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Celebrating 60 years of short Handed Oceanic Racing

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NORTH ATLANTIC OCEANOGRAPHY

A Brief Treatise Relating to

OSTAR/ TWOSTAR 2021

PLYMOUTH TO NEWPORT RHODE ISLAND
SUNDAY 9th MAY 2021

OSTAR/ TWOSTAR: A description of some physical race impediments.

2021 marks the ‘60th’ anniversary of this iconic event. This will be the sixteenth edition of OSTAR and the seventh edition of TWOSTAR.

Here we describe some of the physical barriers the entrants will encounter during their North Atlantic crossing commencing at 1200BST Sunday 9th May. We have tried to explain the physical processes involved in layman’s language.

The 2021 edition departs Plymouth Sound for Newport Rhode Island on Sunday 9th May at midday. During the crossing, entrants will expect to encounter a range of hazards, including equipment failure, diverse ocean currents, inclement weather including storms, icebergs, shipping including trawler fleets, fog, whales etc. Depending on the chosen route, the distance sailed will vary between 2800 and ~4000 nautical miles.

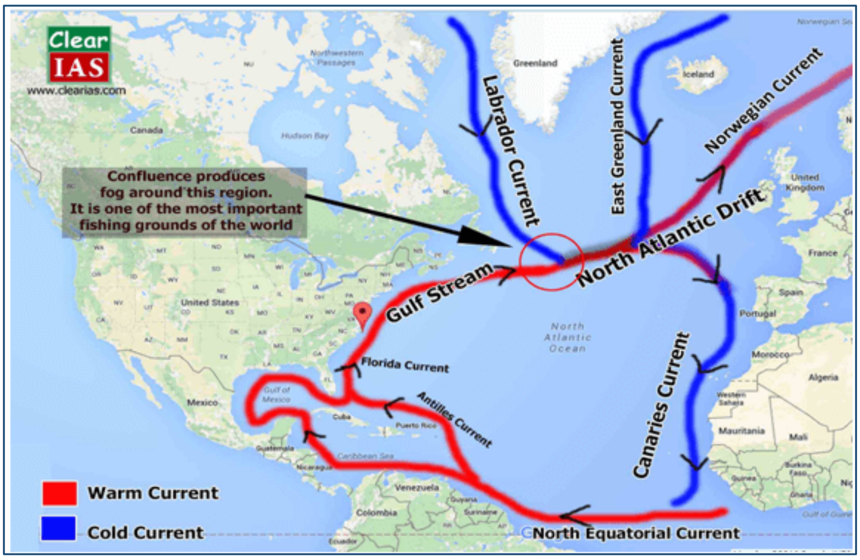

Image 1

Map of race area indicating positions of the main oceanic currents: Courtesy of Clear AIS

The weather patterns (depressions) will be running from west to east as indeed are the main oceanic currents (see image 1). Entrants will be not only have to counteract various oceanic currents but also the inherent westerly wind patterns, with much of the crossing typically being to windward. Some of the quicker boats will likely opt to sail a more northerly route to skirt around the top of the weather depressions running eastwards. Multihulls are not generally able to sail as close to windward as monohulls and may prefer to sail a more southerly route where, even though the distance is much longer, they will be likely to encounter rather freer winds which will be more advantageous to that type of yacht.

Since the inception of the first race in 1960 there have been enormous advances in technology which have assisted the Corinthian Sailor. We are now in both the space age and micro-computing age. One advantage of this is that over the last sixty years, navigational instruments and communicating devices have become integrated within leisure vessels becoming so much smaller and more powerful. Yachts are inherently safer due to skippers knowing with certainty their precise position and where other vessels are within range due to being equipped with both GPS (Global Positioning System) and AIS (Automatic Identification System).

