyond the limits shown. This can be readily done by drawing circles with the origin of the chase as a center and the distance the submarine could have reached at the end of any elapsed time, as a radius. These circles give the limit of distance that the submarine could have traveled on a straight course in the elapsed time since it was seen to disappear. The patrol boat should reach each of these circles at the same time as the submarine. Having reached the end of the last course on the diagram, if this point be taken as a center and an arc enscribed with a radius equal to the

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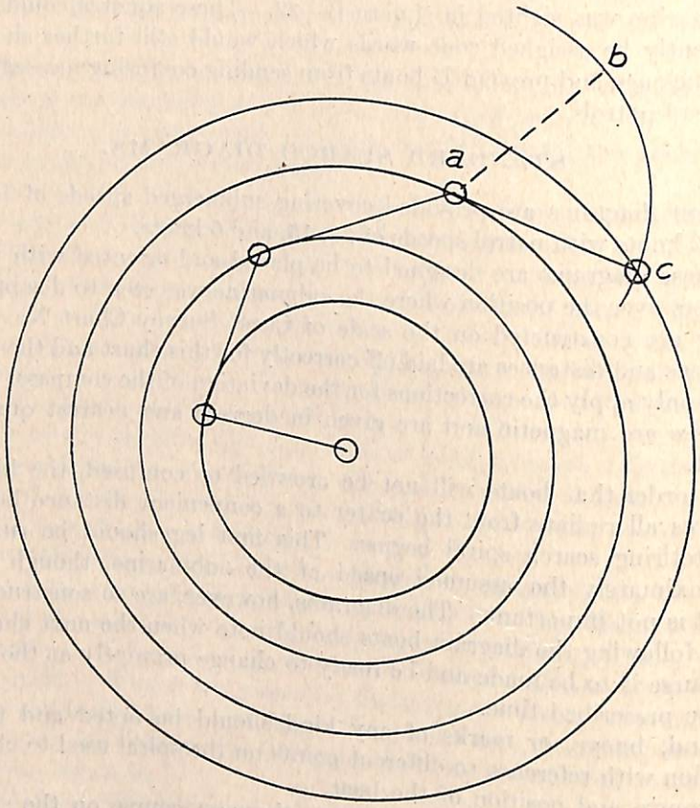
distance the patrol boat would run in the next increment of time, the point where this arc cuts the position circle of the submarine at that time will give the next point to be steered for. (See sketch.)



The distance between concentric circles is the distance that the submarine is assumed to go in, say, 12 minutes. If the patrol boat can go a distance a—b in 12 minutes, then a—c is the course and distance for the next interval.

Since there can be no certainty that a submarine will continue for a definite time at any assumed speed it is of little value to take into account the elapsed time before any boat takes up the search. The essential idea of the plan is that the area shall be searched as promptly and thoroughly as possible and as far as possible in successive relays that search at speeds calculated to cover most completely the area nearest to the last known position of the submarine.

Experience abroad justifies the assumption that as a rule the submarine conserves its battery power and rarely makes long submerged runs.

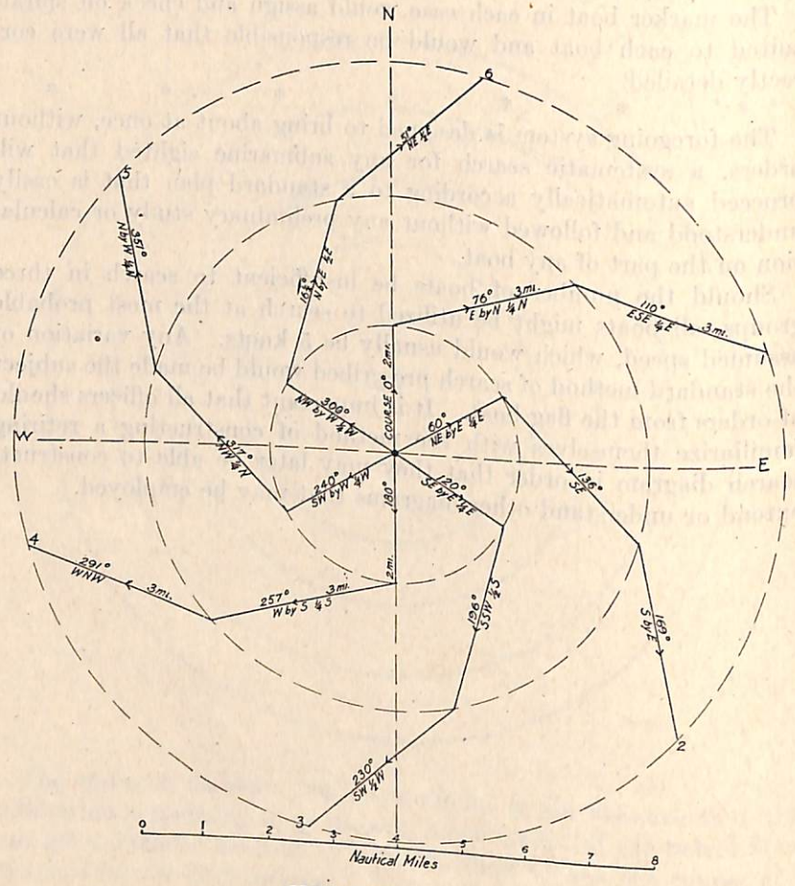
It has been assumed that all boats can make 15 knots. However, should the first boats to arrive be incapable of making such speed, they may be assigned at once to spirals on a lower assumed speed. For instance, if one of the first group to arrive could make but 7 knots, she would be assigned a spiral on the 2 knot submerged speed assumption.

The marker boat in each case would assign and check off spirals suited to each boat and would be responsible that all were correctly detailed.

* * * * * * *

The foregoing system is designed to bring about at once, without orders, a systematic search for any submarine sighted that will proceed automatically according to a standard plan that is easily understood and followed without any preliminary study or calculation on the part of any boat.

