DAVID WALTERS
YACHTS
YOUR CHOICE FOR BLUE WATER BOATS

WHAT TO EXPECT

NAVIGATION & ROUTING

By:
Sloan Burns
Erik Haaland

ANNAPOLIS - NEWPORT
2023

Sloan grew up on the water but did not discover sailing until after college. After his first regatta he was immediately hooked by the mental and physical challenge of the sport. He quickly found a passion for the challenge and adventure of offshore racing. Having an introduction to the sport later in life, he focused his studies on becoming a navigator. Sloan has since been on the podium finishing team for many offshore races including Annapolis to Newport, Newport to Bermuda, Marblehead to Halifax and the Miami to Havana. Sloan is a lead mechanical engineer in the Test and Evaluation Division of Naval Surface Warfare Center Dahlgren Division with expertise in structural dynamics, instrumentation, and data analysis. He brings is passion for data driven decision making and teamwork to his role as a navigator. Sloan will be competing in this year's Annapolis to Newport race aboard the Italia 14.98, Artemis. He has previously competed offshore with the Nanuq and Querencia sailing teams and lives in Richmond, Virginia.

Erik has been sailing and racing boats since a young age on the Hudson River in New York before moving to Annapolis at eight years old. He has raced J/70's through Melges' and Farr's to custom 60 footers, plus numerous offshore deliveries. A high passion for boating Erik worked for several years at West Marine as a store manager prior to becoming a yacht broker with David Walters Yachts. In recent years Erik has taken on the role as Sales Director for Italia Yachts in the Americas. Erik has competed in several major events as navigator including inaugural AYC 24 Hour Double-Handed also as co-skipper (1st Overall), 2021 SORC Wirth Munroe (1st Overall), 2021 A2N (3rd in Class), 2022 Chicago-Mackinac (1st in Section). In this years A2N Erik will be aboard 'Artemis', the newly delivered Italia 14.98. Erik is a member of AYC and lives in Annapolis and Fort Lauderdale.

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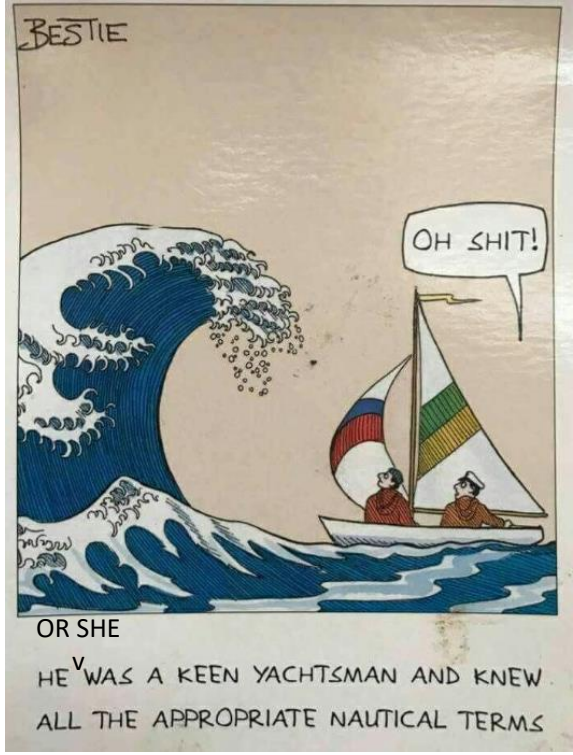
Outline

- Role of a Navigator
- Historical Analysis
- What to Expect for Each Leg
- What to Do When Things Go Wrong
- Technical Tips and Resources

Roles of the Navigator



- Keep the boat and crew safe and headed in the right direction.
- Have quick access to the data your crew needs to know:
  - Time on this board, shallows, mark bearing, etc.
  - Target BSP, TWA
  - Next sail or next maneuver
  - Distance, bearing, and time corrections of competitors
- Communicate your plan in language the crew, skipper, and tactician understand.
  - Sailing mode
  - Expected weather conditions
  - Define triggers/boundaries on when the plan needs to be reanalyzed
- Know the Sailing Instructions.
- Be realistic with the limitations of yourself, the boat, and the crew.
- Apply risk management.

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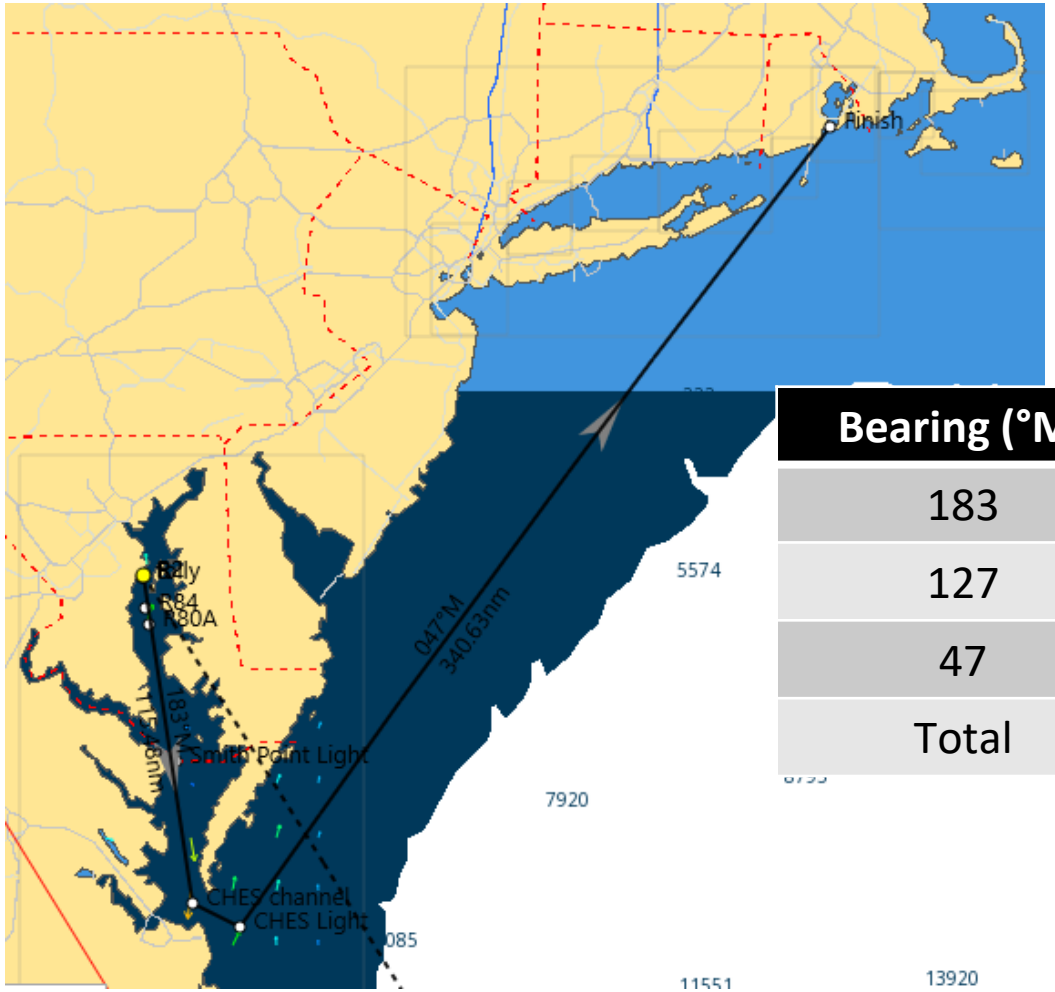
Overview of the Race

- Down the Bay
  - Geographic Shifts
  - Tide
  - Seabreeze
  - Vessel Traffic
  - Fish Traps/ Pound Nets
  - Storms
- Atlantic Offshore
  - Limited Data
  - Current and Weather
  - Coastal Effects
  - Vessel Traffic
- Final Approach
  - Block Island and the Windmills
  - Long Island Sound Tides
  - Decision Point
  - Fog
  - Vessel Traffic
- Finish
  - 200 yards off the rocks
  - Tired crew



Bearing (°M)	Distance (nm)
183	116
127	19
47	341
Total	476

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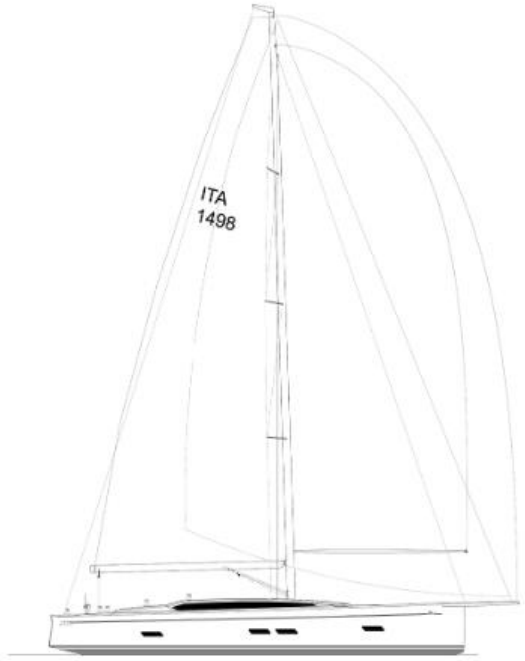
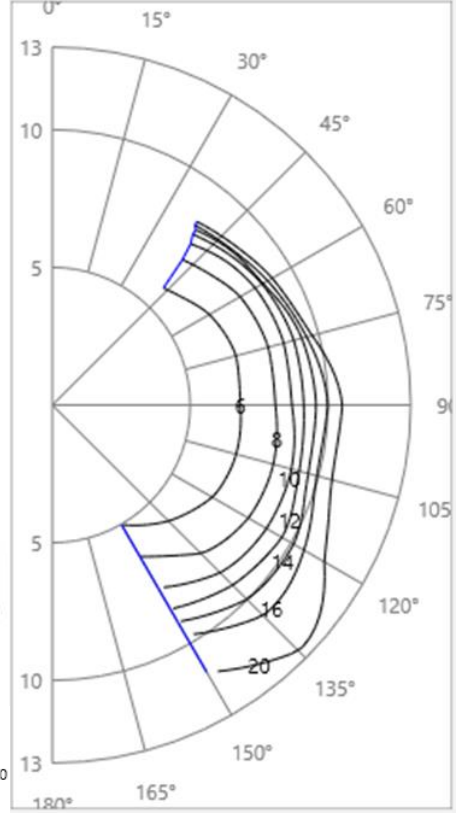
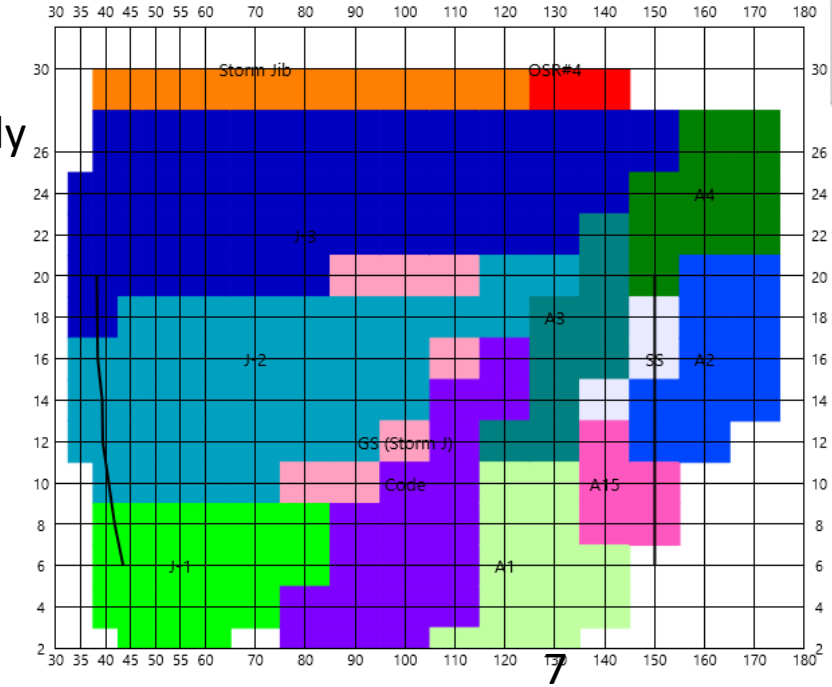
Historical Re-analysis Routing

- European Center for Medium-Range Weather Forecasts (ECMWF) provides “Reanalysis” weather back to 1940. Reanalysis combines model data with observations from across the world into a globally complete and consistent dataset using the laws of physics.
- Utility:
  - Provision planning
  - Estimate sail usage or design specialty sails
  - Identify optimal route variances for further study
  - Develop practice day regimes
- Cautions:
  - 30km grid does not capture localized effects (wind shadows/geographic shifts)
  - Only historical tidal stream data is available
  - It’s all just statistics; every race is different
  - This analysis is based on one boat







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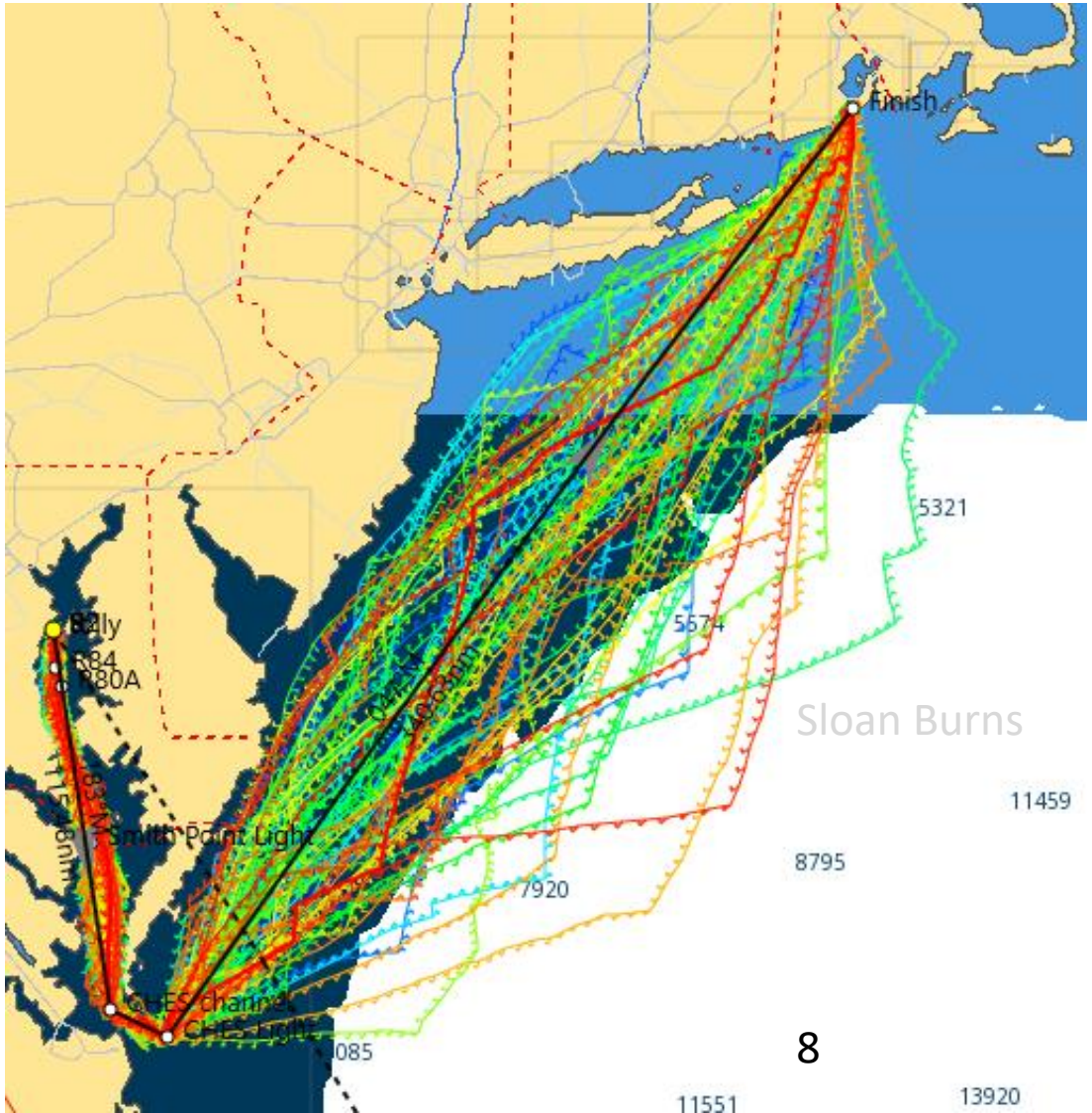
Re-analysis Results

