# Data, Analytics, Visualization

*The Three -Legged Maritime Domain Awareness Stool*

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# Data, Analytics, Visualization
## *The Three -Legged Maritime Domain Awareness Stool*

**GIS provides us the universal visual language…**

**…to help make million dollar 'go/no go' decisions safely and efficiently.**

**Common Operating Picture**

*delivers*

**Maritime Domain Awareness**
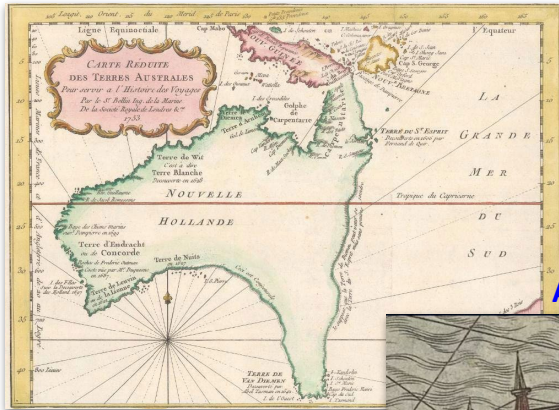
*creates*

**Actionable Intelligence**

# Presentation Overview

- Maritime Domain Awareness
- MetOcean Challenges in the Gulf of Mexico
- Eni Requirements
- Fugro: Loop Current Monitoring & Forecasting
- 40Geo: Raptor MetOcean Dashboard
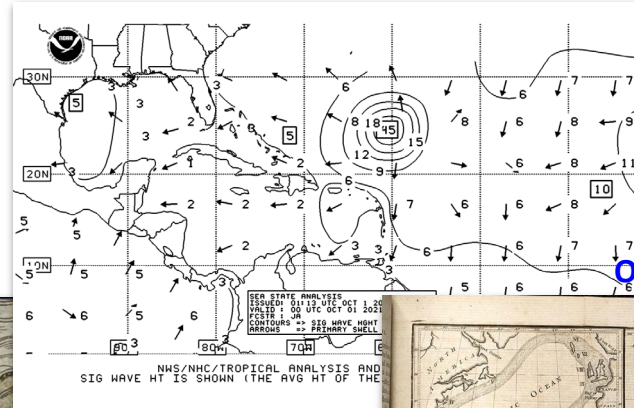
# Maritime Domain Awareness

**Discovery[1]**



**Aids to Navigation[2]**



**Meteorology[3]**



**Oceanography[4]**



*[1]Jacques-Nicolas Bellin (1703-1772)*
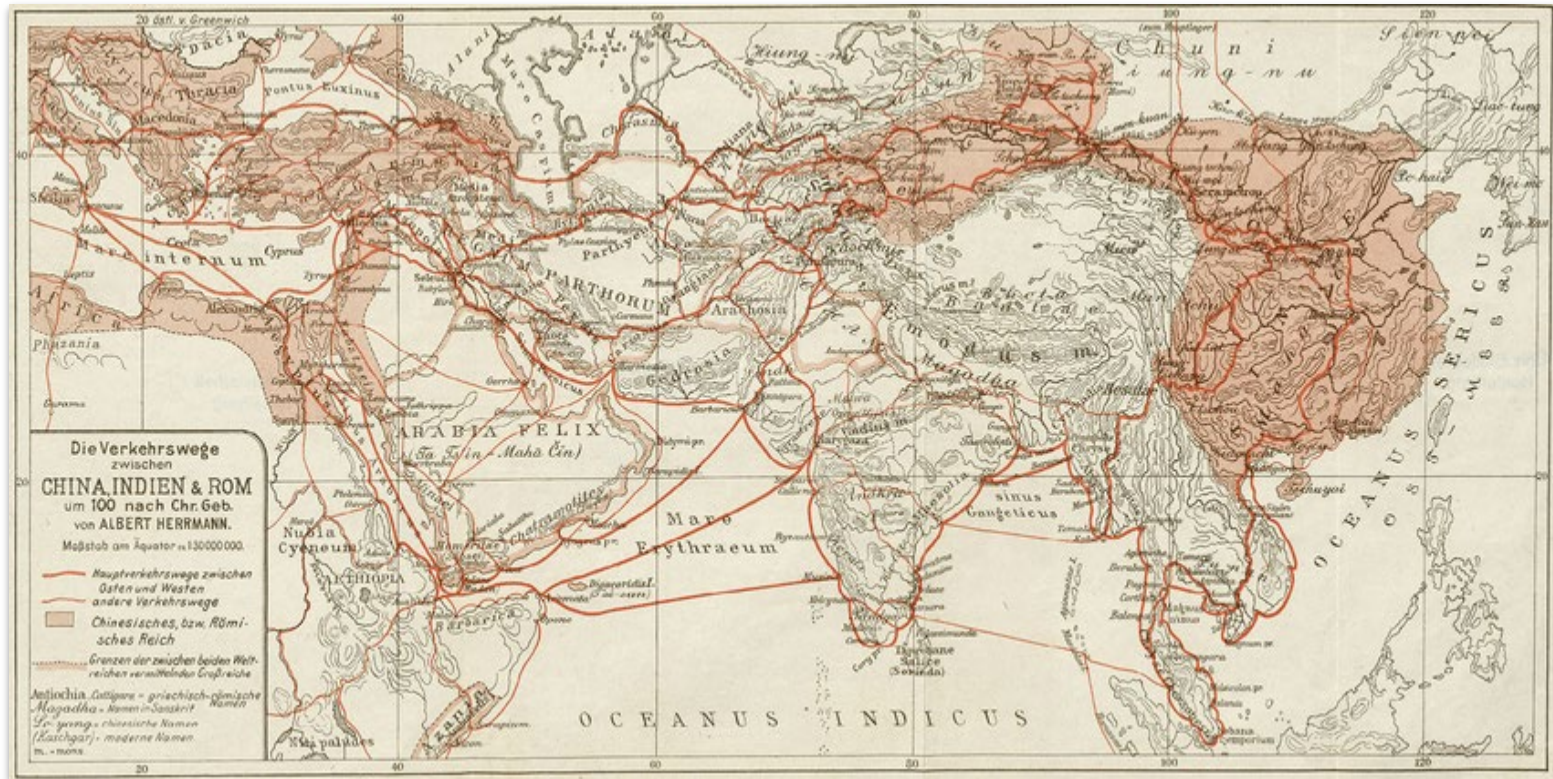*[2]Chet Van Duzer - Sea Monsters on Medieval and Renaissance Maps*

*[3]NOAA National Weather Service Radiofax Chart*
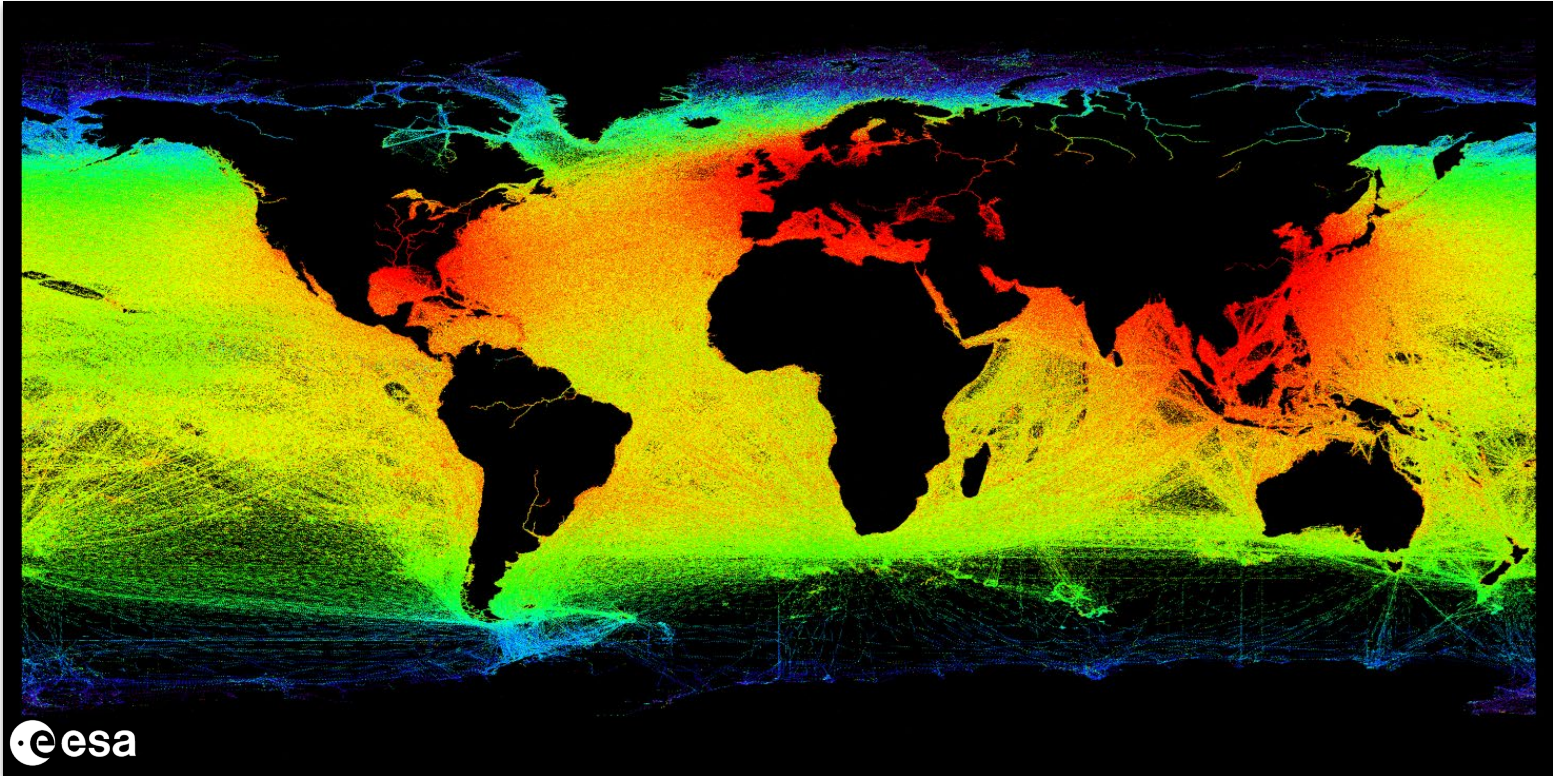*[4]Franklin-Folger chart of the Gulf Stream*

