



# Operational Oceanography in support of Marine Traffic

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# Tidetech – Company Profile

- Science company specialising in providing accurate and detailed environment information for the marine industry
- Based in Hobart, Australia
- Founded 2008 by Penny Haire and Roger Proctor
- Core personnel of 6 with additional resource at hand
- Initial focus on recreational / elite sailing- Olympics, Americas Cup
- Engaged with commercial shipping since March 2012

# Who uses the Oceans ?

- Global Shipping and Trade
- Fishing
- Domestic Shipping, Ferries, Dredging, Workboats
- Sailing – Racing and Cruising
- Windfarms
- Offshore Resources – Oil and Gas
- Cruise ships
- Humanity – Oceans regulate and drive weather on land

# Products

The background features a dark blue gradient. In the upper right, there are several thin, white, wavy lines that resemble a topographic map or a data visualization. Below these, a vector field of small, light blue arrows is visible, pointing generally towards the left and slightly downwards, suggesting a flow or direction.

- Catalogue of 300+ individual data products
- Global coverage
- Regional coverage for higher resolution weather, wave and tidal models

# Tidetech Environmental Data Parameters

## Weather

Wind 10m  
Wind 40m  
Mean Sea Level Pressure  
Precipitation  
Air Temperature  
Humidity %  
Cloud Cover %  
Tropical Storms

## Waves

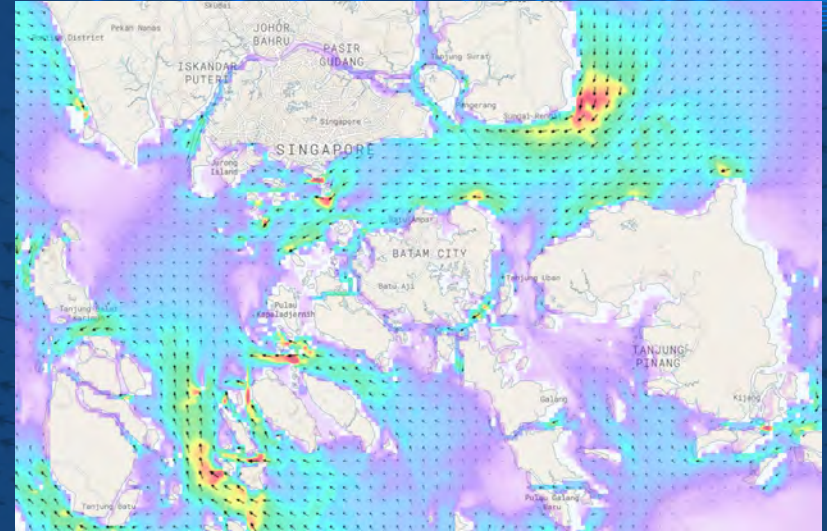
Significant Wave Height  
Primary Wave Direction  
Primary Wave Period  
Primary Wavelength  
Wind Wave height  
Wind Wave direction  
Wind Wave period  
Swell height  
Swell direction  
Swell period

## Hydrodynamic

Tidal Currents  
Non Tidal Currents  
Sea Surface Height  
Sea Temperature  
Sea Ice thickness

# Data Sources

- Tidetechnology Proprietary
- ECMWF
- NOAA / NCEP
- NASA Jet Propulsion Lab.
- Copernicus Marine Environment Service
- University College London