- Distance Sailed:
  - Mean = 516nm
  - Min = 488nm
  - Max = 571nm

IY14.98 Optimal Routing
June 3 1100 Start, 1940-2022



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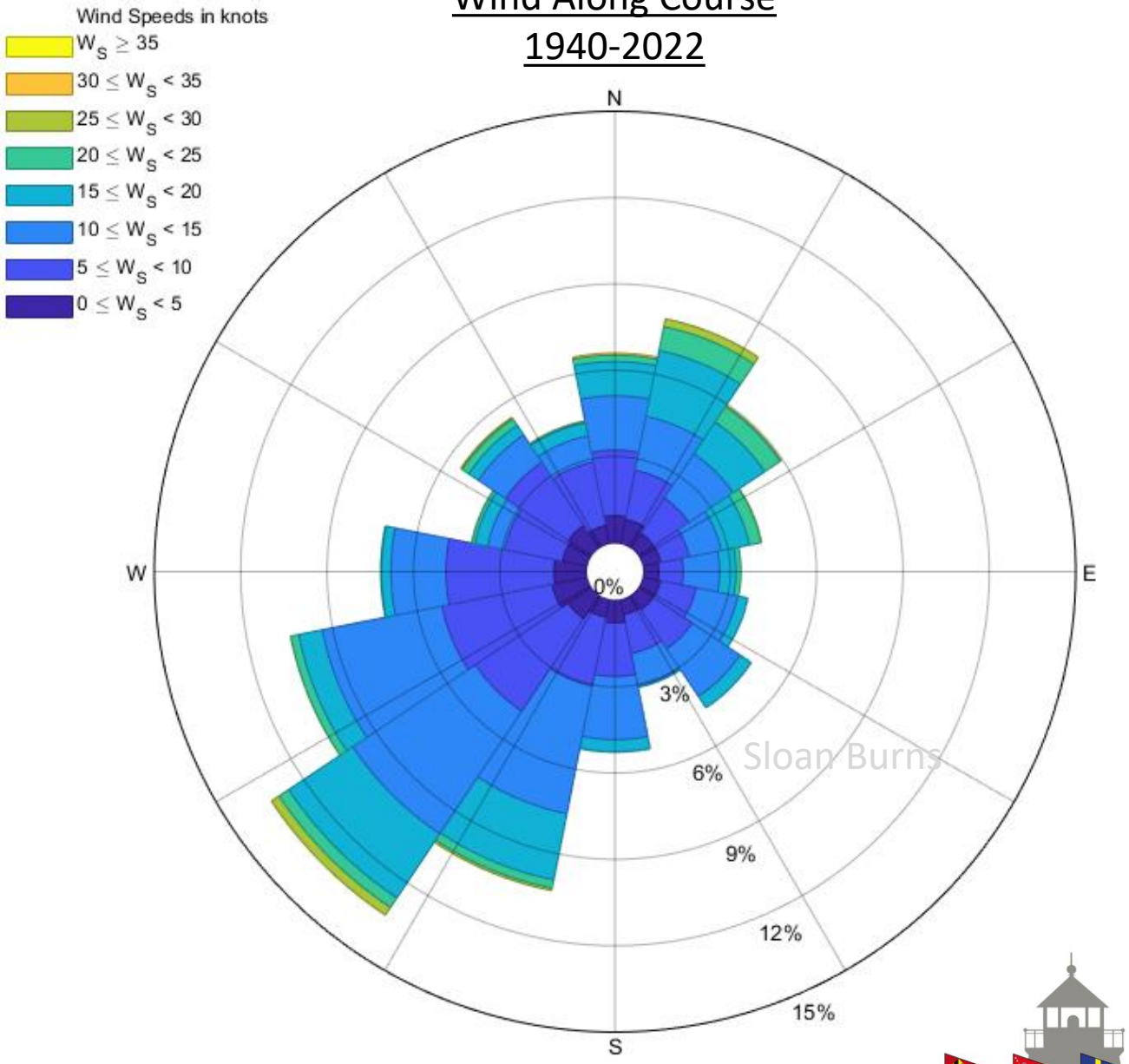
Re-analysis Results

- Predominant Wind:
  - SW 5-15knot prevailing winds
  - Transitioning from spring to summer patterns
  - When NE wind, 10-20knot



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Re-analysis Results

Heat Map: Hours of TWA and TWS combinations during Nominal 63 Hours Race

tws\twa	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105	110	115	120	125	130	135	140	145	150	155	160	165	170	175	180
30	0	0	0.0033	0	0	0	0	0	0	0	0	0.0033	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	0	0.0067	0.0133	0	0	0	0	0	0	0	0	0	0.0033	0.0067	0	0	0	0	0	0	0	0	0	0	0.0067	0	0	0	0	0	0
26	0	0.0533	0.09	0.0433	0.0033	0	0	0	0	0	0	0	0	0	0.01	0.0167	0	0	0	0	0	0	0.0567	0.07	0.1133	0	0	0	0	0	0
24	0	0.0481	0.17	0.12	0.0067	0	0	0	0.0533	0	0	0	0	0	0	0.01	0.0433	0.0033	0.0033	0	0	0	0.09	0.0933	0.0967	0	0	0	0	0	0
22	0	0.0923	0.2753	0.1657	0.0416	0.0067	0	0.01	0.02	0.0033	0	0	0	0	0	0	0.005	0.005	0.0067	0.0067	0	0.0067	0.1467	0.1267	0.0534	0	0	0	0	0	0
20	0	0.3448	0.3358	0.1449	0.055	0.0411	0.0433	0.0267	0.0333	0.01	0.01	0.01	0	0.0349	0.0767	0.0315	0.0167	0.0167	0.0267	0.0367	0	0.04	0.1589	0.2123	0.1133	0.0333	0	0	0	0	0
18	0.0731	0.6658	0.417	0.2372	0.12	0.1071	0.0848	0.04	0.0504	0.0367	0.0273	0.0167	0.0182	0.0616	0.1256	0.0521	0.0167	0.0267	0.04	0.0724	0.0716	0.1961	0.2233	0.19	0.2876	0.2067	0.0834	0.0935	0.0233	0	0
16	0	0.5016	0.649	0.3115	0.1554	0.0967	0.0746	0.0787	0.0933	0.0911	0.0767	0.1092	0.0333	0.0433	0.093	0.0531	0.0239	0.1214	0.0614	0.1012	0.1433	0.1836	0.2267	0.41	0.5922	0.3291	0.16	0.1629	0.0945	0.0133	0
14	0	0.5473	0.7763	0.378	0.2576	0.1267	0.06	0.1462	0.1033	0.1033	0.1115	0.2159	0.1115	0.0933	0.0333	0.0548	0.0965	0.0833	0.1838	0.1531	0.3302	0.359	0.4626	0.6079	0.9167	0.357	0.3746	0.1517	0.0228	0	0
12	0	0.4822	0.9568	0.6567	0.3624	0.1943	0.1015	0.26	0.2667	0.2188	0.3021	0.2318	0.1964	0.1058	0.0727	0.1729	0.1688	0.2179	0.2485	0.3351	0.4666	0.334	0.6226	1.1254	1.0508	0.136	0	0	0	0	0
10	0	0.4008	1.1519	0.7422	0.3443	0.2701	0.1933	0.2383	0.2173	0.1206	0.2196	0.0935	0.1072	0.2017	0.1521	0.2367	0.24	0.1959	0.3354	0.3792	0.4432	0.48	0.4899	0.9102	0.7151	0.0555	0.02	0	0	0	0
8	0	0.1314	0.9055	0.9142	0.599	0.4644	0.4054	0.2258	0.314	0.2583	0.1496	0.1904	0.1512	0.2408	0.2226	0.2573	0.3316	0.2227	0.3724	0.4999	0.6473	0.9823	0.8843	0.1254	0.0108	0	0	0	0	0	0
6	0	0	0.1461	1.1817	0.6727	0.4477	0.4504	0.3023	0.363	0.1751	0.1387	0.1707	0.1737	0.2	0.1963	0.21	0.2329	0.2564	0.4039	0.2833	0.3154	0.4313	0.4495	0.105	0	0	0	0	0	0	0
4	0	0	0	0.8785	0.4962	0.3571	0.2779	0.1524	0.1951	0.1561	0.1267	0.0567	0.0694	0.1163	0.1688	0.1542	0.1701	0.2127	0.2184	0.2355	0.2788	0.6877	0.0612	0	0	0	0	0	0	0	0
2	0	0	0	0.4259	0.1602	0.1189	0.1761	0.0861	0.0994	0.0561	0.0928	0.03	0.0376	0.04	0.0867	0.07	0.0833	0.0988	0.1427	0.1055	0.1655	0.5261	0	0	0	0	0	0	0	0	0

Redlines indicate VMG Targets

Orange circles show high probability “hot spots”

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Re-analysis Results

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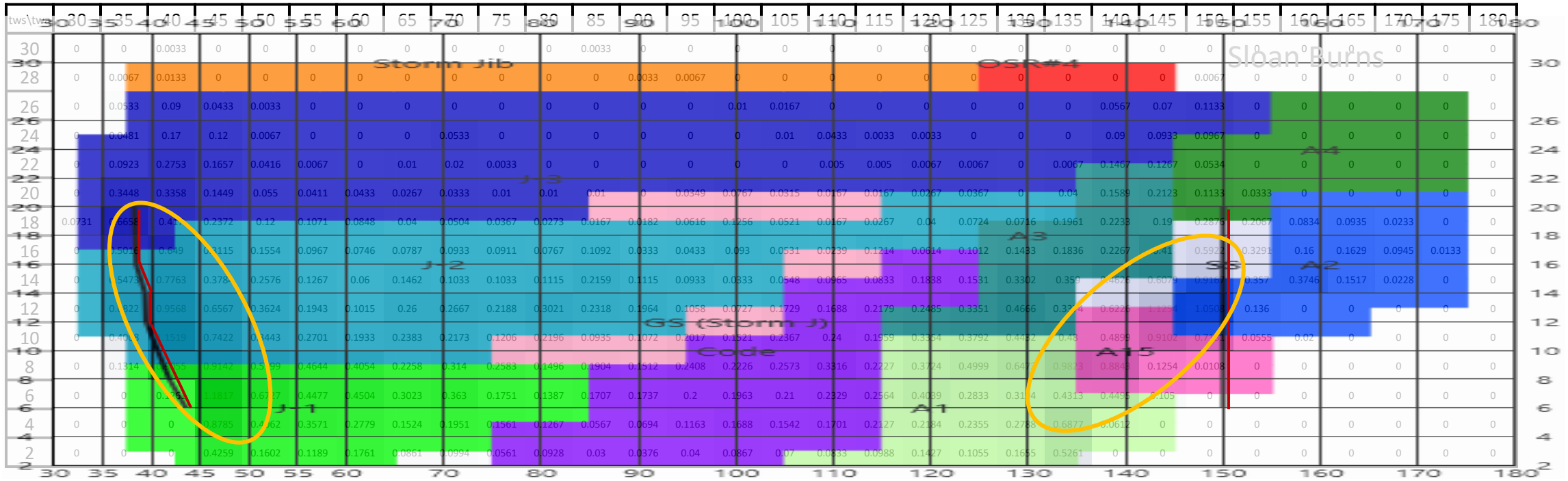

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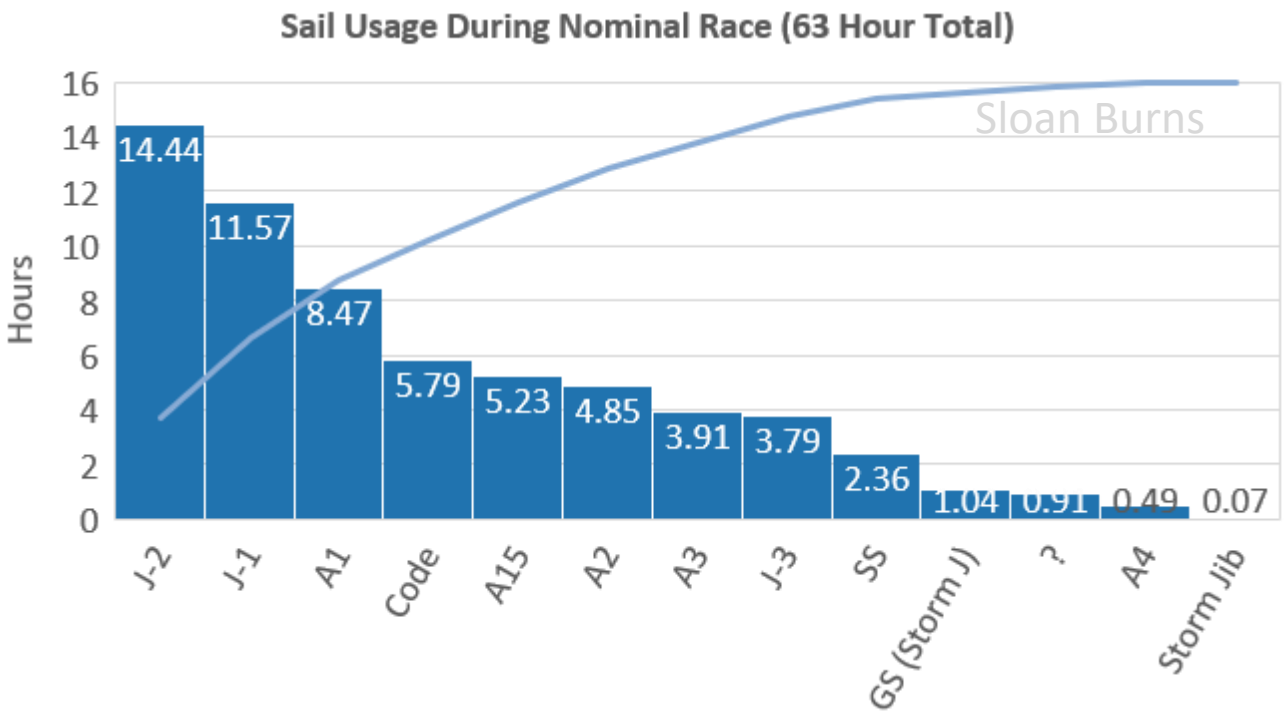

