

NAUT 002ax/bx: Advanced Deepwater Cruising

Senior Skipper (Fall)

Advanced Senior Skipper (Spring) (2+2 [semester] academic units)

General Information

Prerequisite required: Deepwater Cruising: NAUT 001ax and NAUT 001bx

Instructors: Capt. Ron Remsburg and Capt. Noah Pepper Office: VKC 379B, 6-7 p.m. Weds., and by appointment Phone: (213) 821-1261

Website: www.USC.edu/sppd/naut

USC Nautical Science 2015 Proposal

Texts: Navigation Rules (Inland & International, U.S. Government Publication COMDTINST M16672.2

Piloting, Seamanship & Small Boat Handling, Chapman American Practical Navigator,

Bowditch, U.S. Govt. Publication Celestial Navigation, Tom Cunliffe

Charts: 1210TR Martha's Vineyard to Block Island (required) 18720 Point Dume to Purisima Point

Grading Policy: Nautical Science classes include class lectures, dockside demonstration, voyages, and a review session at semester end. It is highly recommended that students attend all four events, as they contribute to the academic concepts and skills tested on the final exam, which is the 100% basis of the course grade. The final exam covers seamanship skills and academic navigation chart work, 50% each area, and is administered according to the University published final exam schedule. Students who sign up for an event and do not attend without making prior arrangements are subject to possible grade reduction.

Meeting Periods: Classroom:

Practical Aboard: 3day performance boat

1 day practical boat handling

8 hrs. Marine Engine Function & Maintenance/ skipper preparedness

Students enrolled in these classes also volunteer as watch captains and sail with the basic classes. Additional time depends upon program enrollments. Course Syllabus (Conducted in Seminar Format)

I. Classroom Theory

1. Marlinspike seamanship
2. Anchoring
3. Rigging and fittings
4. Sails and use of sails
5. Ship forces and ship handling
6. Mooring and docking
7. Rules of the road
8. Man overboard techniques
9. Weather (See Marine Weather Outline, pg. 25)
10. Environmental protection

II. Operations Systems (day/night L.A. Harbor cruise as watch captain for 301b class)

1. Anchoring
2. Mooring (alongside)
3. Buoy mooring
4. Rules of the road: lights and shapes (Video: the Coast Guard License)

III. Watch Station

1. Marlinspike seamanship (4 hrs. classroom lecture with practical knot tying/splicing;

- Video: Sailor's Knots and Splices)
- 2. Sail handling (4 hr. tour through local sail loft; Video: Shape of Speed)
- 3. In port/anchored
- 4. Ship handling and sail handling
- IV. Damage Control (3 hour Marine Survey tour through local boat yard; Video: Prepurchase Survey Vol. 1&2, Basic Yacht Maintenance)
 - 1. Damage control organization
 - 2. Fire and firefighting
 - 3. Structural damage
 - 4. Damage control communications
 - 5. Stability and buoyancy
 - 6. First aid and rescue (10 hrs. First Aid and CPR at sea taught by USC Health Center; 2 hrs. Life raft and survival equipment lecture/tour local life raft inspection station; Video: Abandon Ship: Preparing to Survive; 8 hrs. Safety at Sea Seminars)
 - 7. Damage control safety precaution
 - 8. Main and secondary drainage
 - 9. Portable damage control equipment
 - 10. General damage control requirements
- V. Engineering (9 hrs. marine diesel engine maintenance course [see outline page 26]; one hour video: Marine Diesel Engine Maintenance; 3 hr. visit to Catalina Yacht Factory; 3 hrs. visit with L.A. Harbor Fire Department)
 - 1. Transmission/reduction gear
 - 2. Main shafting
 - 3. Main lube oil
 - 4. Diesel engine system
 - 5. Gasoline engine system
 - 6. Fuel oil diesel system
 - 7. Fuel oil filling and stowage
 - 8. Freshwater cooling system
 - 9. Saltwater cooling system
 - 10. Waste plumbing system
 - 11. Engineer watch duties
 - 12. Engineer operations
- VI. Navigation (2 hrs. visit local electronics and compass repair shop and store; 14 hrs. Celestial navigation lecture and sextant use aboard at sea; 80 hrs. Catalina Island and Special Sr. Skipper sails)
 - 1. Operational dead reckoning and coastal piloting
 - 2. Electronic navigation
 - 3. Celestial navigation
 - 4. Compass error: theory and operation
- 5. Tides and currents
- 6. Nautical Charts and publications

Naut 002 ax/bx Skipper Preparedness Training & Life Raft Workshop (8 Hours)

(Objective: To prepare license track students to take command of a vessel w/ passengers.)