Entrants on passage across the North Atlantic to Newport Rhode Island are likely to meet a varied selection of shipping varying from leisure vessels, trawlers right through the spectrum to super tankers. Those sailing a more southerly route are more likely to come across a higher density of shipping compared to those sailing a more northerly route (see image 2). Reports from sailors en passage over the last few years have indicated that at times they have been in visual sight of more than four vessels at times and substantially greater densities closer to land. See: www.marinetraffic.com

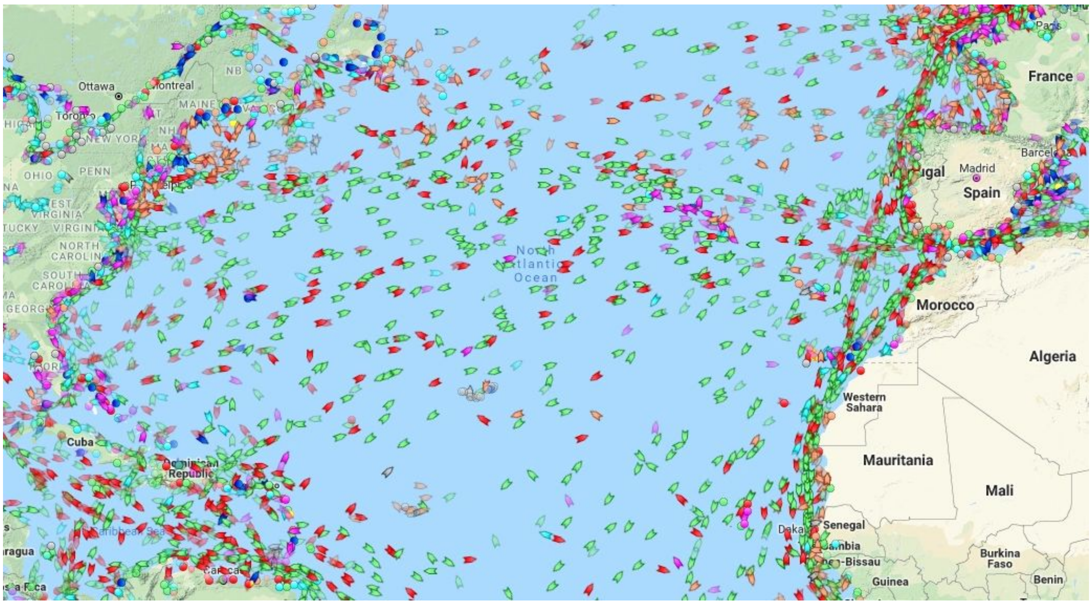

Image 2

Typical North Atlantic Shipping density, courtesy of marinetraffic.com

There is an old phrase that the atmosphere is completely interconnected and everything that forms and evolves will ultimately affect everything else at some point in time. The ocean doesn't sit still like water in a sink. It moves more like a conveyer belt that's driven by changes in temperature and salinity over large areas. Both quick-moving surface currents and slower-moving deep ocean currents circulate water around the globe. These circulation patterns take of the order of hundreds of years! (see Image 3)