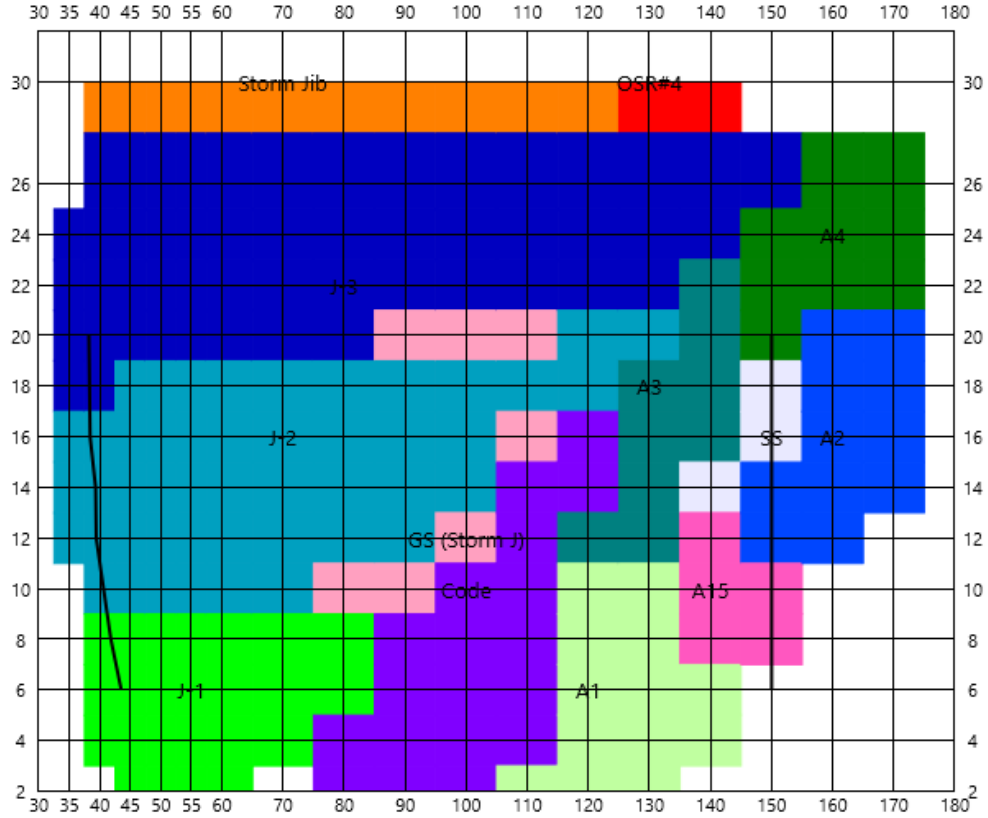

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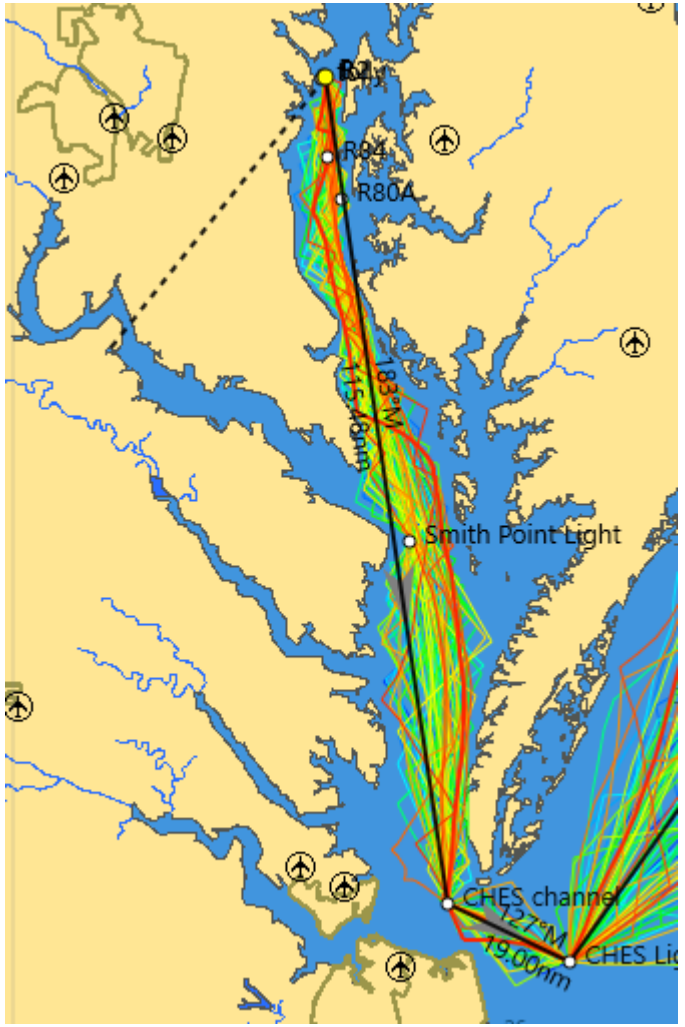
IY14.98 Optimal Routing
June 3 1100 Start, 1940-2022



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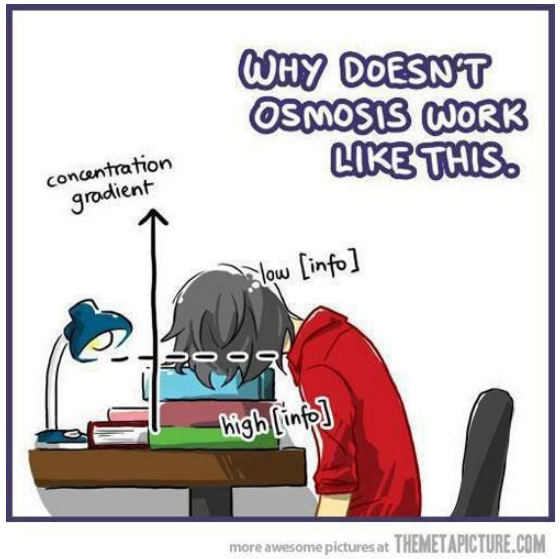

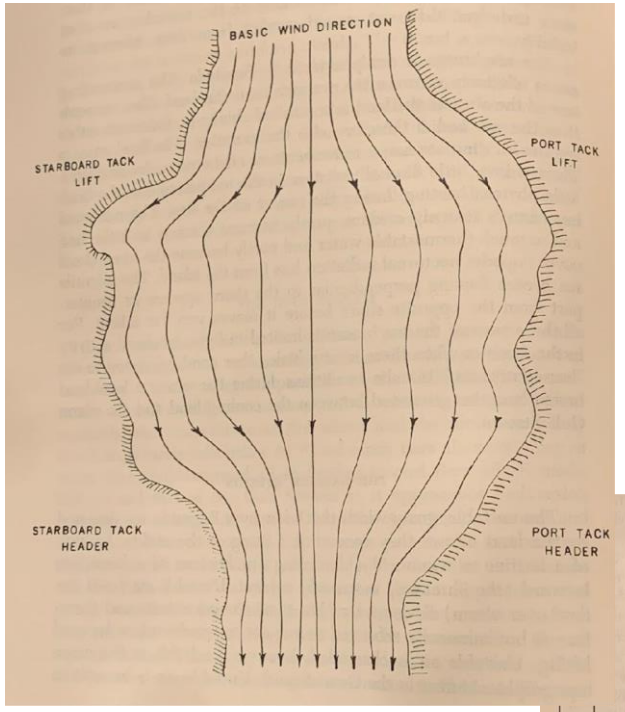

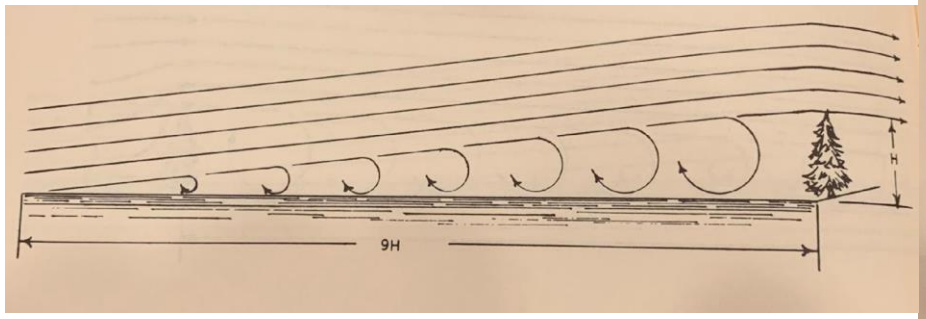

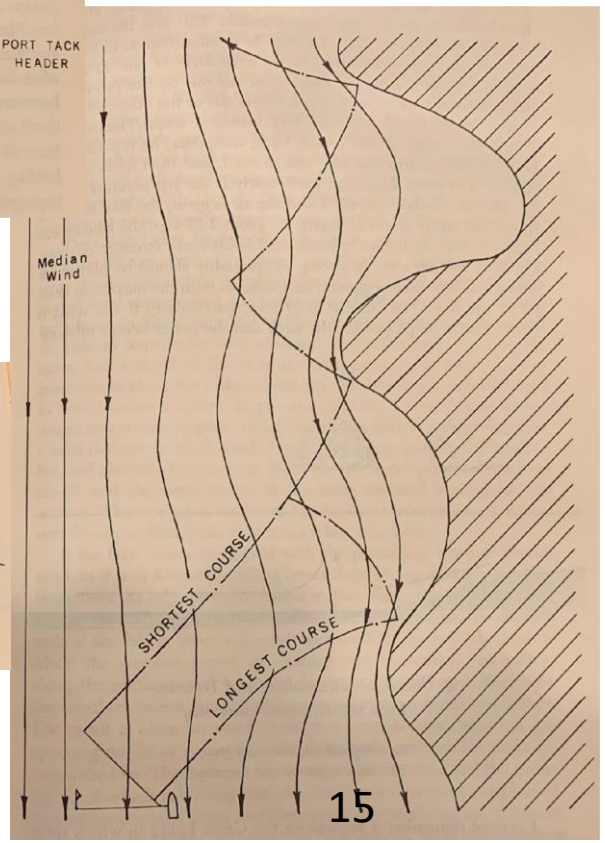

Leeward barrier begin to lift wind at 9 times the height of the barrier. Windward barriers may disturb wind up to 30 times the height of the barrier. – Wind and Strategy by Stuart Walker

Down the Bay

- Geographic Shifts
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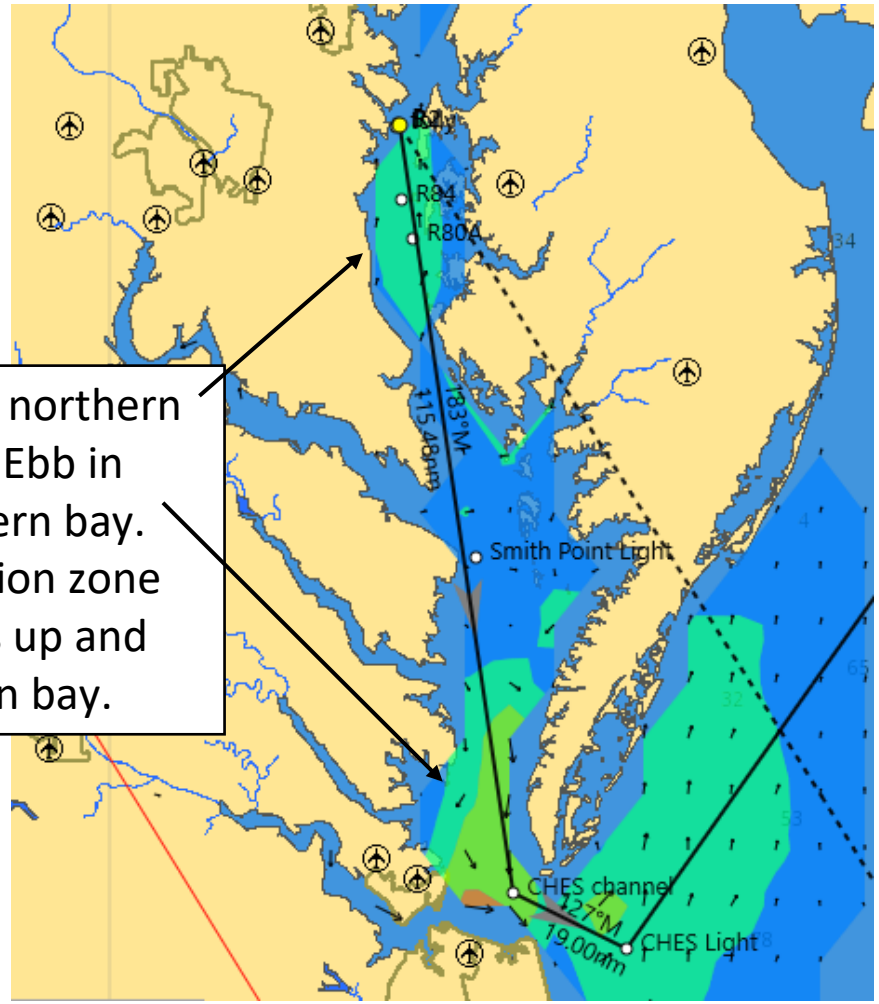
Complexity of the Bay Currents



Flood in northern bay. Ebb in southern bay. Transition zone moves up and down bay.