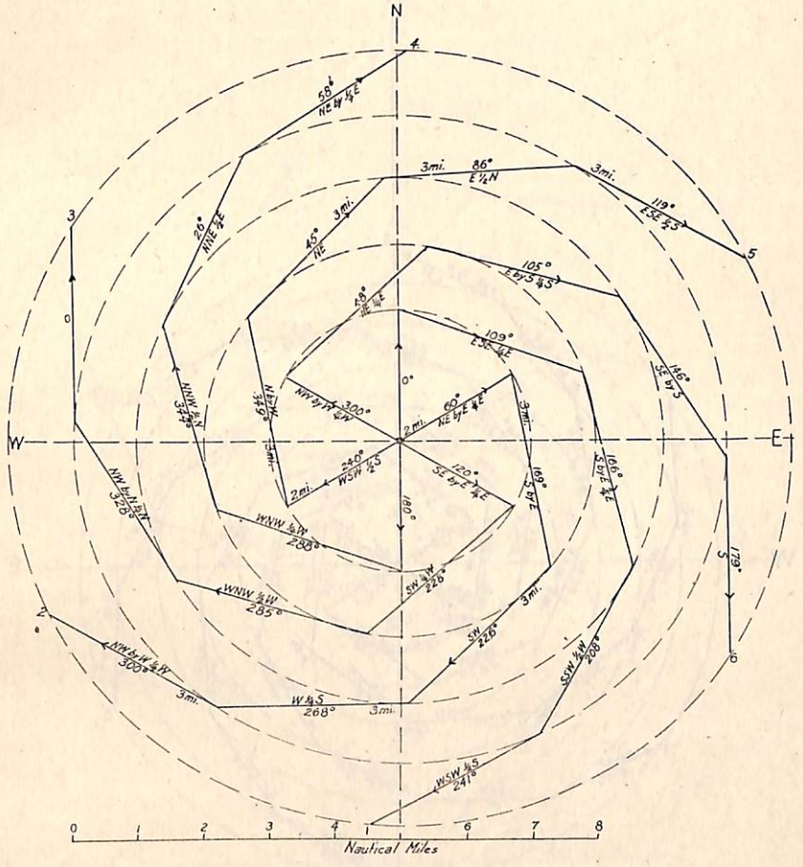
Should the number of boats be insufficient to search in three groups, all boats might be utilized to search at the most probable assumed speed, which would usually be 5 knots. Any variation of the standard method of search prescribed would be made the subject of orders from the flag boat. It is important that all officers should familiarize themselves with the method of constructing a retiring search diagram in order that they may later be able to construct, extend or understand other diagrams that may be employed.



SUBMARINE CHASE.

Scouts speed, 15; submarine speed, 10. Scouts change course every 12 minutes.

Scouts speed to first change of course 10; thereafter, 15 knots; all courses magnetic.



SUBMARINE CHASE.

Speed of scouts, 15; speed of submarine, 5. Scouts hold course for 24 minutes, then change every 12 minutes.

(Scouts speed to first change of course 5; thereafter, 15; all courses magnetic.)

INNER PATROL

By

COMMANDER R. W. McNEELY, U. S. N.

APRIL, 1917

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INNER PATROL.

NAVIGATION.

Definition.—Location of ship and conducting ship from one point to another.

Methods.—Three general:

Piloting—Bearings.

Dead reckoning—Course and distance.

Nautical—Astronomical.

We are concerned with piloting and dead reckoning.

Length of mile.—Nautical, 6,080.27 feet, or 2,000 yards.

Bearing of an object.—Angle between *observer*, the *object*, and the *meridian*.

Kinds of bearing.—True, magnetic, and compass, from north around to right, 0° to 360°.

NAVIGATION INSTRUMENTS FOR OUR PURPOSE.

1. Compass and table of deviation for steering courses.
2. Chart of locality with latest corrections.
3. Azimuth circle for taking bearings.
4. Sextant for taking angles.
5. Parallel rulers.
6. Dividers, for chart work.
7. Log and line (patent), for taking speed.
8. Hand leads and lines, for taking depth.
9. Binoculars.
10. Long glass.
11. Watch, pencils, paper, and a book on navigation.

1. COMPASS.

Nonfreezing liquid, graduated in degrees, 0° north around to right to 360°, also graduated in points and quarter points.

The errors of compass due to: (1) Magnetic influences of the ship are called deviations, and these may be partially corrected with mechanical devices; semicircular magnets, quadrantal balls, heeling error magnets, and flinders bar. When compass has been corrected ship is swung for residuals and the errors on each course (or each 10°, 15°, or 30°) found and tabulated in a deviation table. (Explain care of compass.) (2) The uninfluenced compass points to magnetic

pole, as the magnetic and the geographical poles do not coincide, the angle made by them at the locality of the compass is called variation. The total error of compass is a combination of variation and deviation.

Bearings or courses may be expressed as:

(1) *True*, referring to angle to the geographical or true meridian.

(2) *Magnetic*, referring to angle to earth's magnetic meridian and the correction of variation must be applied to it to get the true bearing.

(3) *By compass*, referring to angle from north indicated by compass on a given heading of ship, and must be corrected for deviation on that heading for conversion into magnetic; and must be corrected both for deviation and variation for conversion into true. (Explain necessity for thorough understanding of application of errors.)

Naming errors.—When effect of any error (variation or deviation) is to draw north end of compass to the right, or eastward, the error is named East or (+).

When the effect is to draw the north end to left or west, the error is named West or (−).

"When correct direction is to the right, error is east."

Variation is always found on chart.

Deviation is found by swinging ship, and there are four methods.

1. Reciprocal bearings.
2. Bearings of sun.
3. Ranges.
4. Distant object.

Post table of deviations on a board for ready reference.

2. CHARTS.

Two general types:

1. Mercator, Hydrographic Office (HO).
2. Polyconic, C. S. (Coast Survey).

For local work both may be considered as developments of plane surfaces, and the track of the ship laid as a straight line.