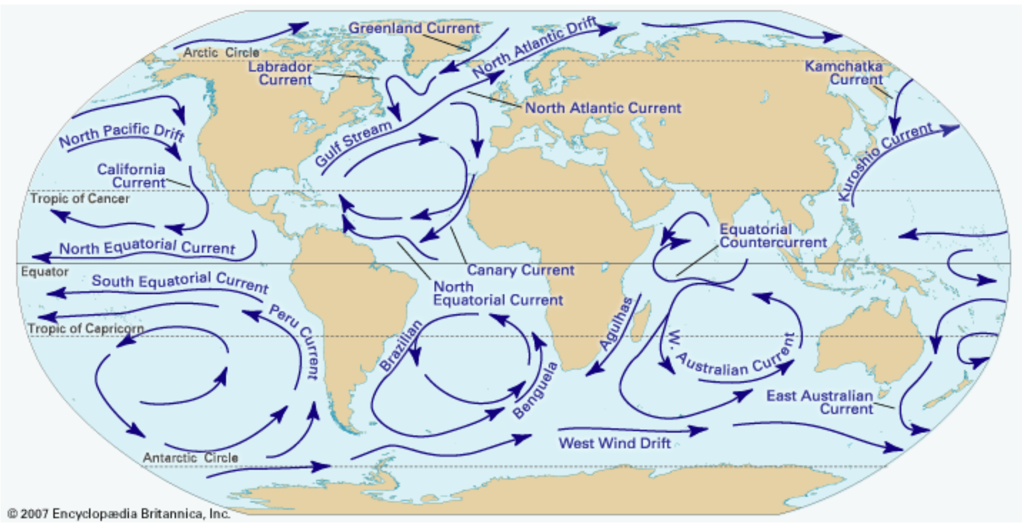

Image 3

Ocean surface circulation patterns

Ocean currents transport warm water together with precipitation from the equator toward the poles and cold water from the poles back to the tropics. You will note that the circulation is clockwise in the northern hemisphere and anticlockwise in the southern hemisphere due to the coriolis force of the earth's rotation. Thus, ocean currents regulate global climate, helping to counteract the uneven distribution of solar radiation reaching Earth's surface.

Weather patterns have become more intense, wetter, and slower since the first OSTAR as the atmosphere continues to warm. Changes in global human activities are linked at least in part to climate change. There are concurrent trends in the vital signs of climatic impacts. Greenhouse Gases (CO_2, methane, and nitrous oxide) continue to increase as does global surface temperature. Globally, ice has been rapidly disappearing, evidenced by declining trends in minimum summer Arctic sea ice, Greenland and Antarctic ice sheets, and glacier thickness worldwide. Ocean heat content, ocean acidity, sea level, extreme weather and associated damage costs have all been trending upwards.

Present research would appear to indicate that the Atlantic's massive ocean circulation system is slowing down. Since the ocean's conveyer belt influences weather over the land masses bordering the Atlantic, a change to the rate of circulation will affect summers, winters, and natural disasters, from the United States to Europe and further afield.

Weather (wind and waves) together with ocean currents influence the speed made good over the ground. Therefore, it is important to take these factors into consideration when planning a transatlantic crossing and to try to minimize the negative influence. Safety and route optimisation are extremely important factors at sea, which is why it is essential to rely on precise meteorological and tidal information. With the development and expansion of technology this information is readily available both on land and at sea.

As the entrants traverse the North Atlantic they will encounter a number of currents including the Gulf Stream, Labrador Current and the North Atlantic Drift (see image 1). The Gulf Stream and the North Atlantic Drift are the regions where the ocean pumps large amounts of heat into the atmosphere that are important on decadal timescales for climatic changes.

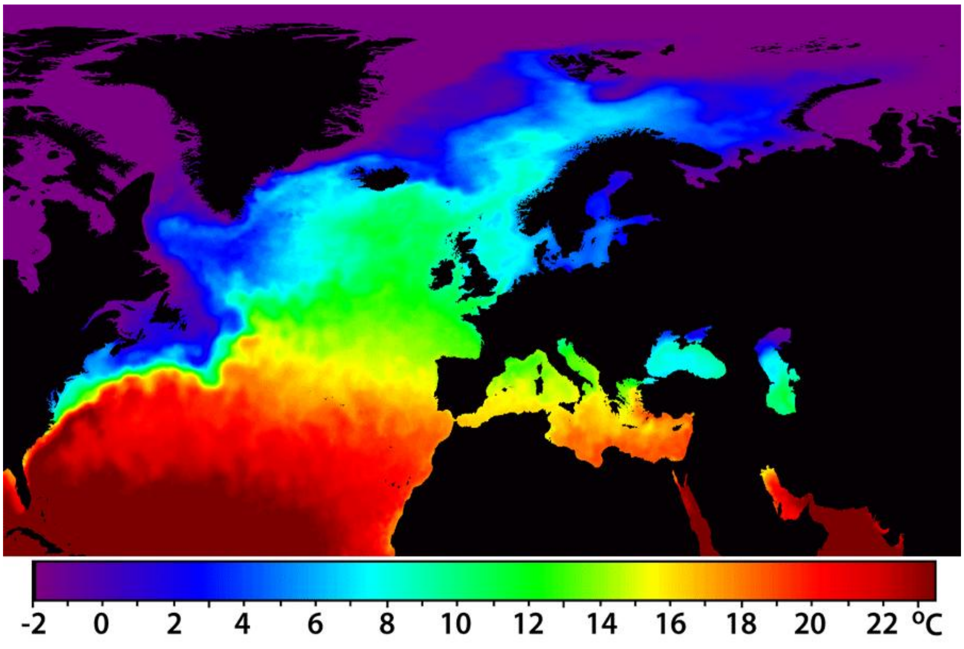

Image 4

North Atlantic Sea Surface Temperature showing Gulf Stream, North Atlantic Drift and Labrador Current. Courtesy of NOC/ Met – Office OSTIA Data

