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SMALL CRAFT OPERATION AND NAVIGATION, INSTRUCTOR'S GUIDE.

LOUISIANA ST. DEPT. OF EDUC., BATON ROUGE
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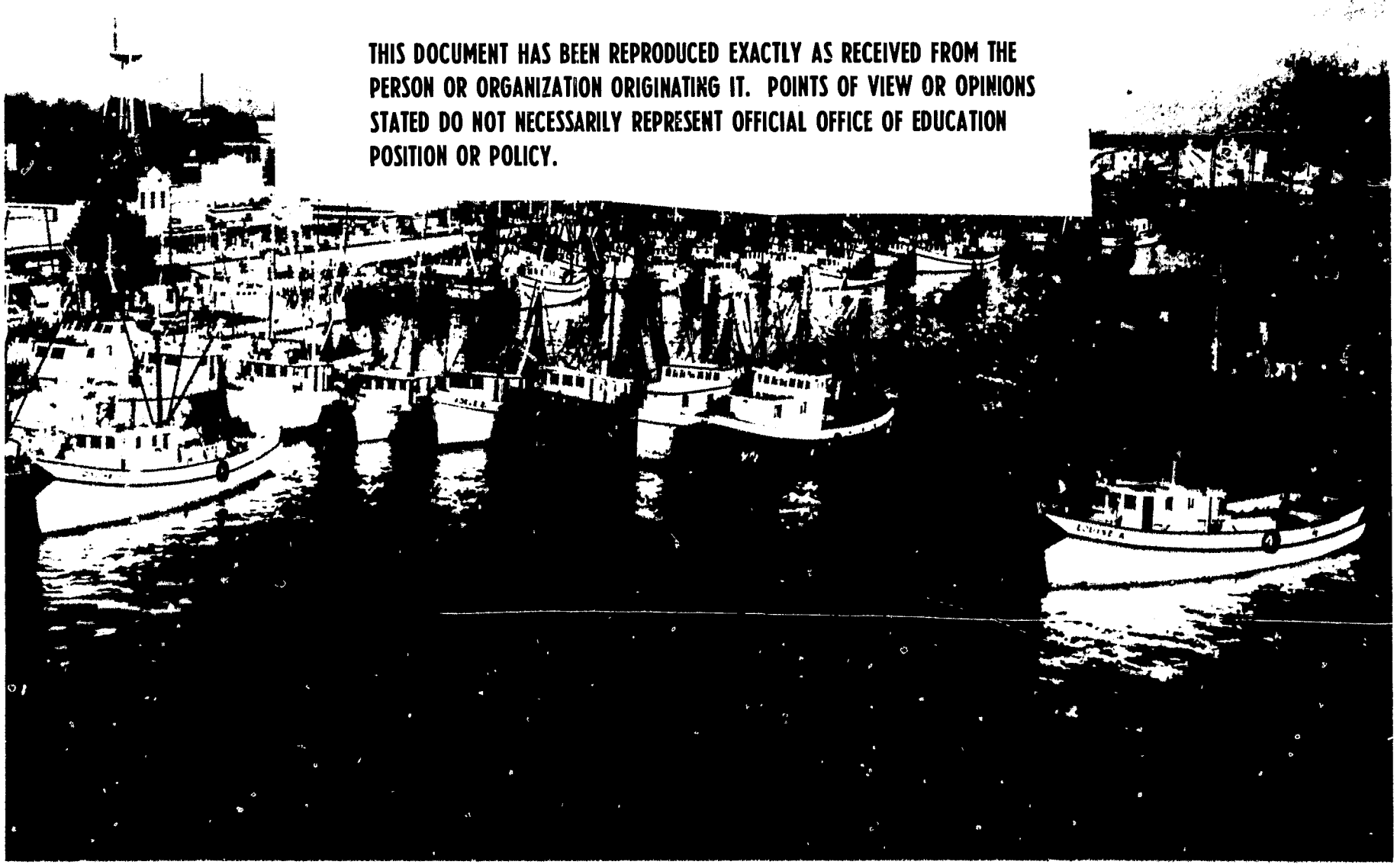
DESCRIPTORS- *TEACHING GUIDES, *CURRICULUM GUIDES *TRADE AND INDUSTRIAL EDUCATION, *BOATMEN, *NAVIGATION, ADULT VOCATIONAL EDUCATION,