# Maritime Domain Awareness

*Trade*



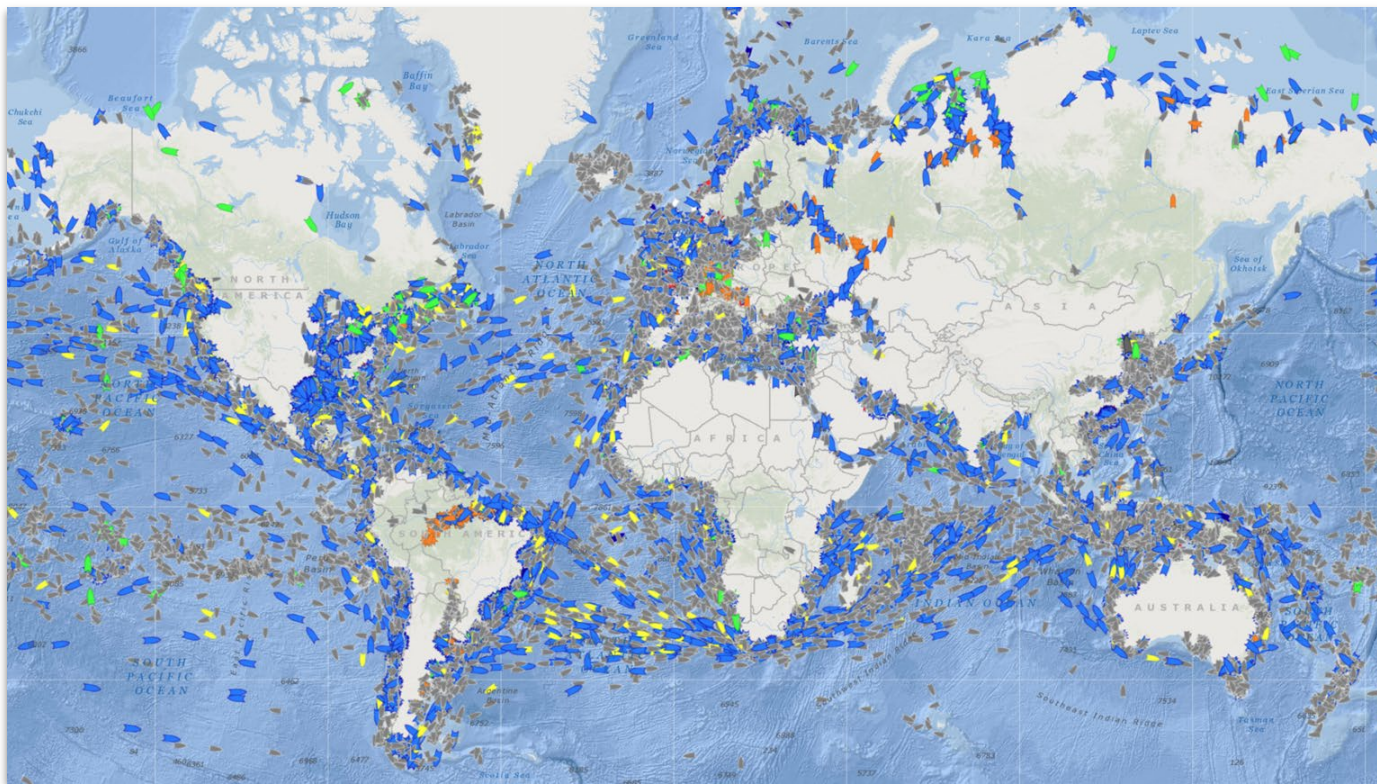Map of the Silk Roads (Herrmann, 1922)

# Maritime Domain Awareness

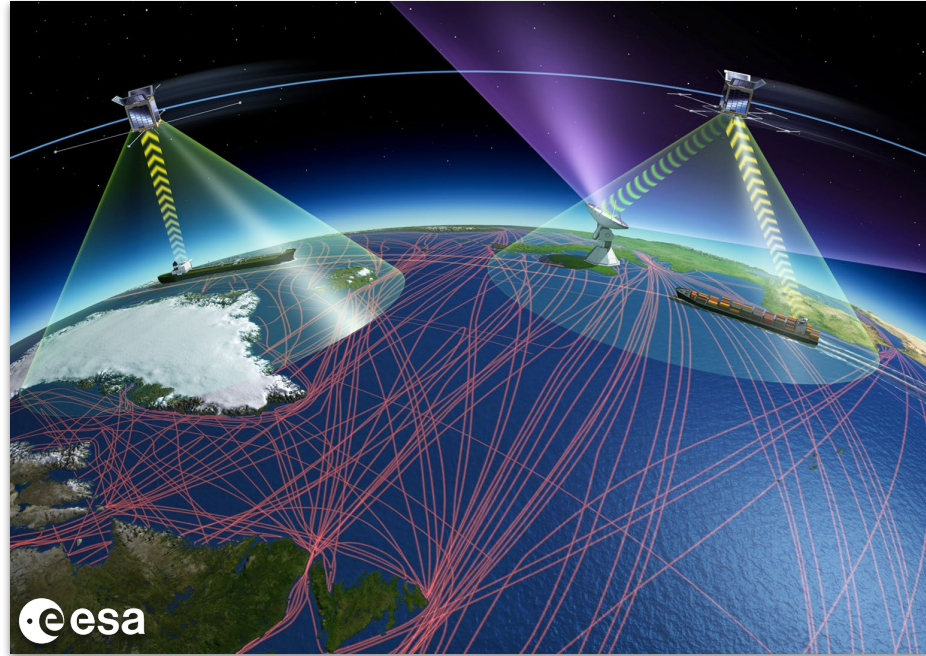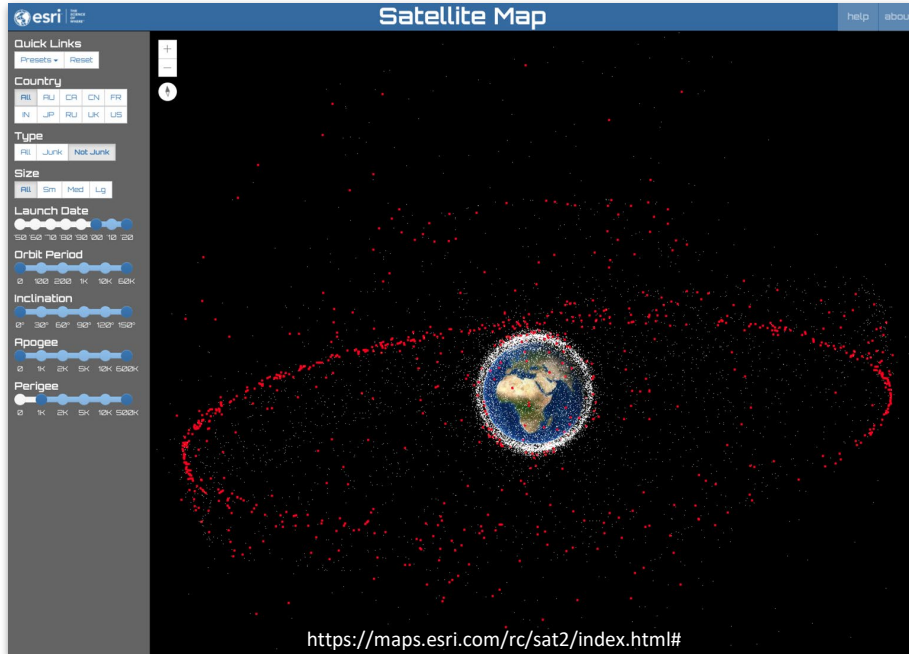*~90% of goods are transported via water*