Visualization of Bay Currents

Current Map by Current Lab (current-lab.com)

OFS Animations (noaa.gov)

Conowingo Dam Flow

National Weather Service Advanced Hydrologic Prediction Service

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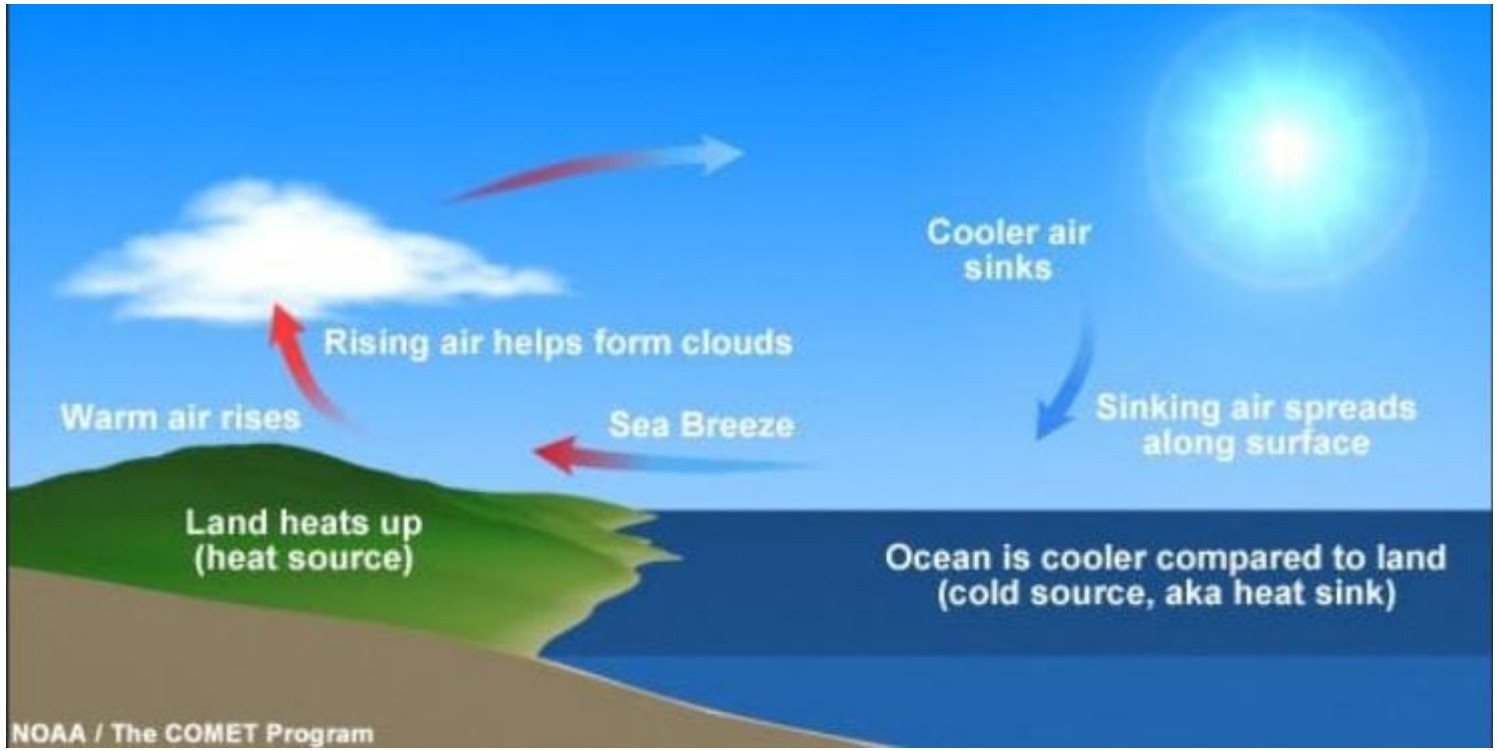
Seabreeze Process



ISLER ACADEMY

Marine Weather University | Peter Isler's Academy of Sailing Secrets (islersailing.com)

SEA-TACTICS MARINE WEATHER SOLUTIONS

Marine Weather Forecasting | Sea-Tactics

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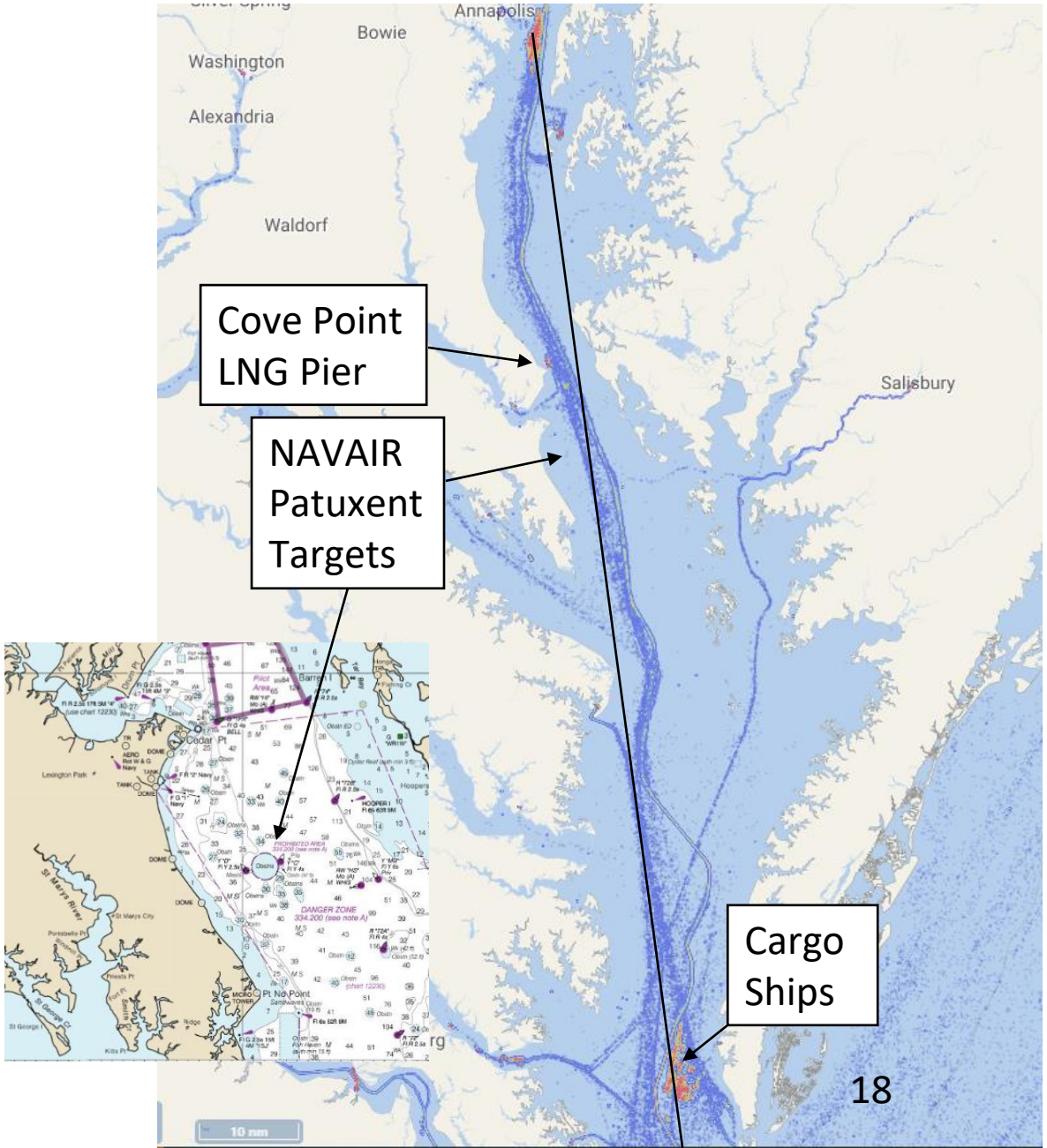
AIS Density Map



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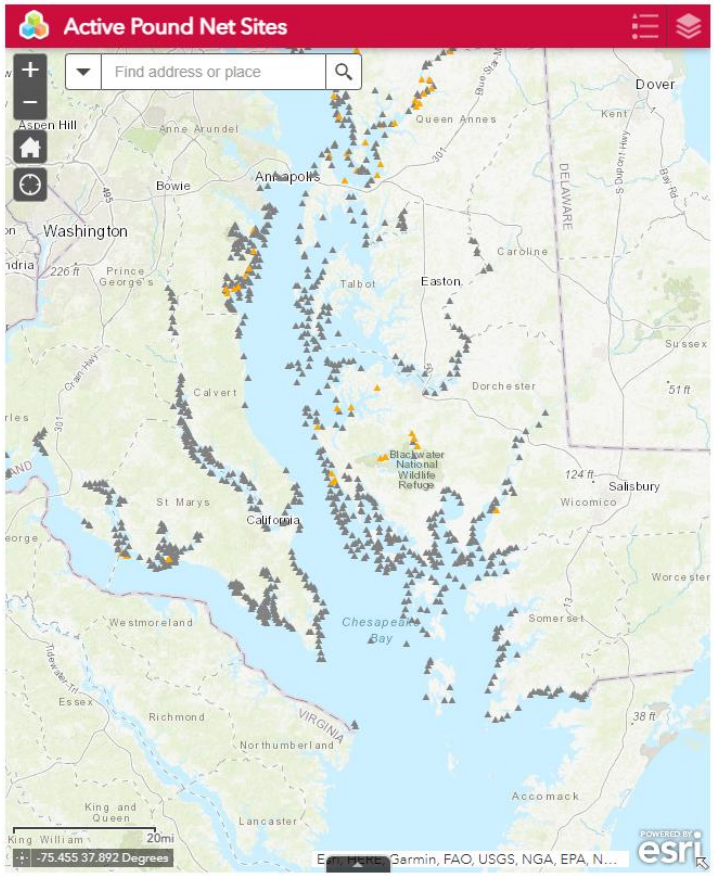
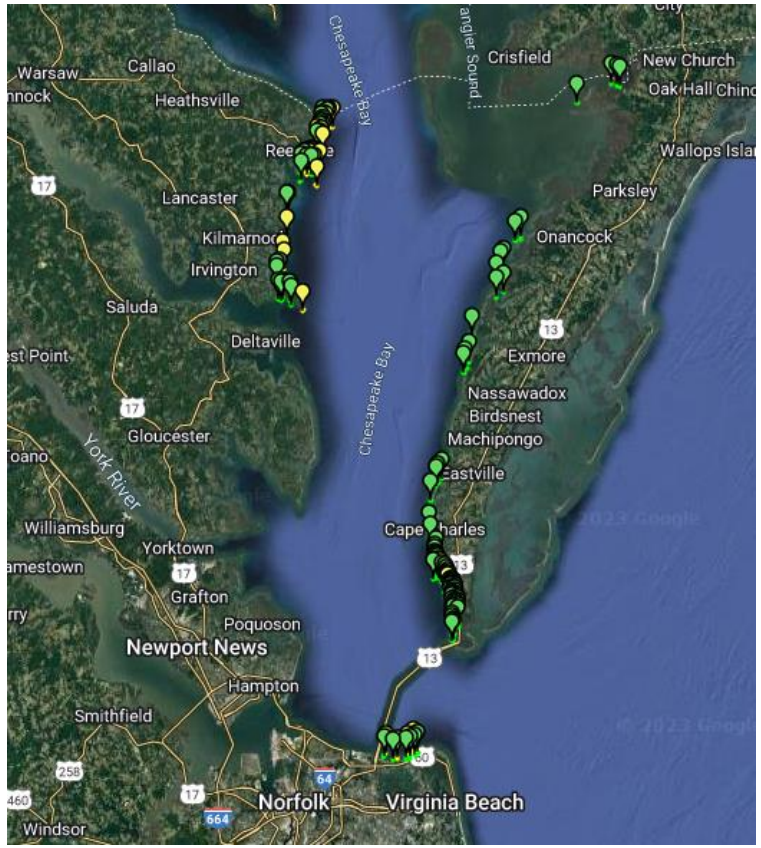
Chesapeake Bay Pound Nets



Virginia Pound Nets



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Down the Bay

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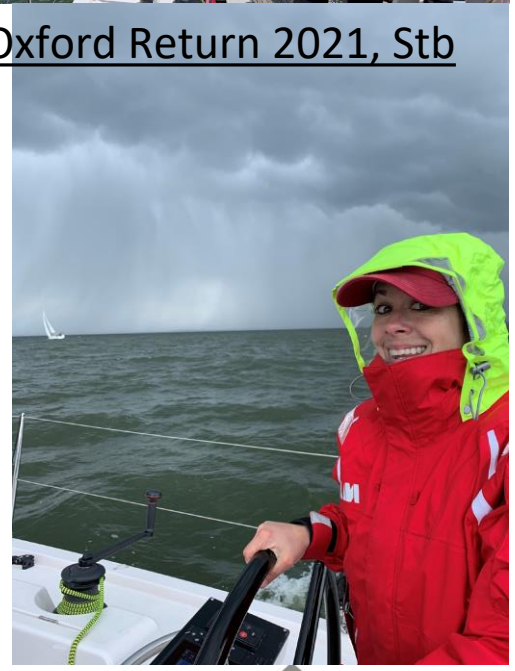
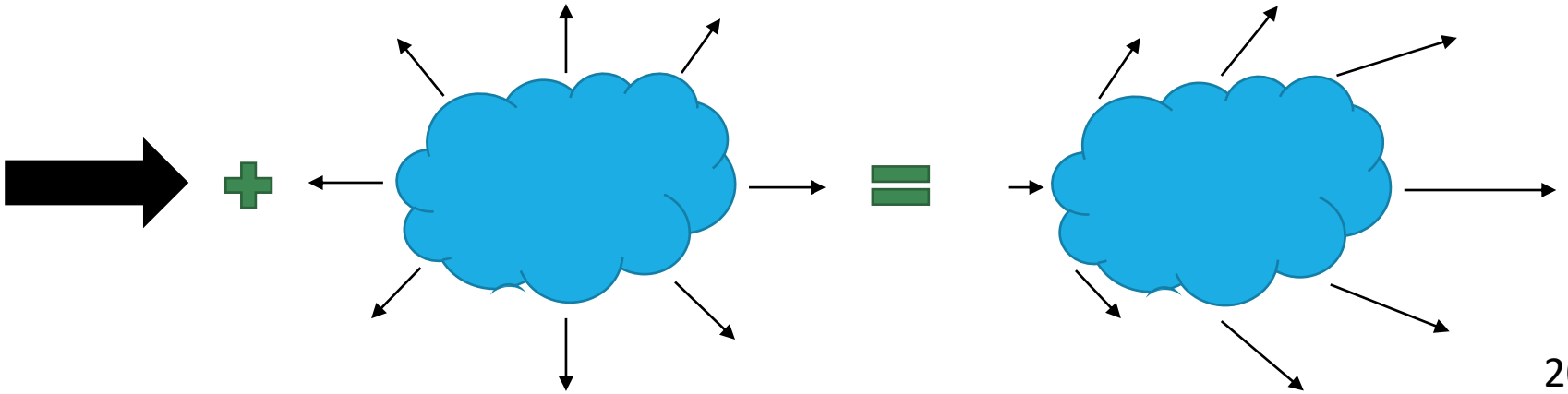
Down the Bay 2021