THE MATERIAL IN THIS COURSE IN MARINE NAVIGATION AND SMALL CRAFT OPERATION ON INLAND AND INTERNATIONAL WATERS WAS DEVELOPED BY AN INDIVIDUAL AUTHOR FOR USE IN TRADE SCHOOL PREPARATORY AND EXTENSION CLASSES FOR MALE ADULTS WHO PLAN TO OPERATE BOATS. THE OBJECTIVE IS TO PREPARE THE SMALL BOAT OPERATOR FOR HIS OWN CONTINUATION IN THE STUDY OF NAVIGATION. THE COURSE IS PRIMARILY CONCERNED WITH TECHNIQUES OF OFF-SHORE NAVIGATION ENCOUNTERED BY THE FISHING INDUSTRIES IN THE GULF OF MEXICO. THE INSTRUCTIONAL MATERIALS ARE -- (1) RULES AND REGULATIONS (12 - 15 HOURS), (2) AIDS TO NAVIGATION (15 - 18 HOURS), AND (3) THE MARINE COMPASS AND PILOTING (9 - 12 HOURS). EACH PART HAS AN INSTRUCTIONAL OUTLINE AND LESSON PLANS. EACH LESSON PLAN PROVIDES OBJECTIVES, INSTRUCTIONAL MATERIALS REQUIRED, INTRODUCTION, OUTLINE, AND CLASSROOM ACTIVITIES GROUPED BY 1-HOUR PERIODS WITHIN EACH 3-HOUR CLASS TIME ALLOTMENT. THE COURSE IS DESIGNED FOR INEXPERIENCED OPERATORS BUT IS COMPREHENSIVE ENOUGH FOR THOSE WITH SOME EXPERIENCE IN OPERATION AND NAVIGATION. THE INSTRUCTOR MUST BE SKILLED IN BOAT OPERATION AND NAVIGATION. THE PRIMARY TEXT FOR THE COURSE IS "CHAPMAN'S PILOTING SEAMANSHIP AND SMALL BOAT HANDLING." THIS GUIDE IS AVAILABLE FOR $2.00 IN SINGLE COPIES FROM VOCATIONAL CURRICULUM DEVELOPMENT AND RESEARCH CENTER, P.O. BOX 657, NATCHITOCHES, LOUISIANA 71457. A STUDENT REFERENCE TEXTBOOK (VT 003 171) IS ALSO AVAILABLE FROM THE SAME SOURCE. (HC)

SMALL CRAFT OPERATION and NAVIGATION

INSTRUCTOR'S GUIDE



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INTRODUCTION OF THE COURSE

The purpose of this course is to provide a set of formalized training sessions for the small craft operator off the coast of the United States with particular emphasis being placed to the Gulf Coast. The type of operation concerned with here is the type encountered in the fish industries in the Gulf coast region. The objectives of the course are to prepare the small boat operator for his own continuation in the study of navigation as an operator. We recognize that the small boat operator will require considerable on-the-job experience and training in order to become a competent navigator. We are attempting, also, in this course to present the regulations and at the same time develop a program of study in the area of seamanship from the point of consideration of good judgment and good seamanship in general. The prime consideration of the course is safety at sea. We are providing exercises in problem solving which will enable the student navigator to become familiar with the techniques of piloting and boat operations consistent with good seamanship and safety at sea.

The primary text for this course is Chapman's Piloting Seamanship and Small Boat Handling. This book is published by Motor Boating, 572 Madison Avenue, New York, Copyright 1957, printed by Hearst Publications. Additional reference work will be cited in Bowditch, the American Practical Navigator, (This is a publication of United States Hydrographic Office) and various pamphlet type publications of the Coast Guard and

other agencies interested in Small Craft Operation and Safety at Sea.

The main point of aim in this course is directed at the trawler and lugger types of operations. We are concerned with the techniques of off-shore navigation encountered in the fishing industries with the boat handling techniques involved in a situation where the boat is towing a trawl or engaged in any of the many activities connected with the fishing industry; such as, coming along side for loading and unloading of refrigeration ice and catch and similar operations of coming along side of the boats and platforms, docks, and other such situations as encountered in the boat operations off the coast of Louisiana in particular.

It is recognized that many of the students enrolling in this course will be those people who have already had some experience in Small Craft Operations and Navigation. The average small craft operator in the Gulf region is assumed to be a man of mature years and somewhat limited educational background. Accordingly the course material is geared to meet his needs in the safe operation of his vessel. At the same time some members of the class will obviously be inexperienced and so the course material is necessary comprehensive so as to fit all members of the group. It is felt that the course of material must be comprehensive even though some members of the class may have had considerable experience in the operation and navigation of small crafts because it is important in an approach of this kind that any gaps in the experienced

student's background be filled in very carefully and that the inexperienced student at the same time be given a thorough foundation for his own continuation in the skills and techniques of small craft navigation and operation.

Course Outline

Part I
Rules and Regulations

Presents the navigation lights, safety equipment signals required by the Coast Guard and other regulating bodies to be displayed or carried aboard vessels of various sizes from outboard motor boats up through trawlers, tugs and motor vessels of 150 feet.

This part is readily presented by visual-aids such as charts, diagrams, models, and films. There are three good films available through the Coast Guard Auxillary covering the subjects in this part.

