Missionary Sailing School

This will be a long and somewhat tedious lesson because I will be requesting you to do considerable reading and careful watching of videos (preferably more than once) to fully 'ingest' some of the most important materials you will learn in this series. It will save your life! Be diligent.

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Enjoy this **video** of a European crew making an Atlantic crossing to the Caribbean, observing the various instruments available to the modern cruiser:
http://www.youtube.com/watch?v=UE4mPfwtD1c&feature=related

Lesson 12: Offshore Navigation

So far we have discussed handling your boat in the relative security of 'land-in-sight' waters, with 'road signs' [buoys and markers] and plenty of other boaters to ask for directions. But what about when your destination is somewhere over the horizon into 'uncharted waters' where another boat may not be seen for days? Your personal skill as a navigator will be the difference between a safe, successful passage and the loss of ship or life [always a possibility]. This is a sobering but necessary statement: it is far safer on the oceans in a well-founded boat than it is driving America's highways, but you can still make some very dangerous mistakes! You need to do all you can to learn, and apply with common sense, the navigational skills that have been tried and proven.

There are many 'tools' available to sailors to make that task more precise and easier. But what happens when the 'lights go out'? [power is lost or the ship's electronics fail]

Every offshore sailor needs to use traditional navigation alongside any modern 'nav' devices, both as a back-up and as a reassuring confirmation that things are going as gauges indicate. For this reason I will be giving just a brief overview of the 'electronics' [with some suggestions of my own.] Then we will move on to the 'old sailor ways.'

1. Primary Gear (the 'should haves')

• **VHF ship's radio** – This will be a necessity, though it's range is limited to line-of-sight [i.e. antennae at the top of your mast to the other sailboat's mast will be about 20-25 miles, less for smaller vessels. The Coast Guard, with their towered antennaes, can 'read' you from quite a greater distance.] For truly long range communication you should add a marine Single-Sideband [SSB] radio. It can be a rather large investment but an invaluable help when there is a medical or other emergency. Also, it is helpful to have a second, handheld VHF for ship-to-shore communication [between crew onshore and those still aboard] but also in the unfortunate circumstance that the ship has to be 'abandoned!'

• **GPS** – You should have a marine model with its needed navigational features. Best if it is a mounted unit, running off the ship's 12v power. You want one with the largest display having bright night-time visibility. A handheld, battery operated unit should also be on board for times when you need to 'explore' an unfamiliar channel or harbor in the dinghy in preparation for bringing 'the mother ship' in. And one will certainly assist if you have to 'finish your journey' in the liferaft [Lord willing that day never comes!] A word of caution: there are now GPS units that come with digital charts, but do not depend on these for navigating, especially in the shoal waters of the Caribbean. Those who use these tend to fail to have also reliable paper charts and find themselves completely lost when the GPS unit fails. Also, I have several times had to help 'rescue' a boat run aground that was following the 'suggested route' of their GPS because something was amiss in the 'program'.

• **Depth sounder** – These are a very necessary help, though a weighted line [called a ***leadline***] with knots tied in intervals will do. I always suggest the 'fishfinder' variety – one that will give a graphic description of the bottom as well as the depth. It aids greatly when selecting a spot to anchor late in the day when the light is not good enough to 'read' the bottom [whether coral heads or uneven bottom is present] When buying, compare the display images and get one that seems to provide the greatest, most natural detail [they also have units with a broader 'cone' of visibility, even some that 'look ahead' of the vessel to see what's coming.] Remember: most units will be displaying the bottom which you have just passed over – don't count on it to warn you of danger ahead!! But having a graphic display will let you see slopes and obstructions on the bottom, sort of a 'heads up' of what may be next.

2. Other Gear (also nice to have)

• **Autopilot/autohelm** – A special help for relieving the helmsman, autopilots use a fluxgate [electronic] compass and adjusts the wheel [or tiller] to keep the vessel on course [usually with a motor driven belt around the helm.] For a long voyage this can be invaluable, but also in times when all hands are needed for some chore but the vessel needs to maintain its heading. There is also a ***windvane*** type which requires no electrical consumption. It mounts on the transom and corrects the heading to compensate for slight shifts or changes in the wind.

• **Radar** –Expensive but useful in three ways: [1] to identify the bearing, speed and direction of other craft and whether they might present a problem for you [great help at night] ; [2] to locate buoys, inlets, and shoreline features in inclement conditions [heavy rain, fog, etc. – many buoys have ***radar reflectors*** on them and will appear on your screen] [3] and for 'early warning' of approaching thunderstorms and other severe weather [again, very helpful at night!]

