Underwater Navigator

PADI

Specialty Course Instructor Guide

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PADI Underwater Navigator Specialty Course Instructor Guide

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Introduction

This section includes suggestions on how to use this guide, an overview of course philosophy and goals, a flow chart to show you how course components and materials work together for success, and ways you can organize and integrate student diver learning.

How to Use this Guide

This guide speaks to *you,* the PADI Underwater Navigator Specialty Instructor. The guide contains three sections – the first contains standards specific to this course, the second contains knowledge development presentations, the third considers optional confined water and/or surface training and details the open water dives. All required standards, learning objectives, activities, and performance requirements specific to the PADI Underwater Navigator course appear in **boldface** print. **The boldface assists you in easily identifying those requirements that you *must* adhere to when you conduct the course.** Items not in boldface print are recommendations for your information and consideration. General course standards applicable to all PADI courses are located in the General Standards and Procedures section of your PADI *Instructor Manual.*

Course Philosophy and Goals

Early Polynesian navigators routinely crossed thousands of miles of open ocean in outrigger canoes, using only their own senses and knowledge, a tradition passed down from generation to generation. These early peoples used natural navigation clues such as the motion of specific stars, weather, wildlife species, and directions of swells on the ocean, colors of the sea and sky and angles of approaching harbors to navigate their way from point A to point B on the ocean's surface. Today, we still use natural navigation clues to navigate above and below the water, but the invention of the compass and other navigational instruments makes navigation a much easier albeit still a very challenging task.

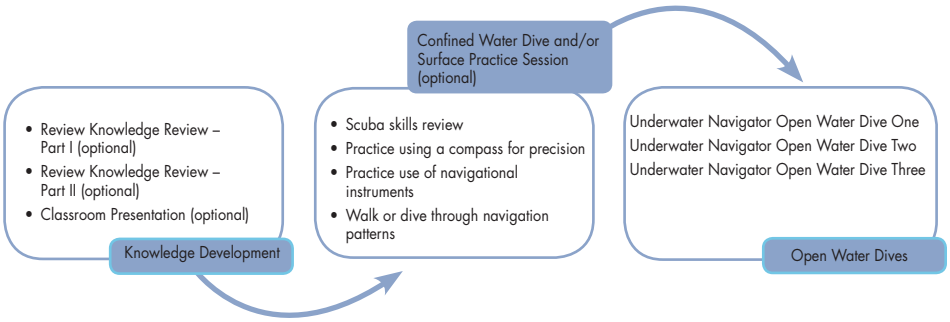
Despite more than an hour underwater and covering a lot of ground, scuba divers can successfully reach their intended mark by integrating natural navigation

techniques (environmental observation) and their skill of using instruments like the compass.

Whether your first navigation dive or your hundredth, few moments in diving compare with the satisfaction and pride you feel when you navigate a distance or specific navigation pattern and hit your mark dead-on. Keep that thought, the philosophy of this course is to focus on *fun and challenging underwater navigation dives* with an emphasis on safety. Thus, the *goal* of this course is to teach student divers a systematic, methodical approach to enjoying underwater navigation. Student divers will develop the techniques involved in navigating underwater within recreational limits and while avoiding disturbing delicate marine life.

The best way to learn underwater navigation procedures and to apply them is by doing it. This *course philosophy* therefore, expands student diver knowledge about environmental clues that help them to navigate, how to use a compass for precision, patterns that aid navigation, navigational instruments and how to interact responsibly with the aquatic life they'll see while navigating underwater. Student divers will apply the knowledge they gain by reading the PADI *Underwater Navigator Manual* and watching the companion video on at least three open water dives practicing and demonstrating the practical aspects of underwater navigation.

Course Flow Options



Course Flow Options provides a visual representation of how knowledge development and confined water and/or surface practice sessions support open water dives. When possible, it's preferable to have student divers complete and review Knowledge Reviews from the PADI *Underwater Navigator Manual* before participating in the open water dives. Knowledge Review – Part I is the same Knowledge Review that appears in the Underwater Navigator section of *Adventures in Diving*. If you have the first part of the Knowledge Review on file, you may at your discretion, have student divers complete only Knowledge Review – Part II.

Confined water and/or surface practice sessions are not required for the PADI Underwater Navigator course; however, you may choose to have practical sessions that allow student divers to practice skills such as using a compass with precision, swimming or walking through patterns that aid navigation, and using other navigational instruments.

There are three dives to complete. **You may rearrange skill sequences within each dive; however, the sequence of dives must stay intact.** You may add more dives as necessary to meet student divers' needs. Organize your course to incorporate environment friendly techniques throughout each dive, to accommodate student diver learning style, logistical needs, and your sequencing preferences. You may choose from one of the approaches from Program Options, or develop your own.

Program Options

Step	Independent Study	Adventure Dive Integration	Instructor-Led
1	Independent study with manual and video (optional)	Independent study with manual and video (optional)	Knowledge Development Classroom Presentation (optional)
2	Review Knowledge Review – Part I and Part II (optional)	Give credit for Navigation Adventure Dive and collect Knowledge Review – Part I (optional)	Review Knowledge Review – Part I and Part II (optional)
3	Confined Water Dive and/or Surface Practice Session (optional)	Confined Water Dive and/or Surface Practice Session (optional)	Confined Water Dive and/or Surface Practice Session (optional)
4	Open Water Dive One	Review Knowledge Review – Part II (optional)	Open Water Dive One
5	Open Water Dive Two	Open Water Dive Two	Open Water Dive Two
6	Open Water Dive Three	Open Water Dive Three	Open Water Dive Three

Section One:
Course Standards

This section includes the course standards, recommendations, and suggestions for conducting the PADI Underwater Navigator course.

Standards at a Glance

Topic	Course Standard	
Minimum Instructor Rating	**PADI Underwater Navigator Specialty Instructor**	
Prerequisites **Minimum Age**	**PADI (Junior) Open Water Diver** **10 years**	
Ratios	**Open Water 8:1 Instructor; 4:1 Certified Assistant**	
Site, Depths, and Hours	Depth: 6-12 metres/20-40 feet recommended Hours Recommended: 12 **Minimum Open Water Dives: 3**	
Materials and Equipment	Instructor: • **PADI Underwater Navigator Specialty Course Instructor Guide** • **Marker buoys, underwater reel and line, and diving navigational aids**	Student: • **Compass** • **Underwater grid slate**

Instructor Prerequisites

To qualify to teach the PADI Underwater Navigator course, an individual must be a Teaching status PADI Open Water Scuba Instructor or higher. **PADI Instructors may apply for the Underwater Navigator Specialty Instructor rating after completing a Specialty Instructor Training course with a PADI Course Director, or by providing proof of experience and applying directly to PADI.** For further detail, reference Membership Standards in the General Standards and Procedures section of your PADI *Instructor Manual.*

Student Diver Prerequisites

By the start of the course, a diver must be:

1. **Certified as a PADI (Junior) Open Water Diver or have a qualifying certification from another training organization.** In this case, a qualifying certification is defined as proof of entry-level scuba certification with a minimum of four open water training dives. Verify student diver prerequisite skills and provide remediation as necessary.
2. **Be at least 10 years.**

Supervision and Ratios

Open Water Dives

A Teaching status PADI Underwater Navigator Specialty Instructor must be present and in control of all activities. If Dive One is conducted deeper than 18 metres/60 feet, the Specialty Instructor must directly supervise at a ratio of no greater than 8 student divers per instructor (8:1) unless all divers on that dive have successfully completed the Deep Adventure Dive. You may not increase this ratio with the use of certified assistants.

The Specialty Instructor may *indirectly supervise* all dives when conducted at a depth less than 18 metres/60 feet at a ratio of 8 student divers per instructor with 4 additional student divers allowed per certified assistant (4:1). Maximum student diver to certified assistant 4:1. It is recommended that a certified assistant, however, accompany each buddy team. **The Specialty Instructor must ensure that all performance requirements are met.**

Children

For open water dives that include 10-11 year olds, direct supervision is required at a maximum ratio of four student divers per instructor (4:1). No more than two of the four divers may be 10 or 11. You may not increase this ratio with the use of certified assistants.

Site, Depths, and Hours

Site

Choose sites with conditions and environments suitable for completing requirements. Shallow dives will provide divers with more time to complete tasks. Use different open water dive sites, if possible, to give student divers experience in dealing with a variety of environmental conditions (incorporate environment friendly techniques throughout each dive) and logistical challenges. Practice skills in confined water sessions first to better prepare divers to apply skills in open water later.