Tidetechnology 0.9km Singapore Strait model

# System Architecture

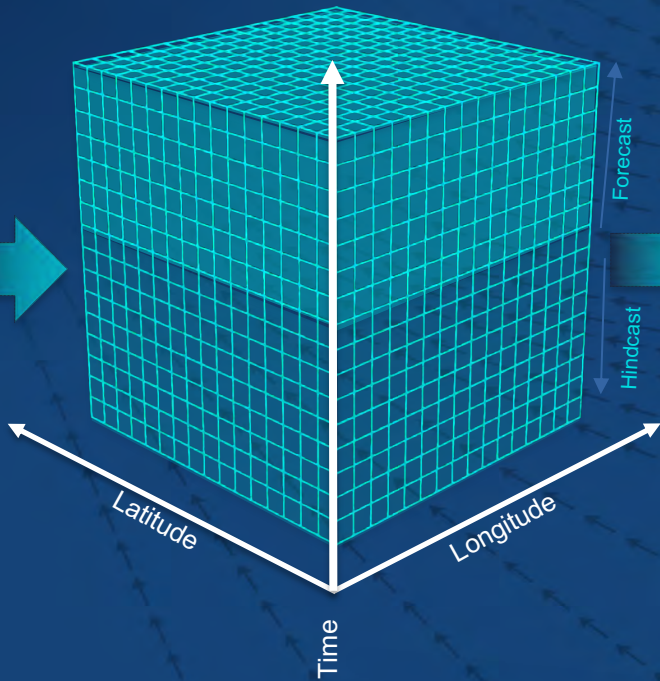
AWS EC2



Tidetech Data Grinder



AWS Relational Database / File system (on ElasticFileShare)



API



Output



# Some features of the system

- The Data Grinder – every dataset is standardised, validated and organised
- All data is stored as readily accessible files on AWS ElasticFileShare, an optimised Network File Share system connected to the API and WMTS
- Access to the files is governed by a PostgreSQL/PostGIS Relational Database System, guaranteeing data integrity, consistency and currency



# Some features of the system (cont.)

- Everything is archived, so data can be compared and contrasted against historic forecasts and re-accessed if necessary
- A custom geospatial toolkit in Python is used by every application
- The toolkit farms out the heavy lifting to C++ to maximise efficiency and speed
- The entire system is platform independent; using Docker, Kubernetes and Python we can run the full architecture from the cupboard in the office, on AWS, Microsoft Azure or Google Compute Cloud with minimal friction

# API Integration

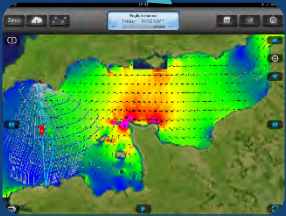
Servers



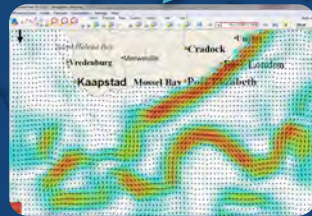
Tidetech  
Interface



Application Programme Interface  
(API) automates process of  
selection and download of data



Apps



Software



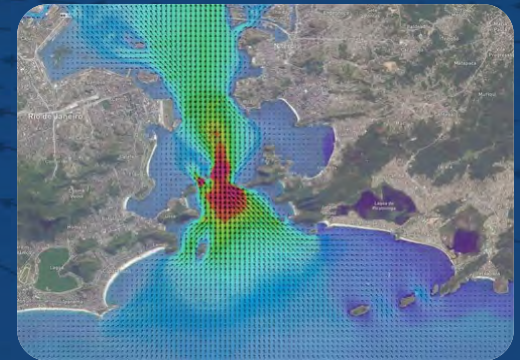
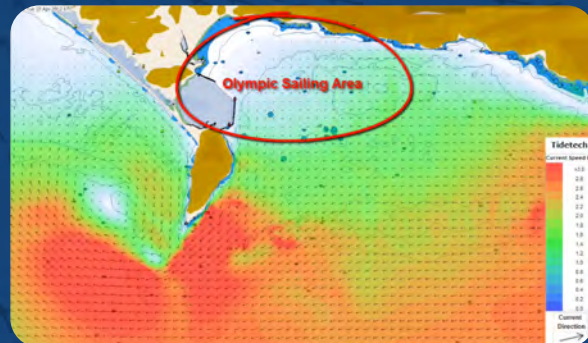
Land Based



On Board

# Sailing Support – Recreational and Elite

- Recreational – 5000 subscribers, 200-300 active at any one time
- Recreational – Sydney-Hobart, Hamilton Island, Cowes week, Fastnet, Newport-Bermuda
- Elite – America's Cup, Volvo Ocean Race, Olympics (2012 (UK), 2016 (Rio), 2020 (Japan))