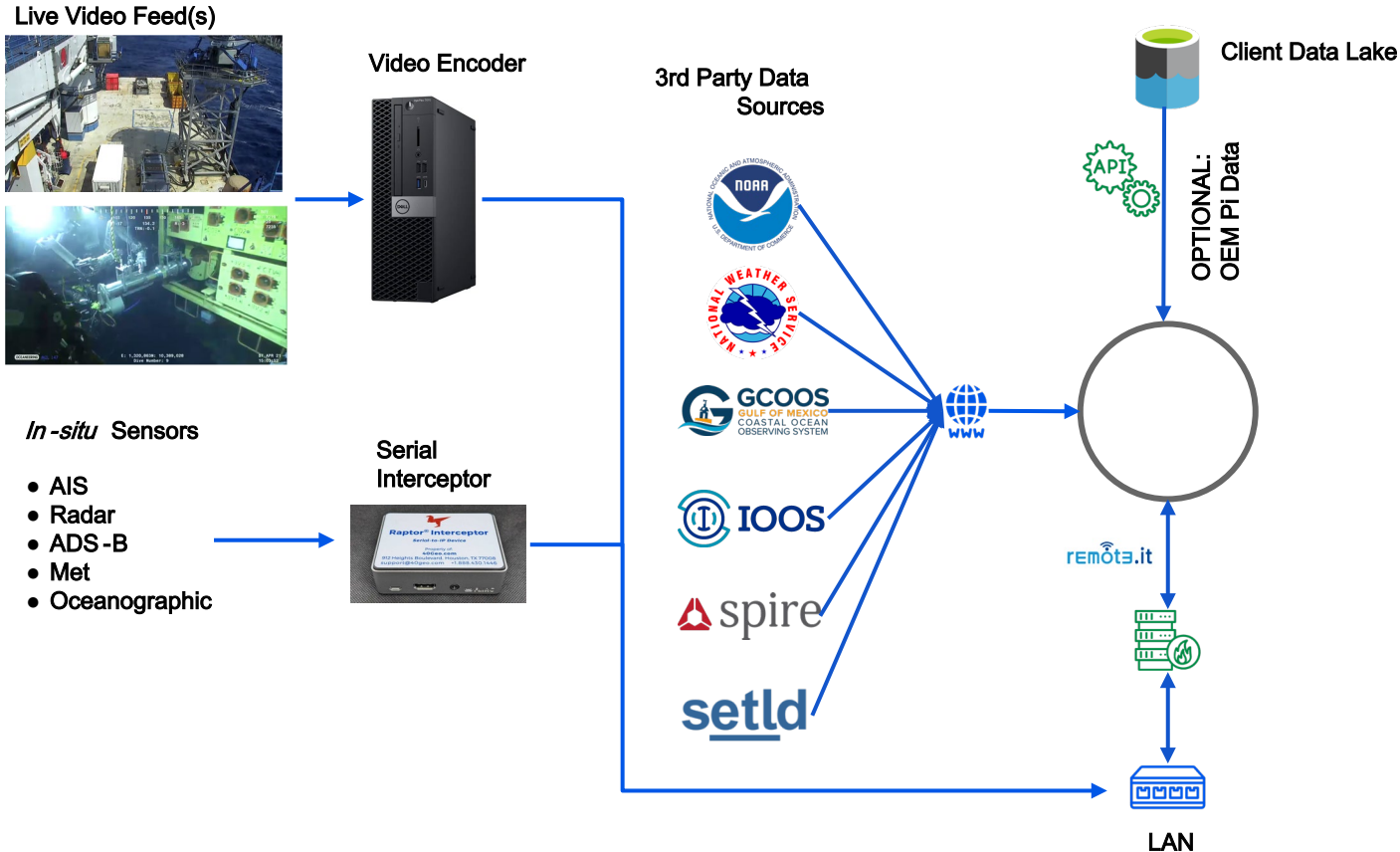# Maritime Domain Awareness

*Location. Location. Location.*

# Maritime Domain Awareness

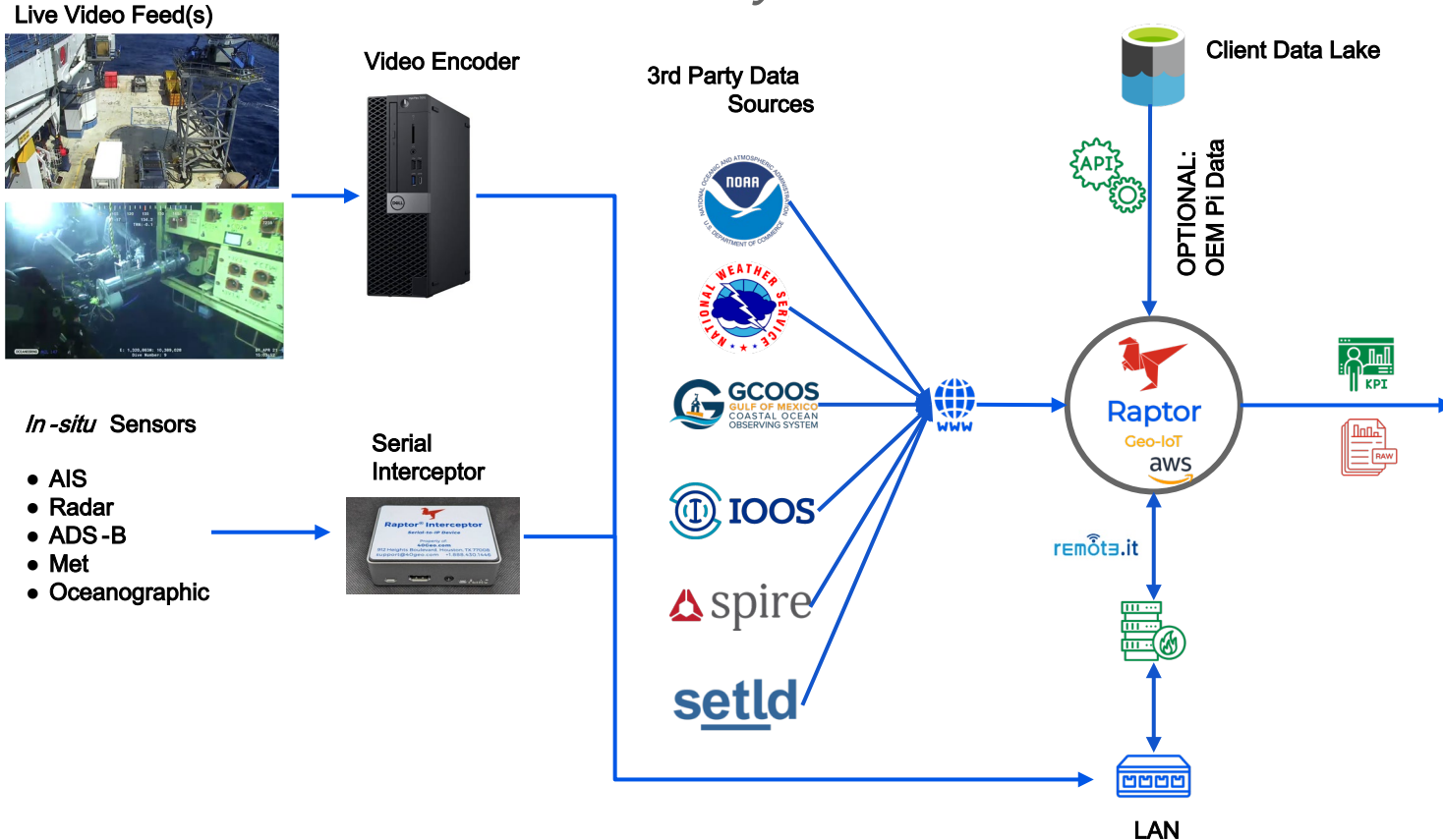*Global Positioning System + Automatic Identification System*



https://maps.esri.com/rc/sat2/index.html#

# Maritime Domain Awareness

*Data.*

**Live Video Feed(s)**

**Video Encoder**

**3rd Party Data Sources**

**Client Data Lake**

API

OPTIONAL: OEM Pi Data

NOAA

NATIONAL WEATHER SERVICE

GCOOS
GULF OF MEXICO
COASTAL OCEAN
OBSERVING SYSTEM

IOOS

spire

setld

www

remote.it

*In-situ* **Sensors**

- AIS
- Radar
- ADS-B
- Met
- Oceanographic

**Serial Interceptor**

Raptor® Interceptor
Serial-to-IP Device

**LAN**

# Maritime Domain Awareness

*Data. Analytics.*

**Live Video Feed(s)**



**Video Encoder**

**3rd Party Data Sources**

**Client Data Lake**

*In-situ* Sensors

- AIS
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NOAA

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GCOOS GULF OF MEXICO COASTAL OCEAN OBSERVING SYSTEM

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setld

WWW

API

OPTIONAL: OEM Pi Data

Raptor
Geo-IoT
aws

KPI

RAW

rem0t3.it

LAN

# Maritime Domain Awareness

## Data. Analytics. Visualization.

Live Video Feed(s)



Video Encoder

In-situ Sensors

- AIS
- Radar
- ADS-B
- Met
- Oceanographic

Serial Interceptor

3rd Party Data Sources

NOAA

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Client Data Lake

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aws

remot3.it

www

LAN

KPI

RAW

Push

Push

SMS/Email: Reports, Alerts, etc.

Common Operating Picture

Integration with Client's Existing Services

API

# Maritime Domain Awareness

*Million dollar 'go/no go' decisions safely and efficiently*



Captain Jan Berghuis

# Gulf of Mexico

- 1,800+ production facilities
- 15% of U.S. oil production
- 5% of U.S. natural gas production
- 47% of U.S. petroleum refining
- 51% of total U.S. natural gas processing



*https://www.eia.gov/special/gulf_of_mexico/*
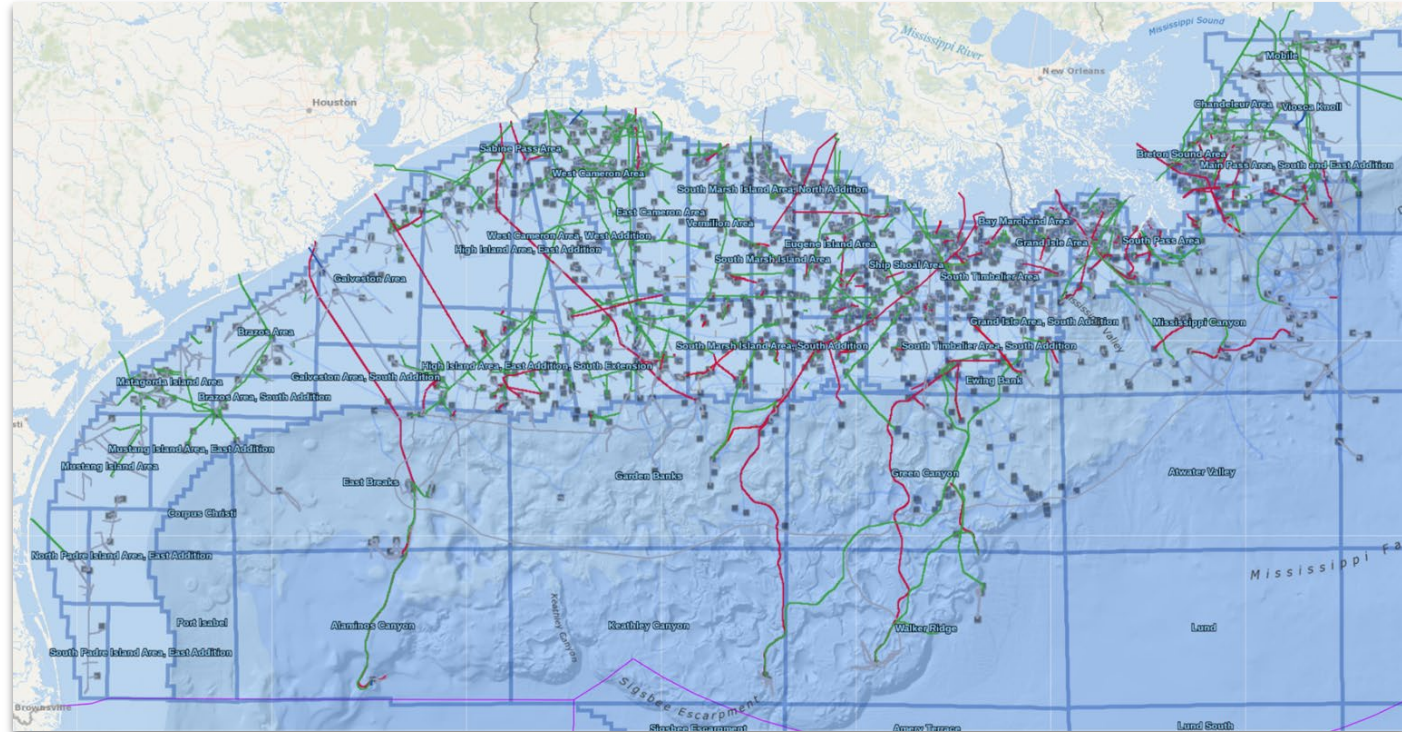
# Gulf of Mexico    - Harsh Environmental

### Water Depth

- max:  14,000' (4,300m)

- Steep escarpment

# Gulf of Mexico   - Harsh Environmental

**Intense Storms**

- *Seacor Power* Tragedy

  Straight Winds Storm

  - Winds: 70-80 kts (130-145 km/h)
  - Max. Gust: 102 kts (188 km/h)
  - Waves: rose 7-9' (2.1-2.7 m)

Cat. 3:
111-129 mph | 96-112 kt I 178-208 km/h



**How a thunderstorm with the power of a hurricane capsized a ship**
By Allison Chinchar, CNN Meteorologist
Updated 5:45 AM ET, Sat April 17, 2021

A Coast Guard boats heads toward a capsized commercial liftboat south of Port Fourchon, Louisiana, on Tuesday, April 13.

**(CNN)** — Nineteen people were on board a commercial ship when it capsized Tuesday during a thunderstorm off the Louisiana coast. But this was no ordinary storm.