Depths

6-12 metres/20-40 feet recommended
18 metres/60 feet maximum for certified Open Water Divers

Children

12 metres/40 feet limit for 10-11 year old
21 metres/70 feet limit for 12-14 year old if they have taken the Deep Adventure Dive

Hours

The PADI Underwater Navigator course includes three open water dives, which may be conducted in one day. Dives may be conducted at night for divers who have completed the Night Adventure Dive or the first dive of the PADI Night Diver specialty course, or have qualifying night diving experience. The minimum number of recommended hours is 12.

Materials and Equipment

Instructor Materials and Equipment

Use the PADI Underwater Navigator course materials prescriptively to accommodate various sequencing preferences and teaching and learning styles.

Required

- **PADI *Underwater Navigator Specialty Course Instructor Guide***
- **Specialty equipment needed for student divers to perform underwater navigation dives.**
  - **Underwater line and reel** for distance measurement
  - **Marker buoys**
  - **Navigational aids** (underwater grid slates, course plotter/Nav-Finder™)

Recommended

- PADI *Underwater Navigator Manual.* Use the student diver manual for detailed content explanation.
- PADI *Underwater Navigator* video.
- As needed: extra line and reels and navigational aids for student divers.

Student Diver Materials and Equipment

Required

- **Compass**
- **Underwater grid slate**

Recommended

- PADI *Underwater Navigator Manual*
- PADI *Underwater Navigator* video
- Access to support equipment as necessary, including but not limited to: course plotter/Nav-Finder and line and reel.

Assessment Standards

To assess knowledge you may review the Knowledge Reviews from the student diver's manual with the diver. **The student diver must demonstrate accurate and adequate knowledge during the open water dives and must perform all skills (procedures and motor skills) fluidly, with little difficulty, in a manner that demonstrates minimal or no stress.**

Certification Requirements and Procedures

Document student diver training by completing the PADI *Specialty Training Record* for Underwater Navigator (see Appendix). **To qualify for certification, by completion of the course, student divers must complete all performance requirements for Underwater Navigator Open Water Dives One, Two, and Three.**

The instructor certifying the student diver must ensure that all certification requirements have been met. Reference Administrative Procedures of the General Standards and Procedures section of your PADI *Instructor Manual* for detailed information on Referral.

Links to Other Courses

The Underwater Navigator Adventure Dive conducted during the PADI Adventures in Diving program may count as the *first dive* toward this specialty at your discretion.

Similarly, divers who successfully complete Underwater Navigator Open Water Dive One and Knowledge Review Part 1 may receive credit as an Adventure Dive toward the PADI Adventure Diver and the PADI Advanced Open Water Diver certifications. They may also credit the specialty certification toward the PADI Master Scuba Diver rating.

Section Two:
Knowledge Development
Conduct

It doesn't take many open water dives before you realize that knowing where you are and where you're going makes a big difference in how much fun you have. Navigating underwater builds confidence and puts you in control of your dive plan, helps you save energy on your dive, makes dive planning more effective, keeps buddies together, and reduces your air consumption. Whether your first navigation dive or your hundredth, few moments in diving compare with the satisfaction and pride you feel when you navigate a distance or specific navigation pattern and hit your mark dead-on. The philosophy of this course is to focus on *fun and challenging underwater navigation dives* with an emphasis on safety. This means to introduce student divers to the planning, organization, and to the procedures of dive navigation. Additionally, to discuss with student divers the hazards to avoid while navigating underwater, the various methods of estimating distances underwater, the basics of natural and compass navigation, the fundamentals of using underwater patterns, how to effectively use dive site relocation techniques, and how to interact responsibly with the aquatic life they'll see while navigating underwater.

Student divers complete independent study of the course by reading the PADI *Underwater Navigator Manual* and by watching the PADI *Underwater Navigator* video. Work hand-in-hand with the student diver manual to address prescriptively student diver misconceptions or for clarification on certain points of interest. If there is a need for instructor-led presentations, use the following teaching outline, which appears in point form, as a road map of the conduct, content, sequence and structure for the PADI Underwater Navigator course.

The result should be student divers with theoretical knowledge and pragmatic experience who can adapt what they've learned to future underwater navigation opportunities. **Regardless of how you conduct knowledge development (independent study, instructor-led or a combination of these instructional approaches), student divers will be able to explain the following learning objectives.**

Knowledge Development

Learning Objectives

By the end of knowledge development, student divers will be able to explain:

The benefits of mastering underwater navigation, techniques for estimating distance underwater, and the use of natural navigation references and techniques.

- **What are five benefits of mastering underwater navigation?**
- **What are five techniques for estimating distance underwater, and how are they performed?**
- **What four predive observations should you make to help you navigate during the dive?**
- **How do you perform a descent that assists you with natural navigation?**
- **What six natural references commonly help divers navigate underwater?**

Common patterns for underwater navigation, compass use, techniques to avoiding errors when using a compass, the use of permanent shore landmarks to relocate underwater sites, and the use of compass bearings to fix and locate underwater sites.

- **What are four patterns commonly used by divers for underwater navigation?**
- **What six tips make using a dive pattern more effective?**
- **What features should a good underwater compass have?**
- **What is the correct position for holding a compass to maintain an accurate heading?**
- **How do you set a compass for a heading, for a reciprocal course, for a square/rectangle pattern and for a triangle pattern?**
- **What techniques can you use to avoid errors when navigating with a compass?**
- **How do you use permanent shore landmarks to fix and relocate an underwater site?**
- **How do you use compass bearings to fix and relocate an underwater site?**

Additional navigational tools and instruments and techniques to use them effectively while navigating multiheading courses underwater.

- **What tools/instruments can help you navigate underwater?**
- **How do you track a multiheading course, return to your start point, and find your way from one point to another using a course plotter?**
- **How do you determine pattern headings with a heading calculator?**

Knowledge Development Teaching Outline

Suggestions to *you,* the PADI Underwater Navigator Specialty Course Instructor, *appear in note boxes.*

A. Course Introduction

1. Staff and student diver introductions

> *Note:*
> *Introduce yourself and assistants. Explain your background with underwater navigation if your student divers are not familiar with you.*
>
> *Have divers introduce themselves and explain why they are interested in underwater navigation. Break the ice and encourage a relaxed atmosphere.*
>
> *Give times, dates and locations as appropriate for classroom presentations, confined water and/or surface practice sessions, and open water dives.*
>
> *Review with student divers other skills they will want as a PADI Underwater Navigator. These opportunities, through additional specialty course training, may include, but are not limited to PADI* Diver Propulsion Vehicle (DPV) Diver, *PADI* Search and Recovery Diver, *PADI* Night Diver, *PADI* Peak Performance Bouyancy Diver, *and PADI* Boat Diver.

2. Course goals – this course will help:
   a. Develop your practical knowledge of underwater navigation.
   b. Increase your diving skills.
   c. You plan, organize, and make navigation dives.
   d. Improve your diving ability and provide you with additional supervised experience.
   e. Encourage you to participate in other specialty training.
   f. Heighten your awareness of underwater surroundings and features as part of natural navigation.
3. Course overview
   a. Classroom presentations and confined water and/or surface practice sessions.

b. Open water dives. There will be three open water dives.

4. Certification
   a. Upon successfully completing the course, you will receive the PADI Underwater Navigator Specialty certification.
   b. Certification means that you will be qualified to:
      1. Plan, organize, make, and log open water navigation dives in conditions generally comparable to or better than, those in which you are trained.
      2. Apply for the Master Scuba Diver rating if you are a PADI Advanced Open Water Diver and a PADI Rescue Diver (or qualifying certification from another training organization) with certification in four other PADI Specialty ratings, and you have 50-logged dives.

Note:
Use the PADI Student Record File. *Explain all course costs and materials, what the costs do and do not include, including equipment use, dive site fees, etc. Explain what equipment student divers must have for the course, and what you will provide. Cover and review points about scheduling and attendance.*

5. Class requirements
   a. Complete paperwork.
   b. Course costs.
   c. Equipment needs.
   d. Schedule and attendance.

B. Benefits of Underwater Navigation

- ***What are five benefits of mastering underwater navigation?***

1. In general, it is important to learn how to navigate underwater to:
   a. Reduce confusion and anxiety. Not knowing where you are or where you are going causes undue stress.
   b. Avoid long surface swims at the end of a dive. Underwater navigation will help you save energy when diving, while maximizing your enjoyment.

c. Increase effectiveness of planning a dive. Knowing how to navigate underwater will allow you to plan your dive more precisely.

d. Avoid buddy separation.

e. Conserve air. Effective navigation will aid you in conserving air by helping you get to point A or B by the shortest route possible.