• **Electronic weather instruments** – Knowing at a glance wind speed and direction can be a great help [though, for me, the handles off a plastic grocery bag tied to each outer stay has been enough for trimming sail to changes in the wind. I also have a wind vane on the masthead, but that requires too much looking up, not to mention the occasional seagull who breaks it while perching himself.] A ***barometer*** [when regularly observed] will be your most important weather 'instrument' [as we will discuss in our next lesson.] This is a must have – the rest are 'toys'.

Before becoming too 'dependent' on your GPS [as some sailors do, remaining transfixed on its screen instead of the horizon] take to heart the advice of these two articles:

• http://www.susanscott.net/OceanWatch2009/jun-29-09.html

• http://www.sailingmates.com/yourGPScankillyou.htm
[This one gets a little technical but consider carefully the last part titled, "What Are The Lessons?"]

3. Eyeball Navigation (when charts aren't available)

Long before the compass, and certainly before the GPS, mariners made their way to distant places relying on their senses - and a whole lot of common sense. We are going to begin our discussion on offshore navigation with "what to do when charts and other tools are not available."

•Read first this **article**:
http://www.boats.com/boat-content/2010/04/eyeball-navigation-the-heart-of-the-art/

• Then re-join our European crew as they arrive in the tropical waters of the Bahamas in this **video**:
http://www.youtube.com/watch?v=_4lBbEbQdto&feature=related

The **depth of the water**, and any possible obstructions lurking beneath its surface, are probably the mariners chief of all concerns [other than, perhaps, "what's the weather going to do next?" – but that's Lesson 13] Fortunately, in tropical waters, the color of the water can tell you a lot about its depth and bottom characteristics. The following clever saying puts it all together:

"Brown, brown - you'll run aground; white, white - you might;
green, green - nice and clean; blue, blue - go on through"

Let's see how this applies to these photos of the Bahamas

This satellite photo of the Bahamas (with Cuba at the bottom and Florida on the left) shows the distinctive difference in color of the deep-blue ocean and the light turquoise of the shallow 'banks'. While ocean cruising, any changes in water color should be noted. However, a cloudy day will yield completely different color spectrums than sunny ones. And don't forget the video you watched – cloud shadows on the water can cause unnecessary worry.

Make a habit of looking up to see if a cloud is causing that dark patch up ahead (as in the case of these boats at anchor.) Believe me, you could burn up a lot of sailing distance trying to 'dodge' all those 'reefs' [as I did on my first trip into the Bahamas!!]

This sailboat, anchored in shallow water, does have a reef nearby [very dark area in upper left] as well as shallow, sandbottomed water off it's stern. The captain wisely lowered his anchor here, though, instead of on that grassy patch between him and the reef [not as dark].

The photo below shows how the water suddenly shallows when heading towards shore from deep water [the lower right corner.] There is a barrier reef of coral formations [greenish-brown], some of it quite shallow, possibly exposed at low tide [see brown patches along right edge of photo.] A vessel approaching this shore must use extreme caution – openings may exist but do not appear in this photo.

When viewed from shore these reefs will likely be breaking [see white caps], but are not so easy to spot from seaward. Best to approach from an angle, paying close attention to the behavior of the waves ahead for any sudden change in their pattern. And listen - waves make noise!

Notice that in early morning or late day sun it is almost impossible to discern water color. Plan your journey to arrive early and be sure to have the sun high and over your shoulder before sailing into un-familiar waters where dangers might exist.

This yacht needs only to follow the natural channel of light green [over a sandy bottom] between the grass [dark, on the left] and the coral bar [brown, to the right.] But always keep a watch on the depth finder 'just in case.'

Navigating around tropical islands can be a relatively easy task provided that you have good light and the right pair of shades [polarized, but especially brown lenses for best color definition!] Can you distinquish the east-west, deep-water channel that passes through these islands? [hint: look for the dark blue line just beyond the second island]

Just keep in mind the following sound advice:

- Where waves are breaking the bottom is shallowing – use caution and head for deeper water.
- If you are uncertain of what is ahead don't hesitate to turn back, regroup, and reconsider. Follow this rule: When in doubt, stay out!
- It is better to stay at sea 'til morning (tacking back and forth if necessary) than to chance entering a risky harbor or channel at night!
- Don't fail to call for "local knowledge" on the radio – other boaters and natives on shore will be more than happy to help.
- Carry a long pole [pvc pipe works well] marked at 1 or 2 foot intervals with which you can 'sound' the depth as you carefully work your way into unknown waters (great help for getting anchored after dark or navigating the brown-water rivers of Central America.)
- If you are approaching an uncharted island, remember that the shore to windward (facing the prevailing winds such as the Trade Winds) will be generally steep and reef strewn – inhospitable. Try your approach on the leeward side where conditions may be more mild and inviting.