# Gulf of Mexico    - Harsh Environmental

## Catastrophic Storms

- 14 named storms
- 7 hurricanes / yr.
- 3x Cat. 3+ hurricanes / yr.

Cat. 1:
74-95 mph | 64-82 kt I 119-153 km/h

Cat. 2:
76-110 mph | 83-95 kt I 154-177 km/h

**Cat. 3:**
**111-129 mph | 96-112 kt I 178-208 km/h**

**Cat. 4:**
**130-156 mph | 113-136 kt I 209-251 km/h**

**Cat. 5:**
**157+ mph | 137+ kt I 252+ km/h**



*Cat. 3 - Hurricane Katrina*

# Gulf of Mexico    - Harsh Environmental

## Loop Current & Loop Current Eddies

- 3+ knot Ocean Currents
- "Predictably Unpredictable"
- No True Seasonality
- Weeks/Months of Impact
- 1,000s hours of NPT /year

**≡ MENU**  🔍                     **HART**ENERGY

**DEEPWATER**

## Loop Currents Blamed For Big Foot Failure

Subsea Engineering News   Fri, 06/26/2015 - 03:13 AM

...Chevron executives identifies strong loop currents as the likely cause of the failure of nine of 16 tendons that were to comprise the Big Foot tlp's four tension legs...