Part I is a 12 - 15 hour course.

I. Introduction to the course and equipment required by regulation

   A. Registration

   B. Orientation

   C. Film - "You are Being Boarded"

II. Classification of boats

   A. Lights and other equipment required for boats

   B. Recommended safety equipment

III. Film - "Rules of the Road"

   A. Discussion of lights and their use in maneuvering to avoid collision

   B. Right of way of vessels under inland and international rules

IV. Rules of the Road

   A. Lights required for trawlers under international and inland rules

   B. Lights required for tugs under international and inland rules

   C. Lights required for motor vessels under inland and international rules

V. Recommended equipment to be carried on motorboats

A. Safety equipment

B. Navigational equipment

C. Spare parts

VI. First Aid

LESSON PLAN 1

RULES AND REGULATIONS

Introduction to the Course and
Equipment Required by Regulations

OBJECTIVE: The purpose of this lesson is to introduce the student to the subject of small craft navigation and operation and to outline briefly for his information the scope of the course.

INSTRUCTIONAL MATERIAL REQUIRED: Film--"You are Being Boarded" Text--Chapman's Piloting Seamanship and Small Boat Handling

INTRODUCING THE LESSON: The instructor should take time to lay out the course for the student; that is, he should be prepared to go through the course outline point by point and explain in some detail just what subject matter is to be covered in each part of the course and what time allotment is contemplated for each part of the course. He should also be prepared at this time to answer any questions with regard to course content as well as correlation with existing legislation and regulations governing the navigation and operation of small craft. Particular emphasis at this time should be placed upon the introducing of the student to the subject matter to be covered in the first part of the course. The instructor should spend a brief few minutes introducing the film to be shown. He should tell the student what to expect in the film and should spend considerable time emphasizing that the Coast Guard is a service agency. That the regulations governing

equipment to be found on small craft having been developed as a result of many years' experience with the operation of small craft and for the purpose of saving lives at sea. He should emphasize that the sailor, no matter how experienced, can do well to study and try to learn new techniques as well as to refresh himself continuously on the safe operation of his vessel.

PRESENTING THE LESSON:

First Hour: Registration

Film - "You are being Boarded"

Discuss and preview the film; show film; discuss film and answer any questions that any member of the class may bring up with respect to the film. Discuss in some detail the advantages of different types of fire extinguishers. The instructor should in preparation of this material familiarize himself with Chapters 1 and 10 of the text.

Second Hour: Discuss the equipment list as pictured on pages 13, 14, 15, 17, and 18 of the text. Point out the relative merits of different type life jackets as compared with the sea cushion type life preserver. Show the type storage which will insure maximum preservation of the canvas and bouyant material in the lifejackets, and discuss their inspections at regular intervals. Discuss briefly the maintenance of lights with particular emphasis to the cleanliness of lenses, and the continuous inspection to insure that adequate voltage is being supplied to the lights. Emphasize the importance of good house keeping in general about the

vessel, with particular emphasis to the cleanliness of deck spaces and their freedom from loose gear which could cause a fall or other accident.

Third Hour: Summarize the material covered so far and provide time for discussion and/or questions and answers.

Assign the material for the next class meeting. This material is found in the text in Chapter 2 beginning on page 28. Hand out diagrams of light sectors of visibility.

Allocate 20 minutes to First Aid instruction - this instruction can be conducted by a representative of the American Red Cross.

Instructor's Outline

Lesson 1

Equipment Required by Regulations

I. Required equipment

A. Lights

1. Side lights

2. Range lights

3. Mast head lights

B. Life Saving Equipment

1. Life jackets

2. Life vests

3. Buoyant seat cushions

C. Fire Fighting Equipment

1. Flame Arresters

2. Fire Extinguishers

a. Carbon tetrachloride

b. Carbon dioxide

c. Foam

D. Signaling Equipment

1. Whistle

2. Horn

3. Bell

4. Flares

II. Care of Equipment

A. Lights

1. Cleaning of lights

2. Repair of lights

B. Lifejackets and vests

1. Moisture-protection to prevent molding and mildew

2. Inspection to detect rotting

C. Fire Extinguishers

1. Inspection

2. Testing

3. Recharging

D. Signaling Equipment

III Recommended Equipment

A. First Aid Kit

B. Deck Equipment

1. Lines

2. Ground Tackle

3. Fenders

4. Boat Hooks and Grapples

C. Tools

D. Navigational Equipment

E. Emergency Lights

IV. First Aid

LESSON 2
Classes of Vessels

OBJECTIVE: Discuss the classification of boats and the lights and other equipment required for boats of different class and also items of recommended but not required equipment.