Charts contain following data:

1. Lat. (parallels) and Long. (meridians).

P. 68, Bowditch. 2. Position of prominent objects, outlines of coast and bordering topography.

3. Depth of water in fathoms or feet.
4. Curves for 5, 10, 20, 30, or 100, etc., fathoms.
5. Character of bottom and abbreviations:
   Clay—C.
   Mud—M., etc.

P. 739 et seq. Muir. 6. Currents: tidal and permanent; their strength and direction.

7. Scale of miles (in large scale charts)

8. Aids to navigation, ranges, buoys, landmarks, lightships, submarine signals.
9. Date and corrections.

3. AZIMUTH CIRCLE.

(*a*) Pair of sight vanes.

(*b*) Mirror and prism for bearing of sun.

P. 18, Bowditch.

PELORUS.

An extension of the compass Azimuth Circle for taking bearings of distant objects not in view from the compass itself. It is unnecessary in small vessels.

4. SEXTANT.

1. Graduated arc on which is mounted horizon glass.

P. 91, Bowditch. 2. Index arm on which is mounted index mirror and vernier.

Accessories: Telescope and colored shade glasses.

Tools: Socket wrench or screw driver.

Corrections and how made:

P. 93, Bowditch. Assume surface of mirrors and shades to be parallel planes, graduations and centers exact.

The index and horizon glasses must be perpendicular and line of sight parallel to plane of limb:

1. Adjust index mirror, reflection plane of arc and direct image form one continuous arc. (Index arc near center and eye lens to mirror.) Next,

2. Adjust horizon mirror, put in telescope and direct to star, move index arm so that reflected image passes direct image—if one passes directly over other, the mirrors are parallel. The sea horizon may be used, if it is well defined, by bringing direct and reflect images in horizontal coincident line. Incline sextant through small angle—if points of coincidence of horizons remain in contact, o. k.

Adjust telescope for parallelism to plane of sextant.

P. 94, Bowditch. Put in parallel wire telescope and adjust on objects separated by at least 90°, or 20′ wall method.

Index error due to index and horizon mirrors being parallel and not coinciding with zero of scale. This error may be eliminated by adjustment of horizon mirror when index arm is at zero and clamp by star, sea horizon, or sun method:

Bring the images in coincidence and read arc, if to left of zero index correction is (+), if to right (−).

Sun method, see paragraphs 250-251, page 95, Bowditch (Care and handling of sextant).

Horizontal and vertical angles, how taken?

Right arc left angles and how applied to three-point problem on three-arm protractor or celluloid protractor.

5. PARALLEL RULER.

P. 110, Lecky. Description and method of using.

6. DIVIDERS.

See page 117, Lecky's Wrinkles.

7. LOGS (PATENT).

Negris and Bliss tabfrail logs, see pages 7, 8, 9, Muir. (Care in handling rotators.)

Calibrate over known courses when unaffected by current.

Calibrate speeds due to engine revolution. Speedometer best for small boats.

8. HAND LEAD LINES.

Weight, lead, 7–14 pounds. Lines, 20–30 fathoms in length.

2 fathoms marked by two strips of leather.
3 fathoms marked by three strips of leather.
5 fathoms marked by white rag.
7 fathoms marked by red rag.
10 fathoms marked by piece of leather with hole in it.
13 fathoms marked same as 3 fathoms.
15 fathoms marked same as 5 fathoms.
17 fathoms marked same as 7 fathoms.
20 fathoms marked by 2 knots.
25 fathoms marked by 1 knot.
30 fathoms marked by 3 knots.
35 fathoms marked by 1 knot.
40 fathoms marked by 4 knots, etc.

Fathoms corresponding to these marks of depths are called marks; intermediate fathoms are called deeps; fractions are ¼ and ½.

The lead line may be marked in feet around critical depth of vessel.

P. 13, Bowditch. Measure lead line wet frequently by steel tape or marks on deck. At night, the distance from the leadsman's hand and the water must be allowed for in sounding.

The lead may have arming to bring up particles of bottom.

Impress the vital necessity of the lead upon the class.

9. BINOCULARS (LARGE FIELD).

Day and night work and their characteristics for the two classes of duty.

10. LONG OR SPY GLASS.

For distant work and consequent small field.

11. WATCH, PAPER, AND PENCIL AND TREATISE ON NAVIGATION.

Don't forget to wind watch.

Use paper in pads.

Use hexagonal pencil, soft, to work on pad and for chart work.

Bowditch's American Practical Navigator, probably the best single treatise.

THE LOG BOOK.

This is a record of the ship's cruise and it should contain the record

See pp. 31–35, Bowditch. of data sufficient to plot the position of the ship at any instant.

PILOTING.

This is the most important part of our navigation. In high sea or nautical astronomical navigation an error may be rectified, but a serious error in piloting usually is disastrous. The navigator should study chart of locality, sailing directions, light and buoy list, and have as much as possible local knowledge as to tides, currents, winds, local works, bird and fish life. Lead, compass, and good eyesight are prime necessities.

LAYING THE COURSE.

(1) True course, (2) magnetic, and (3) compass course. Use chart parallel rulers, compass rose, and deviation table. Look for dangers and currents; allow for leeway or drift.

FIXING THE POSITION.

When in sight of known objects shown on chart:

1. Cross bearings of two known objects.
2. Bearing and distance of one known object.
3. The bearing of one known and the angle between two known objects.
4. Two bearings of a known object separated by an interval of time with the known distance run in the interval.

Pp. 56–65, Bowditch.

5. Sextant angles between three known objects. Besides these there are two important means of assurance of avoiding a particular danger (without fixing previously the ship's position):

(a) The danger angle.
(b) The danger bearing.

(Explain in detail each of 1–5, a, and b.)

SOUNDINGS.

Continuously and at regular intervals. Laid out on tracing paper along lines representing track the position may be fairly determined. Soundings alone do not determine a fix.

LIGHTS.