4. Charts and the tools to use with them

Let's begin with some fundamentals you need to know about charts before sailing over the horizon. Study carefully this **webpage**:

http://www.schoolofsailing.net/latitudeandlongitude.html

Take a break and enjoy this brief, somewhat amusing **video** about chart basics:

http://www.youtube.com/watch?v=96JFecZFIcA&feature=related

The video discussed the ***compass rose*** found on every nautical chart [often in more than one place.] It is an important tool for translating ***true north*** [the actual direction to the north pole - the 'north' represented on charts] into ***magnetic north*** [the 'north' that your compass points to - a direction that will vary depending on where you are positioned on the earth]. Sounds confusing? It did to the young sailors in the video. Try to sort it out with this **webpage**:

http://www.schoolofsailing.net/trueandmagnetic.html

So, with the **compass rose** for determining ***heading*** or ***bearing*** [the direction to or from a point on the chart, measured in degrees] and the **latitude/longitude** scales for locating ***position*** [measured in units of degrees and minutes] let's see how these are used in practical application in this **video:**

http://www.youtube.com/watch?v=BxSZQwF5sds&NR=1

For discussion and illustrations on how the two chart tools, ***parallel rulers*** and ***dividers***, are used consider these two **webpages:**

- **http://boatsafe.com/navigation/rules1.htm**
- **http://boatsafe.com/navigation/divide1.htm**

And finally, three short **videos** again showing these tools in action for plotting positions on charts:

- http://www.youtube.com/watch?v=bTtOtNZ3j30&feature=related
- http://www.youtube.com/watch?v=92PVB9W3wYU
- http://www.youtube.com/watch?v=SSYhbqxDUqc&feature=related

Take care when working with these tools to keep the part that should remain stationary in its place. If there is a chance something moved that shouldn't have – start over. Also, make a practice of marking your charts in pencil, which can be erased later [I slip my charts into a plastic sleeve and use erasable markers for temporary markings. One drawback, though, is that your route notations will not be there next time you come that way again. I do make permanent notes – especially **waypoints** – in blue ink and highlight any hazards or concerns in yellow or green directly onto the chart.]

One other tool you should have aboard is the ***hand-bearing compass*** to get the **bearing** on distant objects for finding your position on the chart [we will learn those skills in the next lesson] In the absence of this tool it is possible to 'sight over' the ship's compass [provided it is in an

adequate position to do so] but usually you will loose accuracy by at least 5 degrees or more. If it is in the budget, a quality pair of binoculars with built in compass will give you the best results.

5. Closing thoughts about the GPS

I mentioned the term ***waypoints*** a few lines back. These are the latitude/longitude co-ordinates for select positions on your chart. Generally they serve as 'destinations' along a given route or as the final destination itself. Using a GPS unit, you can enter these as your objectives and the unit will feed back to you distance and direction, making navigating to your goal so much easier.

But I must encourage you, however, to not put your whole confidence on anyone else's waypoints unless you know for certain that they have used those waypoints more than once to return to the same place. People make mistakes in how they record their waypoints and others have gotten into serious trouble because of it. Also, don't count entirely on making your own waypoints from nautical charts because the chart datum [lat. and long. as well as position of 'dangers' such as reefs, rocks, etc.] is not always accurate [most charts are actually based on soundings and surveys made up to a hundred years ago!] Always depend on your own eyesight and depthsounder, and a lot of common sense.

One other note about 'sailing by GPS': it can sometimes be confusing when the unit tells you that your 'progress' forward is a heading of a certain 'degree' but the compass is reading something different (sometimes a difference of many degrees.) First of all, the GPS can be setup to display information either in degrees 'True' or 'Magnetic' ['true', of course, will be different from your compass – the amount depending on your latitude north of the equator] I recommend that you keep the GPS displaying 'True' for better accuracy when working with your charts.

But also, the actual "course made good" ['CMG'] will be affected by currents and wind so that, whereas you may be facing 90^{o} [as in sailing to Bimini, Bahamas from Miami] your actual progress could be more like 60-70^{o} [especially on this journey where the powerful Gulf Stream will be pushing you northward.] More on adjusting for current in the next lesson. For now, trust the GPS display but be prepared with a 'back up plan' and remember the advice given earlier in the lesson: "When in doubt, stay out!!"

Parting video – with cold, wintry conditions this morning as I complete this lesson, thought you would enjoy this one:
http://www.youtube.com/watch?v=x3IbAIViui8&feature=related