INSTRUCTIONAL MATERIAL: Chapter II of text. Motorboats, this is a C. G. publication 290, April, 1957 published by the Coast Guard Treasury Department, Washington 25, D.C. This is to be used as a handout

INTRODUCING THE LESSON: Point out to the students the minimum legal requirements as presented in C. G. 290 and the suggestions there in the pamphlet for safe operations. Show the sectors of visibility of lights which were assigned at the last meeting and discuss them in terms of visibility from various positions.

First Hour: Present the lights as required for various class vessels using the blackboard to show their position on the vessel and their sectors of visibility. Discuss the lights in general, drawing on the experiences of members of the class on their own or some other vessel.

Second Hour: Present to the group the minimum equipment required by the regulations for boats of different classes. Discuss each item of equipment. Demonstrate combustibility of gasoline fumes.

Third Hour: Discuss recommended safety equipment including such items as spare parts for required equipment. This would include; for example, spare oil lamps which could be rigged as break down lights and a hand operated or mouth operated fog horn. Summarize and discuss the material of

this lesson and assign the material for lesson three, title of which is "Rules of the Road." This material is found on pages 44, 45, and 46 of the text and in Chapter 3.

Allocate 20 minutes to First Aid Instruction.

Lesson 2

Instructor's Outline

Classes of Vessels

I. Sectors of Visibility

II. Required Equipment

A. For Class A Vessels

1. Navigation lights

2. Other equipment

B. Class 1 Vessels

1. Navigation lights

2. Other equipment

C. Class 2 Vessels

1. Navigation lights

2. Other equipment

D. Class 3 Vessels

1. Navigation lights

2. Other equipment

III. First Aid

LESSON 3

Rules of the Road

OBJECTIVE: The purpose of this lesson is to cover the Rules of the Road, discussing the use of lights and maneuvering to avoid collision and the right of way for vessels under inland as well as international rules.

INSTRUCTIONAL MATERIAL: Text--Chapter 3; Film - "Rules of the Road"

INTRODUCING THE LESSON: The instructor should discuss Rules of the Road briefly as to purpose and publication, and should then preview and show the film.

First Hour: Discuss lights and their use in manuevering in channels and in various crossing and meaning situations. Preview Film; show film; discuss film, and be prepared to answer any questions that members of the class may bring up with respect to the film.

Second Hour: Discuss right of way of vessels meeting in channel, overtaking, and in a crossing situation. Discuss the appearance of lights on privileged and burden vessels in different situations.

Third Hour: Show lights carried by tugs under various conditions in inland and international situations. Set up on the blackboard for class participation several sample crossing situations. Have members of the class discuss action to be taken in each case in order to avoid collisions. Assign material for the next lesson which is "Lights Required for Trawlers and Tugs."

Allocate 20 minutes to First Aid Instruction.

Lesson 3

Instructors Outline

I. Right of way

A. For vessels underway

B. Leaving a slip

C. Meeting another vessel

D. Crossing situations

E. Overtaking situations

F. In making a dock

II. Lights required by tugs

A. Lights required under inland rules

B. Lights required under international rules

III. First Aid

LESSON 4

Rules of the Road (Continued)

OBJECTIVE: The purpose of this lesson is to continue the discussion "Rules of the Road" with particular emphases to lights for trawlers, tugs, and other small craft under inland as well as international rules.

INSTRUCTIONAL MATERIAL: Text--Chapter 3

INTRODUCING THE LESSON: The instructor should at this point summarize the previous lesson and answer any questions which members of the class may have carried over from the last meeting.

First Hour: Discuss lights required for trawlers under inland and international rules. Be very careful to make the distinction clear between the inland and international requirements.

Second Hour: Discuss the lights required for tugs under inland and international rules as outlined above. Demonstrate by blackboard problems, various situations of lights under inland and international rules. Show the lights as they might appear and have members of the class identify the vessel represented by these lights. Show lights in different relative positions so as to demonstrate various possibilities. The appearance of lights at night. Considerable class participation of this chapter is indicated and will probably be forthcoming.

Third Hour: Summarize "Rules of the Road". Review and be prepared to answer any questions that members of the class might have on Rules of the Road.

Lesson 4

Instructors Outline

Rules of the Road (Continued)

I. Right of way

A. Sailing vessels

B. Towing vessels

C. Fishing and trawling vessels

D. Vessels traversing approved channels

E. Vessels not under command

II. Lights required by trawlers

A. Lights required under inland rules

B. Lights required under international rules

LESSON 5

Recommended equipment to be carried on motorboats

OBJECTIVES: The purpose of this lesson is to instruct the students in such items of equipment which although not specificly required by the regulations are very desirable and highly recommended to be carried on board.

INSTRUCTIONAL MATERIAL: Text--page 17 and 18

INTRODUCING THE LESSON: The instructor should at this point emphasize that while the regulations are fairly complete they provide for only minimum legal requirements and do not indicate some items of equipment which the conscientious sailor would particularly like to have on his vessel.