Spring Oxford Return 2021, Aft

Spring Oxford Return 2021, Stb





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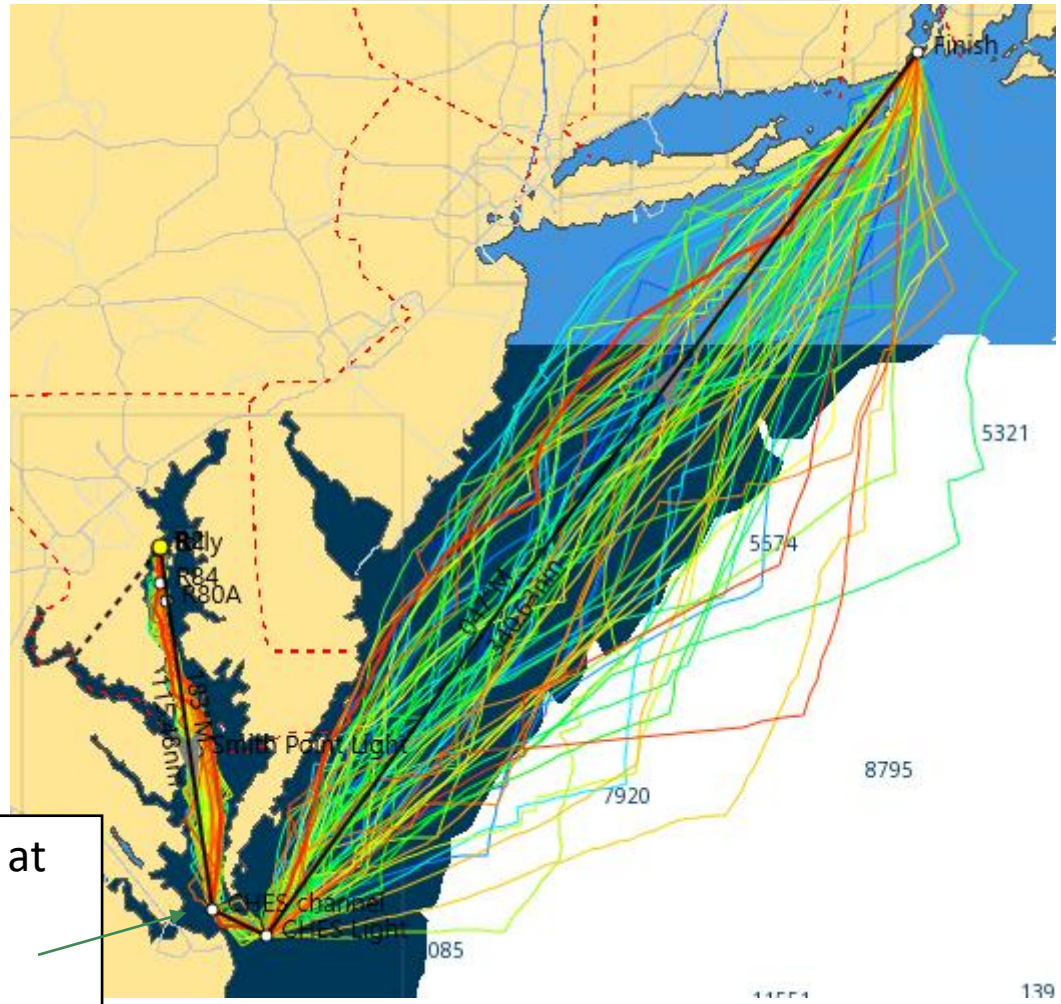

Choke Point at Bay Bridge Tunnel

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Atlantic Offshore

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Atlantic Offshore

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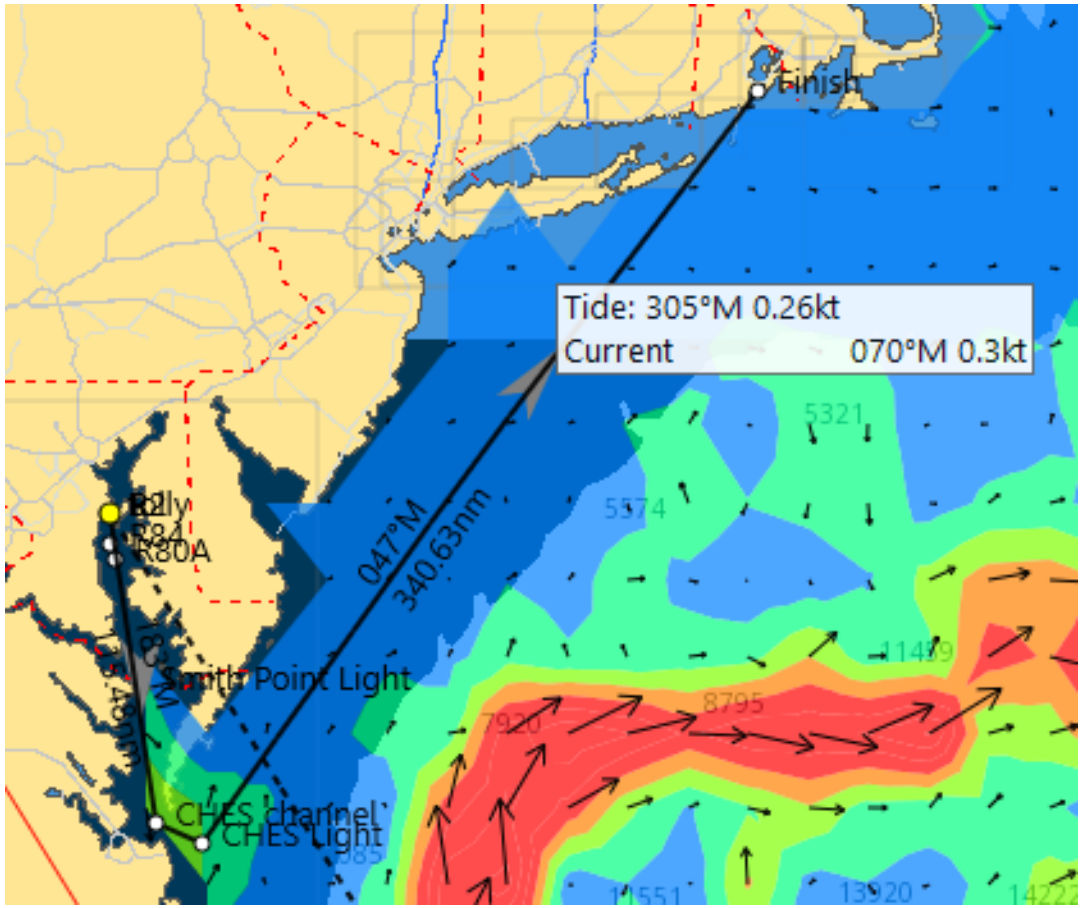
RTOFS Current Model Overlay



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Atlantic Offshore

- Limited Data
- Current and Weather
- Coastal Effects
- Vessel Traffic

Still close enough to shore to experience:

- Sea breeze
  - <3-10 miles offshore
- Localized Thunderstorms
- Less stable winds
- Increased wave action in shallows

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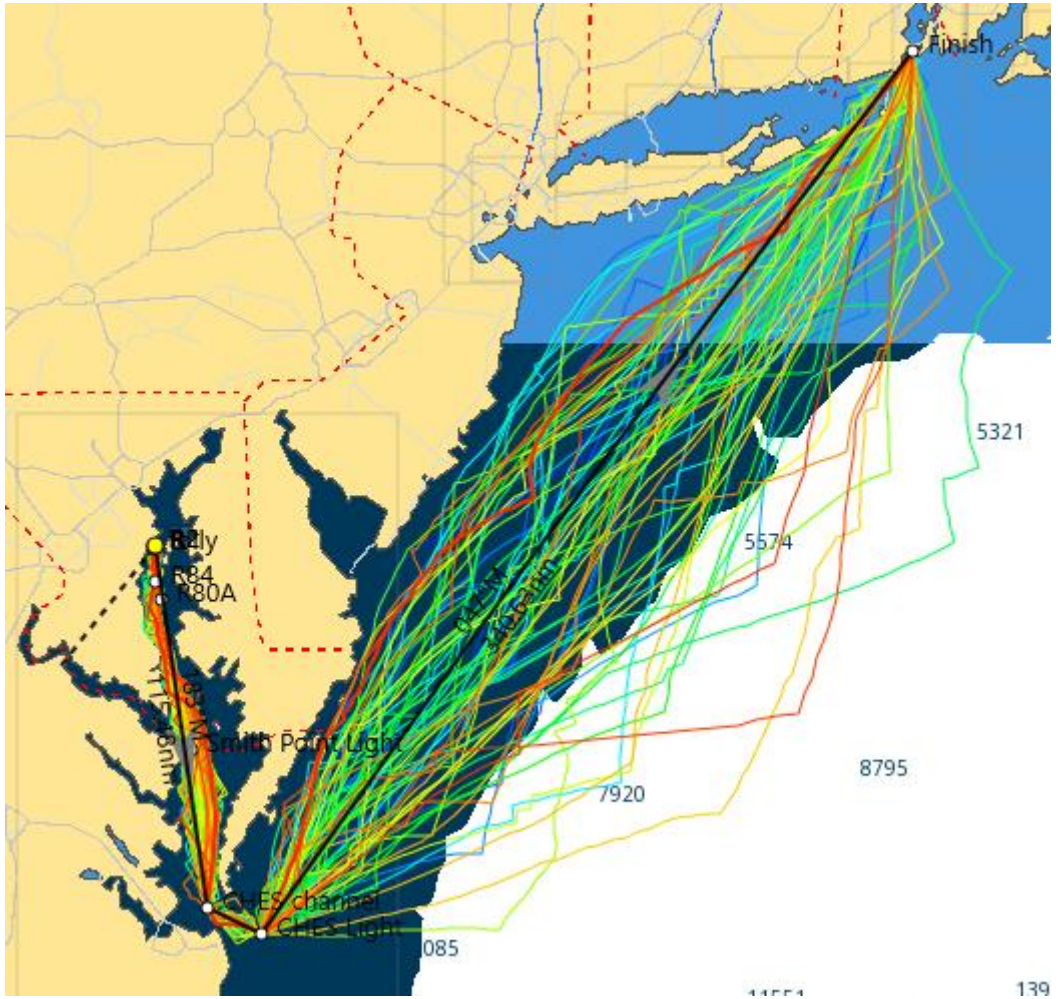
June 3 1100 Start, 1940-2022



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Atlantic Offshore

- Limited Data
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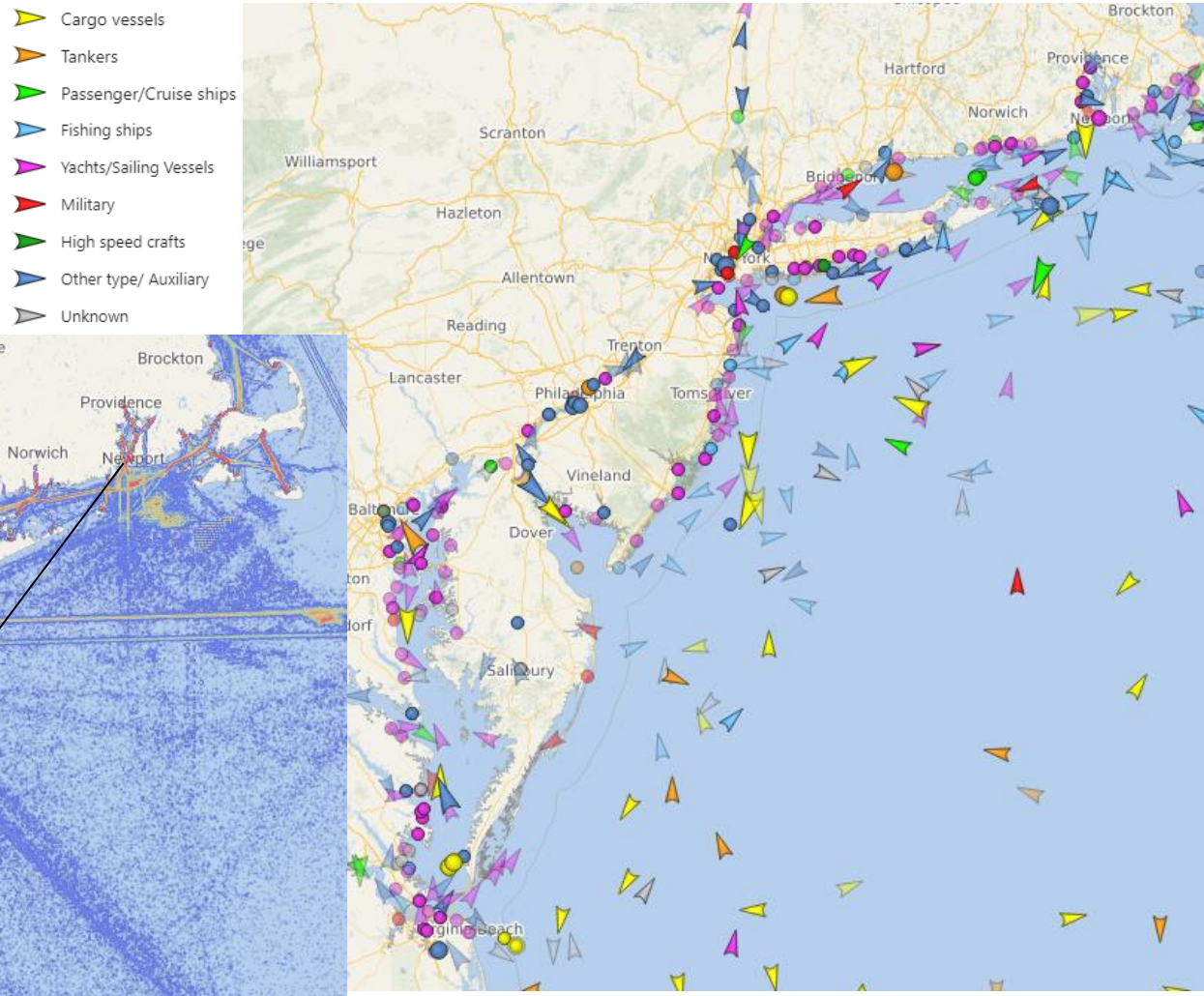
AIS Map on May 8, 2023