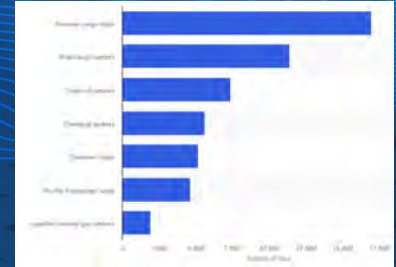


# Example – America's Cup using Tidetech San Francisco Bay Hydrodynamic Model

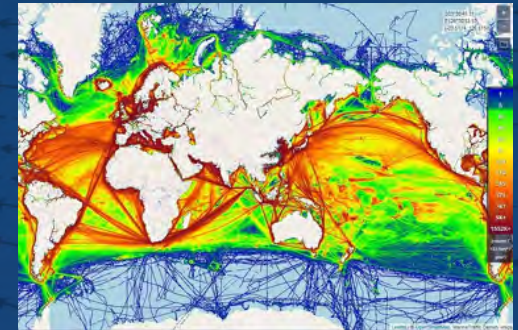


# Commercial Shipping

- Around 80 per cent of global trade by volume and over 70 per cent of global trade by value are carried by sea and are handled by ports worldwide (UNCTAD, 2018)
- But hauling goods around by sea requires roughly 300 million tons of very dirty fuel, producing nearly 3 percent of the world's carbon dioxide emissions, giving the international maritime shipping industry roughly the same carbon footprint as Germany.
- The International Maritime Organization predicts that as trade grows, carbon dioxide emissions from international shipping could increase by as much as 250 percent by 2050.



>53,000 vessels



Traffic density


# IMO Strategy on reduction of GHG emissions from ships

The Initial Strategy envisages for the first time a reduction in total GHG emissions from international shipping and identifies levels of ambition as follows:

- Carbon intensity of the ship to decline through implementation of further phases of the energy efficiency design index (EEDI) for new ships.
  - The EEDI provides a specific figure for an individual ship design, expressed in grams of carbon dioxide (CO<sub>2</sub>) per ship's capacity-mile (the smaller the EEDI the more energy efficient ship design)
- Carbon intensity of international shipping to decline to reduce CO<sub>2</sub> emissions as an average across international shipping, by at least 40% by 2030, towards 70% by 2050, compared to 2008, whilst pursuing efforts towards phasing them out as consistent with the Paris Agreement temperature goals.


# Shipping Company Strategies for emissions reduction

- Exhaust Scrubbing
- Green Steaming – Optimising speed for just in time arrival
- Slow Steaming – Reducing standard speed to use less fuel
- Alternative Fuels – LNG, Reduced Sulphur Fuel Oils, Hybrid, Electric, Wind-assist
- Route optimisation – Avoidance of wave height, adverse weather and currents
- Engine Optimisation – Selection of Engine Performance settings for reduced fuel burn/mile travelled
- Larger Ship Sizes, Ship Design, Autonomous Shipping, Shore based management (e.g. cold ironing)

The background is a deep blue gradient. In the upper right, there are several thin, white, wavy lines that resemble a topographic map or a data visualization. Below these, there are numerous small, dark blue arrows pointing generally to the right, arranged in a grid-like pattern that follows the curvature of the wavy lines. The overall aesthetic is clean, modern, and technical.

The envisaged actions to meet the IMO Strategy increase the need for timely and accurate environmental data