First Hour: Point out the items of equipment, item by item as indicated in the cited text material. Discuss in some detail the emergency signaling equipment such as flares and bunting. Perhaps at this junction some members of the class can contribute to the discussion and of their own experiences with the emergency signaling equipment.

Second Hour: Discuss spare ground tackle, fenders, portable pumps, spare lines, boat hooks, and other items of deck equipment.

Third Hour: Discuss items of navigational equipment which are desirable if a good plot is to be maintained--this includes adequate working space and such instruments as the divider, parallel rules, portable compass for taking bearings, various light lists, tide, and other government publications, lead lines and some sort of a device for measuring the speed of the vessel.

Third Hour: In as much as this is the final section of part one of the course, this part of the period should be

devoted to summarizing the entire material covered in Part I and answering any questions which may be brought up by members of the class. In the absence of such questions as necessary to fill out the class period, sometime might be spent in continuing the discussion of recommended but not required equipment to be carried on board.

Lesson 5

Instructor's Outline

Recommended Equipment to Be Carried on Motorboats

I. Emergency signaling equipment

A. Flares

B. Flags

C. Blinkers

II. Deck equipment

A. Ground tackle

B. Sea anchor

C. Mooring equipment

D. Portable pump

E. Accessibility of gear and proper storage facilities

III. Navigational equipment

A. Plotting area

1. Charts and publications

2. Dividers and parallel rulers

3. Compass and azimuth circle

4. Radio direction finder and other aids

B. Adequate time-piece

C. Sounding equipment, lead line, and timing device

D. Speed measuring equipment, chip log and taffrail log

E. Tools

1. Engine

2. Lights

F. First aid equipment

1. Equipment for treating wounds and burns

2. Medicines for treating acute illness

3. Sedatives

Part II

Aids to Navigation

This is an introduction to navigation. It considers navigation along the inland water ways, rivers, bays harbors and canals. The use and meaning of the charts published by the U. S. Coast and Geodetic Survey and the systematic arrangement of buoys and markers along the inland water ways is presented by visual demonstration and by student participation.

This part is 15 - 18 hour course.

VI. Buoys

- A. Types of buoys
- B. Pillowing of buoys
- C. Marking of buoys

VII. Lights

- A. Characteristics and visibility of lights
- B. Range
- C. Day Markers

VIII. Charts

- A. Symbols and abbreviations
- B. Chart reading

IX. Use of lights and Buoys

- A. Keeping in channels
- B. Measuring distance
- C. Use of soundings as indicated on the charts
- D. Color code
- E. Types of land and navigational aids

X. Navigation in fog and other conditions of poor visibility

A. Speed

B. Lookouts

C. Fog Signals

LESSON 6

Buoys and Markers

OBJECTIVE: Is to present the Buoyage System being used in the United States in both inland and international waters. The objective is to familiarize the students with the United States Buoyage System.

INSTRUCTIONAL MATERIAL: Text chapter 16, Diagrams of buoys found on page 292 and 294 of the text.

INTRODUCING THE LESSON: The instructor should note at this time the necessity for marking channels, fairways, and any waters used by vessels so that the mariner can navigate safely even though he is relatively unfamiliar with the particular waters involved.

First Hour: Buoys--the instructor should at this time present the types of buoys, nun buoys, bell buoys, whistle buoys, lighted buoys, and combination buoys. Beacons--the instructor should discuss at this time the appearance of buoys and markers, their colorings, the characteristics of their lights, and their probable range of visibility.

Second Hour: By means of the lantern, project on the screen the illustrations shown on page 292 and 294 of the text, pointing out the differences between the markings of buoys under inland and international rules. Primary interest of the class, in a course of this type, naturally, will be with the intracoastal waterway markings. This should be covered in detail and as much class participation as possible should be sought by the instructor.

Third Hour: The instructor may at this junction use the projection to show buoyage systems in use, such as the illustration on page 20 of the publication entitled "Nautical Charts and Abbreviation Symbols." This is a publication of the department of Commerce and Geodetic Survey. The class may participate at this time from their own experiences with buoys and markers. A discussion of the system of control and maintenance in inland and international waterways is in order at this point.

Lesson 6

Instructor's Outline

Buoys and Markers

I. Buoys and Markers by Types

A. Types of buoys

1. Bell
2. Whistle
3. Lighted
4. Combination
5. Nun
6 Spar
7. Can

B. Types of Markers

1. Structure
2. Platform
3. Targets

II. Coloring of Buoys and Markers

A. Channel Buoys and Markers

1 Red and black buoys and markers
2. Fairway markers

B. Special Buoys --

1. Obstructions
2. Wrecks
3. Anchorage
   a. Quarantine
   b. Dangerous cargo
   c. Prohibited anchorage

III. Markings along the inland waterway --

A. Channel markings

B. Ranges

C. Targets

LESSON 7

Lights

OBJECTIVE: The purpose of this lesson is to present the system of lights set up for navigational purposes.