Image: https://www.chevron.com/projects/big-foot

**Source:** https://www.hartenergy.com/news/loop-currents-blamed-big-foot-failure-104573

# Intra -America Seas

# Loop Current System
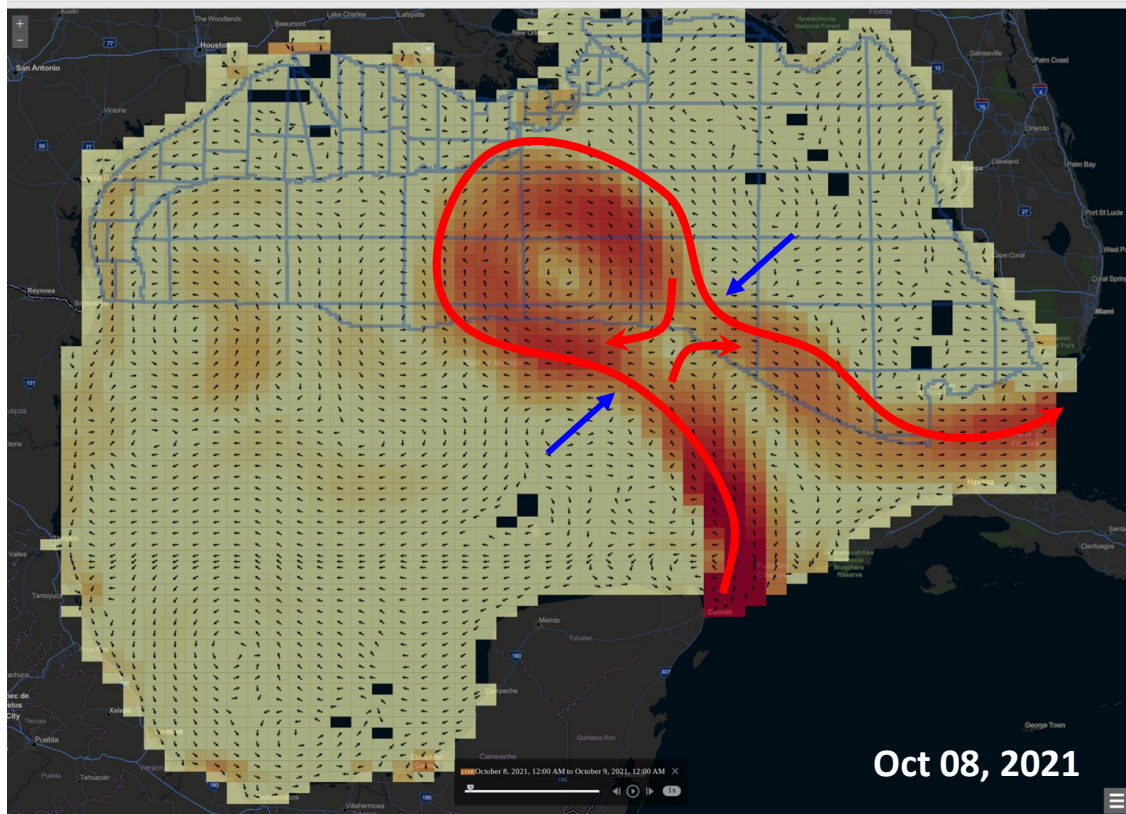


Raptor® MetOcean Dashboard & Mapping Interface

Oct 08, 2021

# Loop Current System



Raptor® MetOcean Dashboard & Mapping Interface

Oct 15, 2021

# Loop Current System
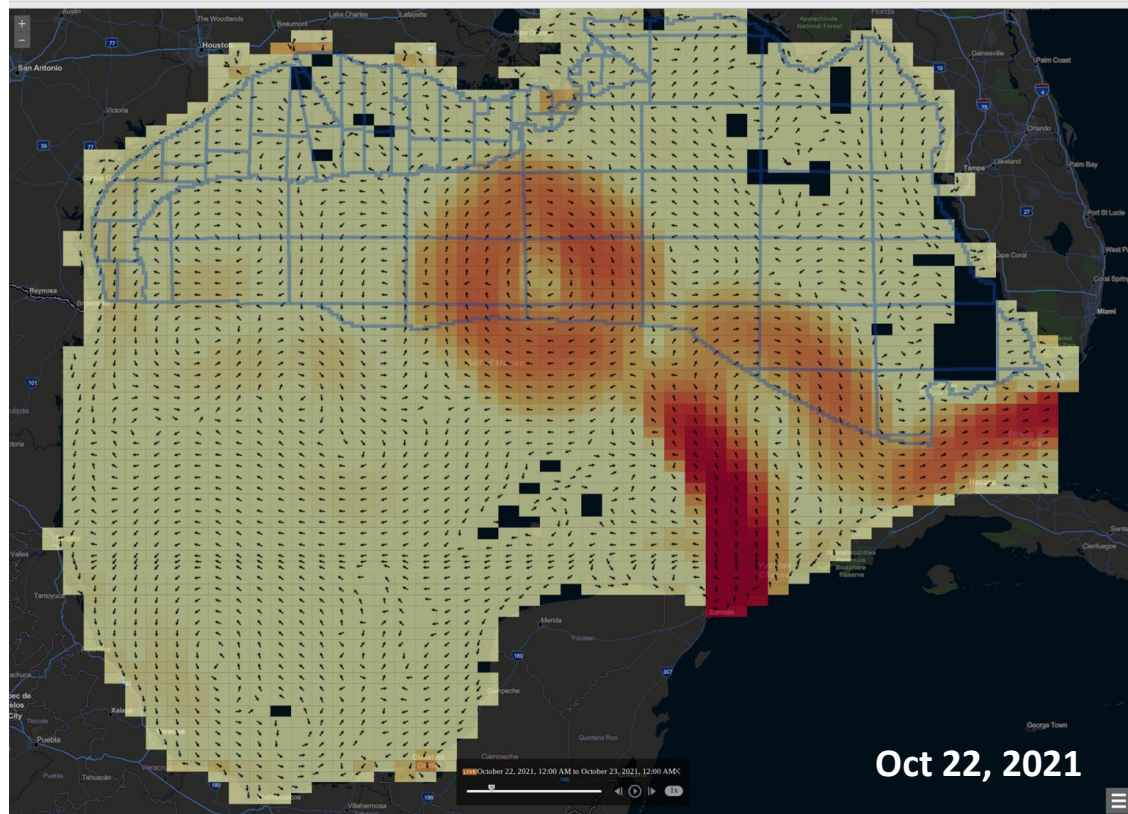
Raptor® MetOcean Dashboard & Mapping Interface



Oct 22, 2021

# Loop Current System



Raptor® MetOcean Dashboard & Mapping Interface

Oct 29, 2021

# Loop Current System

Raptor® MetOcean Dashboard & Mapping Interface



Nov 05, 2021

# Loop Current System



Raptor® MetOcean Dashboard & Mapping Interface

Nov 12, 2021

# Loop Current System



Raptor® MetOcean Dashboard & Mapping Interface

Nov 19, 2021

# Eni - Gulf of Mexico
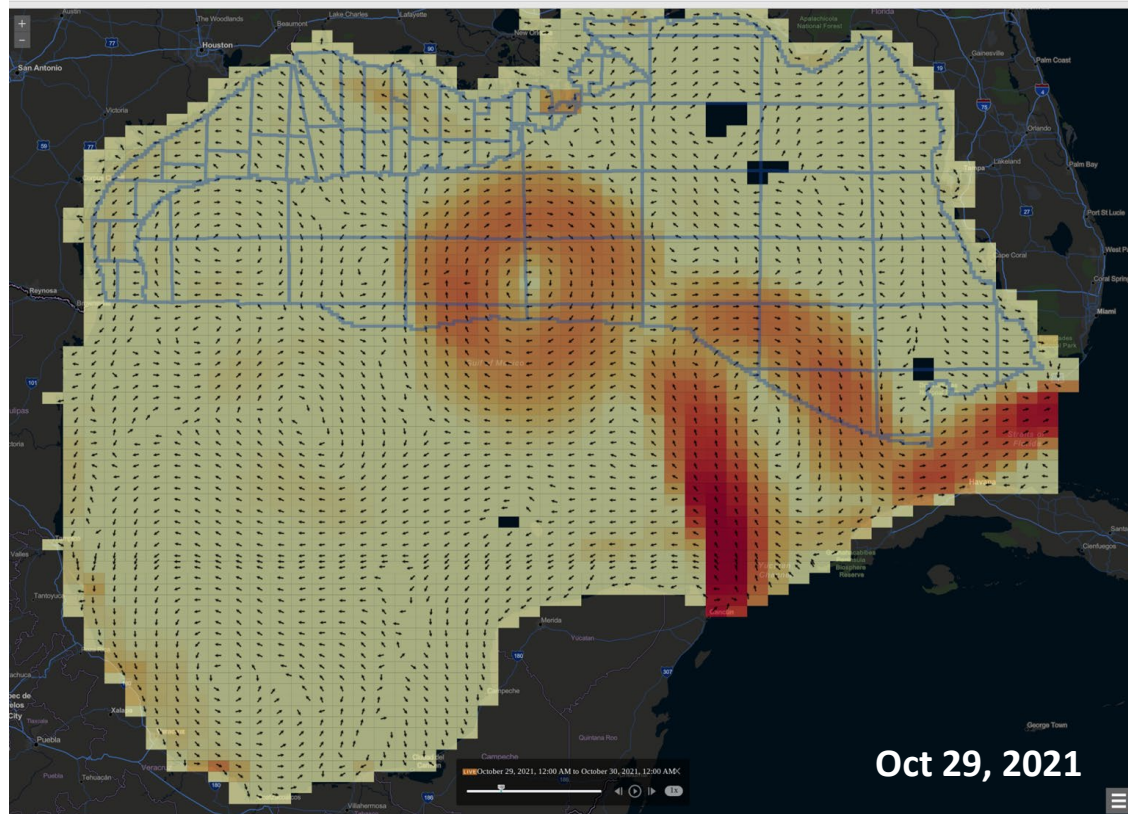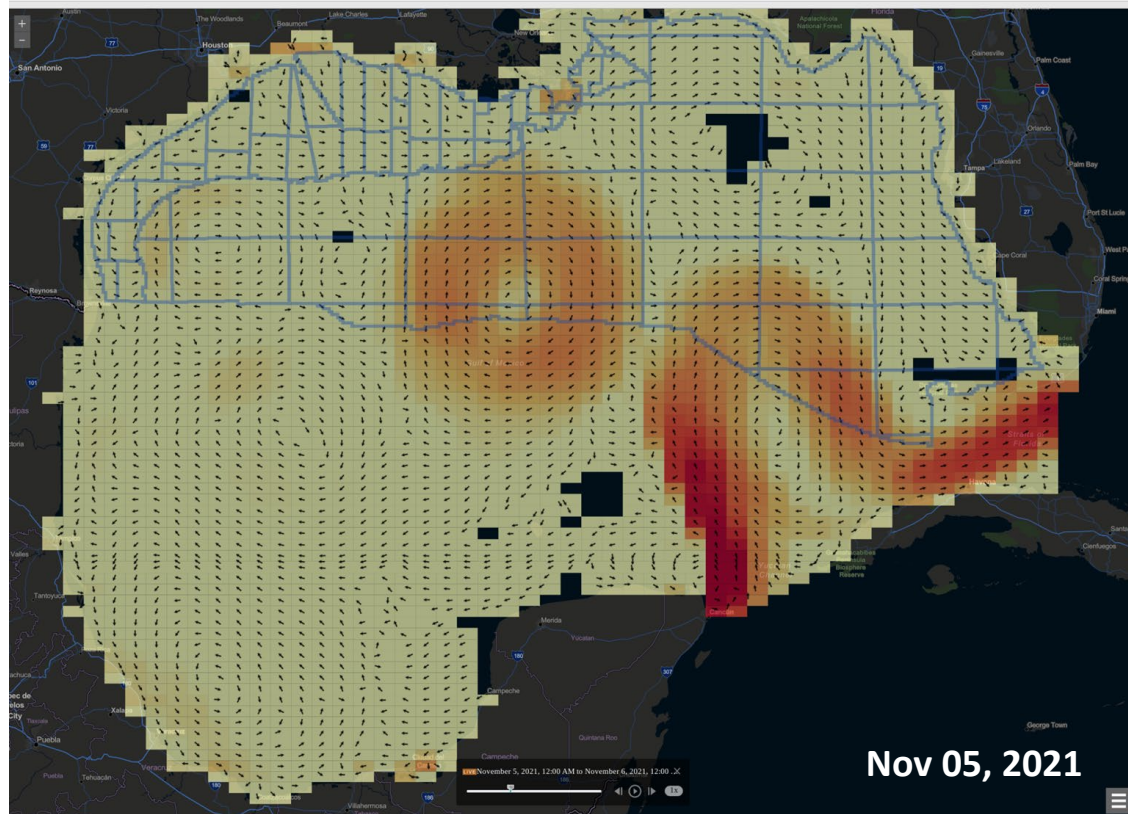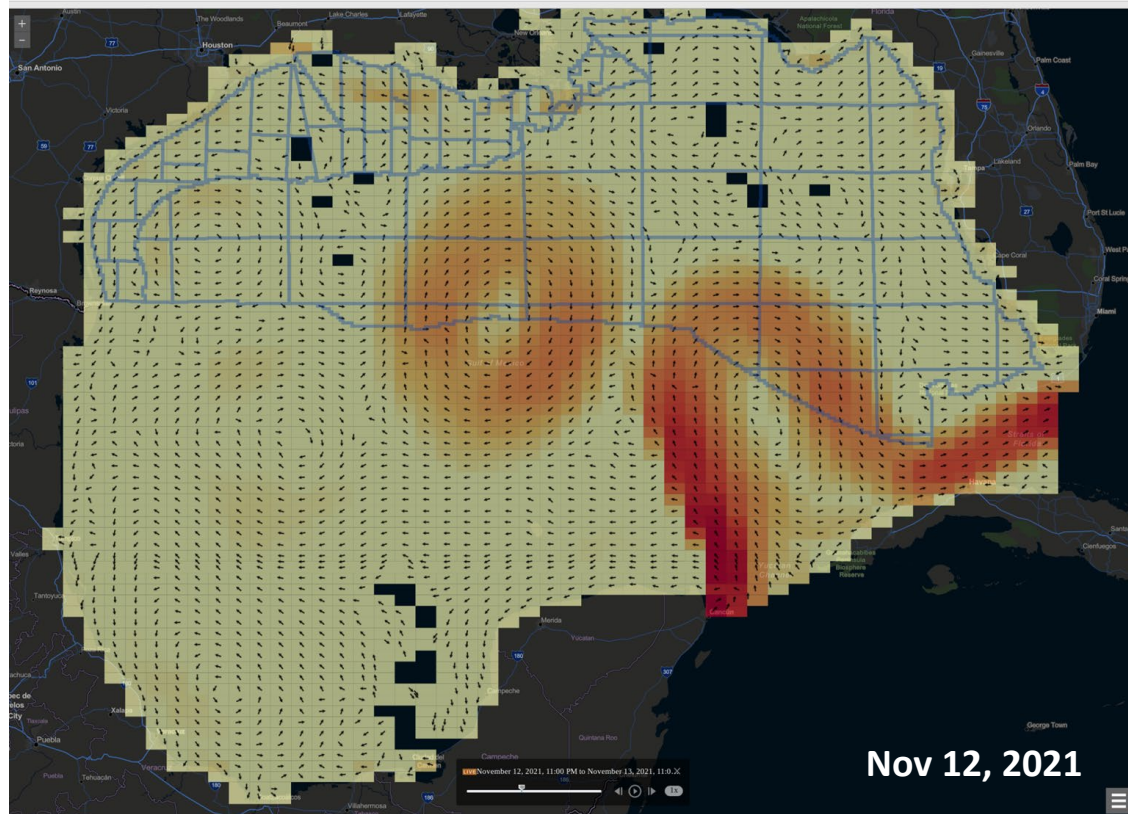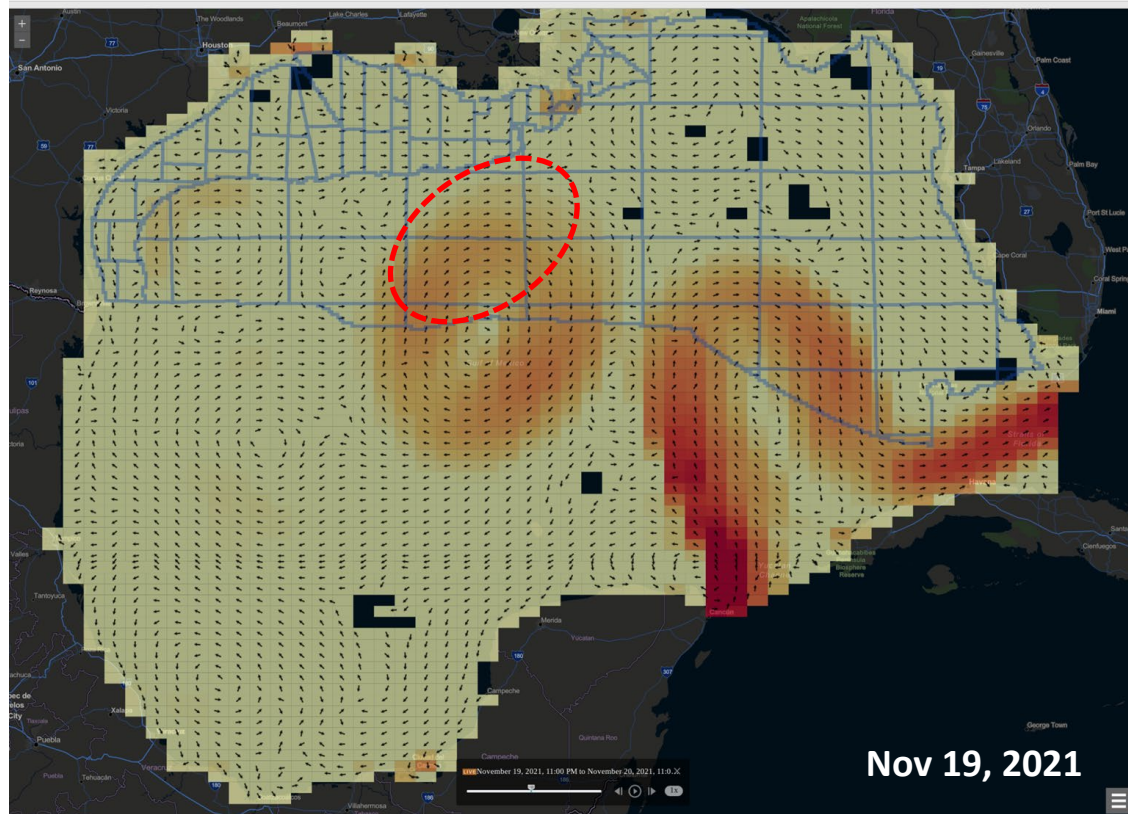
**Operations:**