2. Underwater navigation is a particularly useful skill when participating in specialized diving activities: limited visibility diving, night diving, wreck diving and search and recovery diving.

Note:
Here is an opportunity to promote the specialties you have mentioned in the introduction. Suggest to student divers that through additional specialty course training, they may develop their diving skills even further by completing the PADI Diver Propulsion Vehicle (DPV) Diver *course, the PADI* Search and Recovery Diver *course, the PADI* Night Diver, the *PADI* Peak Performance Bouyancy Diver *course, or the PADI* Boat Diver *specialty course.*

C. Distance Estimation

Note:
Student divers certified to the Open Water Diver level should independently read the student manual, attend instructor-led presentations, or complete a combination of these instructional approaches to cover all of the information in the following four sections: distance estimation, natural navigation, dive patterns and compass navigation. PADI Advanced Open Water Divers or Adventure Divers who have completed the Navigation Adventure Dive should be encouraged to review this information, as they will be evaluated for their mastery of the material.

1. Specific search patterns assist divers in finding objects underwater. However, search patterns are effective only when you have some way to measure the distance covered.

- ***What are five techniques for estimating distance underwater, and how are they performed?***

2. Methods of estimating distances underwater.

a. Kick cycles. A cycle is one up-and-down motion with each leg. When performed over a known distance, divide the distance in metres/feet by the number of kick cycles – giving you your personal speed in metres/feet per kick cycle. This technique is moderately accurate in calm water and works well in surge if you maintain a steady fin stroke. The back-and-forth motion of the surge tends to cancel out the action of the surge. You can also start and stop measurement using kick cycles without much loss in accuracy. Be aware that your known distance per kick cycle will change if you change your fin type.

Note:
Inform student divers that by swimming a known distance counting kick cycles, they can estimate the length of one kick cycle. For example, if you count 40 kick cycles swimming 30 metres/100 feet, you know you cover about .75 metres/2.5 feet per kick cycle. (30 metres ÷ 40 kick cycles = .75 metres per kick cycle; 100 feet ÷ 40 kick cycles = 2.5 feet per kick cycle). Additionally, discuss with students divers that they will use kick cycles as the unit of measure rather than worrying about the number of metres/feet traveled.

b. Elapsed time. Using a timing device, you can time yourself over a measured distance and divide the distance in metres/feet by the time in seconds - giving you your personal speed in metres/feet per second. This technique is moderately accurate in calm water. During measurement, you cannot stop swimming or your estimation will not be accurate. A digital watch with an elapsed time function works best when using this distance estimation technique.

Note:
Review with student divers how to use elapsed time to measure distance underwater. For example, if it takes 20 seconds to swim 30 metres/100 feet, you know you cover about 1.5 metres/5 feet per second. (30 metres ÷ 20 seconds = 1.5 metres per second; 100 feet ÷ 20 seconds = 5 feet per second). Additionally, remind divers that once they know their distance per time, they can establish the estimated time to swim a know distance. Do this by dividing the distance by speed. For example, suppose you swim 1.5 metres/5 feet per second and you intend to swim 150 metres/500 feet. You can expect to cover the distance in just over a minute and a half (150-÷ 1.5 = 100 seconds/500 ÷ 5 = 100 seconds).

c. Cylinder pressure. Divide your air supply by the number of segments of the dive pattern. Change your headings at the respective cylinder pressure readings. Remember to end your dive with between 20-30 bars/300-600 psi remaining in your cylinder.

Note:
Remind student divers that this method of distance estimation usually assumes constant depth and activity because you use more air the deeper you go or the more you exert yourself. Changes in depth, activity, workload, or temperature can change your air consumption rate and throw your measurements off quite a bit.

d. Arm spans. There are two methods of using arm spans: vertical and horizontal. Measure vertical arm spans by reaching overhead and forward with one hand as far as you can, then swim or pull yourself forward, keeping the hand in place on the bottom as you pass it. When you've gone as far as you can, reach your other arm forward and swim/pull yourself to that hand. Repeat the process, counting arm spans. Measure horizontal arm spans by reaching forward with one arm and put your hand down. Then, pivot on that hand and reach out with the other, so you end up perpendicular to the travel direction with your arms wide. Your first arm should be pointing back the way you came and the second the way you're going. For the next arm span, pivot on the second hand and reach out with the first. Use this method in limited visibility or when small distances are covered. Counting arm spans is quite accurate.

Note:
Explain to student divers that for adults the rule of thumb for horizontal arm spans are that they are about the same measure as your height.

e. Measured line or tape measure. Use this technique when extremely accurate distance estimation is required. A measured line or a tape measure is difficult to use when distances are large or terrain contains obstacles over which the tape or line must be placed.

3. Tips to consider when estimating distances underwater:

a. When determining the average amount of time or number of kick cycles required to cover a known underwater distance, swim at a normal, relaxed pace. Don't rush. Wear all of the equipment you normally use.

b. Since you will be with a buddy, the pace should be set by the slowest member of the buddy team.

c. Swim underwater since surface swimming is much less efficient and subject to movement by currents.

Note:

Inform student divers that during their open water dive sessions they will be asked to determine the average number of kick cycles and time required to cover an underwater distance of approximately 30 metres/100 feet. Remind divers that changes to any of the following can affect kick cycle or timed swim estimation: the type of exposure suit worn, their weight system, their level of fitness, the type of fins and accessory equipment and how the equipment is secured while diving, their means of travel (surface vs. underwater), and visibility.

To perform these tasks accurately remind divers to:

a. Set a measured course of 30 metres/100 feet on the bottom (possibly by stretching a line on the bottom between two buoys).

b. Beginning at one end of the course, swim underwater at a normal relaxed pace to the other end counting the number of kick cycles.

c. Once at the end of the course, return to the starting point repeating your kick-cycle count. Divide the total number of kick cycles by two for the average. This technique provides some compensation for possible affects of currents.

d. Repeat the above steps using time, rather than kick cycles.

e. Write the average number of kick cycles and time on a slate.

Remind student divers that this information should be transferred to their log book. Logging this information is very important since other exercises in this course and other PADI Specialty courses use this information. In addition, suggest to divers to update distance information in their log books periodically since efficiency improves with experience.

D. Natural Navigation Techniques

1. Generally, you'll use some aspect of natural navigation on every dive. In addition, it is often used when searching for objects underwater. Successful natural navigation depends on awareness and the ability to pay attention to small details and unique environmental features or changes.

- ***What four predive observations should you make to help you navigate during the dive?***

2. Predive observations of a particular aquatic environment allow you to become familiar with the area by locating various formations to be used as references during the dive.
   a. Note wind, currents and tidal movement (consult tide tables).
   b. Note angle of the sun and direction of its travel across the sky in relation to your planned movement underwater.
   c. Note offshore objects/formations: rocks, piers, kelp beds, navigational buoys and shallow reefs (where waves break offshore).
   d. When diving from a boat equipped with a modern depth finder, note what the bottom topography looks like and the depth profile. Use topographic charts and maps for the area when possible. Note any key features or formations underwater that may be used for natural navigation.

- ***How do you perform a descent that assists you with natural navigation?***

3. Because natural navigation relies in part on your sense of direction, you want to descend in a way that helps you keep your bearings. Begin descents with one buddy facing toward the direction in which you both intend to begin swimming after arriving at the bottom. This technique assists with initial orientation.

- ***What six natural references commonly help divers navigate underwater?***

4. When you reach the bottom, pause a moment or two before taking off toward your destination. While maintaining your orientation to your travel direction, look around to get your bearings. Natural navigation references found underwater to help you navigate during a dive include:
   a. Light and shadows. Note the position of the sun or moon and the direction light rays enter the water.

Note:
Explain to student divers that it may help to think in terms of a clock face when trying to determine their course back. If the shadow falls 45 degrees up to right – about 2 o'clock – at the start of the dive, for example, turn until it's 45 degrees downward to the left – about 8 o'clock – and you'll be facing the way you came.

b. Water motion
    1. Currents – can provide a reference underwater, but be aware that they can change direction during a dive.
    2. Surge (back and forth shallow-water movement due to waves) – can provide information as to the direction toward/away from shore or location of a shallow rock/reef.

c. Bottom composition
    1. Bottom type and changes in bottom composition (reef to sand, sand to rock, etc.) – are something you should note.
    2. Sand ripples – often parallel the shoreline. Swim with the ripples and you are swimming parallel to the shore; swim perpendicular to the ripples and you are either swimming toward or away from the shore (check depth to determine actual direction: deeper indicates moving offshore; shallower indicates moving toward shore).

d. Bottom contour – usually possess notable characteristics (flat, steep drop-off or gentle slope). Sloping bottoms – typically slope away from shorelines or offshore rocks/reefs.

e. Plant and animals – only grow or exist at specific depths. Others orient themselves in specific directions, examples: sea fans grow at right angles to prevailing currents; sand dollars orient themselves parallel to shore.

