

NAUT 001bx: Deepwater Cruising Syllabus

revised 12/17

General Information

Nautical Science Level 2 – 2 Academic Units

Prerequisite required: NAUT 001A or equivalent knowledge

Instructor: Capt. Lars P. Harding

Office: PED 104@ 5:00-5:45pm on Wed's or by appointment (562) 230-5277

Website: www.USC.edu/sppd/naut

Grading Policy: Nautical Science classes include class lectures, 8 hours Day/Night Sail, 2 weekends- 4 Days- 5 hrs. each aboard FJ Sloops, Crewing opportunities as available on Schooner "Atlantas" and Brigantines, 1 final review session and 1 final exam. Students must attend all practical activities, the practicals contribute to academic concepts taught in the classroom and will be tested on the final exam. The final exam covers Navigation and Seamanship at 50% each. The exam is administered during to the University's published final exam schedule.

Students must attend all practical events in order to receive "License Track Exponential Sea Time"

Vessels: 51' traditional Schooner "Atlantas", modern sloops; small 2- person FJ's, 115 Brigantine

Text: Videos: Charts:

The Annapolis Book of Seamanship, J. Rousmaniere Sailboat Navigation; Heavy Weather Sailing 1210TR Martha's Vineyard to Block Island, 18746 Catalina Channel (optional)

18751 Los Angeles Harbor (optional)

Meeting Periods: 15 meetings (21 classroom Hrs.)

Seamanship Theory

Course Syllabus

- I. Advanced hull nomenclature and design
 1. Basic kinds of hull design
 2. Hull measurement and tonnage
 3. Displacement and planing hulls
 4. Theoretical hull speed
 5. Various keel types
- II. Construction of a sailing vessel
Building a replica of a Class B Tallship: Bluenose Schooner Atlantas
- III. The Plimsoll line Displacement and freeboard
- IV. Hull stability
 - Center of gravity
 - Center of buoyancy
 - Righting arm
 - The Warship Vasa: A classic example of instability
- V. Sailing Vessel/Sails (review)
 - Types and parts of sails
 - Jib-headed and gaff-headed sails
 - Kinds of sail cuts: the art of the sailmaker
 - Extended sail plan: Cruising/Racing vessels
 - Angle of heel and exposed sail area
 - Furling sails

- IX The problem of being in irons: review; Cause and avoidance
 - How to escape irons in the tack selected
- X. Apparent and true wind: the relation of the wind to a moving vessel
 - Speed
 - Direction
- XI Tacking upwind and downwind
- XII Basic rigging types of sailing vessels and their seagoing characteristics
 - 1. Sloop
 - 2. Cutter
 - 3. Schooner
 - 4. Ketch
 - 5. Yawl
- XII Great sailing ships of the past
 - A. Coastal sailing schooners
 - B. Whalers of 9th Century New England
 - C. Clipper ships "The Wings of Speed"
 - D. German windjammers
 - E. Warships of the line
 - F. Sailing ships of today which return to the past
 - a) XIV Types of rigging
 - A. Square rigging
 - B. Fore and aft rigging
- XV Weather and lee helm
 - A. The basis of sail balance and reefing
 - B. Center of lateral resistance
 - C. Center of effort and its calculation
 - D. Vessel balance and seamanship
- XVI Sailing and heavy weather seamanship
 - A. The basis and structure of waves
 - B. "Heaving to" a sailing vessel
 - 1. Sloop "heave to"
 - 2. Yawl/ketch "heave to"
 - 3. Schooner "heave to"
 - C. Sea anchors and warps
 - D. Hulls in adverse seas
 - 4. Pitch pole
 - 5. Yaw
 - 6. Broach
- XVII Sail handling in heavy weather
- XVIII The tiller and the wheel: helmsman ship Advanced boat handling
 - A. Picking up the mooring
 - B. Dock lines and their definition
 - C. Docking under power and sail
 - D. Handling, heaving and securing dock lines
 - E. Assisting vessels in heavy seas with lines
- XX Man Overboard: Returning the vessel to the person
 - A. Retrieving the person aboard
 - B. Man overboard safety equipment