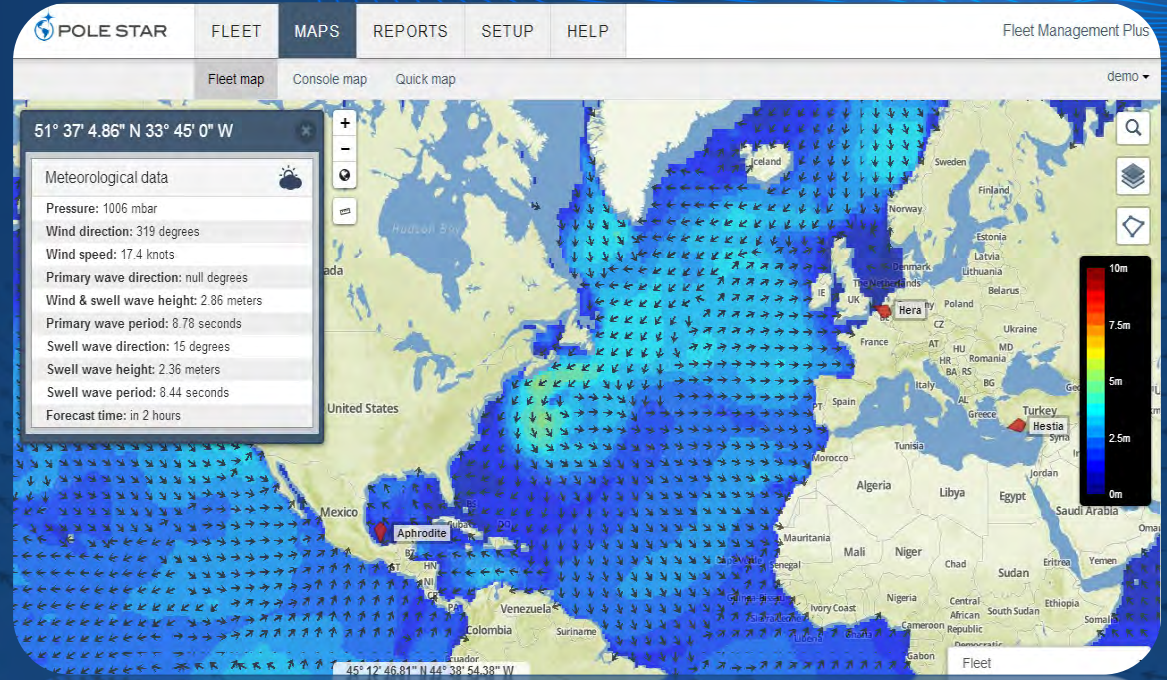
The background is a dark blue gradient. In the upper right, there are several thin, white, wavy lines that resemble a topographic map or a data visualization. In the lower right, there is a grid of small, light blue arrows pointing generally towards the right, with some arrows slightly curved, suggesting a flow or direction. The text is centered in the middle of the image.

Some examples of environmental data use by  
commercial shipping (Tidetech customers)

# In Commercial Operation:



Fleet Management, SSAS Alert  
Advanced and Marine Asset  
Tracker 2.0 customers



Web map service for met-ocean data layers

- 40,000 vessels, LRIT and fisheries tracking

# In Commercial Operation:



## ECDIS Integration



ECDIS 17:24:45 UTC

Orientation: North Up  
Range: 6 NM  
REF: OCRP  
Heading: 256.8 °  
STW: 10.4 kn  
CYR: 256.7 °  
Sv: 075.7 °  
LAT: 35°59.657' N  
LON: 005°27.150' W  
Mode: Ground  
VDR: 12 min  
FNC: FNC  
Tides: Tides Off  
Sloping: All AIS  
Mx: Mx Off

No Unacknowledged Alarms

Alarms: AEGEIRAS-SOUTH

Track: 252.6 ° 4.00 NM  
AUTO II: 270.0 ° 4.00 NM  
Schiffs: Economy 3

NAV: NAV  
Data: Data  
Auto select: Auto select  
Show Symbols: Show Symbols  
Interpolate: 961 09:00:12:00 UTC  
Select: Select  
Routes: Routes

ENC (Category: Standard, Depth: metres)

ENC: 36702228 N  
ENC: 36702228 N  
ENC: 36702228 N  
ENC: 36702228 N

Algeiras SOUTHAMPTON

Route	View	Options	Next arrival	SBB	Wz	116/4 NM	LIA @ 10.3 kn	11	10:21 UTC	Delay 10:36:11
4	BCF	36705364 N 005222028 W	156.1	3.10	R	15.4	1.00			15.0 16.1
5	TARIFA TRAFIC	36702228 N 00521541 W	165.7	1.87	R	7.7	2.00	0.3		24.0 16.1
6	GIBRALTAR ST...	36700215 N 00525697 W	296.6	4.17	R	3.8	4.00	-1.0		24.0 16.1
7	TARIFA - SHIP	3557580 N 00536379 W	243.6	5.03	R	3.8	4.00	-0.5	06 Feb 2014 17:51	24.0 16.1
8	OUTSIDE 4NM	3557580 N 00541128 W	220.0	4.55	R	4.00	0.1	06 Feb 2014 18:08		24.0 16.1