- I. General Orientation: Secure gear, take roll and sign roster.
- II. Boarding an Unfamiliar Chartered Vessel
 - Why not to: load the vessel w/ supplies, gear, water, food, and rig for sailing first thing.
 - What the skipper should check first:

1. Check the bilge: Look for excessive water, oil, diesel, transmission fluid, coolant &/or sewage effluent. "Black, red, pink, & green what does that bilge color mean"
2. Evacuate bilge to ensure pump is operational. Discharge of oil or fuel prohibited
3. Note: # of cycles on bilge pump counter
4. Check the engine- Motor oil, transmission, belts, coolant, and raw water intake strainer.
5. 120 volt shore power charging- ascertain if batteries are charging with shore power
6. Start engine- Locate and review positions on battery selector switch, check exhaust
7. Cooling water discharge, verify that alternator is producing a charge.
8. Ensure gear shift and the propeller are operational in forward and reverse.
9. Check oil pressure gauge, engine water temperature gauge and fuel gauge.
10. Navigation- check GPS, Radar, AIS, depth sounder, VHF radio check, EPIRB etc.
11. Check GPS against paper chart. Verify Radar settings and targets in clear weather.
12. Check head function, holding tank and discharge are operational.
13. Check for tool box and first aid kit (skipper should have their own travel tool box)

•Rig

1. Check reefing system, sail operation, set up vessel for sea.
2. Check for PFD'S, Horn, Visual distress signals, fire extinguishers, and running lights
3. Begin loading gear, passengers, and supplies.

•Discuss: Knowledge of Systems:

1. Battery Systems:
 1. Locate battery selector switch, sometimes locked.
 2. The importance of starting and running the engine with batteries on "ALL"
 3. Discuss damage to alternator or generator if battery switch is changed under load.
 4. Why must the battery selector switch NOT be in the "All" position at anchor
 5. Discuss amps, amp hours, and volts as they relate to batteries and charging.
 6. Checking battery integrity when no "battery interface gauge" is available.
2. Head Systems:
 1. Hydrogen Sulfide gas (S) Detection and what causes it. How to remedy.
 2. When is it legal to use direct discharge or empty black water tank?
 3. Note: discharge placard required by USCG
 4. How to manage holding tank to avoid (S) build up.
 5. How to manage a plugged head line.
3. Managing fresh water usage: how to keep from running tanks dry. Tank isolation valves.
4. Stove and oven: Different types of fuels used.
 1. Pressurized tank shut off and electric solenoid switches.
 2. Demonstrate safe lighting techniques. Allow students to smell unlit stove fuel.
 3. How to avoid fires and burns- Most common injury at sea (boiling liquid burns)
 4. How to fight galley fires. When not to use water on fires.

5. Anchoring Systems:
 1. Anchors- Danforth, Bruce, Delta, CQR, Fortress, Fisherman's, Mushroom.
 2. Line rode- determining scope, type of line used.
 3. Chain rode- Function of chain on an anchor and minimum length for holding
 4. Operating an electric or a hand crank Windless. (Capstan)
 5. Sea anchors- what are they and how they can operate work as an emergency rudder?
6. Reefing:
 1. How to reef a sail that does not have tack, clew or reef point lines installed. Why did Irving Johnson say, "Always Reef your sails 2 hours before it occurs to you"
 2. Order of reefing sails while underway in rising wind & sea
 3. Striking in heavy weather, what to keep up and what to take down?
 4. How to Jury rig a jack line and/or harness.

•Weather

A. Sources-

1. VHF Channel WX-1, 3, 7, Internet sites, NOAA, "dial a buoy" & Telephone #'s for NOAA
2. Listening and interpreting. (synopsis, statements, warnings)
3. When to check weather prior to voyage and verifying accuracy of reports
4. Small craft warnings- wind to 33knts and 8 ft. seas in 12 hours.
5. Gale- wind 34-47knts, seas to 15 feet in 12 hours.
6. Weather in Southern California South Easterly wind "mackerel scales and mares tails" or a North Easterly with red skies at dawn, hot, & sunny.
7. Preparations in thunderstorms, what to do when a water spout is sighted.
8. Barometers- How to set them, how to interpret. Millibars and isobars.
9. Weather Fax- what is it?