Known characteristics and check them on sight. (Go over the means of checking in detail.)

BUOYS.

Caution in placing absolute dependence on their position. Red on right in entering.

FOGS AND FOG SIGNALS.

Check fog signals. Proceed with utmost caution. Watch for submarine signals and radio signals and their deviation and distance found. Effect of current incurred on slowing. Listen for echoes.

TIDES AND CURRENTS.

Study chart. Effects of barometer and strong wind on tide and current. Rise and fall, slack and stand, and flood and ebb.

Counter currents and eddies. Tide rips. Note direction and strength around buoys, islets, and shoals.

CHARTS.

Carefully studied. Use largest scale when navigating by landmarks. Remember that buoys and lightships may be removed owing to the state of war, therefore range on shore should be picked out, safety bearings and danger angle used, and the ship's position in doubt at no time. Best plan is to follow exact course and change at exact intervals. The color of water on shoals is influenced much by bearing of sun. Do not give up a well-known landmark if possible. In running back and forth over a certain locality mark down on chart or notebook courses, distances, times, danger angle, and bearings for ready reference.

If sound or light signals are not picked up when predicted and soundings show danger, proceed with redoubled caution.

RECORDS.

Keep handy notes, bearings, fixes, changes of course, soundings, and other important notes. Do not mutilate or mark up chart unnecessarily. Anchor in safe berth.

Keep a constant check on your position.—This is most important, for the following reason:

When you sight the enemy you must be able to report immediately his and your position.

If you are uncertain of your position, or report a wrong position, confusion will and disaster may result.

SAILINGS.

Plane and mercator sailings are the ones concerned. The surface of earth is considered a true plane and the course or rhumb is a straight line.

P. 72, p. 78, Bowditch.

The distances are taken from the latitude divisions of the chart in mercator charts (HO) and the graduated divisions of Polyconic Charts (CS).

BOOKS.

Bowditch: American Practical Navigator.
United States Government:
Coast Pilot.
Light List.
General Tide Tables.

HANDLING BOATS UNDERWAY—CARE AND EQUIPMENT OF BOATS—STATIONING OF CREW

By

COMMANDER F. N. FREEMAN, U. S. N.

HANDLING BOATS UNDERWAY—CARE AND EQUIPMENT OF BOATS—STATIONING OF CREW.

In addressing you gentlemen of the United States Naval Reserve, about to take up your duties in command of units of the scout patrol, I feel like I used to do in addressing the officers of my flotilla. The work is similar in many respects, and you will be in constant touch not only with the destroyers but with all other ships of the fleet and with the officers connected with the various shore stations. The fleet and country will depend for safety on your alertness and vigilance. You will be the connecting link between the forces ashore and afloat. You will conduct our merchantmen safely through the mine fields and escort them to the outside patrols.

It is therefore of the utmost importance that you should be thoroughly indoctrinated in your duties, so that you may act intelligently in unforeseen circumstances not covered by your orders. By "indoctrination" is meant teamwork. You all know what that is. Our motto in the destroyer flotilla was to "get there." Do not give up in the face of adversity. Persevere and find a way to accomplish your task. If your task seems to be an impossible one, it should only make you struggle the harder to accomplish it. Above all, be loyal. Be loyal to one another. Endeavor to make your boat the best, smartest, most reliable, and most efficient boat in the flotilla. Encourage your crew to be loyal to you and to their boat. Be loyal to your own division commander, and endeavor to aid him in making his division the best in the flotilla. Then all of you be loyal to your flotilla commander, and in this way, coupling loyalty with keen competition and friendly rivalry, you will soon be known as the crack scout patrol flotilla of the Navy, which is your object. By engaging in friendly rivalry as outlined above much hard work and drudgery will be forgotten, and you must remember that this duty you are about to embark on is no picnic, but real man's work, that will at times drag wearily when the excitement of the chase will be lacking for long periods. At these times it will take all your strength of character to keep your crew interested, alert, and on the constant lookout, and also to keep them and even yourself from "knocking" your superiors and asking the oft-repeated question, "I can't see a damn bit of use in doing this. Why doesn't So-and-So do something else?" etc.

ORGANIZATION.

Motor boats enrolled in a naval district are known as scout patrols. Six patrols form a division. One or more divisions with harbor entrance patrols and other vessels employed in a section form a section patrol. These vessels, together with mine sweepers, will form the inshore patrol and will cooperate with the vessels of the offshore patrol which are of larger size and will be attached to the fleet.

The motor boats to which you will probably be assigned on inshore patrol may be classified as follows:

Type A, slow.—Sufficiently seaworthy to maintain station in harbor in all weather up to moderate gale; to have a speed of not less than 7 knots; and to mount one 1-pounder rapid-fire gun and one machine gun (if practicable).

Type A, fast.—Sufficiently seaworthy to keep the sea in a moderate gale; to have a length of not less than 40 feet, a speed of not less than 16 knots; to mount one 1-pounder rapid-fire gun and one machine gun; to be self-sustaining for four men for four days.

Type B, slow.—Able to keep the sea in a moderate gale; to have a length of not less than 60 feet and a speed of not less than 10 knots; to mount one antiaircraft gun fitted for horizontal fire, of as large a caliber as possible, but not less than 3-pounder rapid fire, and at least two machine guns. Until antiaircraft guns are available, other guns to be assigned. To be self-sustaining for eight men for five days. To be equipped with radio and searchlight.

Type B, fast.—Able to keep the sea in a moderate gale; to have a length of not less than 60 feet and a speed of not less than 16 knots. To mount one antiaircraft gun fitted for horizontal fire, of as large a caliber as possible, but not less than 3-pounder rapid fire, and at least two machine guns. Until antiaircraft guns are available, other guns to be assigned. To be self-sustaining for eight men for five days. To be equipped with radio and searchlight.

New scout patrols being built will be arranged to carry guns and mounts assigned to their type and will probably all be fitted with radio.