INSTRUCTIONAL MATERIAL: Chapter 15 of the text.

INTRODUCING THE LESSON: The instructor should point out that lights have been placed ao as to facilitate navigation, and, therefore, are found in greatest numbers and in best state of maintenance where required.

First Hour: Characteristics and visibility of lights. The table--Bowditch in visibility of objects at sea; that is table 8 on page 1254 of Bowditch entitled "Distance of the Horizon." The instructor should introduce at this point and demonstrate on the board so as to give an idea of the visibility of objects at sea with respect to their height above the water. This discussion could be correlated with an introduction to the light list itself. Secondly, the characteristics of lights should be shown on the board by means of the table which appears on page 291 of the text.

Second Hour: Bay markers--their shapes, sizes, markings, and numbering system. The last part of this hour should be spent in general discussion and in a question and answer period. Assign the material for lesson No. 8 which is entitled "Charts." This material is found in Chapter 18 of the text.

Lesson 7

Instructors Outline

Lights

I. Lights

A. Characteristics

1. Flashing

2. Occulting

3. Group flashing

B. Visibility

1. Color of lights (effect on range of visibility)

2. Range of visibility

3. Sector of visibility

LESSON 8

Charts

OBJECTIVE: The purpose of this lesson is to introduce the student to the Nautical charts.

INSTRUCTIONAL MATERIAL: Chapter 18 of the Text. Page 324 - charts symbols and abbreviations. The chart C. and G. S. 1116 will be used in this class meeting as a demonstration item.

INTRODUCING THE LESSON: The instructor should first present the material in the text which has to do with Abbreviations and Symbols on the chart--pointing out the necessity for ready reference to the navigator.

First Hour: A discussion of topographical symbols covering coast line features, land marks, control points, harbors, buildings, and other symbols.

Second Hour: Buoys, beacons, anchorage areas, stations, lights, and soundings.

Third Hour: The compass rose and the scales of longitudes and latitudes. The last part of this period should be devoted to a discussion and a class participation exercise in which the students examine and locate various land marks on the Chart No. 1116. The material for the next lesson which has to do with the use of charts should be assigned at this time.

Lesson 8

Instructors Outline

Charts

I. Projections

A. Mercator

B. Polar

C. Polyconic

II. A. Scales

1. Longitude scale

2. Latitude scale

a. Use in measuring distance

b. Local application

B. Use of the Chart

LESSON 9

The Use of Charts in Piloting

OBJECTIVES: To familiarize the students with the capabilities of the chart; that is to say just what information can the chart supply and just what its short comings are. The short comings are inherent in the transition from a round to a flat surface which is of course the major problem in making of charts.

INSTRUCTIONAL MATERIAL: Chapter 18 of the text, beginning on page 310.

INTRODUCING THE LESSON: The instructor needs to emphasize at this point the difficulties encountered by the Cartographer in representing on the flat chart's surface areas of the earth's surface which actually are sections of the surface of a sphere. The different types of projections should be discussed briefly with particular emphases being placed upon the Mercator projection; besides the Mercator projection the Polar projection and the Polyconic type projections should be covered briefly.

First Hour: Discuss the different types of projection; show graphically how they are derived and show in considerable detail how the Mercator projection type chart is constructed.

Second Hour: Use of Charts: In this period we want to use the Mercator projection. This is a class participation period. We will demonstrate first-off that the latitude scale can be used as a distance scale. The longitude scale is useless as a distance scale except in regions of equatorial waters. We will demonstrate that the latitude scale to be used must be a latitude scale

which is found at the edge of the chart at the same latitude as the area on the chart to be measured and demonstrated; also, the errors that can accrue if any other scale on the chart is used so as too much north latitude or too much south latitude or of course the longitude scale. We will now have the students pick off and measure certain distances on the chart using this latitude scale.

Third Hour: We will continue the class participation type technique in which the student will use land marks on the chart; such as buoys, lights, point of land, scales to measure distances, and continue to measure distances on the Mercator projections. At the conclusion of this period we will have a short discussion hour in which the short comings of the different types of projections will be re-emphasized and the value of the Mercator projection, also re-emphasized. At the conclusion of this period the material for the next period will be assigned. Title of the next lesson is "Navigation in Fog and other conditions of poor Visibility." The text material for this section is found on page 67 and on page 178 and 179 of the text.