Note:
The presence and distribution of plants and animals can be great navigational references. Take this opportunity to invite student divers to learn more about the life in their local diving environment by participating in the PADI Underwater Naturalist Specialty course.

f. Noise – such as the sound of a boat compressor or rocks tumbled by surf can be helpful guidance.

Note:
Inform student divers that during their open water dive sessions they will be asked to use natural references and distance measurement to navigate to a predetermined location.

To perform these tasks accurately remind divers to:

a. *Selected a predetermined location/objective (possibly a buoy) approximately 30-90 metres/100-300 feet from a starting point.*
b. *Navigate to the location/objective and then return. While first navigating to the location/objective, one buddy will keep track of distance, while the other becomes a mapmaker recording significant underwater features that will be used as reference when you return. During this initial swim to the buoy, buddy teams may surface as often as necessary.*
c. *Upon reaching the location/objective, buddy teams will swim a reciprocal course back to the starting point, surfacing only once for orientation. You will have successfully completed the exercise when you navigate to within 15 metres/50 feet of the starting point.*
d. *During the debriefing of the dive, buddy teams will compare maps.*

E. Underwater Patterns

- ***What are four patterns commonly used by divers for underwater navigation?***

1. Patterns give you a mental map that's easier to comprehend and follow than meandering aimlessly underwater. Orientation and navigation are easier if you try to follow one of four predetermined patterns, such as:
    a. Out and back along a straight line. This pattern is very restrictive although you'll find that many environments lend themselves well to this pattern. This pattern is best used for long, narrow formations - travel down one side of the narrow formation (reef or wreck) and then back again along the other side.
    b. Square/rectangle. These two patterns are easily visualized; use desirable right angle turns (estimated) and both allow you to cover larger areas.
    c. Triangle. Triangles sometimes work well when a rectangle/square won't – requires the use of a compass.

d. Circle. Of the patterns mentioned, this is the least desirable due to a general lack of reference. This pattern is used by search and recovery divers with the aid of a rope – one diver acts as a pivot in the center while the other swims in a circle, holding on to the rope for reference.

Note:
Inform student divers that learning to use a square/rectangle pattern is also important for mastering other, more complex maneuvers and patterns that rely on 90-degree turns. These include navigating around an obstacle and U-patterns. A precise, true circle is very difficult to follow, with or without a compass, unless you use a line. Encourage student divers to learn more about the square, rectangle, U-pattern, and circle pattern by completing the PADI Search and Recovery Specialty *course.*

- ***What six tips make using a dive pattern more effective?***

2. The following tips will make implementation of dive patterns easier and their use more enjoyable.
   a. Discuss and agree on the pattern with your buddy before the dive.
   b. Visualize the pattern prior to and during the dive.
   c. Keep patterns small and move slowly.
   d. When you deviate from the pattern, remember the direction of your general heading.
   e. One diver of the buddy team should be in charge of the navigation.
   f. Surface periodically to check your location.

F. Underwater Navigation with a Compass

1. Value and use
   a. Provides reliable directional reference when no others are available – midwater, featureless bottom, limited visibility or at night.
   b. Enables you to follow a directional heading with precision.
   c. When combined with distance estimation techniques, you can accurately:
      1. Relocate an entry area or a dive site while underwater.
      2. Map a particular dive site.

- ***What features should a good underwater compass have?***

2. Features to look for when purchasing an underwater compass.
    a. North needle. Has a needle or compass card that swings freely even when the compass is tipped slightly.
    b. Liquid filled. This enables the compass to withstand pressure and dampens movement of the needle. It is difficult to read a compass with the needle swinging back and forth.
    c. Low profile. This is especially important when the compass is worn on the arm. A large compass may snag something when putting on your cylinder.
    d. Numerical degree markings. Has numerical degree markings (usually 30, 60, 90, 120, 150, 180, 210, 240, 270, 300, 330 and 360 or 0 degrees) instead of the cardinal points of north, south, east and west.
    e. Luminous dial. Glow-in-the-dark markings let you navigate without having to keep your light on the compass.
    f. Lubber line/direct sight and bezel. Has a lubber line or direct-sight capability. A lubber line is a fixed reference, usually located in the middle of the compass. It is used for taking bearings and following headings. Figuratively splits the diver's body into two equal halves. A direct-sight compass does not have a lubber line, but instead has a side-viewing slot for taking bearings and following headings. In addition, look for a compass with an adjustable bezel, which you use (by setting compass index marks) to set compass headings most effectively.

Note:
Make sure student divers read the side bar entitled "Electronic Underwater Navigation." Unfortunately, electronic underwater navigation devices (whether transmitter/receiver system or an inertial/sonar system) are still very expensive and cumbersome to use.

- ***What is the correct position for holding a compass to maintain an accurate heading?***

3. Compass use
    a. Holding the compass
        1. When the compass is strapped to your arm, bend the arm the compass is attached to and place your middle finger of one hand on the depression on the back of your arm at the elbow of the extended arm.

2. When holding the compass with both hands – place the compass in your cupped hands and extend both arms in front of your face so that they are positioned down the centerline of your body. This is the most accurate method of holding your compass.
3. When the compass is in an instrument console – position the console so that the lubber line is pointing in the direction of travel. Hold the console with both hands and tuck your elbows into your sides.
4. Remain aware of your surroundings. You don't want to run into things or kick up the bottom disturbing both visibility and aquatic life.

Note:
Using the equipment students divers intend to use on their dives, have student divers demonstrate how they would hold their compass.

- ***How do you set a compass for a heading, for a reciprocal course, for a square/rectangle pattern and for a triangle pattern?***

b. Setting a heading
   1. Aim the lubber line at your destination.
   2. Then take the heading in relation to north and turn the bezel so that either your lubber line or the index marks point to the desired number, depending upon whether you have a direct or indirect reading compass. Note the degree heading.

c. Setting a reciprocal (return) heading
   1. Stop swimming and first turn the bezel 180° opposite your present heading.
   2. Next, turn your entire body (while properly holding the compass) so that the magnetic needle is positioned between the index marks.
   3. Begin swimming the reciprocal course.

Note:
Remind student divers they will use this basic setting when following an out-and-back line pattern.

Show student divers how it might help them to think about compass degrees as a clock face. To do this divide the compass heading by 30 to get the clock number, or multiply the clock number by 30 to get the compass heading. For instance, suppose your heading is 60 degrees and you want to know your reciprocal heading. 60 ÷ 30 = 2. On a clock, the number opposite 2 is 8; 8 x 30 = 240. You can determine headings for other patterns by thinking about the relation of numbers on the clock, and multiplying/dividing by 30.

Inform student divers that some compasses have two sets of index marks, with the extra pair already set for a reciprocal course. With these, you do not need to reset the bezel; just turn until you center the compass needle in the second index marks.

d. Maintaining a heading while swimming a course
    1. Keep the lubber line in position with the center of your body.
    2. Look over rather than down on the compass.
    3. Avoid having your compass too close to ferrous metal objects.
    4. Keep your compass level to avoid needle trapping.

e. Setting and navigating squares/rectangles
    1. When navigating a square or a rectangle, make sure turns are 90°.
    2. To make a right turn (swim the pattern clockwise), add 90 degrees to your original heading. To make a left (swim the pattern anti clockwise), subtract 90.

f. Setting and navigating U-patterns
    1. U-patterns apply 90-degree turns to a course commonly used for searches. It alternates long search swims with short swims.
    2. Your pattern will be: search leg, right, short leg, right, search leg, left, short leg, left, search leg, right, short leg, etc.

g. Setting and navigating around obstacles
    1. If you have a short detour and good visibility, you can often handle it simply by swimming around the obstacle.

2. If the detour is long, you'll need to navigate around the obstacle. To do this, you use 90-degree turns to detour. Your turns will be right, left, left, right, or left, right, right, left.

h. Setting and navigating an equilateral triangle

1. Navigate a triangle just as you would a square, except make 120-degree turns instead of 90-degree turns, and only swim three sides.
2. With any equilateral pattern, you can determine the degrees for each turn by dividing the number of sides into 360 degrees.