XXI Capsizing and what to do

XXII Rules of the road

- A. Power vessel rules of the road
- B. Sail vessel rules of the road
- C. When is a sailboat a powerboat?
- D. Relative bearings: collision at sea

XXIII Legal requirements: U.S. Coast Guard regulations

XXIV Ship safety equipment and damage control

XXV Anchoring

- A. Mooring usage in Catalina
- B. Winter Santa Ana season in Avalon: what to do and where to hide
- C. Anchoring techniques and considerations
- D. The use of range perspective and anchoring
- E. Raising a fouled anchor
- F. Types of anchors and their purposes

XXVI Marlinspike seamanship

- A. Knot tying
- B. Whipping
- C. Simple splices
- D. Types of line and their function and care

XXVII Rigging and fitting systems aboard

Marine Weather

- A. Basics of the Atmosphere
 - 1. History
 - 2. Composition
 - 3. Water vapor
 - 4. Carbon dioxide
 - 5. Greenhouse gasses
 - 6. Definition of weather
 - 7. Definition of climate
- B. Temperature and Heat Transfer
 - 1. Temperature scales
 - 2. Atmospheric energy balance
 - 3. Conduction
 - 4. Convection
 - 5. Radiation
 - 6. Controls of temperature
 - 7. Specific heat
- C. Phases of water in the Atmosphere
 - 1. Specific humidity
 - 2. Relative humidity
 - 3. Dew point temperature
 - 4. Measuring humidity at sea
 - 5. Fog types
 - 6. Cloud types
- D. Air Pressure and Wind
 - 1. Definition of air pressure
 - 2. Measuring air pressure
 - 3. Surface and upper-level pressure

4. Pressure gradient force
 5. Coriolis force
 6. Friction
 7. Buys Ballot's law
 8. Vertical motion
 9. Large-scale atmospheric motion
 10. Trade winds
 11. Westerlies
 12. Jet streams
 13. Wind-driven ocean currents
 14. El Niño/Southern Oscillation
 15. Sea breezes
 16. Santa Ana winds
- E. Fronts and Mid-Latitude Cyclones
1. Air masses
 2. Identification of fronts
 3. Cold front
 4. Squall line
 5. Warm front
 6. Occluded front
 7. Stages of mid-latitude cyclones
- F. Thunderstorms, Tornadoes, and Waterspouts
1. Air mass thunderstorms
 2. Lightning
 3. Multi-cell thunderstorm
 4. Supercell thunderstorm
 5. Tornado formation
 6. Tornadic waterspouts
 7. Non-tornadic waterspouts
- G. Tropical Weather and Hurricanes
1. Ingredients for severe tropical weather
 2. Hurricane requirements
 3. Hurricane structure
 4. Hurricane formation and dissipation
 5. Hurricane locations and seasons
 6. Devastating effects of hurricanes
 7. Notable storms
- H. Basic Weather Forecasting
1. Forecasting tools
 2. Forecasting methods
 3. Surface charts
 4. Upper-level data
 5. Computer models
- I. Waves, Tides, and Tsunamis
1. Ocean topography
 2. Astronomical tides
 3. Wave formation
 4. Tsunamis

Navigation Theory

- I Charts and nautical guides
 - A. What is a chart?
 - B. Antique navigational charts and instruments
 - C. Chart sources and navigational materials
 - D. Pilot charts, light lists and sailing directions
 - E. Chart catalogues
 - F. Scales as applied to charts
 - G. Types of chart projections
 - H. Soundings found on charts: feet and fathoms
 - I. Tides and currents

- II Chart interpretation and aids to navigation
 - A. Buoys and their significance
 - B. Lighthouses
 - 1. Historical lighthouses
 - 2. Light character, period and range
 - 3. Lighthouse symbolism and its interpretation
 - C. Lateral system: lights and markers in a channel
 - D. Range lights and range markers