The minimum crew of a boat of the type A class will be:

One officer in command, lieutenant (junior grade), ensign, or boatswain.

One engineer, artificer branch (engineers).

Two deck hands, seaman branch.

Type B (slow or fast):

One officer in command, lieutenant (junior grade), ensign or boatswain.

One engineer, artificer branch (engineers).

Six deck hands, seaman branch.

These complements are tentative only, and it will probably be necessary to revise the complements on each individual boat to suit the conditions of service and equipment.

Boats that have not already been converted for naval use will be converted either at Government yards or at private yards as soon as possible. The armaments in general to be carried by patrol vessels are as follows:

(*a*) *Nonseagoing tugs.*—Two 1-pounders, one machine gun; 240 rounds of 1-pounder per gun; 3,600 rounds of machine-gun ammunition per gun.

(*b*) *Section patrol boats.*—Type A, slow and fast; one 1-pounder, one machine gun; 240 rounds 1-pounder per gun; 3,600 rounds of machine-gun ammunition per gun.

Type B, slow and fast; one antiaircraft gun, not less than 3-pounder, or other substitute gun until antiaircraft gun is available; two machine guns; 304 antiaircraft cartridges, or other suitable ammunition; 3,600 rounds machine-gun ammunition per gun.

(*c*) *Lighthouse tenders, coast and survey vessels, public health vessels.*—Two 6-pounder or two 3-pounder and one machine gun; 605 6-pounder or 608 3-pounder cartridges; 3,600 rounds machine-gun ammunition per gun; .38 caliber revolvers and ammunition as per allowance.

(*d*) *Mine sweepers (on mobilization plan).*—Two 3-pounder guns; 800 3-pounder cartridges; rifles and pistols as per allowance list.

Target-practice ammunition will be furnished on the ratio of 10 rounds per gun for the purpose of trying installation and such other purposes as may be desired.

The question of electrical and radio installations will be taken up direct with the Bureau of Steam Engineering, which is sending out a circular letter to commandants covering matters of equipment under its cognizance.

The question of additional fuel supply and of changes in berthing and messing will be handled in the district without reference to the department.

While the department has not approved of any specific method of organization except as outlined above, a scheme for organization submitted by the officers of the submarine base at New London has merit and will probably be used as a starter. This scheme contemplates one or two flotillas under the immediate command of an officer of the United States Navy not below the rank of commander to be attached to each naval district. For instance, the patrols in this district will guard the coast from Nantucket Shoal Lightship to Gay Head; Gay Head to Cuttyhunk; Cuttyhunk to Brentons Reef, including Buzzards Bay; Brentons Reef to Point Judith; Point Judith to Block Island; Block Island to Montauk and the Race.

This is a very extensive territory to cover and it can be seen that a large number of boats will be needed in order to afford the proper test for the crews. Each flotilla commander will have an appropriate staff and will probably be assigned a mobile flagship, either a yacht or large tug carrying special armament to back up the small patrol boats and to render assistance to them in case of bad weather.

The personnel of each patrol vessel will be organized by its commanding officer; each division commander will systematize the organization and administration of the vessels of his division. The routine for instruction of tugs, trawlers, mine sweepers and patrol scouts will be regulated by the flotilla commander. This will all come later after you have become familiar with your duties and with your individual boats.

In the Navy we have found that the care and upkeep of motor boats requires the best talent attainable, in order to keep them ready and fit for duty at all times. You will undoubtedly receive detailed instructions as to the care to be exercised in running your engines, making landings and keeping track of your equipment. The suggestions offered by the New London officers may help you in this regard, and a list of their recommendations is as follows:

Each department at the base will undertake certain routine overhaul irrespective of any special repair work found necessary by the inspectors. The work will be performed by the permanent details in each department as far as practicable.

The following routine overhaul must be done:

In the engineer's department:

1. Intake and exhaust valves reground.
2. Carbon cleaned out.
3. Oil drained off.
4. Sump tank cleaned out.
5. Oil lines blown through.
6. Clean oil put in the reservoir.
7. Gasoline lines broken, drained and gasoline strainer and separator cleaned out.
8. Carburetor drained out.
9. Gasoline line replaced.
10. Gasoline tanks filled.
11. Oil tanks filled.
12. Stuffing boxes in circulating system and pumps set up or repacked as necessary.
13. Engine spares checked up and replaced where missing.

In the electrical department:

1. Batteries taken to shop, watered and given an equalizing charge or replaced by a spare if necessary.
2. Fuses and switches examined and cleaned.
3. Spark plugs replaced by clean ones, the old ones taken to the shop and cleaned for future use.
4. Insulation tested and wiring renewed as found necessary.
5. Contact points trued up and readjusted.

In the electrical department—Continued.

6. Lights examined, cleaned, and new bulbs installed where necessary.
7. Commutators on starting motor and dynamo cleaned and brushes renewed if necessary.
8. Magneto, starting motor, and dynamo bearings oiled.
9. Electrical spares checked and replaced where missing.

In the construction department:

1. Minor repairs to fittings made.
2. Steering gear tried out and repaired as necessary.
3. Calking and painting, work as necessary.
4. Equipment checked up and replaced where unfit or missing.

In the ordnance department:

1. Overhaul guns, mounts, and breech mechanism; make replacement spare parts and tools.
2. Overhaul machine guns.
3. Clean battery and put in working order.
4. Inspect all ammunition.
5. Remove all empty boxes and empty cartridges.
6. Clean magazines.
7. Replace all used ammunition.
8. Remove all bombs from boat and replace full allowance when crew moves aboard.

In the commissary department:

1. Remove any left-over provisions from the boat.
2. Clean out provision lockers and ice chests.
3. Furnish provisions for the next tour of duty.

The commissary department will endeavor to standardize the supply of provisions, putting up rations in packages, one day's supply in each package. Special preparation of rations for this type of boat will be made in order that the food may be more successfully preserved from weather and sea. The executive officer of the base will notify the supply or commissary officer when provisions are required.