•Handling Under Power:

1. Propellers: right hand, left hand, folding, 2 & 3 bladed. How each handles differently.
2. Quad, tri, twin, and single screw: How they affect handling, give examples.
3. Backing: prop walk and rudder pressure. Dangers of backing and losing grip of helm or tiller.

•Maneuvering under Power:

4. Getting underway: beam spring line technique and bow spring line technique. Why passengers should never fend off vessel from the dock.
5. Coming to Berth: Use of beam spring line to stop and hold vessel position. Why attempting to stop vessel from dock is inadvisable
6. Backing: Demonstrate steerageway, propeller walk, how losing control of wheel or tiller could damage steering mechanism or injure operator.
7. Beam Ends Turn- Getting out of a tight spot. Turning to windward or leeward? Which is more effective? Practice
8. MOB –"Williamson Turn & Destroyer Turn": Practice by retrieving fender
9. Docking: Weather side tie & lee side tie. Entering a slip.

•Closing up Cleaning and leaving vessel according to checkout sheet

NAUT 002ax Practical Operations Aboard Sloop Artemis (8 hours)

(Objective: To improve sailing skill to a competent crew level with emphasis on the sail handling)

I. Boat orientation

A. Below decks

1. Safety items
2. Battery switch
3. Electrical board
4. Through hull valves
5. Head
6. Engine, oil, water
7. Stowing gear

B. Above decks

1. Parts of boat

2. Standing and running rigging
3. Rigging for sail
4. Review of points of sail, jibing, tacking, port and starboard tack
5. Sail trim
6. Getting under way

II. Sailing operations

1. Order of sail raising
2. Sail all points of sail and sail trim
3. Sailing closed hauled (trim and steering)
4. Tacking, (coming about) and jibing
5. Crew position and teamwork
6. Sail shape (outhaul, boom vang, luff tension)
7. Heavy weather sailing (reefing and heaving to)
8. Wing to wing
9. Man overboard

III. Down

1. Secure jib and main
2. Dock boat
3. Shut down systems
4. Wash down and button up

NAUT 002bx Advanced Senior Skipper Practical Operations Aboard Sloop Artemis (8 hours)

(Objective: To improve boat skills with an emphasis on boat handling and seamanship)

I. Boat orientation

1. Below decks

1. Battery switch
2. Electrical board
3. Electronics
4. Through hull valves
5. Engine, oil, water, belts

2. Above decks

1. Parts of boat
2. Safety items
 1. PFD
 2. MOB
 3. life sling
3. Docklines
4. Anchor and rode

5. Knots
- II. Casting off and docking
 1. Order of dock lines
 2. Prop walk to starboard or port
 3. Docking practice
- III. Boat handling
 1. Pulling up to a dock
 2. Pulling up to a mooring under sail
 3. Anchoring under power and sail D. Bow and stern anchor
 4. Sailing short handed
 5. Two person crew
 6. Tacking, (coming about) and jibing
 7. Sailing small sail courses
- IV. Man overboard drill
 1. Upwind pick up
 2. Life sling pick up
- V. Down rigging
 1. Docking
 2. Shutting system down
 3. Wash down

NAUT 002ax Performance Boat Sailing I

General Orientation (below): Stowing gear and supplies on an ocean racing sailboat considering:

1. Extreme boat movement.
2. Easy access at sea
3. The order in which provisions may be consumed.
4. Which gear will be continually wet and where to keep it so it dries and does not make life unpleasant.
5. Where do sails go so boat is balanced and dry?
6. Consider all gear movable ballast.
7. Setting up your bunk so life is manageable.

Amenities: How to use head and galley and electrical in order to monitor and conserve supplies (stove fuel, amp hours, water).

Diagnosing Possible Problems:

1. Locate and Review how to use all throughhulls and plugs.
2. What is in a toolbox and where is it.
3. Look at hose clamps on plumbing and be sure all water tanks are secure and closed.
4. Check oil
5. Check transmission
6. Check coolant
7. Turn prop shaft and identify type of stuffing box (bellows on a dripless stuffing box may tear if the shaft is not turned by hand before putting gear).