- III Latitude and longitude determination
- IV Time theory
- V Measuring distance and the nautical mile in relation to latitude
- VI Tools of the navigational trade
- VII What is a knot?
 - A. Methods of determination of speed of a vessel
 - B. Speed, time and distance computations
- VIII The history of the riddle of longitude determination
- IX Charts and the magnetic compass
 - A. Variation--magnetic north and true north
 - B. Deviation--shipboard compass influences
- X. Use of the hand bearing compass and Pelorus
- XI Definition of position by bearing and distance
- XII Types of navigation—Definition:
 - A. Coastal piloting,
 - B. Dead reckoning,
 - C. Celestial Navigation,
 - D. Electronic navigation
 - 1. Sonar
 - 2. GPS
 - 3. Radar
 - 4. AIS
 - 5. VHF

- XIII Beam bearings
- XIV Current and drift problems
- XV Advancing L.O.P.'s and running fixes
- XVI Correcting compass error: deviation and variation
- XVII Low visibility navigation

Practical Operations Aboard: 8Hr. Day/Night Navigation Practical

1. Initial dockside 3 bearing fix
2. Overall voyage plan/assignment of duties: navigation and deck watches
3. Discussion of rules of the road and rights of way: power and sail; day shapes, traffic lane determination; definition of relative bearings/collision course
4. Use of Coast pilot and Light Lists discussed and demonstrated
5. Nominal ranges of relevant local lights determined from visibility broadcast of marine weather;
discussion of nominal and geographic range of lights
6. Underway/seamanship: brief deck orientation with backstay function and reefing demonstration
7. Coastwise day navigation (4 hours); coastwise night navigation (4 hours)
8. Applied running fixes and turn bearings
9. Statement of position demonstration by bearing/distance (use of radar and GPS)
10. Statement of position every hour by latitude and longitude; by bearing/distance (use of the stadimeter)
11. Utilization of relative bearings to determine collision course both day and night
12. Buoy markers entering harbor from seaward
13. Required shipboard lights for night operation: sail and power
14. Ships operation at night/navigation at night/identification of night navigation aids
15. Sailing/navigating of sailing vessel on weather course
16. Right of way determined by shipboard lights at night
17. D.R. navigation run by ships log and compass only; through harbor transit under power
18. Demonstration and use of AIS System

Small Boat-FJ Instruction:

Sail Only Lesson Plan (2 weekends- 4 Meetings @ 5 hours each.

To reinforce skills demonstrated on the larger vessels, students will sail small boats without engines. Five lessons of four hours or four lessons at five hours each will cover the following material:

- A. Day 1
 1. Pre-Class
 2. Lifejackets out
 3. Registration
 4. daily routine
 - a. You
- B. Environmental awareness
- C. Dressing for sailing as a Sailor (SSR Ch. 1. pg. 8)
- D. Safety:
 1. Life Jackets
 2. Communication:
 - a. Verbal/non-verbal
 - b. Whistles, hand signals
- E. Wind Awareness "Outside Drill":
 1. Why do we need wind?
 2. Signs of wind and wind direction
 3. Cannot sail straight into the wind (No-Go Zone)

- F. Parts of a Sailboat:
 1. Parts of the hull: bow, stern, transom, port, starboard, keel, rudder, tiller, tiller extension
 2. Parts of the rig: Mast, boom, shrouds, spreaders, halyards
 3. Lines and sheets: Mainsheet, jibsheet, boomvang, traveler
- G. Rigging the Boat:
 1. Taking off covers
 2. Rigging the mainsail
 3. Rigging the jib
- E. First Sail (SSR Ch. 7, pg. 34)
 - A. Boarding the boat
 - B. Crew positions
 - C. Steering with the tiller
 - D. Starting/Stopping--Sail Trim
 - E. Tacking
 - F. De-rigging the Boat
 1. Tying the boat to the dock
 2. Folding sails
 3. Covers