Note:
Inform student divers that they will be able to practice setting a compass for a heading, for a reciprocal course, for a square/rectangle pattern, for navigating around obstacles, and for a triangle pattern during surface practice.

- ***What techniques can you use to avoid errors when navigating with a compass?***

i. Hints for compass navigation

1. Trust your compass – but not entirely – it's probably right, even though you may be disoriented. You'll know what to expect from a compass, what to expect from the environment, and what to expect as you navigate. When something doesn't fit check it out to see if you may be off course.
2. Use natural references. Consider natural navigation as a rough directional reference and the compass as a fine-tuning device.
3. Practice on land. Practice compass use on land before you enter the water.
4. Work with your buddy. It's usually best if one buddy navigates while the other watches depth and time.
5. Adjust for the effects of currents. You can do this by ignoring the current and then relocating your objective, by determining a compensated start point, by using an adjusted heading, by creating an intentional error, or by using point-to-point navigation.
    a. Ignoring the current and relocating your objective. The simplest compensation is to follow your compass and ignore the current. Swim until you've covered the distance, then stop and you will be directly down current from your destination. Turn and swim directly into the current until you reach it.

b. Determining a compensated start point. The idea is to determine a new start point that adjusts for the current as you swim on the desired heading.

Note:

Review with student divers how to find a compensated start point.

1. *Estimate swim time to destination in seconds.*
2. *Drift 5 seconds.*
3. *Count kick cycles back to start point. Multiply kick cycles by swim time.*
4. *Drop the last digit and multiply by 2.*
5. *Start your swim directly up current that number of kick cycles from the original start point.*

   For example: Time to destination 60 seconds. After drifting, it takes 4 kick cycles to return to start. 4 x 60 = 240. Drop the "0" = 24. 24 x 2 = 48. Swim 48 kick cycles directly up current to find compensated start point.

c. Using an adjusted heading. If you only know a heading, but not a distance, you'll have to swim on an adjusted heading. It's simpler to determine an adjusted heading than a compensated start point.

Note:

Review with student divers how to use an adjusted heading.

1. *Swim five kick cycles without fighting the current. Stop where you are, and face your start point. Set the compass heading back to your start point.*
2. *Return to your start point and set your compass to the reciprocal of the heading you came back on.*
3. *Note the difference between this setting and your original heading.*
4. *Adjust your original heading by that amount into the current. For example, the intended heading is 270 degrees and you have a north-to-south current. You swim out five kick cycles and stop. Turning around, you note that your start point lies on a heading of 70 degrees from where you are. You swim back to the start point and set your compass for the reciprocal of 70 degrees, which is 250 degrees. This is 20 degrees off your original course (270 - 250 = 20). Determine your adjusted heading by correcting your original heading 20 degrees into the current. Your adjusted heading would be 290 degrees (270 + 20 = 290). By swimming steadily on a 290-degree heading, you will actually track along a 270-degree course*

   d. Create intentional error. Aim slightly to one side of your intended destination; if you miss it, you'll know in which direction to search.

   e. Point-to-point navigation. Use your compass to determine your desired compass bearing, and then pick out an object ahead on that bearing. Swim to the object, and when you get there, use your compass to find another object to swim to on your desired course. Continue this until you reach your destination.

6. Swim slowly and deliberately. Relax and take your time. Use a compass board to extend the length of the lubber line. This will increase your accuracy.
7. Understand the limits of underwater navigation; it's useful only within a relatively small area.

Note:
Inform student divers that during their open water dive sessions they will be asked to use a compass to:

a. Take a bearing and follow a course (and its reciprocal) without significant deviation while swimming underwater.

b. Navigate underwater to a predetermined location and return to within 15 metres/50 feet of the exit without surfacing.

c. Swim a square pattern underwater and return to within 8 metres/25 feet of the starting point.

Refer student divers to the side bar entitled "How to Map." Ask if anyone has any questions on the procedures for creating a map of an underwater site. If there is time for a recreational dive in the course, suggest to divers that they try their hand at mapping. Also, point out that this optional exercise is a required exercise for the PADI Divemaster course. If their finished map shows quality technique, they may submit it as fulfilling the Divemaster course exercise.

G. Dive Site Relocation

1. Knowing how to relocate a dive site is valuable.
    a. Increases diving efficiency – cuts down on lost time and air searching for a particular dive site.
    b. Increases safety – helps you avoid areas of unknown depth and while night diving, unfamiliar areas not previously explored.

- ***How do you use permanent shore landmarks to fix and relocate an underwater site?***

2. Fixing with permanent landmarks
    a. Once you discover an area that you want to find again, note the following before you ascend.
        1. Bottom composition and topography of the general area. Write this down on a slate to be transferred to your log book.
        2. Depth. What is the average depth? Again, write this down on a slate.
    b. Make a proper ascent, noting currents that may affect your readings at the surface. Using an anchored buoy will help you maintain your location over the dive site while you take your fix.

c. Once on the surface, take your bearings quickly in case currents cause you to drift from the area.

d. To fix your position using permanent, in-line landmarks (when available), do the following:

1. Select two permanent landmarks that line up exactly. Pick one marker close to the water and another directly in line with it but as far behind the first as possible (increases accuracy of relocation).
2. Once the first set of landmarks are found and noted, rotate in the water at least 60° (the greater the angle the more accurate the fix becomes) and choose another two permanent landmarks that line up exactly.
3. Draw a sketch of your landmarks on a slate and note important information. For future reference, transfer this sketch and information to your log book after the dive.

e. Hint: when possible, use tall, thin landmarks. If tall, thin landmarks are not available, use vertical edges of objects (houses, windows or signs).

- ***How do you use compass bearings to fix and relocate an underwater site?***

3. Fixing with a compass. To fix your position using compass bearings (used when permanent, in-line landmarks are not available), do the following:

a. Face towards one clearly visible object (palm tree, sign, or building) or area (end of an island, small cove) on shore. Take a compass bearing on the object or area and write it down on your slate.

b. Once the first bearing is found and noted, rotate in the water as far as possible (the greater the angle the more accurate the fix becomes) to find a second bearing on another clearly visible object or area on shore. Take a compass bearing on the second object or area and write it down on your slate.

c. It might be beneficial to draw a sketch of your objects or areas, with noted corresponding bearings, on a slate. For future reference, transfer this sketch and information to your log book after the dive.

d. Hint: you may be able to use a permanent, in-line landmark for one heading and a compass bearing for the other.

4. Relocating the site

a. Transfer the landmark and/or compass bearing information from your log book to your slate.

b. Swim on the surface to the approximate area of the dive site. While swimming, watch carefully for each set of landmarks and/or watch your compass.

   1. Line up the landmarks or compass bearings as precisely as possible, then begin your descent.
   2. If after a one-minute search you can't find the dive site, you may want to ascend and realign your landmarks or compass bearings.

c. GPS is by far the easiest way to relocate a dive site. You can do this with a boat-based GPS, or with a handheld GPS – be sure the GPS antenna (or hand-held unit) is directly over the fixed location. Get the GPS coordinates for your fix.

Note:
Inform student divers that during their open water dive sessions they will be asked to take a "fix" on a dive site (landmarks or compass bearings). If the same dive site is used for a subsequent open water session, they may also be asked to relocate the site.

H. Navigational Aids

1. While your number one navigation instrument is your compass, other navigational aids can make underwater navigation more fun and more effective. These range from simple tools that enhance compass use to sophisticated electronics that put your boat within a few metres/feet of a dive site.

- ***What tools/instruments can help you navigate underwater?***

2. Electronics

   a. The higher tech electronic instruments for underwater navigation remain a bit expensive and logistically complex for the typical recreational diver, but there are a few electronic instruments you may use for navigation.

      1. GPS. A GPS device receives signals from satellites to determine your position electronically, and gives you a margin of error less than a few metres/feet. Compact, handheld units are relatively inexpensive and make it possible for any diver to have a GPS device – remember a GPS doesn't work underwater.

2. Hand-held sonar. The versions more suited to recreational diving are simple distance-finding devices. Hand-held sonar works well for determining depth, on surface swims or from small boats without a depth finder.

3. Compass Aids

   a. The navigational aids that are most useful in recreational diving are, at present, those that help you get maximum effectiveness from your compass. These include compass boards, course plotters and heading calculators.

      1. Compass board. A compass board lengthens the lubber line, which improves your accuracy by making it easier to align it properly with your body centerline.