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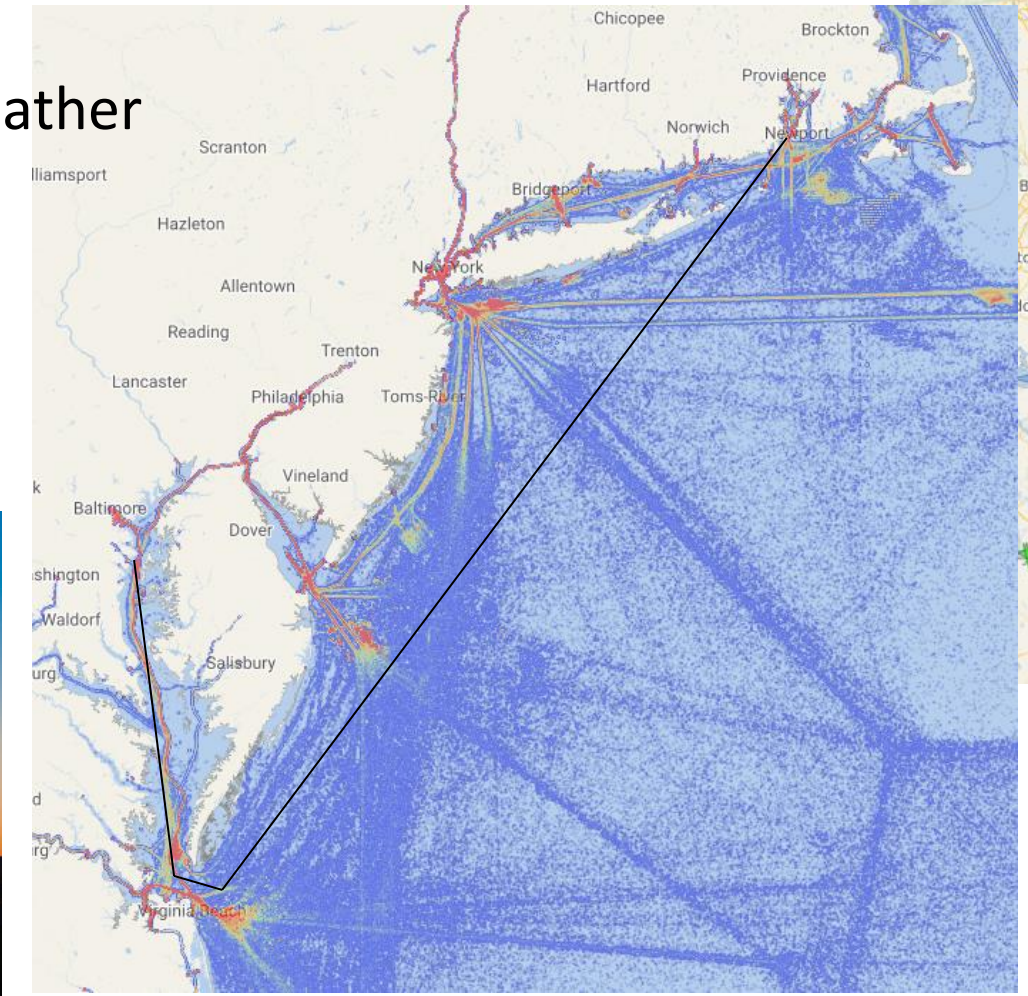

Wallops Island Launch Facility

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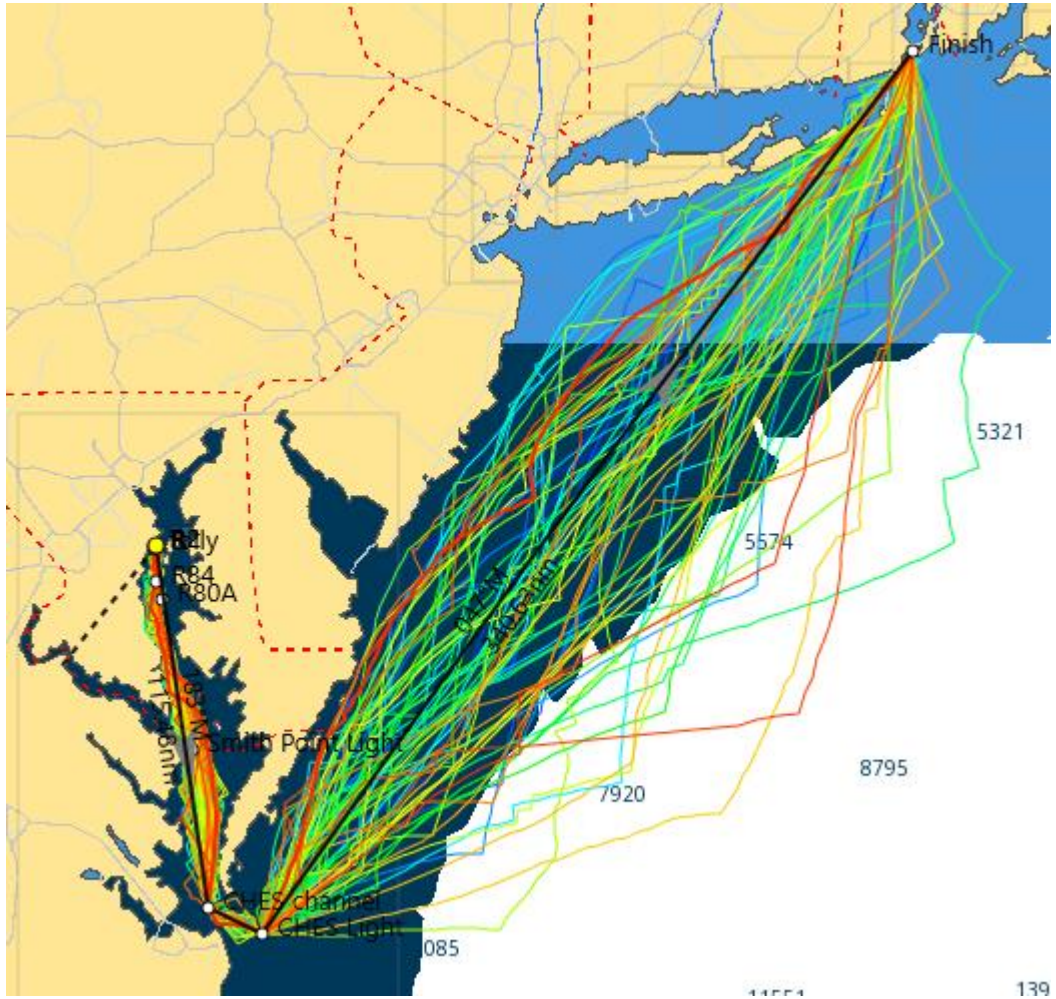
  - Fog
  - Block Island and the Windmills
  - Long Island Sound Tides
  - Decision Point
- Finish
  - 200 yards off the rocks
  - Tired crew

IY14.98 Optimal Routing
June 3 1100 Start, 1940-2021



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2023

Final Approach

- Fog
- Block Island and the Windmills
- Long Island Sound Tides
- Decision Point

Return from Newport 2021

Almost Finished 2021

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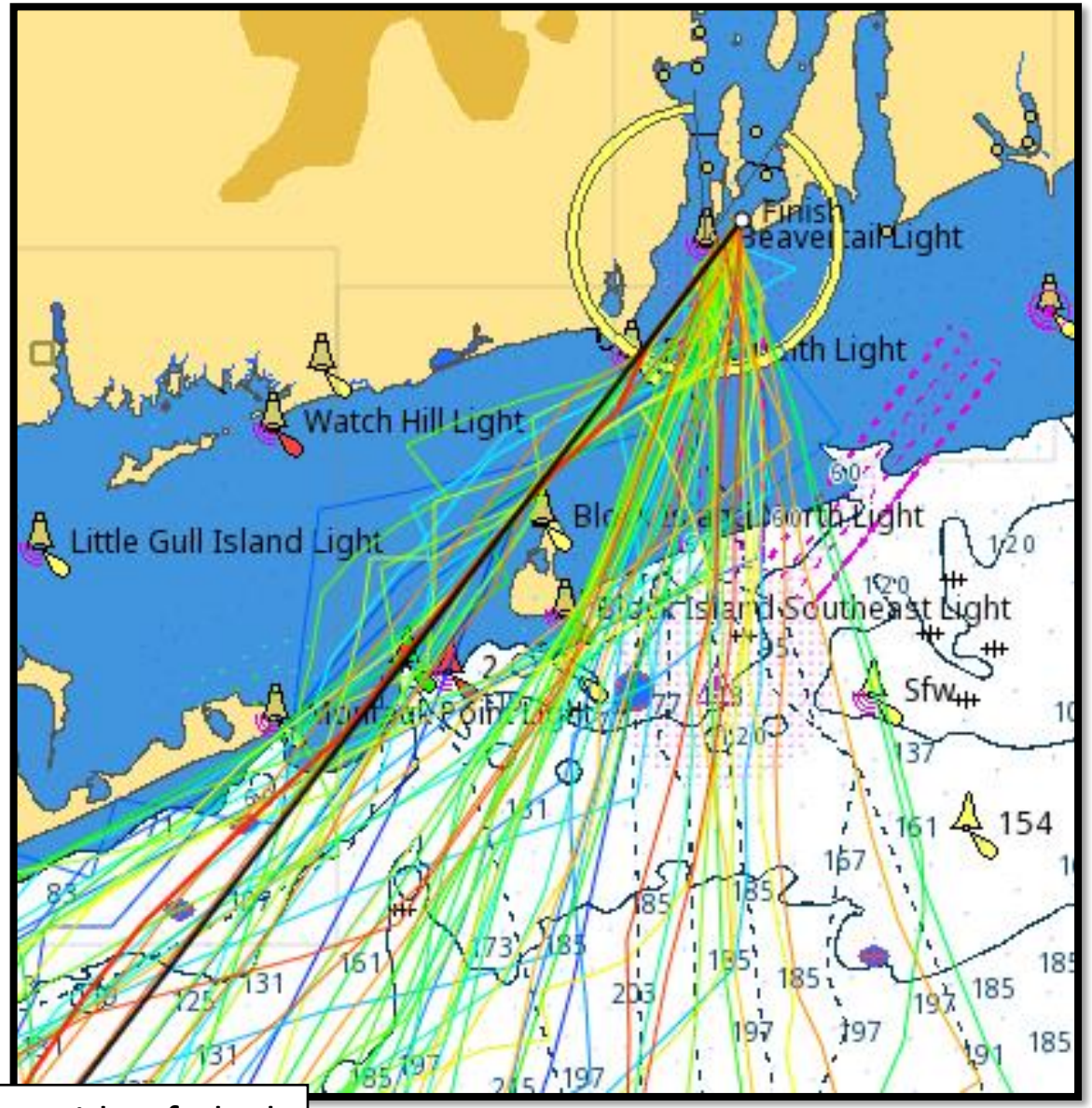
Final Approach

- Fog
- Block Island and the Windmills
- Long Island Sound Tides
- Decision Point



Routing goes outside of Block Island on 70% of the routes.

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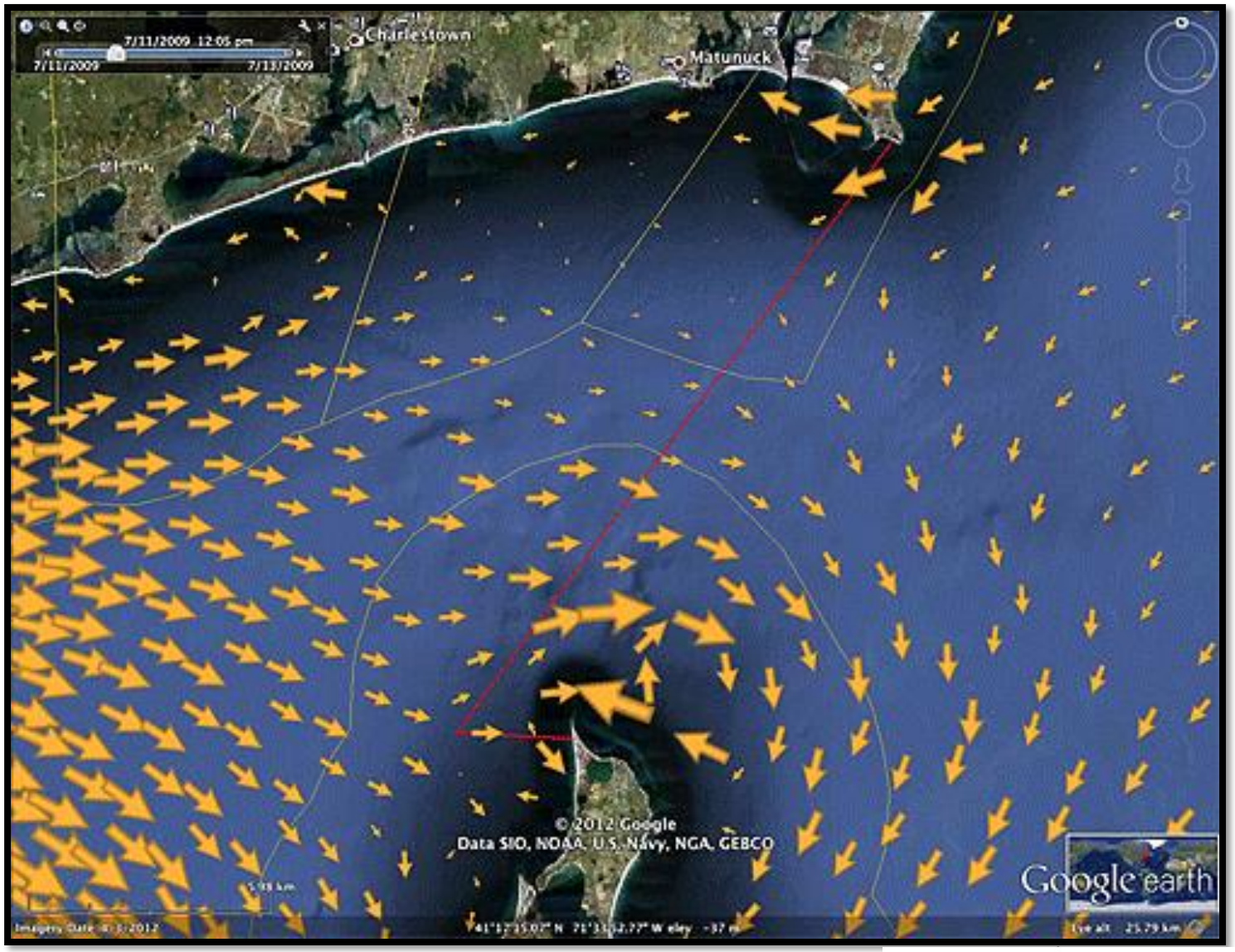
Final Approach

- Fog
- Block Island and the Windmills
- Long Island Sound Tides
- Decision Point