Day 2

- A. Review
 1. First sail
 2. Wind awareness/Today's Weather
 3. Parts of a sailboat
 4. Rigging the boat
 5. Parts of the Sail "New" (SSR, pg. 28)
- B. Points of Sailing/Sailing Directions (SSR Ch. 8, pg. 42)
 1. No-go zone
 2. Close Hauled/Upwind/Beating
 3. Close Reach
 4. Beam Reach
 5. Broad Reach
 6. Running/Downwind
- C. Trimming Sails: Trim for all points of sailing
- D. Tacking/Reach to Reach (SSR pg. 41 and 50)
 1. Heading Up: Tiller Toward the Sail
 2. No-go zone: Switch Sides
 3. Tiller Straight: Off you go!
 4. Possible problems (SSR pg. 51)
- E. Jibing (SSR pg. 59)
 1. Heading Down: Tiller Away from the Sail
 2. Dead Down Wind: Switch Sides
 3. Possible Problems
- F. Docking (SSR Ch. 13, pg. 68)
 1. Glide Zone
 2. Coast to a stop
 3. Site specific docking techniques

- G. Sailing Plans
 - 1. Sailing Area
 - 2. Crosswind drills
 - a) Oval
 - b) Figure 8
 - c) 3)Free sailing

Day 3

- A. Review
 - 1. Wind/Today's Weather
 - 2. Parts of Sailboat/Sail
 - 3. Points of Sailing/Sailing Directions/Sail Trim
- B. Tacking & Jibing
- C. Upwind Sailing (SSR Ch. 9, pg 48)
 - 1. Taking upwind
 - 2. Key points (SSR pg. 53)
- D. Downwind Sailing (SSR Ch. 10, pg. 56)
 - 1. Points of Sailing/downwind
 - 2. Wing and Wind
 - 3. By the Lee/Accidental Jibes
- E. Sailing Plans
 - 1. Sailing Area
 - 2. Crosswind Drills (Review)
 - 3. Windward/Leeward Drill
 - 4. Free Sailing

Day 4

- A. Review:
 - 1. Wind/Today's Weather
 - 2. Parts of a Sailboat/Sail
 - 3. Points of Sailing/Sailing Directions/Sail Trim
 - 4. Tacking/Jibing
- B. Right of Way Rules:
 - 1. Avoiding Collisions
 - 2. Starboard vs. Port
 - 3. Leeward vs. Windward
 - 4. Overtaken vs. Overtaking
 - 5. Sailboats vs. powerboats
 - 6. Commercial vs. Pleasure
 - 7. Taking vs. On a Tack (room to tack exception)
- C. Knots:
 - 1. Figure 8
 - 2. Bowline
 - 3. 2 Half Hitches
 - 4. Clove Hitch
 - 5. Cleat Hitch

- D. Sailing Plans
 - 1. Sailing Area
 - 2. Crosswind Drills (Review)
- E.
 - 1. Windward/Leeward Drill (Review)
 - 2. Free Sailing

Day 5

- A. Review
 - 1. Parts of sailboat/Sail
 - 2. Points of Sailing/Sailing Directions/Sail Trim
 - 3. Tacking/Jibing
 - 4. Right of Way Rules
 - 5. Weather: Sources of Information, Warnings: Small Craft Warnings, High and Low Pressure, Fronts, Sea Breeze,
- B. Overboard Recovery (SSR Ch. 12, pg. 66)
 - 1. Three methods:
 - a) Quick Turn Method (tack around)
 - b) Jibing Method (jibe around)
 - c) Heave-To Method (tack around/back jib)
 - d) Retrieval over the transom
- C. Sailing Plans
 - 1. Sailing Area
 - 2. Windward/Leeward Drill (review)
 - 3. Free Sailing
 - 4. Written Exam