- 3x Production Platforms
- Decommissioning
- Drilling
- Inspection

**Logistics:**

- 6x Fleet vessels + adhoc fleet
- Crew change/Resupply
- Upto 4x helicopters
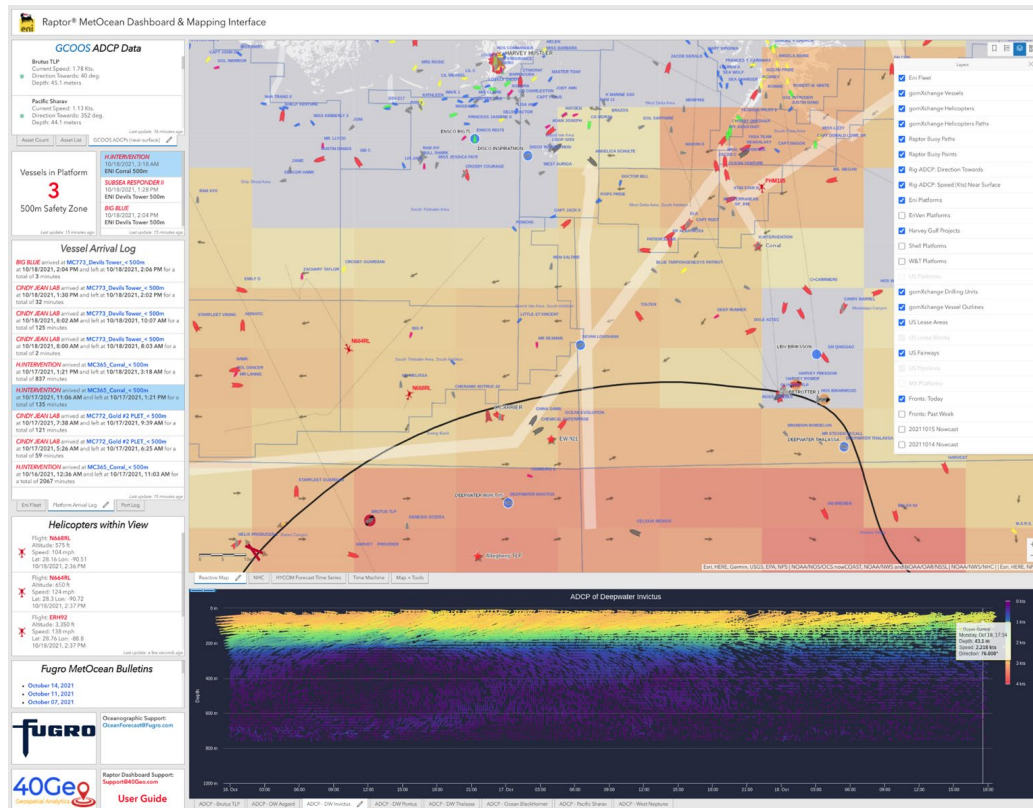
# Eni - Loop Current Monitoring Requirements

- Daily Frontal Analysis
  - In-situ Data
  - Remotely-sensed Data
- Twice Weekly Reports
  - Nowcast
  - 3-5 day Forecast
  - 7 day outlook
- Phone & Email Consultation
- Data & Analysis via COP
  - Frontal Analysis
  - Forecast
  - Vessel Tracking
  - Helicopter Tracking
  - Hurricane Tracking
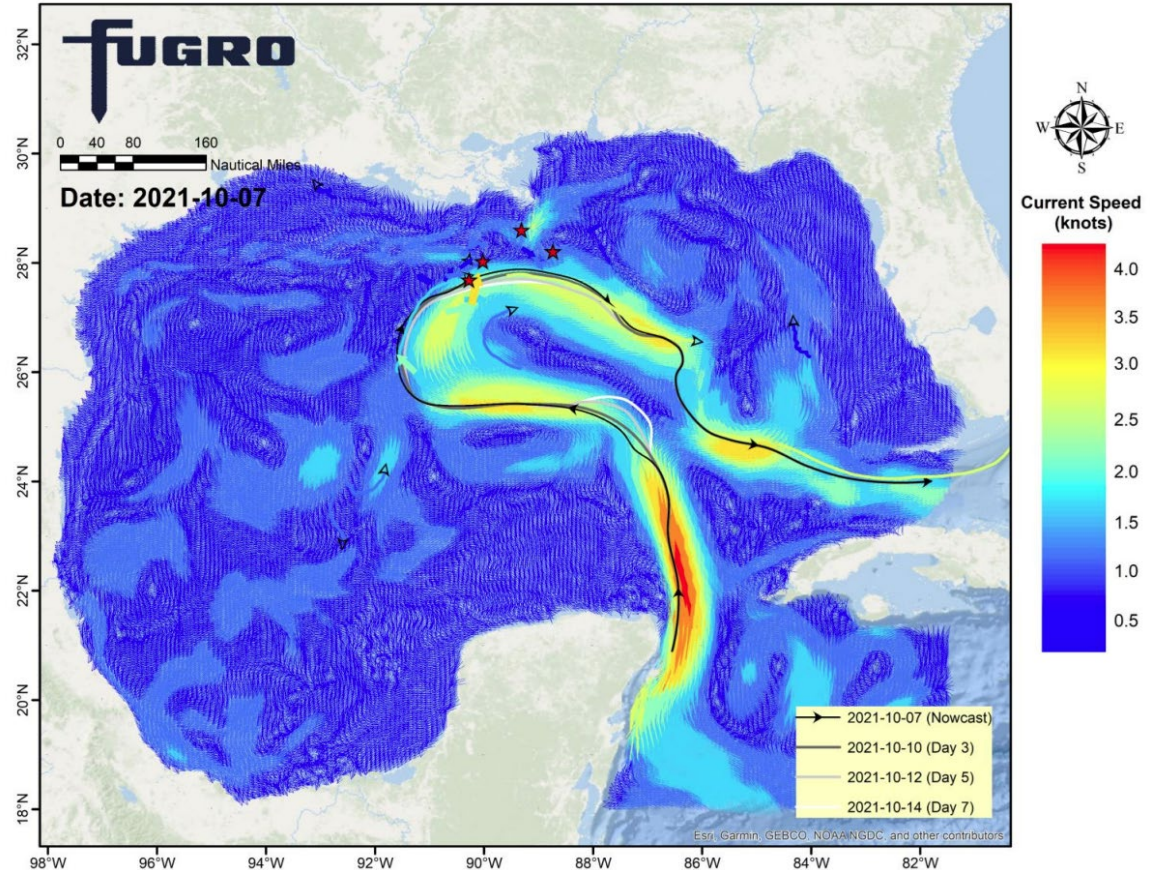
# In -Situ Data
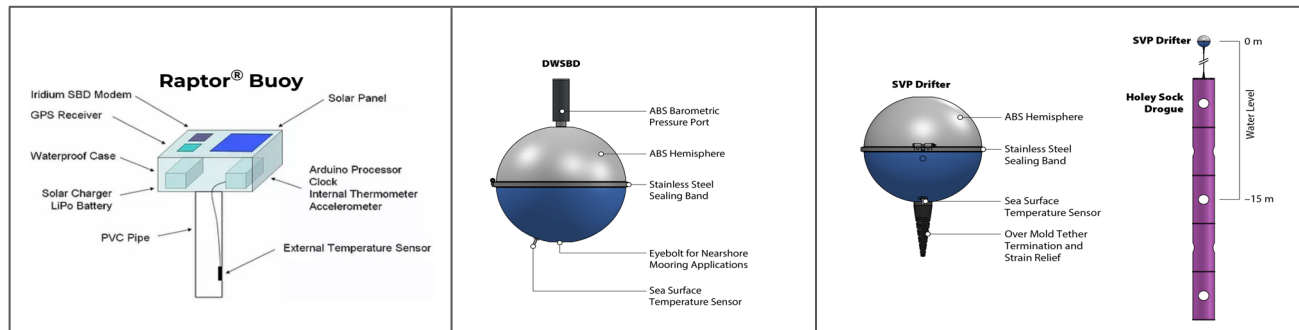


"...the instruments cannot be regarded as marine debris…"