Planning View: 46 Waypoints (2,092.99 NM, 30.22)

# In Commercial Operation:



## Maritime Energy Management Systems

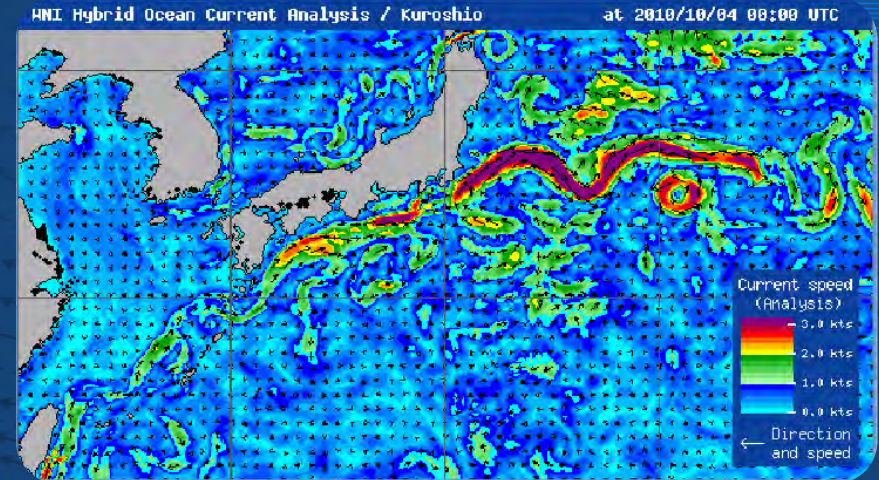


460 vessels using Tidetech Metocean Data  
Eniram customers include:  
Hapag Lloyd, Hamburg Sud, Carnival, Royal  
Caribbean and Norwegian Cruise Lines

# In Commercial Operation:



Weathernews International  
Total Fleet Management Service



Supply of current data:

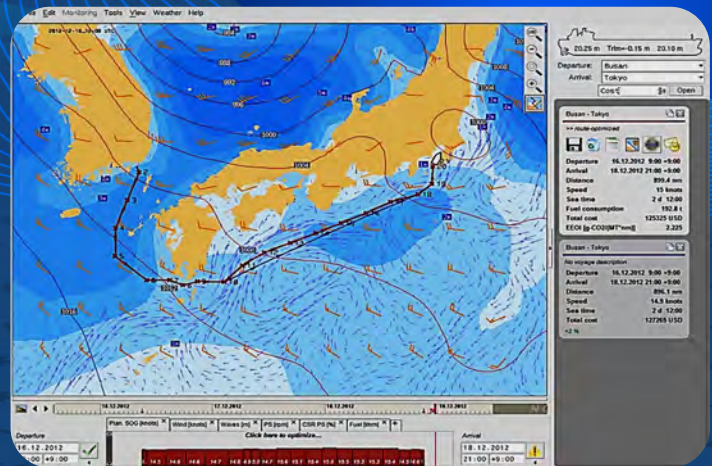
- Global Ocean Currents
- Tidal model – Singapore and Malacca Straits
- Tidal model - North Australia / Indonesia
- 5,000+ vessels