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Final Approach

- Fog
- Block Island and the Windmills
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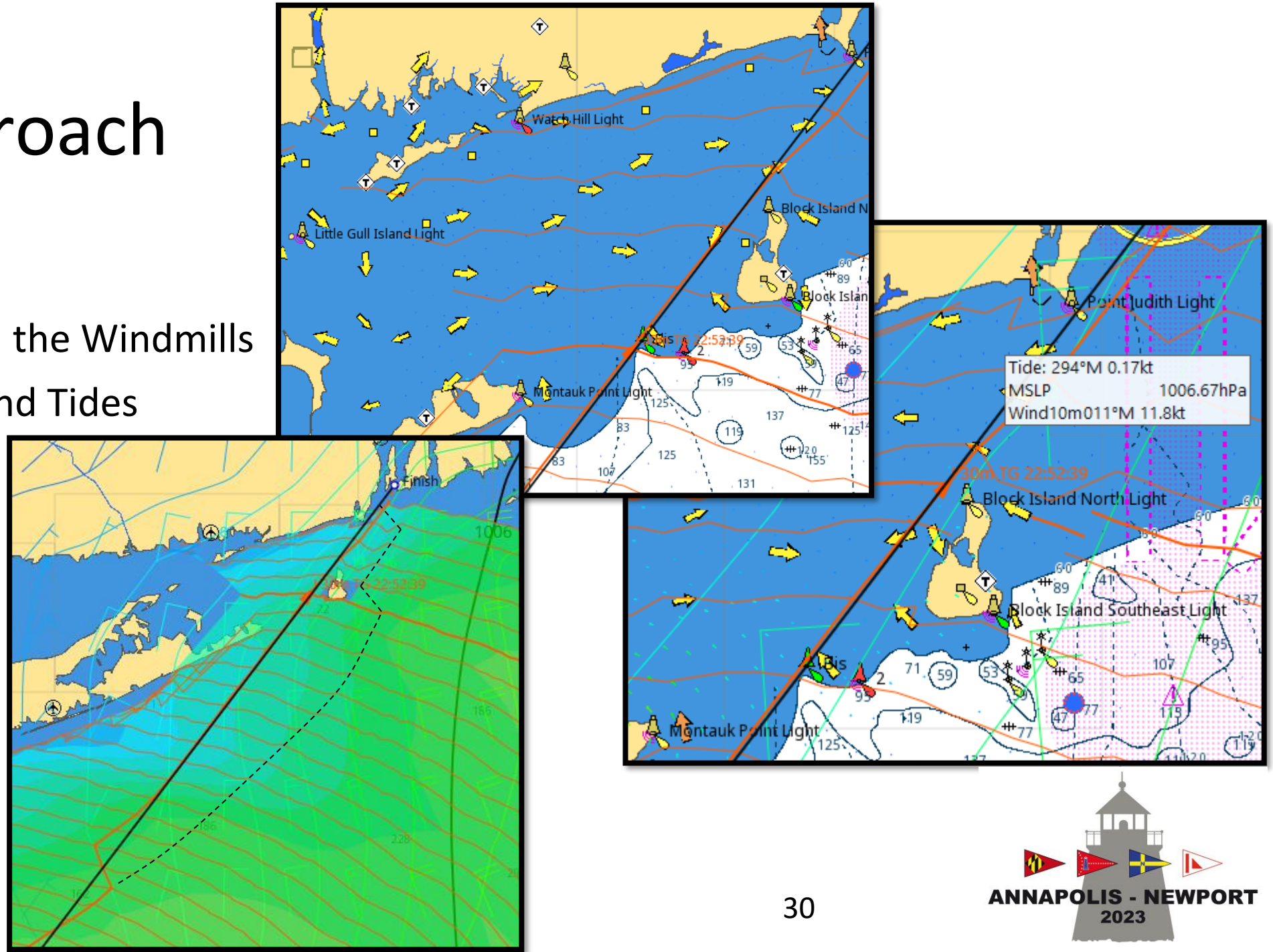

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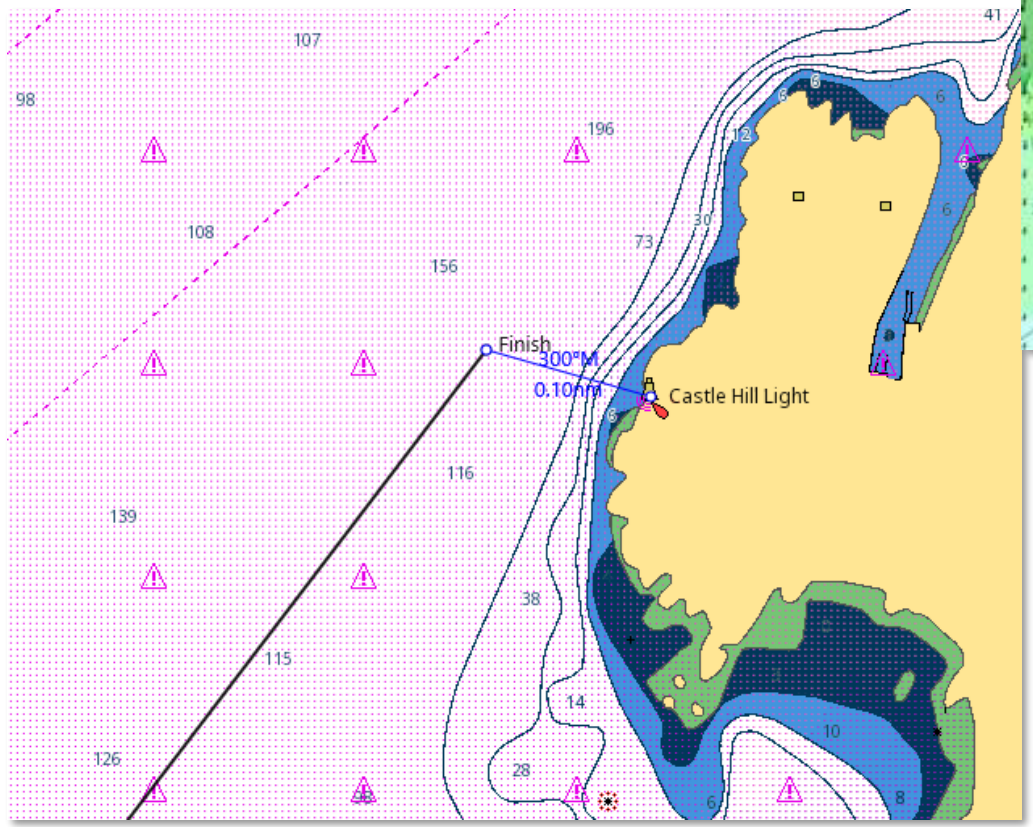
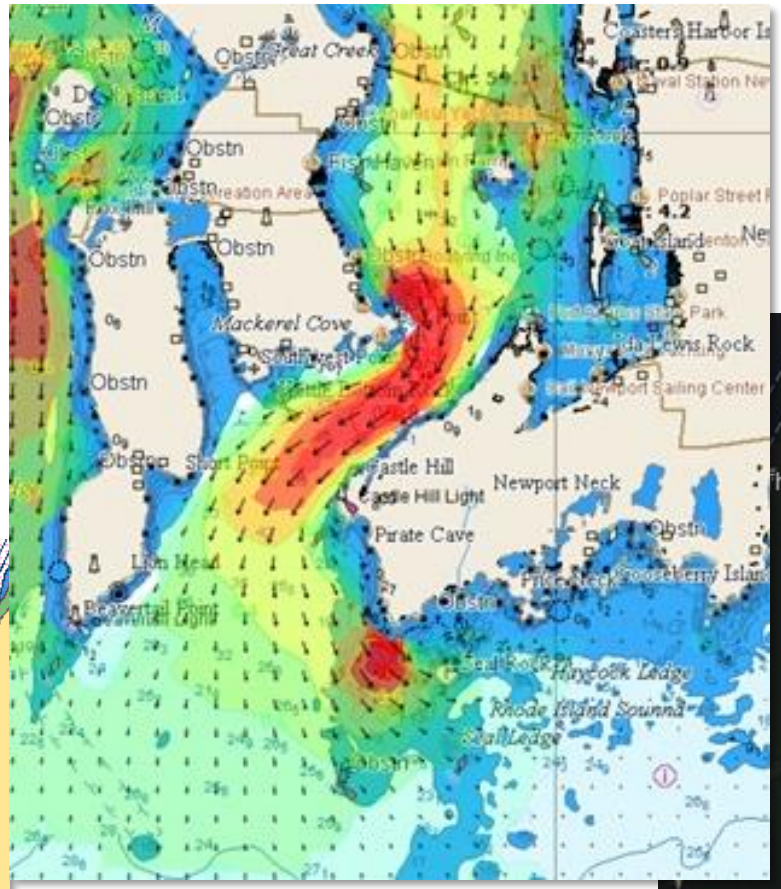
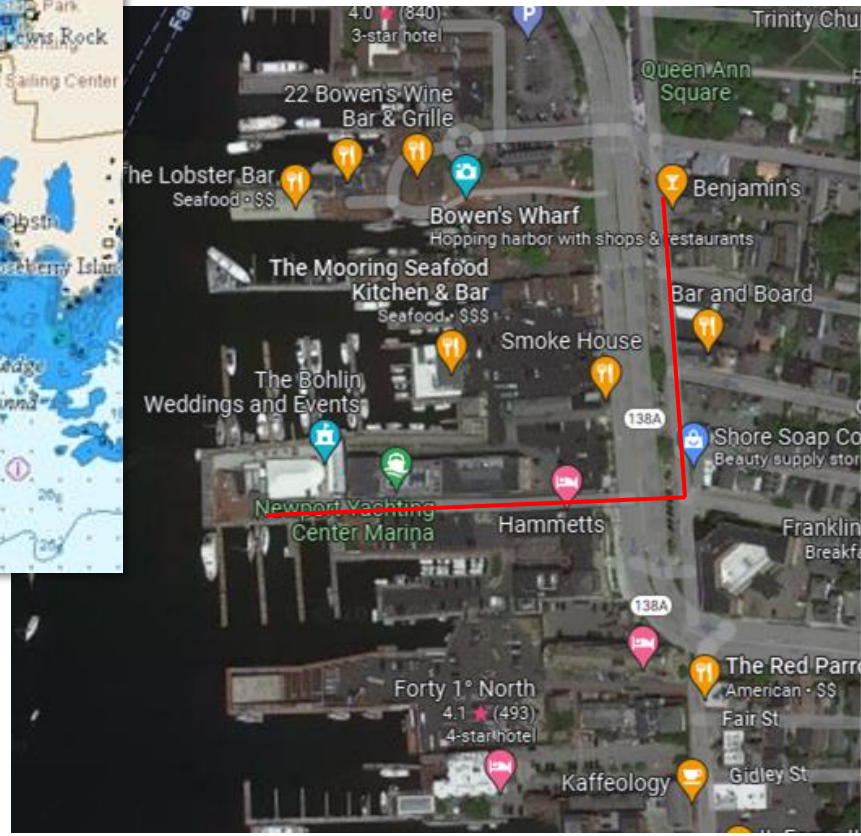
Finish

Finish Line







ANNAPOLIS - NEWPORT 2023

Outline

- Role of a Navigator
- Historical Analysis
- What to Expect for Each Leg
- What to Do When Things Go Wrong
- Technical Tips and Resources

Roles in the Event of Emergency

Querencia's "Station Bill"

	MOB (roles may need to flex; one will be spotter)	FIRE Joe commands fire control	FLOODING/DAMAGE	ABANDON SHIP
Skipper	Event Manager; head count; orders PFDS	Skipper—stops boat; orders PFDs; Determines Stay or Go	Event Manager, take helm, stop boat, start engine, assess damage, order PFDs, readies life raft, determines Stay or Go	Event Manager, gives order, final head count; ensures water, EPIRB, ditch bag, etc. transferred to raft
Helm	Pushes MOB on plotter; gives quick stop command and initiates maneuver, starts engine	Stops boat, assist with dropping/securing sails	Stops boat, join pump or repair crew as instructed	Stops boat, stops engine (if on)
On-Watch Captain (Matt or Joe)	Deploys MOB buoy; calls out heel/boom danger; directs/assists sail handling, "lines clear" before engaging engine	Grabs cockpit fire extinguisher	Pumping: Direct/assist w/ sail handling to stop boat, organize pump crew and start pumping/bailing	Deploys raft, supervise crew PFDS, 1st into raft, supervise raft boarding, confirms head count, Raft Captain
Navigator (Sloan)	Coms; transmits Mayday; grabs searchlight, assists with navigation back to PIW	Coms, Mayday, grabs fire blanket if indicated; kills batteries if indicated, readies VHF, Satphone for Abandon Ship	Coms, Mayday, assists with damage control, readies VHF, Satphone for Abandon Ship	Coms, Issue Mayday, activates SOS on Satphone. Brings Sat phone and VHFs, ensures their transfer to rafts
Off-Watch Captain (Matt or Joe)	Organizes retrieval gear and crew	Readies life rafts; head count; deploys raft if ordered	Source/Repair: Organize crew to identify source, deploy tools and repair kit, slow/fix leak	Deploys raft, supervise PFDs, 1st into raft; supervises raft loading, confirms head count, Raft Captain
On-Watch #1 (Austin or Pete)	Spotter—otherwise sail handling and securing, debris field	Grabs stb cabin fire extinguisher	Douse/secure sails, man cockpit pump	Monitors deployed raft for potential sources of damage
On-Watch #2 (Ben or Max)	Spotter; otherwise sail handling and securing; debris field	Grabs port settee fire extinguisher	Douse/secure sails, man cabin pump	Bring water, searchlight
On Watch #3 (Nancy or Kira)	Spotter—otherwise sail handling and securing, debris field	Readies ditch bag and EPIRB (for her raft)	Readies ditch bag and EPIRB (for her raft)	Gets Ditch Bag (for her raft), activates and brings EPIRB
Off-Watch #1(Austin or Pete)	Readies Lifesling and heaving line; assists with retrieval	Grabs stbd fwd cabin fire extinguisher	Find/stem/repair leak (starts forward of galley)	Bring water, searchlight
Off-Watch #2 (Ben or Max)	Sail handling and securing, then assists with retrieval	Assists as directed	Find/stem/repair leak (galley, head, and aft)	Monitors deployed raft for potential sources of damage
Off Watch #3 (Nancy or Kira	Sail handling then assists with retrieval	Readies ditch bag and EPIRB (for her raft)	Readies ditch bag and EPIRB (for her raft)	Gets Ditch Bag (for her raft), activates and brings EPIRB

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What to do when unpredicted events occur?

- The forecast is accurate but only in hindsight.
- Look outside and try to keep the boat rolling.
- Keep your crew's faith in you. Give them data!
- Know your clouds and the winds around them.
- Understand VMC.