Image 4 shows the Gulf Stream at bottom left running from the Gulf of Mexico northwards with the North Atlantic Drift running from the Gulf Stream to the west of Great Britain. The Labrador Current is the mass of very cold water running south eastwards between Labrador and Greenland and thence running south west past Newfoundland. Where the warm surface waters of the Gulf Stream meet the cold winds accompanying the Labrador Current, one of the densest concentrations of fog in the world occurs.

The Grand Banks of Newfoundland are a group of underwater plateaus south-east of Newfoundland on the North American continental shelf. These areas are relatively shallow, ranging from 15 to 91 metres in depth. The mixing of these waters and the topography of the ocean bottom lifts nutrients to the surface. These conditions help to create one of the richest fishing grounds in the world. The cold Labrador Current (< 5 degrees centigrade) mixes with the warm waters of the Gulf Stream in this region with the net result being the formation of foggy conditions. So not only will the entrants have fog to deal with but also encounters with fishing fleets.

The Gulf Stream meanders up from the Gulf of Mexico, it is a highly active stream with typical speeds of 2 – 3kts but can run up to 5kts in places, but as the stream widens north of Newfound its speed drops to ~ 1kt or less. The Gulf Stream transports 4 billion cubic metres of water per second! The most energetic meanders propagate downstream with a period of around 46 days and an amplitude of ~150km.

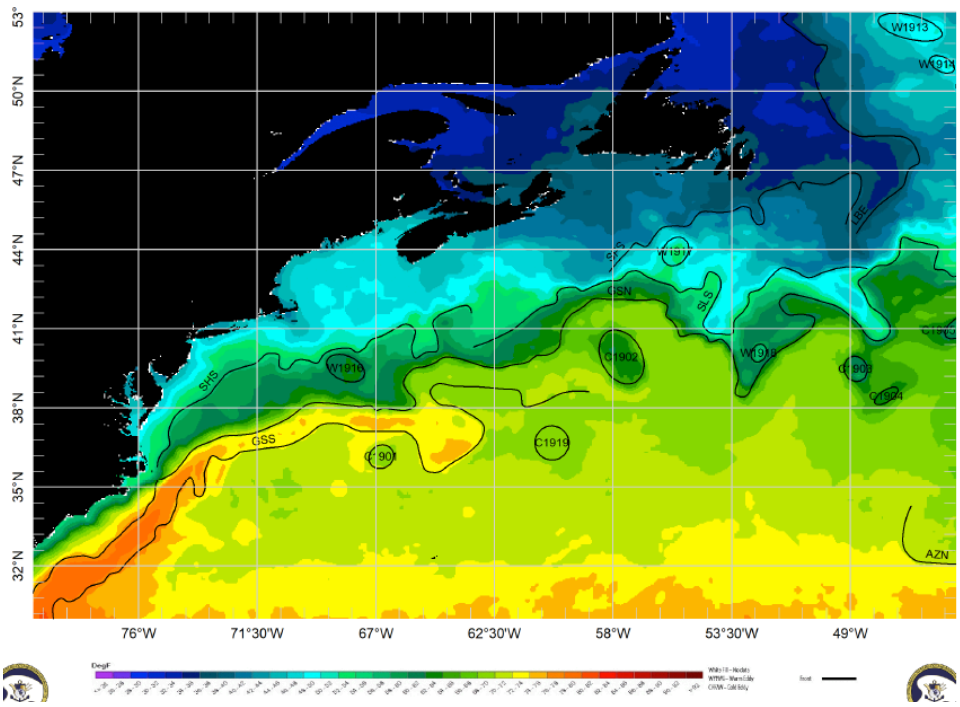

Image 5

The Gulf Stream, 21st December 2019 showing both Warm Core Rings (W) and Cold Core Rings (C)
Courtesy of NOAA Data Prediction Centre