# In Commercial Operation:



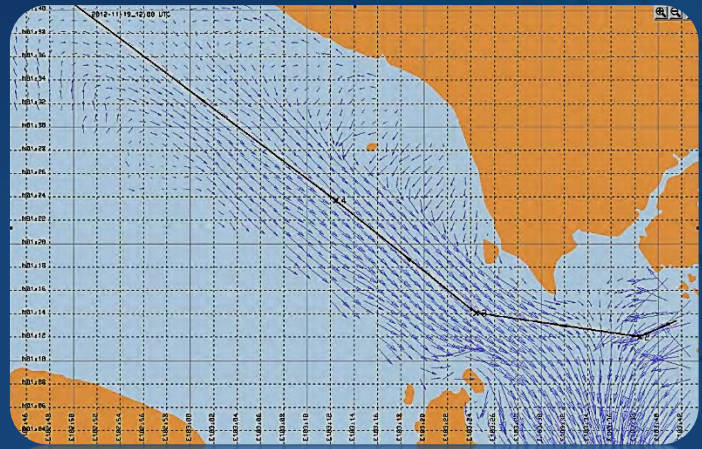
ClassNK Napa Green  
Voyage Optimisation

Reported savings of  
4-6% (BORE vessels)

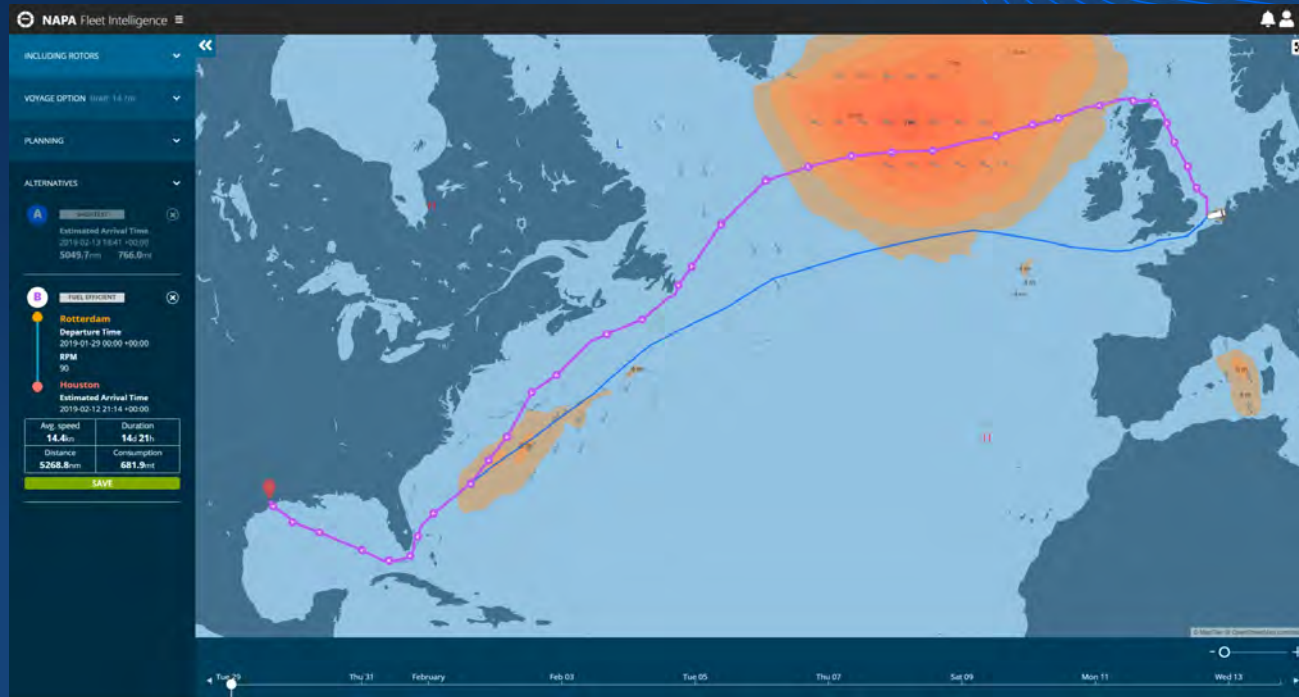


450 vessels using data directly

55,000 vessels for Fleet Monitoring  
<https://fleetintelligence.napa.fi/>



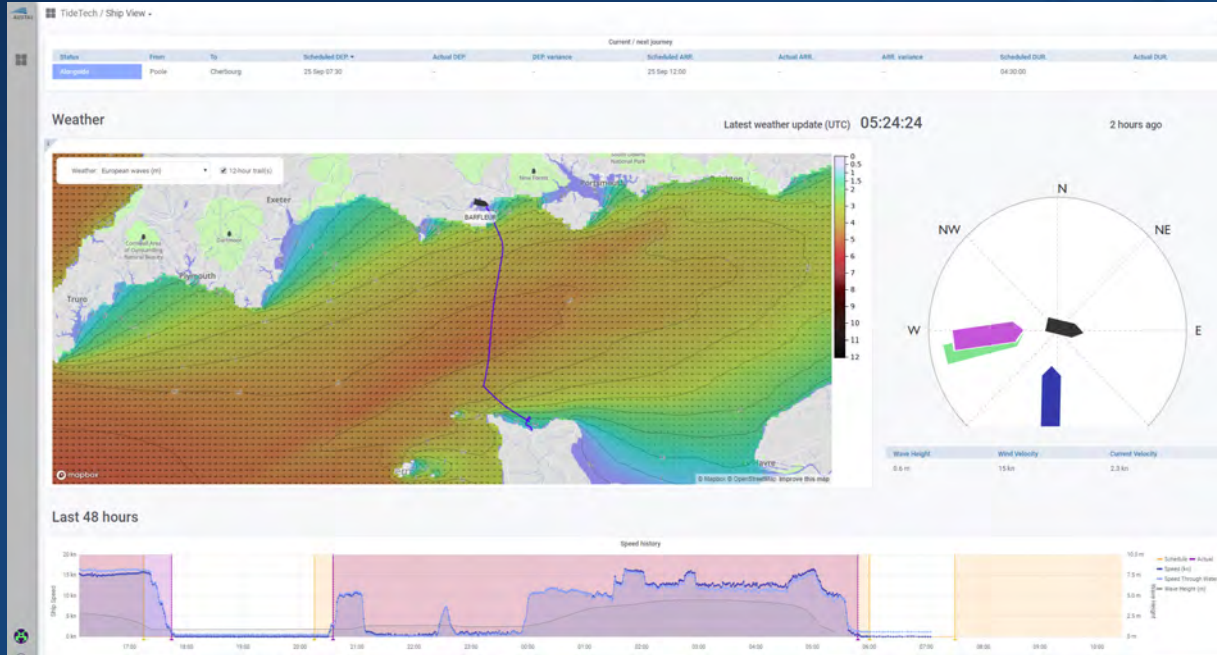
# Napa route optimisation



Optimised route saves 84 tonnes of fuel = 46,200 \$USD and 261 tonnes CO2

# Austal MarineLink

– showing Brittany Ferry and effect of big waves

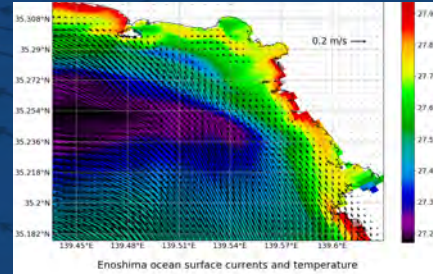
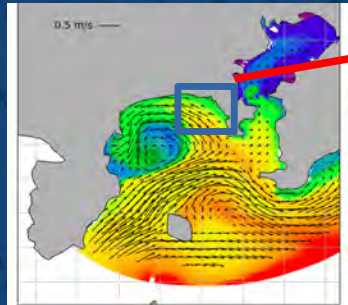
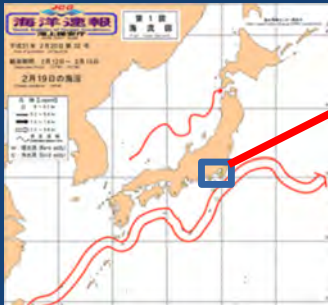




# Business partnership with CSIRO - KickStart

## Aim:

- to explore opportunities to use the Environmental Model System to support operational oceanography, i.e. in delivering 24/7 oceanographic services to commercial shipping and sailing
- Test case: Enoshima, Sagami Bay, site of 2020 Olympic Sailing



Thanks for listening

[www.tidetech.org](http://www.tidetech.org)

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Applied Oceanography