A good many of you are experienced yachtsmen or practical motor-boat men and probably know these waters thoroughly and will have no difficulty in handling your boats; but, for the benefit of those who have not had a great deal of experience, I call your attention to a few important matters that should not escape you in undertaking your duties. Although most of your work will be in sight of land, you may at any time be caught with a broken-down engine in an offshore wind where you will have to act quickly in order to keep within reach of assistance. In the Navy we invariably require the coxswain of a broken-down launch to anchor if he is in a strong current, or if the wind is drifting his boat out of reach. You will undoubtedly receive a list of the equipment you will be required to carry, which will depend upon the length of your tour of duty on station, but there are many important things a seaman always sees to before leaving port in a small boat. Among these may be mentioned boat hooks, breakers with fresh drinking water (at least three day's supply), fenders, compass, lanterns and electric flash lights,

matches in water-tight packages, buckets, a boat box containing tools and materials for meeting emergencies which may arise, anchor with chain, tarpaulins, boat ensign and staff, hand grapnels with light chain or line, rifle and shotgun with ammunition, provisions, night signals or other fireworks as may be specified, and electric flashlights, life belts, medical box, running lights, buoy and anchor, chart, and navigational instruments. The boat gun, machine gun, and ammunition will probably be kept in the boat at all times; in addition all motor boats should carry two fire extinguishers. The Navy Regulations prohibit smoking in motor boats. As the motor boats of the Navy are of the small type this provision may be modified in larger boats, allowing smoking in certain places on the upper deck, the same as is now the custom in submarines.

As you are all familiar with high-speed automobile engines and motor-boat engines I will not go into details as to the method of operating, as you will have many different kinds of engines to handle, but would refer you to the standard works on motor-boat engines which can be obtained in the War College library or purchased in Newport. Every captain should know his engine and pay immediate attention to any erratic performance. Another very valuable book which has just been printed is by Mr. C. F. Chapman, editor of Motor Boating, called "Practical Motor Boat Handling, Seamanship, and Piloting." This little book, it seems to me, contains everything that is needed by a commander of a scout patrol, and coupled with a service deck and boat book is sufficient to make him an expert small-boat handler in a few months. Admiral Knight's Modern Seamanship, to be obtained in the War College library, also has valuable information regarding boats.

There may be cases where you will have to board a vessel, in which case it is well to remember that the scout patrols are lightly built and should be well protected with fenders before going alongside. Remember that a boat lying at the gangway in a tideway, holding on by a line from some distance forward made fast to a cleat on her inboard bow, can be controlled perfectly by a touch of the helm, throwing the stern out or in a little and thus catching the current on one bow or the other. This same thing applies to a vessel that is underway when you go alongside; if she is of deep draft always go to her lee side; if she is a light-draft vessel and stopped, the wind will drive her off to leeward rapidly and you may have difficulty in clearing her side if on her lee side. It is therefore best sometimes in cases of this kind to go alongside her weather side. This happens many times when launches go alongside destroyers. If your boat is single screw, put your port side alongside either a ship or landing. Have your painters ready both forward and aft and your boat hooks handy. Do not make too much speed in

making landings until you are sure of your control. A good coxswain in the Navy in handling his boat in a strong tide or moderate sea lands his boat near the gangway platform, but not against it, and having caught and made fast the boat line, drops in by skillful use of his helm, and holds her just where he wants her while his passengers enter or leave the boat.

HEAVY SEA.

The sea being heavy and the wind blowing a hard on-shore gale, you will have to head into the sea in order to gain sea room. You will have to regulate your speed to keep steerage way and yet not take on too heavy water in order not to damage your boat. By carefully nursing the engine, watching the smooth spells, you can shoot her ahead without doing damage. If the sea is breaking the following general rules apply:

1. If sufficient command can be kept over the boat by the skill of those on board, avoid or dodge the sea if possible, so as not to meet it at the moment of its breaking or curling over.

2. Against a head gale and heavy surf get all possible speed on a boat on the approach of every sea which can not be avoided. But this speed should not be more than sufficient to prevent your being carried back by the surf or breaker.

A great danger in a heavy sea will be that the boat's head will be turned away and the broadside presented, allowing the sea to fill up the engine room and stop your engines. With the flat stern motor boats of high speed there is very little danger in running before a sea provided the steering gear is staunch and the after part of the boat can be closed in so that in case of pooping water will not fill the boat. I have run the breakers in many shallow harbors in the open motor boats of the Navy but only after watching very carefully for a favorable opportunity and being certain of my steering gear and engine. This experience is not unlike "shooting the chutes," but it all depends upon the skill of the helmsman.

If driven offshore with a broken-down engine and offsoundings where it is impossible for you to anchor, you should immediately rig a sea anchor. This may be improvised of boat hooks, tarpaulin, anchor, buckets, and other gear around the boat. On one destroyer some years ago a very good sea anchor was found to be to lower the ship's bower anchor and all the chain to the full scope of 90 fathoms. This anchor and chain made such a drag going through the water that it constantly kept the vessel's head to sea. Oil may be used effectively in trying to make a landing alongside a vessel in rough weather or in trying to assist another boat or when riding out a gale with a sea anchor. In the latter case a line should be rove through a block on the sea anchor and the oil distributed from a bag hauled

out to the sea anchor in order that it may be to windward and spread out on the surface of the water making a slick where your boat is lying. Your engine oil will be suitable for this but some other kinds are better, animal and vegetable oils are best, thick and heavy oils are better than light ones; mineral oils are less effective, but a very thick, sticky oil or one that tends to thicken or congeal in cold weather may be improved by thinning with kerosene or gasoline. The bag in which the oil is placed should be filled with waste or oakum.