Down the Bay 2021

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2023

Outline

- Role of a Navigator
- Historical Analysis
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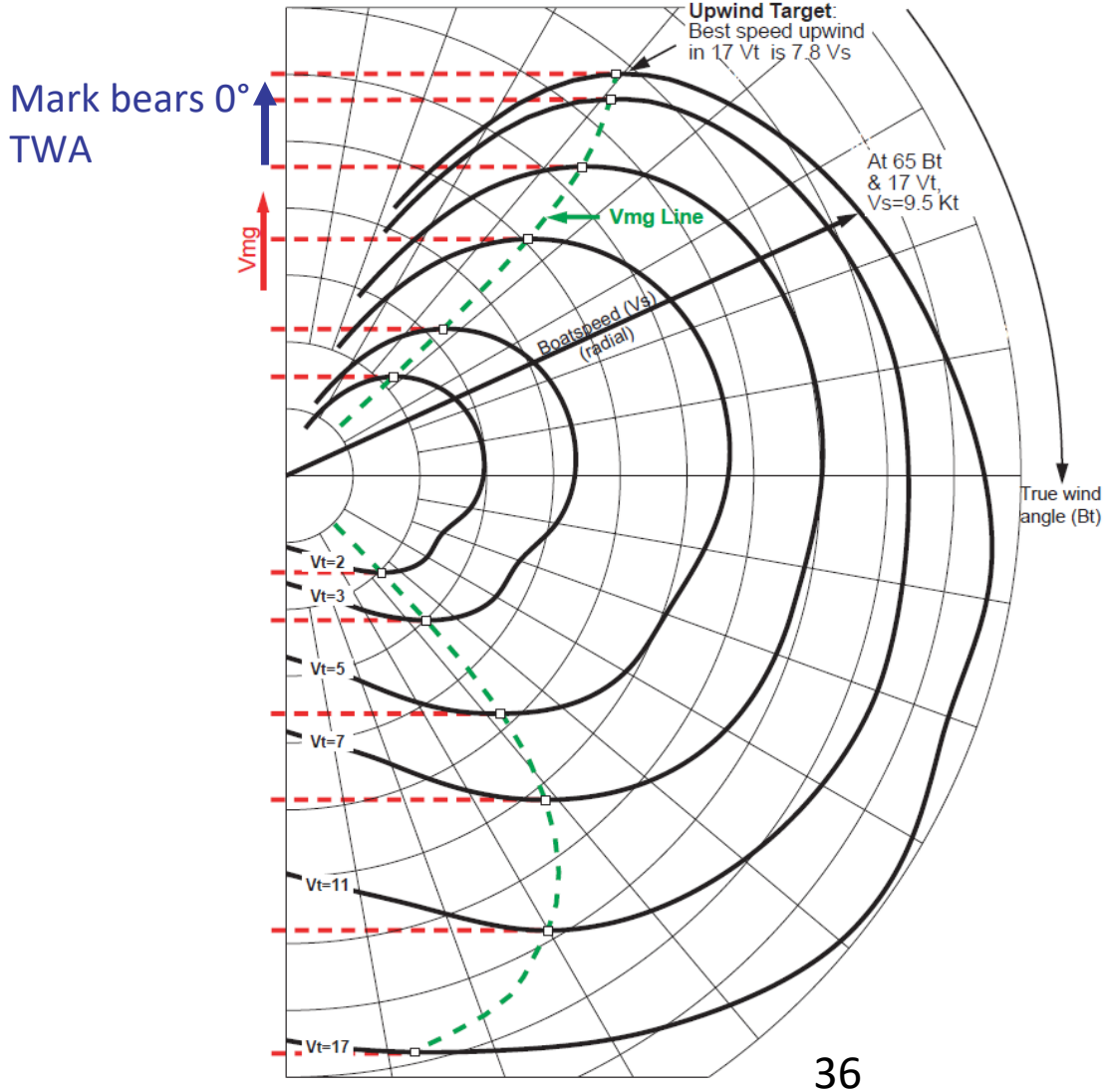
Velocity Made Good (VMG)

- VMG is a special case of Velocity Made on Course (VMC) sailing where the bearing to the mark is aligned with the True Wind Direction (TWD)



Ockam Instruments

OCKAM Instruments Inc. "The OCKAM Polars", Figure 2

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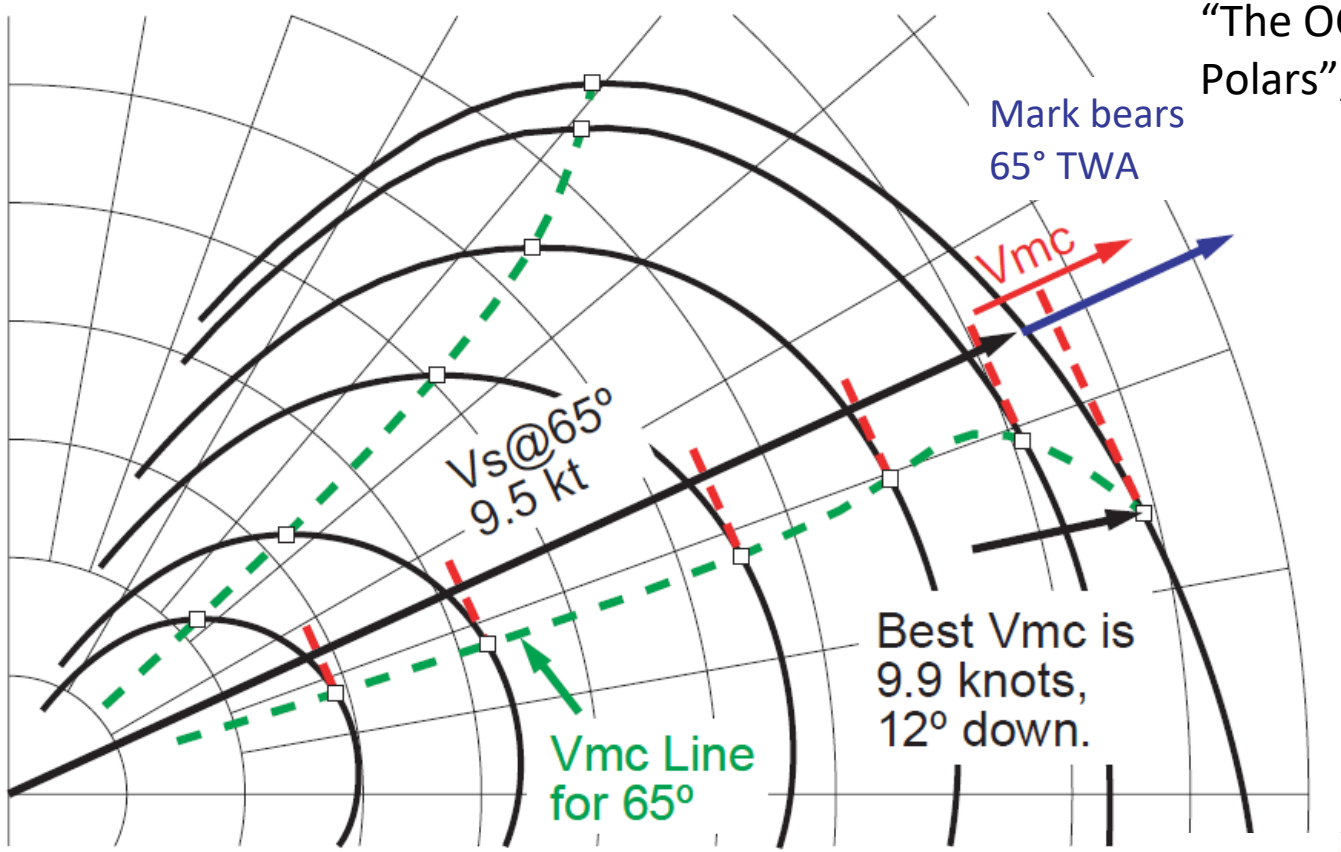
Velocity Made on Course (VMC)

- VMC sailing optimizes performance for the current wind condition.
- Applicable if the wind will change and sufficient time remains to return to the rhumb line.
- Provides guidance on a minute time-scale rather than the hour time-scale of a GRIB (i.e. Expedition Routing)

OCKAM Instruments Inc. "The OCKAM Polars", Figure 3



By bearing off 12°, we are going 0.4 knots faster towards the mark (~4% performance boost). This is equivalent to 15 seconds per mile performance boost.

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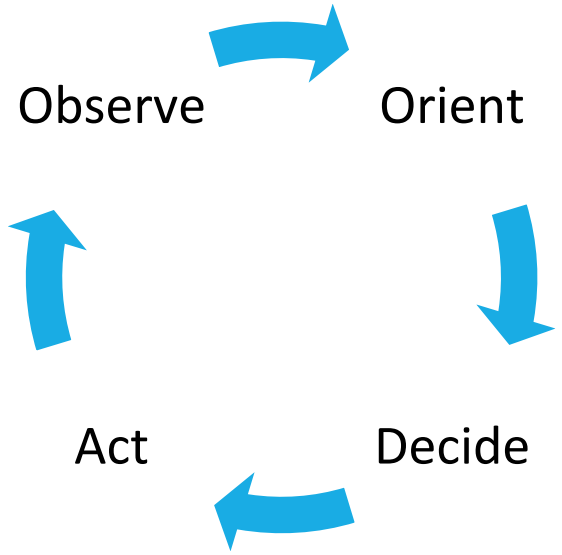
Instruments



- Beware of software updates this close to the race.
- Check your spring calibration but don't chase perfection.
- Try to set a standard display on deck for the crew.
- "O-O-D-A Loop"

Helm

BSP
AWA/ TWA
HDG/ COG

Up/Down Performance

Target AWA/ TWA	Target BSP
Heel	Rudder

Reaching Performance

Polar %	VMC
Heel	Rudder

Navigation

Bearing to Waypoint	Distance to Waypoint	Current Set
COG	SOG	Current Drift
HDG	BSP	Depth

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Expedition Routing

- Try to understand why the routing is optimal.
- Interrogate the routing:
  - Time sensitivity
  - +/- TWS, TWD, or Polar %
  - Current versus no current
  - Isochronal versus grid
  - Exclusion zones to force route
- Develop a plan with justifications.

Leg Destination	Driving Factor	Sailing Mode	Target BSP	HDG	TWD	TWS	Current Direction		ETA
R80	Favorable Current								
Smith Point	Current Shot out of Potomac								
Bay Tunnel	Turning Mark								
Chesapeake Light	Turning Mark								
Off Delaware	Right Shift								
Reanalysis Point	Decision Point for Block								
Off Windmills	Too much current inside block								
Finish	Drinks								

Weather Resources

CHELSEA'S

Weather Resource Guide for Offshore Sailing

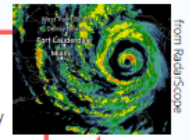
1 Understand Types of Weather Data

It is important to understand what kind of data you are looking at. Is it ground-truth observation or is it a projected forecast? Does it have human forecaster input? You want to make sure you are looking at accurate data from a quality source, ideally that has also been reviewed by a meteorologist whenever possible.

OBSERVATIONS

Real, ground-truth readings from instruments showing what is currently happening in the atmosphere.

Examples: Wind readings, Radar, Satellite Images, Weather balloon data (Radiosondes), Temperatures



COMPUTER MODEL DATA

Mathematical model projections of what could happen in the atmosphere.

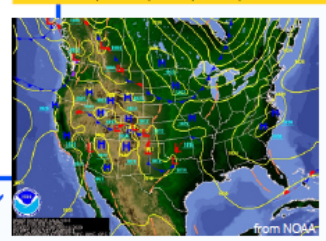
Observations from around the globe are put into super computers as initial conditions. Assumptions and approximations are made about how the atmosphere will behave. The computers then run millions of mathematical equations, and the output is a numerical weather forecast.
In the sailing community, these are often called "gribs" referring to the output file type (.grb) from the computer models.

Examples of models: GFS, NAM, ECMWF, HRRR, CMC, ICON, etc.

ANALYZED DATA

Analyses are edited and verified by human forecasters, making them more accurate than computer model forecasts. Most National Weather Service products count as analyzed data. Whenever possible, verify that you are looking at an analysis and not a model forecast.

To the right is a surface analysis; a weather map showing current locations of weather features such as highs, lows, and fronts, based on the ground observations that is verified by human forecasters.



Weather Resource Guide

2 Check out at least 1 source from each major category

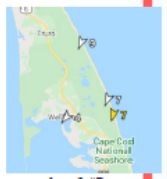
Observations (red box) give you an idea of what the weather is doing right now. A Surface Analysis (blue box) will give you an accurate big-picture idea of the atmosphere. Then, look at a few different computer models (yellow box) to see what matches with what is happening now. Other analyzed data (blue) will help you determine which forecast is most accurate.

Observations

The one-stop shop: NowCOAST from NOAA
overlay radar, satellite, observations, marine warnings, on nautical charts

Wind & Weather

- SailFlow / iWindsurf (web + mobile app)
  - use sailflow.com/chelsea for a discount
- National Data Buoy Center
- NOAA Weather & Hazards Data Viewer
  - go to Overlays -> Observations -> Surface Observations
- WeatherObs.com - worldwide



Global Satellite Imagery

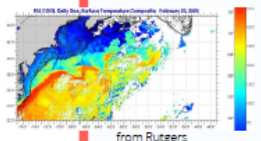
- basic: NASA World Satellite (click map to zoom)
- advanced: RAMMB/CIRA interactive Satellite
- UW-Madison SSEC w/ GoogleEarth
- NOAA Aviation Weather Center
- Sat24 - Europe
- Southwest Pacific

Radar (coastal)

- ZoomRadar
- NOAA National Weather Service Radar
- Bermuda Radar
- Caribbean Composite (from Barbados Weather)

Ocean Temp & Current

- NOAA Ocean Prediction Center (OPC)
- Sea Surface Temps (SST)
- Great Lakes Environmental Research Lab
- Rutgers Gulf Stream



Tips

- Don't get overwhelmed! There is SO much data out there.
- Find a few sources from this list that you like and stick with them.

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Weather Resources

Weather Resource Guide

Analyses by Forecasters

- Ocean Prediction Center (OPC)
- National Hurricane Center (NHC)
- National Weather Service (NWS) local forecasts
- Pro forecasts from SeaTactics
- UKMet Office - for Europe

Tips

- Look at a couple of different computer models to get a "feel" for what they are saying
- Which matches best with what is happening now?
- Remember, there is no 1 model better than the rest
- Never rely solely on computer models to be 100% correct!

Model Data

The Major Models

- Global Models - best for big picture forecasting, gradient wind, and longer term forecast
  - GFS (American from NOAA)
  - ECMWF (European)
  - Others: UKMET, CMC (Canadian), NAVGEM (US)
- Regional Models- coastal use only, hi-res, better for short term.
  - NAM (North American Model, NOAA)
  - HRRR (High Resolution Rapid Refresh, NOAA)
  - ARPEGE /AROME (France + Mediterranean)

Web Sources

- Windy.com - toggle 'on' pressure in bottom right
- TropicalTidbits - Select "Regions" to change area to offshore
- SailFlow - coastal model data available

Getting Grib Files & Charts

- SailDocs - free by e-mail
- Low bandwidth options- NOAA Products by email or FTPmail
- NOAA OPC Atlantic and Pacific Briefings
- OpenSkiron - for Europe & Mediterranean

Programs & Software

- Expedition Marine - comprehensive software with grib file viewer and route optimization. Download Free.
- Model Accuracy - Determine which grib file(s) are most accurate against rea wind observations (from boat log data or a NOAA buoy) Download Free.
- RadarScope (desktop and mobile app) - for the highest quality radar and storm tracking. Best for Intermediate to advanced users. ($9.99 one-time)
- CloudRun - Use the Forecast Wizard to run a WRF model for a custom area. (Pay per use)

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3 Practice Good Habits

Practice your forecasting before you go out on the water
Use online weather resources and create your own hypothesis, or work with a forecaster. Then observe + notice what really happened - did it match your hypothesis? Check with your coach or email me if you have questions!

Record what happened and when
The top sailors keep journals of observed weather conditions. On offshore trips, I try to record observations every few hours, along with any significant weather or wind shifts so I can easily understand what happened.

Keep Learning!
Check out all of our free content on YouTube, Instagram and our newsletter. Ready to take your weather knowledge to the next level? Sign up for a webinar series or online course through SeaTactics.

Questions? Want to learn more?

I'd love to work with you!

SEA-TACTICS
MARINE WEATHER SOLUTIONS

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Chelsea Carlson
Meteorologist and Navigator

Learn more about me here

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DAVID WALTERS
YACHTS
YOUR CHOICE FOR BLUE WATER BOATS

Thank You!

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