Lesson 9

Instructor's Outline

The Use of Charts in Piloting

I. Layout

A. Pilot charts

B. Coastal Charts

II. Symbols and abbreviations

A. Topographic

1. Coast lines

2. Heights

3. Buildings and structures

4. Stations

5. Aids

6. Landmarks

B. Hydrographic

1. Bottom

2. Obstruction

3. Wrecks

4. Tide

5. Current

6. Winds

7. Magnetic Direction

C. Scales - (Introduction)

1. Longitude

2. Latitude

LESSON 10

Navigation in Fog and Other Conditions of Reduced Visibility

OBJECTIVE: To develop the student's understanding of fog conditions and their effect upon navigation; also to engage in some discussion of look-outs to be posted during the fog and fog signals.

INSTRUCTIONAL MATERIAL: Page 67 of the text and again on pages 178, 179, and 180 of the text.

INTRODUCING THE LESSON: In this part of the lesson the instructor should spend sometime emphasizing the boat operator's responsibilities to other mariners in his vicinity during conditions of poor visibility.

First Hours: A discussion of speed in the fog or other conditions of reduced visibility. It should be emphasized this point that the operator is responsible to reduce speed so as to maintain better control of his vessel whenever conditions of visibility warrant increased vigilance. It is to be emphasized that the vessel cannot be stopped or cannot change course as readily at normal speed as it can at reduced speed and in consideration of reduced visibility the operator should exercise good seamanship in maintaining a speed at the level of which he can keep his vessel in adequate control at all times. A discussion of the normal distances of stopping a vessel of a given size at various speeds is in order at this junction. Some discussion by members of the class from their own experiences should be highly interesting and beneficial to the group. On the blackboard a situation may be set up in which vessels are crossing or meeting and distances

may be laid off to demonstrate precautions relative to speed during conditions of reduced visibility. Some mention should be made at this time of the doctrine of posting lookouts with particular of the advantage to be accrued from placing the lookouts in as forward and as high in position on the vessel as possible.

Second Hour: A discussion of fog signals, as set forth in the "Rules of the Road", is indicated here. This will be in a measure or review of previous lessons. It should be covered very thoroughly point by point. This is the concluding lesson of Part 2 of the course and some time during the third hour of this lesson should be devoted to review and summary over the whole topic.

Lesson 10

Instructors Outline

Navigating in fog and other conditions of reduced visibility

I. Visibility factors

A. Fog

B. Smoke

C. Smog

D. Rain

E. Glare

II. Safe speed

A. Stopping distance

1. Backing power

2. Momentum

B. Maneuvering room

1. Speed factor at sea

2. Speed factor in narrow channel

III. Fog Signals

Part III

The Marine Compass

This is devoted to the Marine Compass. The compass is such an important part of navigation that its study will constitute one complete part of this course. The history, basic principle, installation, and use of the compass will be taught by text, pictures, examples, demonstration, and diagrams.

This is a 9 - 12 hour course.

XI. The Historical Background and Construction

XII. Magnetism

A. A study of magnetism as a physical phenomena

B. Its application to navigation in general as a magnetic compass in particular

XIII. Compass Error

A. Directing a course

B. The use of the compass rose as given on the chart

XIV. Practical Work in Application of Compass Error

A. In steering a course

B. In taking bearings

XV. Practical Work in the Use of the Compass

Part III

The Marine Compass and Piloting

Lesson 11

Historical Background and Construction

OBJECTIVE: To introduce the student to the Marine compass and provide him with the historical background material necessary to understand the operation and its application to the science of navigation.

INSTRUCTIONAL MATERIAL: Chapter 13 of the text. The instructor should also provide himself with a working model of the compass to use for classroom demonstration purposes along with slides or cards which may be projected on the wall showing the points of the compass and the bearing circle itself.

INTRODUCING THE LESSON: The instructor should emphasize the importance to the mariner of accurate directional gear in solving the navigational problem. He should at this junction locate approximately the Magnetic North Pole on a world map so that the student may see its location with respect to the geographic pole.

First Hour: The compass card--discuss the points of the compass--leave them out for the students, and conduct a drill in which the students participate by identifying the points of the compass. Now relate the points of the compass to the bearing circle. 0 to 360 degrees and azimuth. Also mention at this point and demonstrate the civil engineer's bearing circle which is calibrated in quadrants rather than in degrees in azimuth and demonstrate reciprocal bearings.

Second Hour: Show several examples of compass card construction. Have students identify compass points and corresponding points on the bearing circle.

Third Hour: Have students identify points on the compass and various bearings on the bearing circle by using the compass rose as printed on chart 1116. Conduct a drill in which the students participate by laying out compass courses on the chart. Emphasize reciprocal courses.