The scout patrols are very much like the earlier torpedo boats which were built for the Navy, which, of course, were steam propelled vessels, such as the *McKenzie*, *Cushing*, and *Stilleto*. They were little larger than most of the patrols that we are now building. A good rule that applies to these earlier torpedo boats also applies to scout patrols. It is that every precaution should be taken to keep out of any situation where bucking a head sea may become necessary. Keep away from lee shores. Practical experience shows that the commander of a torpedo boat should bear this warning in mind. Its importance can not be too strongly urged. The above injunction applies even more so to vessels driven by internal combustion engines, so that if you are caught in this situation with a broken down engine act at once, anchor if possible, signal for help, and rig a sea anchor if necessary. Remember if you are steering courses wind beam or nearly, you will make a large amount of leeway. Guard against it.

SPEAKING A LARGE VESSEL.

Do not get so close to a large vessel underway that you can not swing your stern clear. Remember that the boats you will handle have most of the keel cut away aft and have flat sterns, and they, therefore, pivot well forward of amidships. Watch your stern in handling your boat.

CAUTIONS IN NAVIGATION.

As already mentioned, leeway, real or apparent, must be carefully watched. It is impossible to compensate your compasses for heeling error, so there will be oscillations of the compass in a seaway. It can not be taken for granted, therefore, that a correct course has been steered. It will be especially hard to eliminate changes of compass deviation due to the presence of movable iron near the compass. Your eye will be so near the water that lights, etc., are sighted at much less distances than will be ordinarily expected. Great difficulty will be had in using navigation instruments if it is rough. The use of the hand lead will be difficult except when having a very little way on.

Remember the three l's, log, lead, and lookout. As you will probably have no log, be careful to keep track of the length of time you run and the engine speeds. If it threatens to become foggy, be sure to get a fix on the chart before it closes in.

In conclusion, I would advise you all to read chapters 17 and 18 of Mr. Chapman's book, Motor Boat Handling. It gives in concrete form excellent directions for handling a boat of the scout patrol class. Also Mine Sweeping Manual of the United States Navy, and Knight's Modern Seamanship.

Your ancestors here in New England furnished the daring, brains, and ingenuity which solved our problems in our previous wars. It took a long time to destroy the commerce raiders of the Civil War, but they finally met their fate. It is now up to you to help solve this new problem, the submarine which threatens to drive our commerce off the seas, but I firmly believe that that problem will be solved if we all get together and do our utmost.

CARE OF BATTERY—TRAINING OF CREW—PRINCIPLES OF GUNNERY

By

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CARE OF BATTERY—TRAINING OF CREW—PRINCIPLES OF GUNNERY.

This paper relates to minor caliber and machine guns mounted upon a small craft such as the patrol boats of about 100 feet in length, used for the purpose of destroying submarines.

All minor caliber guns now being manufactured for the Navy are of the semiautomatic type, and in the case of the 1, 3, and 6 pounder guns are similar to the rapid fire guns of the same caliber, with the semiautomatic features omitted. The different semiautomatic guns are designated Vicker's Sons, Maxim, Hotchkiss, and Driggs Seabury, although, without regard to the maker, these are usually designated by "Mark" solely; for example, the 3-pounder, Mark IV, is a Hotchkiss semiautomatic, 50-caliber, 3-pounder.

CARE OF BATTERY.

The care of the battery should be the first consideration of the commanding officer, and too much stress can not be laid on this important point. The Navy regulations and instructions are very explicit upon this point, and it must be remembered that unless the battery is maintained in a state of readiness and efficiency at all times the vital purpose for which you are destined to use it can not be well accomplished.

The difficulties to be expected in caring for the guns on small boats are those due to rust formation and damage due to being struck by some other object disarranging the sights and mechanism. Every part of the gun should be moved daily. The bores should be kept thoroughly clean and coated with oil—the oil to be frequently renewed. All steel work covered with oil or vaseline. Tompion in, and muzzle and breech bags securely on as well as gun covers.

The delicacy of the machine gun and its more numerous working parts demand unusual care; all gritty substances must be avoided.

Do not clean bright work with brick dust or similar substances.

Do not scrape parts of the mechanism with a knife or metal scrapers.

Particular care should be taken that the slope and origin of rifling are clean and well oiled.

After firing, completely dismount the breech mechanism and wash every part with fresh water and soap. Dry carefully, and then rub all parts with a well-oiled rag and assemble the mechanism.

When boats are near shore, keep guns covered to keep coal dust and grit from blowing on them.

On pleasant days withdraw the tompions and clean and recoil the compression slope and rifling.

Keep bearing and moving parts well oiled and cups full of grease.

Keep ball bearings clean and well lubricated.

Do not paint guns in rear of slide.

Keep telescope lenses clean with a soft linen rag and a little alcohol. (Lens paper may be used.)

Be careful not to burr any part in handling.

Do not bend or stub firing-pin point.

Try all shells before using (long before using, and mark the boxes which contain shells which have been tried and fit the gun).

Remove the firing pin and work the plug gently while so doing.

Beware of hangfires, misfires, and do not unload except under conditions specified by safety regulations for the type of gun.

Be sure gun is accurately bore sighted at all times.

Last but not least, remember to remove the tompion before firing. This may seem an unnecessary caution, but it has happened too many times in the experience of all officers not to be a pertinent reminder.

TRAINING.

Admiral Sims says: "Train the pointers to aim accurately and the guns' crews to load rapidly, * * * then train the officers in controlling their fire in bringing their shots on the target. The training of the pointer is the foundation stone of all success in battle."

From a lecture by Lieut. Commander Palmer on concentration of gunfire, 1911: "What we want to find out definitely is the greatest range at which we can reasonably make hits."

We have then to consider—

(*a*) Training of pointers;
(*b*) Training of sight setters;
(*c*) Training of loaders;
(*d*) Training of fire-control parties;
(*e*) Training of spotters;

and the coordination of these various elements to insure successful gunnery.

The crews should be timed in their work and competition urged and fostered by publishing within the patrol division the results of competitions, loading, and aiming.

The sight setters should be given frequent daily tests from a schedule of ranges, and at the end the sight should be read to see if it agrees with the last entry on the schedule. Ranges will generally be given initially in definite terms, as 1,400 yards, 1,000 yards, and deflection as 40 or 53.