Safety Equipment: Locate and describe how to use:

1. PFD/Lifering/Lifesling
2. Fire extinguishers
3. Flare kit (what goes in an off shore kit)
4. Ditch Bag
5. EPIRB
6. Life raft
7. Horns (review emergency signals)
8. VHF (review stations)

9. Harness, Tether, Jacklines

Pohono:

1. History of the ULDB; George Olson, Bill Lee, Ron Moore, Carl Schumacher and the Birth of Fast in the backyards of Santa Cruz.
2. What she was built to do and how she was built.
3. Why a ULDB is rigged and sailed differently than previous iterations of ocean racing boats. Discuss very swift changes in apparent winds as boat accelerates.
4. Identify movable ballast and talk about the value in adjusting the boats trim in varying conditions.

VI. Electronics:

1. **Chart Plotter/ AIS (Automatic Identification System):** Explain how to scroll around and read all information of other vessels such as cog, sog, cargo, destination, cpa, tcpa
2. **Depth:** talk about navigating with depth and how shallow Alamitos Bay is.
3. **Computer:** Introduce SCCOOS net, SailFlow, NOAA web sites. Examine each and look at forecast discussion. Discuss the importance of multiple recent grib and how they interface with programs like expedition. Describe managing sweet spot and wind angles in long distance races. Describe interfacing computer with Ham radio and or Satphone.

VII. Sail Wardrobe:

1. **Inventory:** sails aboard Pohono. Discuss different technologies in sailmaking like battens, Dacron, Kevlar, Carbon Fiber and what applications are appropriate for which sail shapes and materials. What destroys sails?
2. **“Gears”:** Which sails function best in which wind conditions? Possible pairing of sails.
3. **Parts of the sail:** Head, tack, clew, leech, luff, foot, cringle, reef points
4. **Sail Shape:** review up and downwind sail trim for light, medium, and heavy air with the dry erase board. Apparent vs. true wind (always watch the chicken).

VIII. Running Rigging:

1. **Halyards**
2. **Sheets**
3. **Traveler**
4. **Out haul**
5. **Cunningham**
6. **Jiffy Reefing**
7. **Roller furling**
8. **Tack line**
9. **Adjustable sheet cars**
10. **Running backs**
11. **Winches:** Discuss cross sheeting, how to thread sheets safely, and safe easing under load.

IX. Standing Rigging:

1. **Identify and name:** Shrouds (lowers, intermediate, and uppers), Head stay, Back stay, Baby stay, Running backs, and boomvang.
2. **Materials:** Rod Rigging, Wire rigging, Composite (spectra, dyneema, dynadux)
3. **Hydraulics:** Explain adjustable backstay, boom vang, babystay. Keep loads under 1800 pounds. How is the boat constructed to handle loads on the rig? You cannot put hydraulics on any boat.

All students put on harness and take a tether

- X. Raising and Dousing Sails:
 - A. Set up sheets and lay out headsails. Explain foil, prefeeder, and running rigging inside or outside shrouds.
 - B. Assign positions: two foredeck, one halyard, one driver.
 - C. Verbally rehearse raising and dousing.
 - D. Leave the dock and practice raising, dousing and flaking the #2 E. Raise sail appropriate for conditions.
- XI. Go Sailing to weather:
 - A. **Up wind sailing tactics:** tacking, trim, vmg, reading the water, looking at wind patterns to know where to be (for example the wind in San Pedro channel usually goes farther North has you get farther from land.)
 2. **Reefing:** tuck in and shake out reef until everyone has done it. Discuss at which wind amplitudes first, second and third reefs are used.
 3. **Navigate:** Use all the information at hand (computer, vhf, gps, AIS, and visual observation to decide on a destination and have students set up a rhumb line and navigate to destination.

Day 2 Performance Boat Class

- I. Prepare to go to sea:
 1. **Review multiple weather resources:** As group decide on the appropriate sail configuration and lay out a rough outline by which to navigate based on wind predictions, visibility, and ship traffic.
 2. **Asymmetrical spinnaker:** Lay box on deck, identify tack, clew and head. Locate tack line, lay sheets out correctly. Describe positions for raising and dousing. Go over in detail raising and dousing spinnaker. Describe in detail jibing and trim.
 3. **Stow:** Stow all gear and prepare the vessel for sea.
- II. Downwind sailing:
 1. **Set up good angle on the wind:** Sail the boat into position to get the best angle on the wind.
 2. **Raise and douse spinnaker:** Raise and douse the spinnaker until everyone has tried every position and the crew is confident they can do it with more breeze.
 3. **Jibe:** Practice jibing until it is smooth.
 4. **Sail home:** Practice all downwind tactics such as; surfing, heating up, releasing vang, jibing and sail changes.
- III. Put the boat away:

1. flake sails
2. coil lines
3. stow sheets and sails
4. put all covers on (except main)

NAUT 002bx Performance Boat Sailing II

Day 1

- I. General Orientation (below): Stowing gear and supplies on an ocean racing sailboat considering:
 1. Extreme boat movement.
 2. Easy access at sea
 3. The order in which provisions may be consumed.
 4. Which gear will be continually wet and where to keep it so it dries and does not make life unpleasant.
 5. Where do sails go so boat is balanced and dry?
 6. Consider all gear movable ballast.
 7. Setting up your bunk so life is manageable.
- II. Amenities: How to use head and galley and electrical in order to monitor and conserve supplies (stove fuel, amp hours, water).
- III. Diagnosing Possible Problems:
 1. Locate and Review how to use all through hulls and plugs.
 2. What is in a toolbox and where is it.
 3. Look at hose clamps on plumbing and be sure all water tanks are secure and closed.
 4. Check oil
 5. Check transmission
 6. Check coolant
 7. Turn prop shaft and identify type of stuffing box (bellows on a dripless stuffing box may tear if the shaft is not turned by hand before putting gear. 34

USC Nautical Science 2015 Proposal

- IV. Set Boat Up, for an up wind and downwind course.
 1. Listen to weather, look at sail flow, SCCOOS, and small-scale weather chart for the Pacific
 2. Pick appropriate sail wardrobe
 3. Set up all headsails and running rigging so that sails may be hoisted and doused without a wrap. Discuss the different ways to lay out sails and rigging until everyone clearly understands the premise and can problem solve the lay out themselves.
 4. Discuss sails, sail fabric and maintenance.
- V. Sail Upwind and Downwind legs:
 1. Upwind work on: draft, twist, block placement, halyard and Cunningham adjustment, and driving fast.
 2. Downwind work on setting an asymmetrical spinnaker, trimming, driving, surfing, jibing and dousing.
- VI. Putting the Boat away:

1. Cleaning and drying sails and running rigging.
2. Proper stowing of sails and running rigging.
3. Cleaning and inspection of the boat.

Day 2

- I. Set Up Boat:
- II. Upwind Tactics:
 1. Long tacks vs. short tacks (time the same course doing both)
 2. Judging when to tack (have one crew play tactician and call tacks)
 3. Reading the water to locate the fastest path to destination.
- III. Downwind Tactics:
 - A. Jibes vs. sailing DDW (time both and discuss merits of each)
 - B. Sailing hot vs. Deep (time and discuss)
 - C. Short jibe vs. long (time and discuss)
 - D. Reading water to get the most out of the boat in the current conditions.
- IV. Put Boat Away

NAUT 002ax/bx Skipper Marine Diesel Engine Orientation (8 hours of lab and one hour video) (Course Objective: General servicing and emergency at sea repairs of marine diesel; this segment of nautical science offers a "hands on" instruction at a local marine diesel shop.)

- I. Introduction
 1. Basic components
 2. Engine performance; terminology
 3. Cycle operation (2 cycle/4 cycle)
- II. Structural working and design within the engine
 1. Combustion chambers-cylinder head design
 2. Valve-cam shaft design, function
 3. Cylinder block design
 4. Connecting rod design
 5. Piston and rings
 6. Engine lubrication systems
 7. Crankshaft and flywheel
 8. Gear train--transmission
 9. Bearings (babbit, ball, needle, roller, bronze)
- III. Engine Systems
 - A. Air intake system
 1. Turbo

35

2. Centrifugal
3. Roots
2. Exhaust system; wet-dry
3. Cooling systems
 1. Pumps
 2. Heat exchangers
 3. Keel cooling
 4. Air cooled
4. Fuel injection systems
 1. Injector types
 2. Pumps
 3. Governors
5. Electrical systems
 1. Theory

2. Circuits
 3. Gauges
 4. Test instruments
 5. Batteries
 6. Starters
 7. Alternators
- IV. Standard
- A. Filters (oil, fuel, air)
 - B. Zinc pencils
 - C. Clean water, fuel, oil, air
 - D. Batteries, etc.
- V. Trouble shooting
1. Recommended tools
 2. Test equipment