- ***How do you track a multiheading course, return to your start point, and find your way from one point to another using a course plotter?***

      2 Course plotter/Nav-Finder. Using a course plotter requires you to record the heading and direction every time you move.

         a. Course plotter/Nav-Finder basic operation – course tracking. Begin plotting a course from center point. Distance may be measured by noting time or counting kick cycles. For accuracy, travel at a constant rate. Direction is determined using a magnetic compass.

Note:
Show student divers the basic operation of a course plotter/Nav-Finder. If possible, student divers should be using their own course plotter and following the steps with you. Use the following example:

1. *You decide on a course due east (90 degrees) on your compass. Move the compass ring until 90 lines up with the compass-heading arrow. Now begin traveling*
2. *After 12 kick cycles on the 90-degree heading you decide to turn due south. Stop and plot the course just completed by using one space on the grid for each kick cycle traveled. Mark a 12-space long line from the center (start point) toward the top of the course plotter/Nav-Finder along the heavy grid line. Be sure to count grid spaces under the center rivet.*
3. *Now turn the wheel so that the compass reading of your next course – 180 degrees due south – lines up with the compass heading arrow. Begin the second leg of your trip.*
4. *Eight kick cycles later you stop again. Mark an 8-space long line on the grid, counting from the end of the previous plot line toward the top of the course plotter/Nav-Finder.*
5. *You now decide to travel on a new course of 265 degrees. Move the wheel until 265 lines up with the compass-heading arrow. Begin the third leg.*
6. *After traveling five kick cycles, you decide to return to your start point. To plot your present location, mark a 5-space long line on the grid, measuring from the end of the previous course toward the top of the course plotter/Nav-Finder.*
7. *To determine the shortest route to your starting point, move the wheel until the end of your previous plot line (your present location) touches the heavy grid line directly below the center. The number on the compass ring align with the compass heading arrow indicates your return course – approximately 323 degrees.*
8. *Count the number of spaces from the end of the last plot line to the center. It will take 11 kick cycles on a course of 323 degrees to return to your start point. Set your compass to 323 degrees, or the closest increment, and begin traveling.*

b. To find your way between points underwater. A course plotter comes in handy when you know the approximate location of several spots relative to one spot, but not to each other.

Note:

Show student divers how to find their way between points underwater using a course plotter. If possible, student divers should be using their own course plotter and following the steps with you. Use the following example:

Suppose you know that when you are moored at a particular spot, there is a reef you want to see 42 kick cycles away on a heading of 320 degrees, a small wreck 60 kick cycles away at 74 degrees and a fish cleaner station 24 kick cycles away at 229 degrees. To visit all three on one dive:

1. *First, plot the relative positions for each spot. Set the compass ring for each point's heading, then on the grid move directly up from the center to draw in each point. Following the example, locate the reef by setting the compass ring to 320 degrees, and assuming three kick cycles per box, count 14 boxes up from the center (14 x 3 = 42 kick cycles). Draw a dot there. Locate the wreck by setting 74 degrees and count 20 boxes (20 x 3 = 60 kick cycles) up from the center. For the cleaner station, set 229 degrees and find the spot by counting up eight boxes.*
2. *Enter the water and navigate to the first spot by following the known heading and distance. Track your course on the plotter as usual. You decide to visit the wreck first, so you set the plotter and your compass for 74 degrees. You follow that heading out 60 kick cycles and upon arriving at the wreck, draw a straight line from the plotter center up to the wreck spot you positioned earlier.*
3. *To find your way to the next spot, turn the compass ring so the next position and your present position are vertically aligned on the grid, with your present position directly below the next. The compass ring shows the necessary compass heading and the grid shows the distance. You decide to go to the reef from the wreck. Turning the compass ring, you find they align vertically on a heading of 281 degrees. There are 30 grid boxes between the points, so you know that the reef is approximately 90 kick cycles (30 x 3 = 90) away.*
4. *After reaching the next spot, track your course as usual. Repeat Step 3 to reach another position. To return to your start, turn the bezel until your present position is directly under the center as usual. When you reach the reef, you draw a line directly up the grid, following the course you swam from the wreck. You explore the reef a bit and then decide to visit the cleaner station.*
5. *As before, you rotate the bezel until they line up vertically with your present position directly below the desired position. You note the heading of 169 degrees and a 48-kick cycle swim based on the grid. On reaching the fish cleaner station, you track your course by marking it on the plotter. After watching the cleaning of fish by a wrasse for several minutes, you decide to return to the boat. You rotate the plotter compass ring to put your present position directly under the center, which shows that the boat is 24 kick cycles away on a heading of 50 degrees.*

- ***How do you determine pattern headings with a heading calculator?***

3. Heading calculator. Heading calculators streamline navigation by showing you appropriate compass headings for turns and patterns.

Note:
Show student divers how to use a heading calculator. To use a heading calculator, simply set it on your initial heading. The calculator shows your compass headings for 90-degree turns (right or left), all the headings for a clockwise/counterclockwise square or rectangle, and your reciprocal course. Having these conveniently displayed not only saves time, but it reduces confusion about whether to add or subtract from your headings to make right/left turns.

Section Three:
Open Water Dives
Conduct

There are no required confined water and/or surface practice sessions for the PADI Underwater Navigator Specialty Diver course, however, developing student diver abilities in conditions that doesn't add complexity to learning new skills such as using a compass with precision, swimming or walking through patterns that aid navigation, and using other navigational instruments, before progressing to more challenging conditions, is sound instruction. Some of the underwater skills, such as distance estimation, navigating a straight line, its reciprocal, a square pattern using a compass, and navigating a multi-leg compass course, are much easier to learn if you have student divers practice them in a confined water session or on the surface first. You may add confined water and/or surface practice sessions at your discretion. The confined water session may also include a scuba skills review. After completing the course, suggest to divers to dry-rehearse navigation techniques and the use of navigation instruments before navigating a course underwater.

On the first dive, student divers determine the average number of kicks cycles and the average amount of time required to cover a specified distance underwater. Divers also learn to position a compass correctly to maintain an accurate heading. They use their navigation skills, natural and compass, to swim out and back to predetermined locations and to swim a relatively easy square pattern underwater. On the second dive, student divers build on their compass use by navigating a pre-determined course with more than five compass turns. Divers also learn how to fix a specific underwater location to be relocated on a future dive. On the third dive, student divers practice navigating a compass course with headings on underwater markers and learn to draw a map of the underwater area covered by the course. Divers who finish exercises with sufficient air remaining may continue to dive for pleasure and experience, at your discretion. Bottom time on each dive should not exceed the no decompression limits of the Recreational Dive Planner or each diver's computer, if used. **Regardless of how you conduct the open water dives, student divers must demonstrate the following performance requirements to qualify for certification.**

Open Water Dives

Performance Requirements

By the end of the open water dives, student divers will be able to:

Underwater Navigator Open Water Dive One

- **Maintain neutral buoyancy during the dive.**
- **Determine the average number of kick cycles AND average amount of time required to cover a distance of approximately 30 metres/100 feet while swimming underwater at a normal, relaxed pace.**
- **Navigate (surfacing only if necessary to verify direction or location) to a predetermined location and return to within 15 metres/50 feet of the starting point using natural references and estimated distance measurement (kick cycles or time).**
- **Demonstrate the correct positioning and handling of a compass needed to maintain an accurate heading while swimming underwater.**
- **Navigate (without surfacing) to a predetermined location and return to within 6 metres/20 feet of the starting point using a compass and estimated distance measurement (kick cycles or time).**
- **Swim a square pattern underwater returning to within 8 metres/25 feet of the starting point using a compass and beginning from a fixed location.** Recommended size of square — each side 30 metres/100 feet or total combined length of approximately 120 metres/400 feet.