Changes will generally be given at "up 200," "left 2," and must be applied to the existing sight setting by the sight setter.

The team work of the spotters and fire-control officer and sight setters is very much a matter of becoming familiar with a certain man's manner of speaking, tone of voice, habitual phraseology, etc., and frequent drill together makes it possible to work in lots of little short cuts, and thereby save time.

For instance, it is customary in the service to call out "five-ty," when fifty is the usual pronunciation. In the same way, flags having significance T, P, B, and E all have a common "ee" sound and are invariably called out by words standing for those letters.

The duties of spotter and fire-control officer would be combined in one person in the patrol boats, the duties of whom would be to command "Open and cease fire," estimate the range and deflection, spot and correct the range and deflection. These duties may all be practiced at drill.

Familiarity of the spotter with the danger space of his gun at various ranges is very important, as the following tables disclose.

For target 20 feet high.	Danger space. *Yards.*
1-pounder:	232–900
Range, 1,000–900 yards	100
Initial velocity, 2,000 F. S., 1,500 yards	56
Weight, 1 pound, 2,000 yards	16
Maximum, 3,500 yards	
3-pounder:	300–1,200
Range, 1,300–1,200 yards	215
Initial velocity, 2,200 F. S., 1,500 yards	
Weight, 3.3 pounds—	116
2,000 yards	51
3,000 yards	25
Maximum, 4,500 yards	
6-pounder:	314–1,300
Range, 1,400–1,300 yards	273
Initial velocity, 2,240 F. S., 1,500 yards	
Weight, 6 pounds—	150
2,000 yards	65
3,000 yards	29
4,500 yards	19
Maximum, 5,500 yards	
3-inch:	391–1,600
Range, 1,700–1,600 yards	277
Initial velocity, 2,700 F. S., 2,000 yards	
Weight, 13 pounds—	114
3,000 yards	46
4,500 yards	24
6,000 yards	11
Maximum, 8,500 yards	

It should be particularly noted, for instance, that at range 900 yards in the 1-pounder the danger space is 900 yards, but at 1,000 yards the danger space is 232 yards, while at 1,500 yards the danger space is 100 yards; 900 is a critical range for this gun.

In the same way, the danger space is most rapidly reduced for the 3-pounder gun between 1,200 and 1,300 yards, the danger spaces being, respectively, 1,200 and 300 yards.

For the 6-pounder the critical range is 1,400 to 1,300 yards, and for the 3-inch, 1,700 to 1,600 yards.

CASUALTIES TO MATERIAL.

This is a very important point, and sensible drill will go far to prevent accident as well as to promptly correct the difficulty, whatever it may be.

A breech block jamming for any reason would be very demoralizing in action. Have each man in the gun's crew in drill see how many ways he can jam the block; how prevent it; how extricate himself from the difficulty without ruining the piece.

A powder charge fits too closely in the chamber, a powder bag is torn, and things are awkward to say the least. Fit every bag and projectile by carefully trying them in the gun with the firing pin removed before you need to load them for business purposes.

Have the crew present and explain matters. A cartridge case carelessly hit against some metal projection will be burred or upset, or a bag will be torn, and when you come to load the gun it may be difficult to find the burr, and you will be wasting precious minutes looking for it, or picking up the spilled grains of powder from your torn bag. And it must be remembered that without all the powder the shell will not go where the gun is pointed.

A sight accidentally hit will, of course, throw out your initial shots; but if correctly set, the shots may be brought on the target.

The bore sighting—that is, getting the line of sight parallel at zero range and deflection with the axis of the gun—is a matter of obvious importance.

In gunnery the inclination becomes very strong to regard all details but the simple mechanical operations of loading and firing, of gun pointing and of sight setting, as belonging exclusively in the hands of officers. The usefulness of petty officers, in whom much reliance must be confided in battle, is apt to be overlooked.

The number of officers can never be sufficient to give one to command at every gun station. To the gun captain belongs the knowledge and the ability to fight his own weapon, and if he is removed, another member of the crew should possess the understanding which insures an intelligent control of the piece.

In the small cruiser, the gunboat, the destroyer, and particularly in patrol boats, centralized control of the battery is difficult if not impossible. Therefore, in those vessels, training the individual for control of the guns is of paramount importance. There is nothing abstruse or incomprehensible with regard to the details; the men take an interest in their proficiency with arms greater than in any other detail of ship's life. What is needed is a frank statement of what you know in regard to the piece; its possibilities and limitations frequently defined at drill; unrelentless casualty drills until every conceivable disaster has been considered and discussed by all, and everything that human agency with the tools at hand can correct, familiar to all.

The method of training for spotters and fire-control officers are fully covered in the various gunnery publications. Generally, for small gunfire the "slick" of the projectile on the surface of the water is referred to the target in terms of vertical increments of changes of range and the range changed to bring the shots on the target.

For drill, spotting boards are recommended.

But the most important point of all is the immediate authorization for you to have actual practice with a stationary and a moving target under practically target practice conditions, as we have found, and I have no doubt you will find, that this is the successful manner in which to gain efficiency.

PRINCIPLES OF GUNNERY.

The basic principles of naval gunnery are the same for the battleship as the patrol boat and remain the same now as when artillery was first employed on ship board.

By principles is meant those fundamental requirements such as the—

Necessity for expeditious loading.

Quick, exact determination of the range.

Estimation of the change of range.

Prompt, accurate sight setting, and above all, accurate gun pointing.

The details, important for us to investigate, are those which apply to armaments such as you are most likely to be called upon to handle. Such may be expected to be minor caliber guns and machine guns.

Let us glance for a moment at the situations which might confront us on a small patrol boat operating near the entrance to Narragansett Bay and armed with one or two 1-pounders, 3-pounders, or 3-inch, with perhaps a machine gun. A recent conception of such a situation as might occur indicated a submarine 5 miles due east of Point Judith steaming on the surface.