Lesson 11

Instructors Outline

Historical background and construction

I. The first compass

A. Lode stone

B. Magnet

II. The compass card

A. Points of the compass

B. The bearing circle

1. Azimuth

2. Recriprocal bearings

C. Surveyors' bearing circle

III. The compass rose

A. Magnetic error due to displacement between geographic and magnetic North Poles.

B. Compass error

1. Variation

2. Deviation

LESSON 12

Magnetism

OBJECTIVE: To introduce the student to the science of magnetism as a physical phenomena and to apply its physical facts to the compass operation.

INSTRUCTIONAL MATERIAL: Text material previously assigned and the working model of the compass as well as slides and charts to be projected.

INTRODUCING THE LESSON: In this part of the lesson the instructor should demonstrate magnetic attraction and repulsion using some sort of small bar magnet.

First Hour: The earth's magnetic field--the instructor should attempt to present the earth's magnetic field in the concept of the earth itself as a magnet by means of diagrams on the blackboard and charts projected by magic lantern.

Second Hour: Discussion of the magnetic compass as an instrument in detecting magnetic fields. The instructor at this point should demonstrate that the earth's magnetic field effects the compass much in the same way as two magnets effect each other.

Third Hour: The application of the magnetic compass to navigate. The dip effect and the error induced due to discrepancy between the earth's magnetic pole and its geographic pole.

Lesson 12

Instructors Outline

Magnetism

I. Magnetic effect

A. Attraction

B. Repulsion

II. The earth's magnetic field

A. The compass needle

B. The dip needle

C. North Magnetic pole

III. Magnetic effect on the compass

A. Dip

B. Damping

C. Oscillation

LESSON 13

Compass Error

OBJECTIVE: To develop the student's understanding of compass error and its compensation. Particularly is the instructor interested at this point in emphasizing to the student that compass error, while in the present, is something that can be accurately measured and taken into consideration in order to give the navigator good navigational information.

INSTRUCTIONAL MATERIAL: Text--page 257. The instructor should provide himself with a small bar magnet in addition to the working model to the compass so that he can demonstrate magnetic effect upon the compass.

INTRODUCING THE LESSON: The instructor should emphasize the importance of accurately determining compass error and applying that error in order to give the navigator good information.

First Hour: Discuss magnetic variation, its cause and effect on the compass. Point out the variation as it effects the compass in different parts of the world. Show the lines of magnetic variation on the chart for the United States waters.

Second Hour: Show the causes of deviation starting with the location of the compass itself in the vessel. Show how compass error may be determined by sighting a fixed object at some distance from the ship and also taking a bearing of a celestial body. Demonstrate the determination of compass error by reciprocal bearings. Discuss "swinging ship."

Third Hour: Review the entire subject of compass error and have the students apply compass errors on the charts for practical work

LESSON 14

Practical work in application of compass error

OBJECTIVE: To give the student an opportunity to apply the principles of previous lessons in actual chart work.

INSTRUCTIONAL MATERIAL: Charts, parallel rulers, and pencils.

INTRODUCING THE LESSON: The instructor should emphasize the fact that the student gains most of his knowledge and skill through practical experience and application of lessons learned in a real situation.

First Hour: Have students lay out courses on the compass rose and plot them on the chart using true bearings. Have students then apply the variation and using a napier diagram apply deviation for a particular compass. The instructor should assign each student or each pair of students a different set of deviation values to use in solving these problems.

Second Hour: The entire hour of this class meeting should be taken up with actual chart work.

Third Hour: During this hour the instructor may conduct a general discussion on correcting a course in the use of the compass rose on the chart.

Lesson 14

Instructor's Outline

Practical Work in Application of Compass Error

I. Variation (Magnetic)

A. Compass Rose

B. Applying variation directly

II. Deviation (Compass)

A. Deviation Card

B. Napier's Diagram

III. Correction

A. Course

B. Bearing

C. Recriprocal bearings and courses

Lesson 15

Practical Work in Use of the Compass

OBJECTIVE: To familiarize the student with techniques involved in steering a course and taking bearings using the compass information.

INSTRUCTIONAL MATERIAL: Charts, parallel rulers, and a working model of the compass.

INTRODUCING THE LESSON: The instructor should stress the importance in maintaining a plot so that the navigator can at all times not only fix his position but also alter his course with certainty.

All Three Hours: The whole period of this lesson is taken up with the solution of problems in laying a course between known points on the chart. The instructor should require students to derive from the chart the bearings of various land marks at intervals along the coast.line. A demonstration of the techniques involved in taking bearings from the compass circle by means of an azimuth ring or sighted vine and participation by the students in the use of the azimuth ring should conclude this session.

Lesson 15

Instructor's Outline

Practical Work in Use of the Compass

I. Laying out a course

A. Correct for variation

B. Determine deviation

II. Obtaining a Fix

A. Maintaining a plot

B. Taking bearings

C. The running fix

D. Bow and beam bearings

III. Simultaneous Bearings

A. Use of the bearing circle

B. Correcting the bearing

C. Plotting the fix.