Underwater Navigator Open Water Dive Two

- **Demonstrate the correct compass positioning and handling needed to maintain an accurate heading while swimming underwater.**
- **Navigate a predetermined course (provided by the instructor prior to the dive) with more than five compass turns, returning to the starting point within 15 metres/50 feet of the exit, without surfacing.**
- **Fix a specific underwater location to be relocated on a future dive, using two permanent sets of landmarks with an angle of at least 60° between them, or using a compass bearing.**

Underwater Navigator Open Water Dive Three

- **Demonstrate the correct compass positioning and handling needed to maintain an accurate heading while swimming under water.**
- **Navigate a compass course under water when new course headings (five or more) are provided on underwater markers.**
- **Draw a map of the underwater area covered by the course conducted during the dive.**

Open Water Guidelines for Navigation Dives

A. General Open Water Considerations

1. Involve student divers in dive-planning activities. Have student divers prepare training buoys and reference lines.
2. Conduct a thorough briefing. The better the briefing, the more smoothly the navigation dive will proceed. Assign buddy teams according to ability (weak with strong).
3. The use of qualified assistants is highly recommended. Assistants can help keep track of buddy teams, accompany student divers underwater, and at the surface can help with check in, check out procedures and be prepared to help in an emergency. Before Dive One begins, have assistants set up the 30-metre/100-foot measured course. On subsequent dives, have assistants place reference buoys as needed.
4. During the dives in this course, you can best determine student diver performance from the surface. Prior to the dive, assign each buddy team a colored buoy and line (small painted bleach bottles work well). By observing the buoys on the surface, you can easily determine the progress of each team and the severity of any errors (conditions permitting).

B. Underwater Navigator Open Water Dives

Dive One

- ***Maintain neutral buoyancy during the dive.***
- ***Determine the average number of kick cycles AND average amount of time required to cover a distance of approximately 30 metres/100 feet while swimming underwater at a normal, relaxed pace.***
- ***Navigate (surfacing only if necessary to verify direction or location) to a predetermined location and return to within 15 metres/50 feet of the starting point using natural references and estimated distance measurement (kick cycles or time).***
- ***Demonstrate the correct positioning and handling of a compass needed to maintain an accurate heading while swimming underwater.***
- ***Navigate (without surfacing) to a predetermined location and return to within 6 metres/20 feet of the starting point using a compass and estimated distance measurement (kick cycles or time).***
- ***Swim a square pattern underwater returning to within 8 metres/25 feet of the starting point using a compass and beginning from a fixed location.*** *Recommended size of square — each side 30 metres/100 feet or total combined length of approximately 120 metres/400 feet.*

    a. Briefing

        1. Dive sequence – review Dive One tasks

    b. Predive procedures

    c. Dive One Tasks

        1. Distance estimation

            a. Set a measured course (a line stretched between two buoys) of 30 metres/100 feet.

            b. Buddy teams begin at one end of the course following the reference line. Swim at a normal, relaxed pace to the other end. While doing so, count the number of kick cycles it takes to cover the distance.

            c. Each buddy team is then to return to the starting point. While doing so, measure the elapsed time needed to cover the distance.

d. Student divers are to record on their slate the number of kick cycles and time needed to swim 30 metres/100 feet.

2. Navigate a straight line underwater using natural navigation techniques.
   a. Select a predetermined location approximately 30-90 metres/100-300 feet from the starting point and mark it with a buoy.
   b. Assign one buddy the duty of keeping track of distance (using either kick cycles or elapsed time).
   c. The other buddy will have the duty of noting and recording significant underwater topographical features that may be used as reference upon return.
   d. During the swim to the location, buddy teams may surface as often as they desire to verify direction or location.
   e. Upon reaching the location, buddy teams are to return to the starting point surfacing only once for orientation.
3. Navigate a straight line and its reciprocal using a compass.
   a. Select a predetermined location approximately 30-90 metres/100-300 feet from the starting point and mark it with a buoy.
   b. Instruct one student diver to take a compass bearing on the destination at the surface and the other diver will keep track of distance.
   c. Buddy teams are to descend, and follow the compass heading for the estimated time or number of kick cycles needed to cover the predetermined distance.
   d. At the end of time/kick cycles, and without surfacing, the student diver using the compass calculates a reciprocal compass course and the buddy team swims back to the starting point while the other diver estimates distance.
   e. At the conclusion of the course, buddy teams are to ascend and check accuracy.
   f. Repeat exercise until error is within the criteria of 6 metres/20 feet. If error is acceptable, buddy teams are to switch roles (compass navigation and estimating distance) and complete the exercise again.
4. Navigate a square pattern underwater using a compass.

a. Using a fixed reference point, instruct teams to swim a predetermined heading for a distance of 30 metres/100 feet. One student diver navigates with a compass, the other estimates distance.

b. At the conclusion of the first leg, teams make either a left or right 90° turn for another 30 metres/100 feet.

c. Repeat these maneuvers until three turns are complete. These maneuvers should return the teams to the general proximity of the starting point.

d. Teams ascend and check accuracy.

e. Repeat exercise until error is within the criteria of 8 metres/25 feet. If error is acceptable, buddy teams are to switch roles (compass navigating and estimating distance) and complete the exercise again.

d. Post-dive procedures

e. Debriefing

1. Student divers discuss distance estimation techniques and the natural navigation techniques they used to navigate a straight line. Also, have student divers discuss their compass techniques in navigating a straight line, its reciprocal, and a square pattern underwater. Guide discussions to address what worked, what didn't work, and how things may be done differently the next time.

f. Log dive (instructor signs log)

Dive Two

- ***Demonstrate the correct compass positioning and handling needed to maintain an accurate heading while swimming underwater.***
- ***Navigate a predetermined course (provided by the instructor prior to the dive) with more than five compass turns, returning to the starting point within 15 metres/50 feet of the exit, without surfacing.***
- ***Fix a specific underwater location to be relocated on a future dive, using two permanent sets of landmarks with an angle of at least 60° between them, or using a compass bearing.***

a. Briefing

1. Dive sequence – review Dive Two tasks

b. Predive procedures

c. Dive Two Tasks

1. Multiple-leg compass course (five or more heading changes), return to within 15 metres/50 feet of the starting point.
    a. Swim on surface to starting buoy. Begin compass swim underwater from buoy location. Use distance estimation techniques.
    b. Underwater, follow compass pattern (heading and distance covered) provided by instructor. If the pattern is followed exactly, the last leg returns to the starting point.
    c. At completion of last leg, surface – determine accuracy. Note distance from starting buoy.
    d. If necessary, repeat exercise until error is within 15 metres/50 feet of starting point.
2. Fixing a specific underwater location to be relocated on a future dive.
    a. Find an area of the dive site to be relocated.
    b. Surface; fix the location using two sets of landmarks with an angle of at least 60° between them and/or compass bearings.
    c. Draw a sketch of the landmarks on a slate or write down the compass bearings.

d. Post-dive procedures

e. Debriefing

1. Student divers discuss and review how they performed on their multi-leg compass course. Compare student divers' slate sketches of the surface landmarks used to fix their underwater site. Discuss with student divers other possible sets of landmarks they could have used. Guide discussions to address what worked, what didn't work, and how things may be done differently the next time.

f. Log dive (instructor signs log)

Dive Three

- ***Demonstrate the correct compass positioning and handling needed to maintain an accurate heading while swimming under water.***
- ***Navigate a compass course under water when new course headings (five or more) are provided on underwater markers.***
- ***Draw a map of the underwater area covered by the course conducted during the dive.***

a. Briefing
   1. Dive sequence – review Dive Three tasks

b. Predive procedures

c. Dive Three Tasks
   1. Underwater compass course – following marker headings
      a. Descend at designated point. Once on the bottom, write down time.
      b. Find first underwater marker – read new heading, set compass, turn in given direction and begin swimming to next marker.
      c. Continue following markers until the course is complete. Once the last marker is found, write down time.
      d. Surface and note location.
   2. Relocate dive site from Dive Two. (Optional task)
      a. Line up landmarks and/or compass bearing and descend.
      b. If fixed location is not found after a one-minute search, ascend and realign the landmarks and/or compass bearings prior to a second descent.

d. Post-dive procedures

e. Debriefing
   1. Student divers discuss how they fared with the underwater compass course. Ask student divers to comment on how they kept accurate time and depth, whether they recorded the new headings on the underwater markers, the ease or difficulty in setting the compass to new headings, and how accurate they were in completing the course. Guide discussions to address what worked, what didn't work, and how they may conduct responsibilities between themselves differently the next time.

f. Log dive (instructor signs log)

Appendix

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Underwater Navigator
Knowledge Review Part I Answer Key

Note:
To assess knowledge you may review the Knowledge Review from the student diver's manual with the diver, ideally prior to participating in skill practice. Prescriptively teach answers to questions student divers may have missed or have answered incorrectly or incompletely. Ensure student divers understand what they have missed.

1. List five benefits for learning to navigate underwater.
   1. *Reduce confusion and anxiety.*
   2. *Avoid long surface swims at the end of a dive.*
   3. *Increase effectiveness of planning a dive.*
   4. *Avoid buddy separation.*
   5. *Conserve air.*

2. Describe how to estimate distance with kick cycles and with elapsed time.
   Kick cycles:

   Each time both your legs complete one fin stroke.