Frequently the edges of individual large meanders merge and coherent pieces of the Gulf Stream separate from the main current in the form of large eddies or current rings. Gulf Stream rings are typically 100 – 300 km in diameter. These are known as Core Rings and will be either Warm (to the north and west of the Gulf Stream) or Cold (to the south and east of the Gulf Stream). The decay rate suggests a lifetime of 2- 4 years, but normally last for 6 – 12 months. These Core Rings can be compared to weather patterns in that the Cold Core Rings circulate in an anticlockwise direction (Cf. Depressions) and the Warm Core Rings in a clockwise direction (Cf. High Pressure areas).

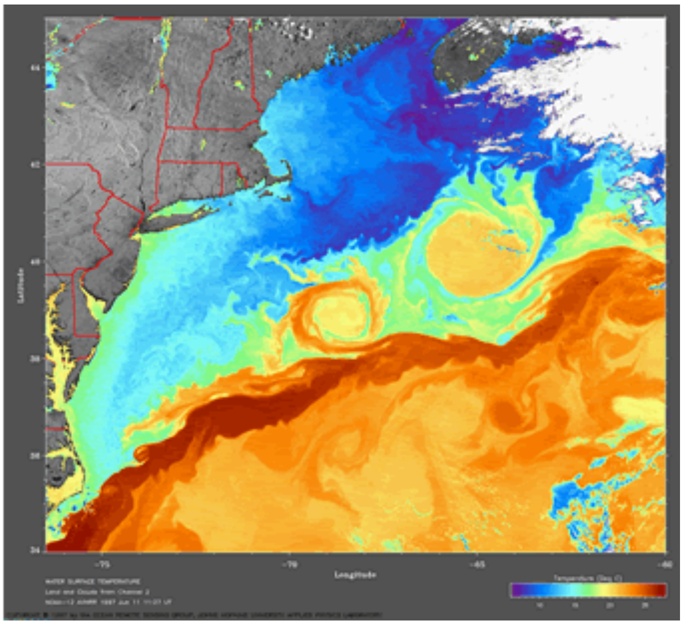

Image 6
Two large Warm Core Rings north of the Gulf Stream, to the south and south east of Cape Cod and Newport. Older Cold Core Rings as eddies can be seen to the south of the Gulf Stream.
Courtesy of John Hopkins University

The sailors of old realised that these circulating eddies could add several hours or even days to a voyage when traversing the Gulf Stream. They were used to utilising these circulating currents so that voyage times could be reduced substantially.

These days a substantial amount of information is available to skippers to assist not only with passage planning but acquisition of data whilst traversing these currents. The National Oceanic and Atmospheric Administration website (https://www.noaa.gov) has information such as weather forecasts, Gulf Stream and data from buoys and nearby ships which is updated on a regular basis. Gulf Stream positions and data are updated 3 times a week on the Ocean Prediction Centre website (https://ocean.weather.gov/gulf_stream.php). Gulf Stream data is available as either raw data or monochrome or colour charts.

A large number of weather resources are available online at https://www.weather.gov/marine These include synoptic charts, weather forecasts including wind strengths and sea state, current observations and links to other resources.

NOAA also runs the National Data Buoy Centre, see https://www.ndbc.noaa.gov from here skippers can get up to date information on wind data, ocean currents, water temperature and other parameters. Each buoy is WMO numbered (World Meteorological Organisation) and usable data can be acquired from the above website. It should be noted that all the buoys are lit and have AIS, so should be easily sighted by entrants. As entrants close in on Cape Cod, buoy data can also be acquired from http://www.maineharbors.com/weather/buoy.htm .

This is just a brief description of some of the physical hazards that all the participants will have to overcome during their Atlantic crossing. A number of the participants will be old friends participating for yet another time so will have encountered these conditions previously, but for new participants it will be a major challenge, and for both made doubly difficult by having to make the return passage before the hurricane season gets underway. The race organisers wish all participants a safe and enjoyable transatlantic crossing.