   Elapsed time:

   Measure how long it takes to cover a fixed distance. Swim at a normal relaxed pace, preferably timing with a digital or sweep second hand stopwatch.

3. List four predive observations that can assist you with natural navigation.
   1. *Waves, currents and tidal movement*
   2. *Sun angle*
   3. *Offshore objects and formations*
   4. *Fathometer readings*

4. Describe how to descend to benefit natural navigation.
   Feet-first; facing the direction you intend to travel

5. What six natural references can help you navigate during a dive?
   1. *Light and shadows*
   2. *Water movement*
   3. *Bottom composition and formations*
   4. *Bottom contour*
   5. *Plants and animals*
   6. *Noise*

6. To maintain an accurate heading, describe how to hold and swim with an underwater compass.
   Compass is held squarely in front. Keep lubber line centered with body's centerline, looking over the compass face. Keep compass level and needle inside the index marks on the bezel.

7. Describe how to set a compass heading and how to set a reciprocal heading.
   a. Setting a heading:

      Point lubber line in desired direction of travel, rotate bezel until index marks are set over compass needle.

   b. Setting a reciprocal (return) heading:

      First, turn bezel so that the index marks are 180° from original heading. Next, turn your body so the compass needle centers between index marks.

8. List several tips for using a compass underwater.
   Trust the compass.

   Use natural references.

   Practice on land.

   Allow for effects of currents.

   Be prepared to navigate around obstacles.

   Share responsibilities midwater.

   Understand the limits.

   Swim slowly.

Adventure Dive: Underwater Navigator

Skills Overview

- Knowledge Review
- Compass Use on Land
- Briefing
- Suiting Up
- Predive Safety Check (BWRAF)
- Entry
- Descent
- Distance/Time Estimation Swim
- Navigate a Straight Line Underwater Using Natural Navigation Techniques
- Navigate a Straight Line and its Reciprocal Underwater Using a Compass
- Navigate a Square Pattern Underwater Using a Compass
- Ascent and Safety Stop
- Exit
- Debrief
- Log Dive – Complete Adventure Dive Training Record

Underwater Navigator
Knowledge Review Part II Answer Key

Note:
To assess knowledge you may review the Knowledge Review from the student diver's manual with the diver, ideally prior to participating in skill practice. Prescriptively teach answers to questions student divers may have missed or have answered incorrectly or incompletely. Ensure student divers understand what they have missed.

9. Describe how to use cylinder pressure to estimate distance.
   Using air pressure works best at a constant depth and activity level. For a straight reciprocal, equilateral triangle, or square course, you can expect your air use to be the same on each leg given that depth and activity level remain constant.

10. Describe how to navigate a square/rectangle pattern.
    Swim an initial heading and distance. Stop and reset your heading for a 90-degree turn. Turn until your compass needle is properly aligned and swim the second leg. Repeat this process until you have completed all four sides.

11. Describe how to navigate a triangle pattern.
    Swim an initial heading and distance. Stop and reset your heading for a 120-degree turn. Turn until your compass needle is properly aligned and swim the second leg. Stop and make another 120-degree turn and swim the third leg.

12. Describe how to navigate a U-pattern.
    Swim an initial heading and distance. Stop and turn 90 degrees, then swim a shorter leg. Stop and turn 90 degrees, the same as before (right or left) and swim the next leg. Stop and turn 90 degrees in the opposite direction from the last turn (left or right) and swim a shorter leg. Repeat this process to continue the search pattern.

13. Describe how to fix a dive site for relocation using permanent landmarks.
    Look shoreward for two permanent landmarks that line up. Rotate 60-120 degrees and find a second set of aligned landmarks. Note the landmarks on your slate for future reference.

14. Describe how to fix a dive site for relocation using a compass.
    Point the compass at a permanent landmark and use the index mark and needle to find a degree heading. Rotate 60-120 degrees and find another landmark and its degree heading. Note landmarks and heading on your slate for future reference.

15. List two electronic devices that can assist you with underwater navigation.
    1. *GPS*
    2. *Hand-held sonar*

16. Describe how to use a course plotter to track your location during a dive.
    Set bezel to initial heading. From the center of the plotter, draw a line toward the top of the plotter using the grid to indicate distance traveled. Rotate bezel to second heading. From the end of the first line, draw a line toward the top of the plotter indicating distance traveled on second leg. Repeat steps for each leg of course.

17. Describe how to find the heading and distance back to the start point when using a course plotter.
    Turn bezel until the end of the last line is directly below the center of the plotter. The heading indicated at the top of the plotter indicates direction and the number of grid lines to center indicates distance.

18. Describe how to set a heading calculator to get the headings for a counterclockwise square/rectangle.
    Set initial heading at top, then follow the arrows to the left to find the headings indicated for a square (90-degree turns) and the heading indicated for a triangle (120-degree turns).

PADI Adventure Dive Training Record
Adventure Dive:
Underwater Navigator

Skills Overview

- Knowledge Review
- Compass Use on Land
- Briefing
- Suiting Up
- Predive Safety Check (BWRAF)
- Entry
- Descent
- Distance/Time Estimation Swim
- Navigate a Straight Line Underwater Using Natural Navigation Techniques
- Navigate a Straight Line and its Reciprocal Underwater Using a Compass
- Navigate a Square Pattern Underwater Using a Compass
- Ascent – Safety Stop
- Exit
- Debrief
- Log Dive – Complete Training Record

Instructor Statement

"I verify that this student diver has satisfactorily completed the Knowledge Review and Performance Requirements (as described in PADI's Adventures in Diving Program Instructor Guide) for this PADI Adventure Dive. I am a renewed, Teaching status PADI Instructor for the current year."

Instructor Name: _____

Instructor Signature: _____

PADI #: _____ Completion Date: _____
Day/Month/Year

Instructor Contact Information (Please Print)

Instructor Mailing Address: _____

City: _____ State/Province: _____

Country: _____ Zip/Postal Code: _____

Phone/Fax/email: _____

Student Diver Statement

"I verify that I have completed all of the Performance Requirements for this Adventure Dive. I realize that there is more to learn about navigating underwater and that completion of a PADI Underwater Navigator course is highly recommended. I also agree to abide by PADI Standard Safe Diving Practices."

Student Diver Signature _____ Date: _____
Day/Month/Year

PADI Specialty Training Record
Underwater Navigator

Instructor Statement

"I verify that this student diver has satisfactorily completed all academic and/or any confined water training sessions as outlined in the PADI Specialty Course Instructor Guide for Underwater Navigator. I am a renewed, Teaching status PADI Instructor in this specialty."

Instructor Name: _____ PADI #:_____

Instructor Signature: _____ Completion Date: _____
Day/Month/Year

Open Water Dives

Dive One

I verify that this student diver has satisfactorily completed Dive One as outlined in the PADI standardized guide for Underwater Navigator, including:

- Land practice with compass
- Distance/Time-Estimation swim
- Navigate straight-line/reciprocal underwater using natural navigation techniques
- Navigate straight-line/reciprocal underwater using a compass
- Navigate a square pattern underwater using a compass

I am a renewed, Teaching status PADI Instructor in this specialty.

Instructor Name: _____ PADI #:_____

Instructor Signature: _____ Completion Date: _____
Day/Month/Year

Dive Two

I verify that this student diver has satisfactorily completed Dive Two as outlined in the PADI standardized guide for Underwater Navigator, including:

- Land practice with compass and instructor provided navigation pattern
- Multiple-leg compass course (five or more heading changes), return to within 15 metres/50 feet of the starting point
- Fix a specific underwater location

I am a renewed, Teaching status PADI Instructor in this specialty.

Instructor Name: _____ PADI #:_____

Instructor Signature: _____ Completion Date: _____
Day/Month/Year

Dive Three

I verify that this student diver has satisfactorily completed Dive Three as outlined in the PADI standardized guide for Underwater Navigator, including:

- Land practice with compass
- Navigate a course underwater following marker headings (five or more heading changes)
- Map the marked course on a grid slate
- Relocate dive site from dive two (optional task)

I am a renewed, Teaching status PADI Instructor in this specialty.

Instructor Name: _____ PADI #:_____

Instructor Signature: _____ Completion Date: _____
Day/Month/Year

Student Diver Statement

"I verify that I have completed all performance requirements for this Wreck Diver specialty. I am adequately prepared to dive in areas and under conditions similar to those in which I was trained. I agree to abide by PADI Standard Safe Diving Practices."

Student Diver Name: _____

Student Diver Signature: _____ Date: _____
Day/Month/Year