# In -Situ Data

# In -Situ Data

# Remotely   -Sensed Data

# SST

# SST

# Ocean Color

# 2-day SST

# 2-day SST + Buoys + ADCPs

# HYCOM Nowcast

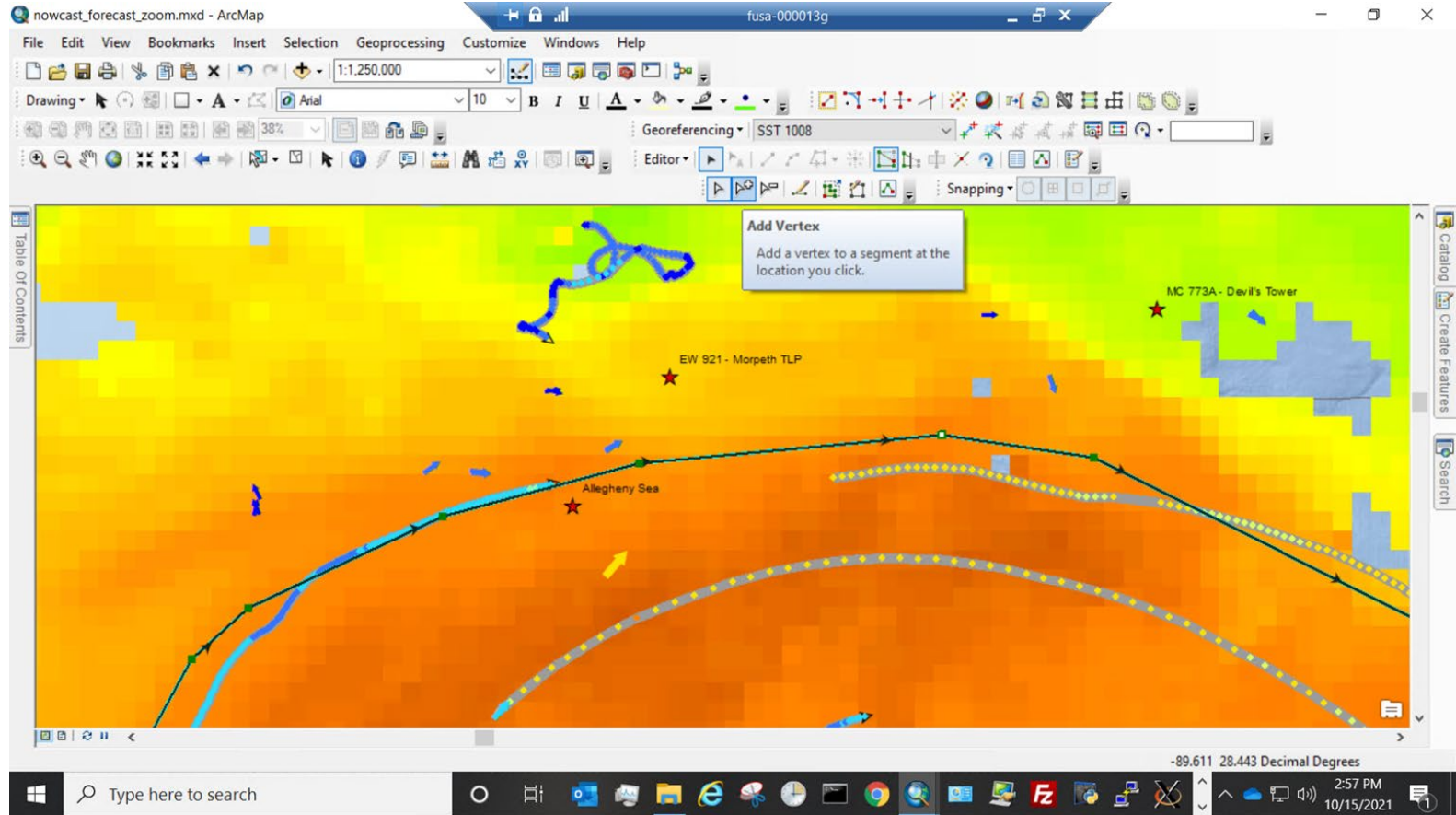# HYCOM Nowcast

# Frontal Analysis
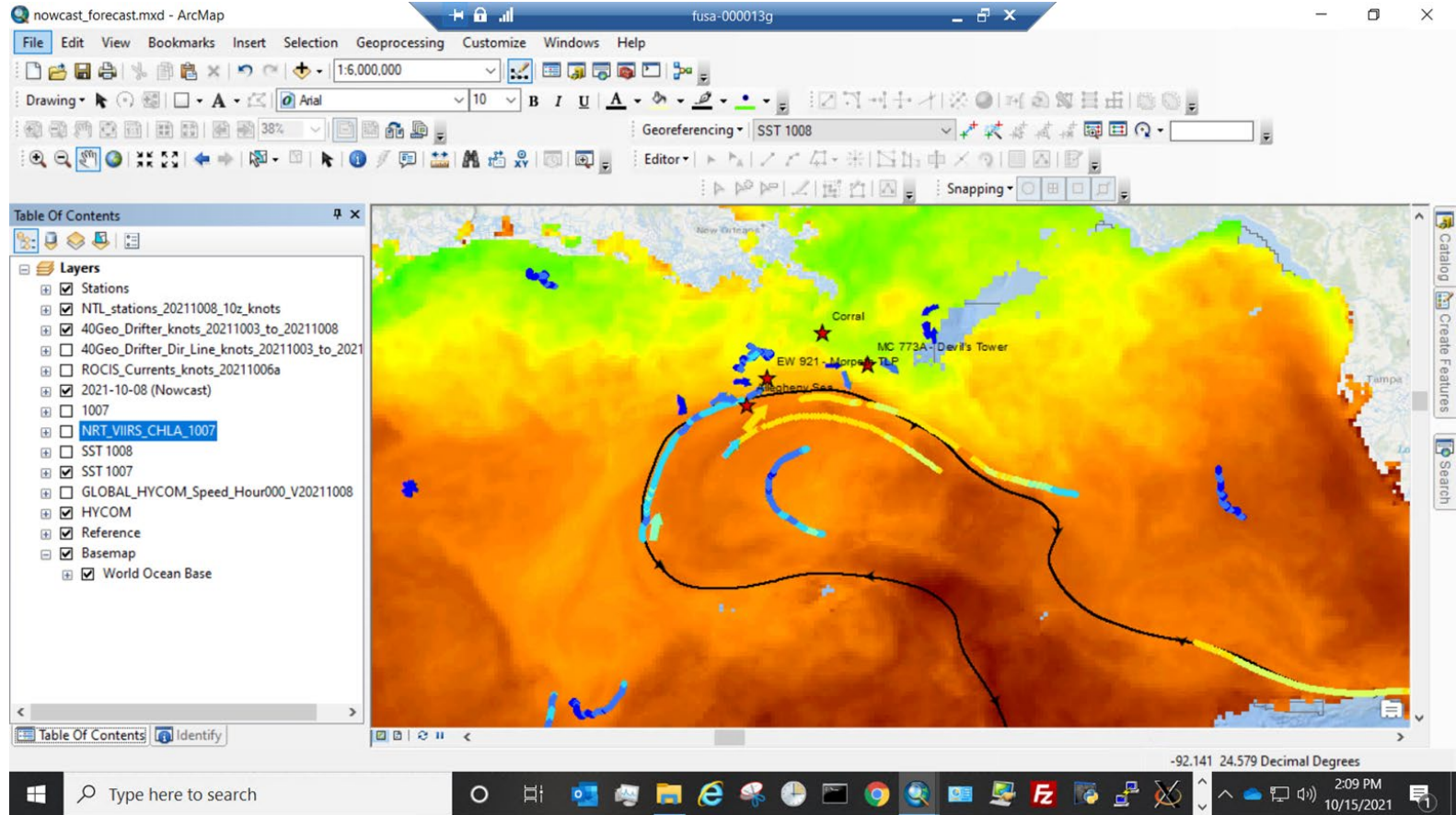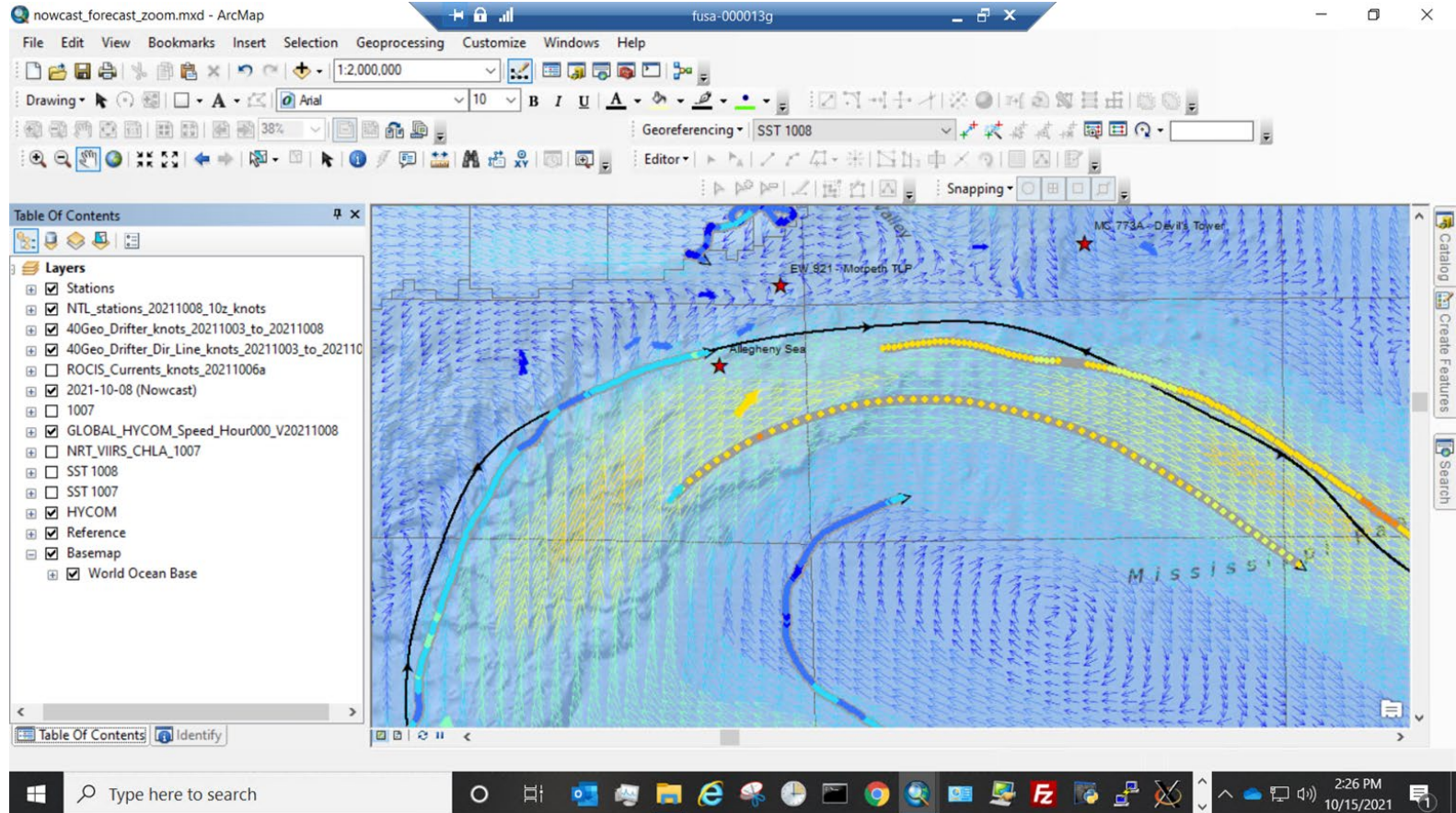
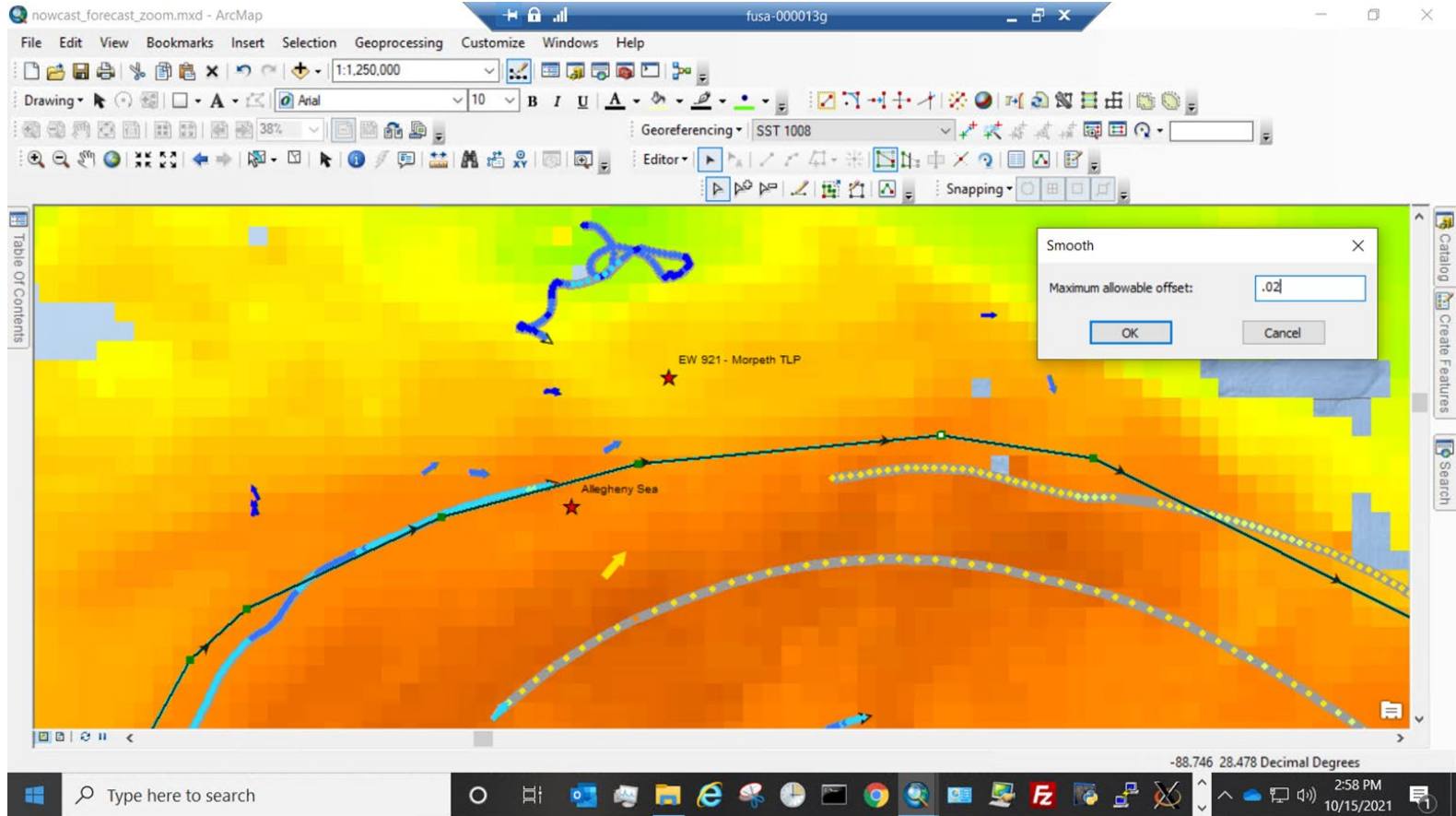# Frontal Analysis
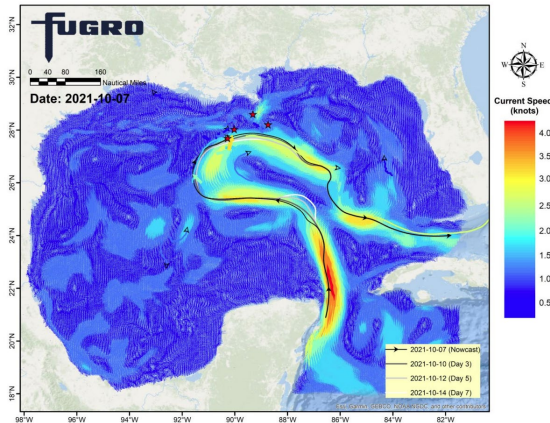
# Frontal Analysis
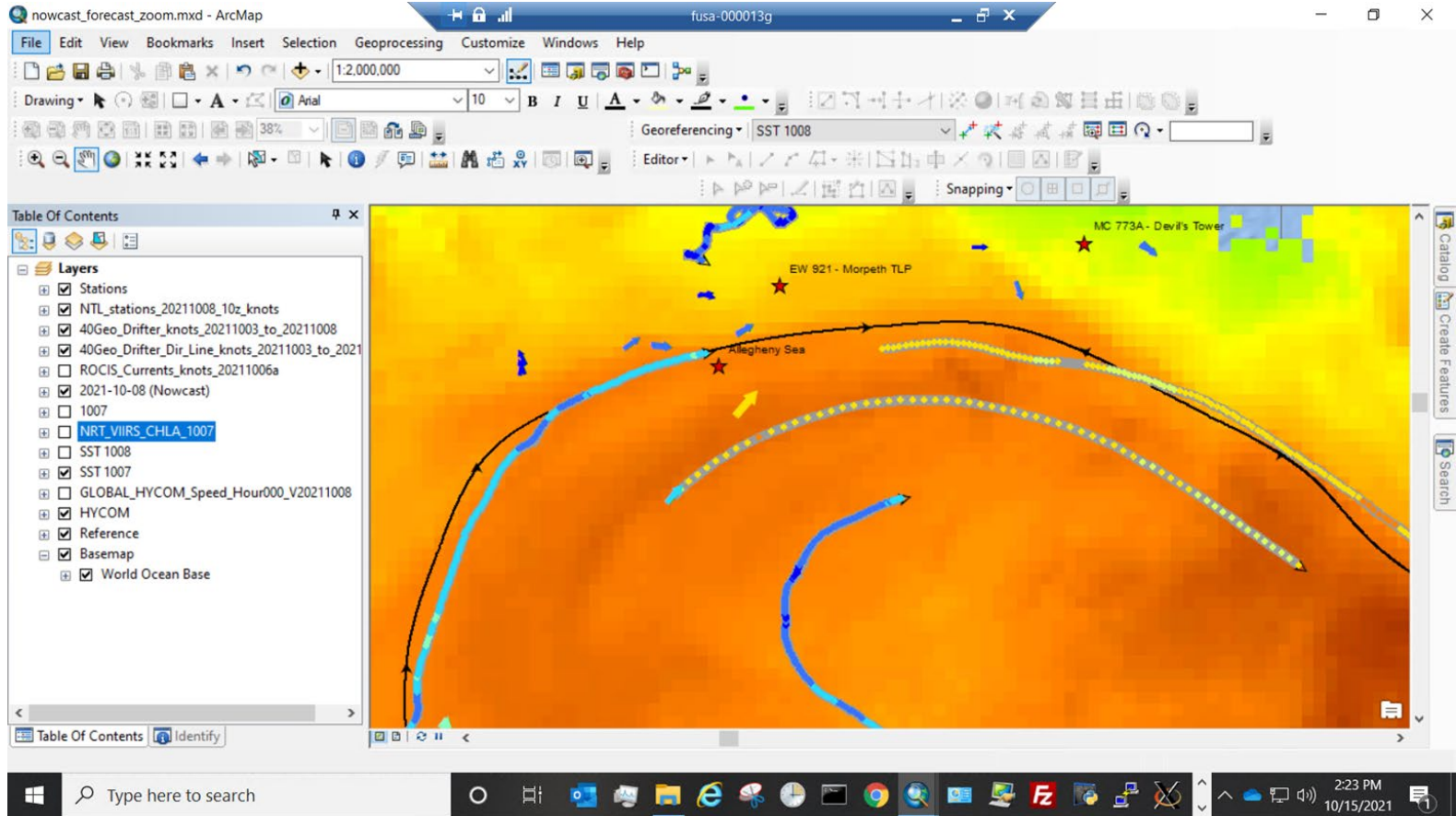
# Frontal Production
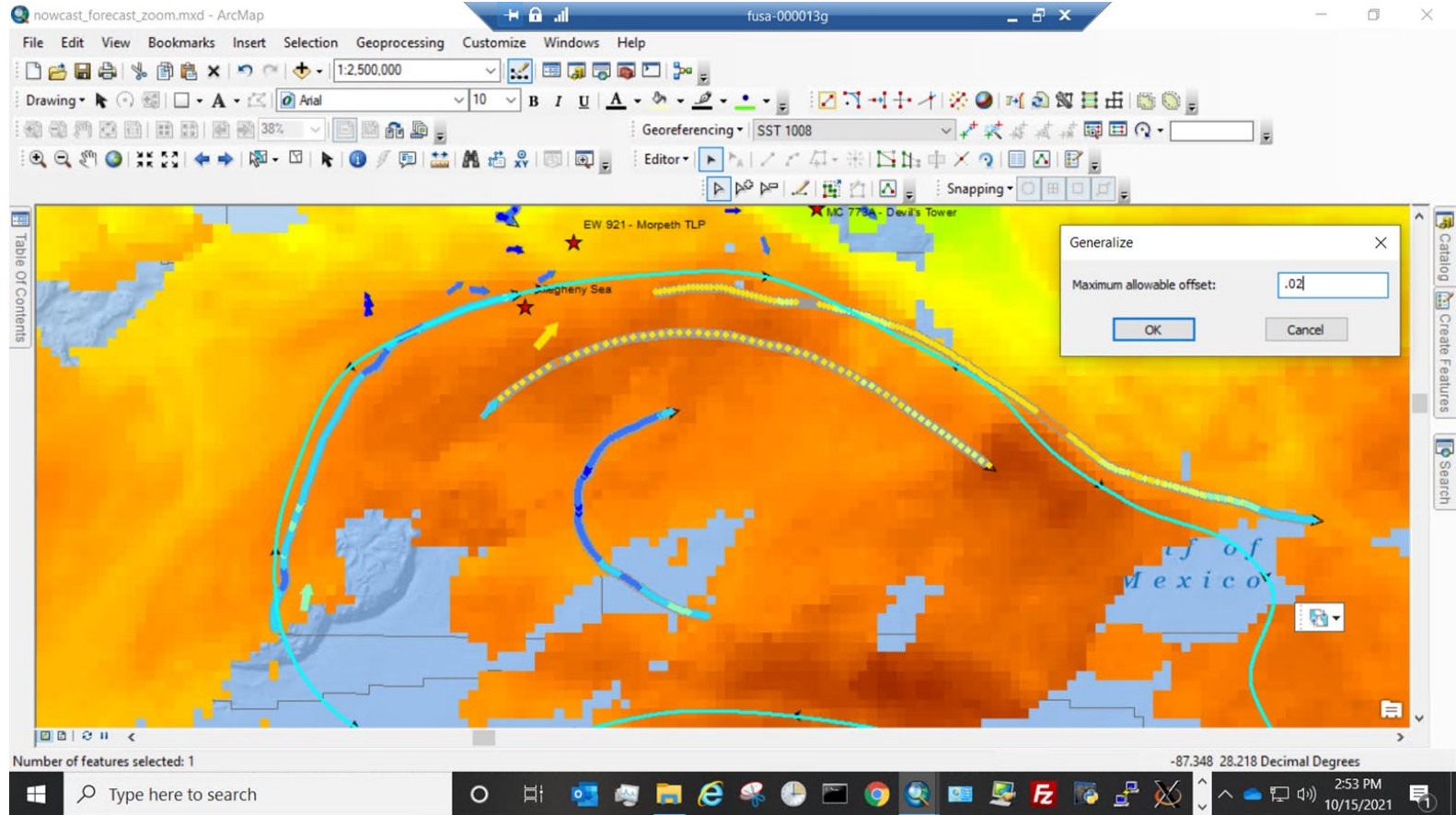
# Front Production

# Front Export

# Loop Current Bulletin



Oceanographer: J. Molina
Technical Reviewer: R. Schiller

Ocean Model: Global HYCOM
Region: Gulf of Mexico (GOM)

Contract Number: F194359
Positions: 28.2086°N, 88.7372°W (Devil's Tower)
28.0300°N, 90.0200°W (Morpeth TLP); 27.6916°N, 90.2755°W (Allegheny TLP)

Client: ENI

**Current Advisory Bulletin for Allegheny TLP – 7 October 2021**

**Loop Current Advisory - Allegheny TLP - 7 October 2021**

• The Allegheny TLP site is currently being affected by the Loop Current (LC).

• Based on the measurements in the area, the near-surface currents at the Allegheny TLP site are ~1.0 knot with a northeastward direction. Near-surface current speeds of ~1.0 knot to ~3.0 knots are being observed at nearby rigs.

• 3-day outlook
  • Depending on where the band of high currents are, current speeds near the Allegheny TLP site will remain above ~1.5 knot over the next 3 days.

• 5-day forecast
  • Depending on where the band of high currents are, current speeds near the Allegheny TLP site will remain above ~2.0 knots over the next 5-7 days.
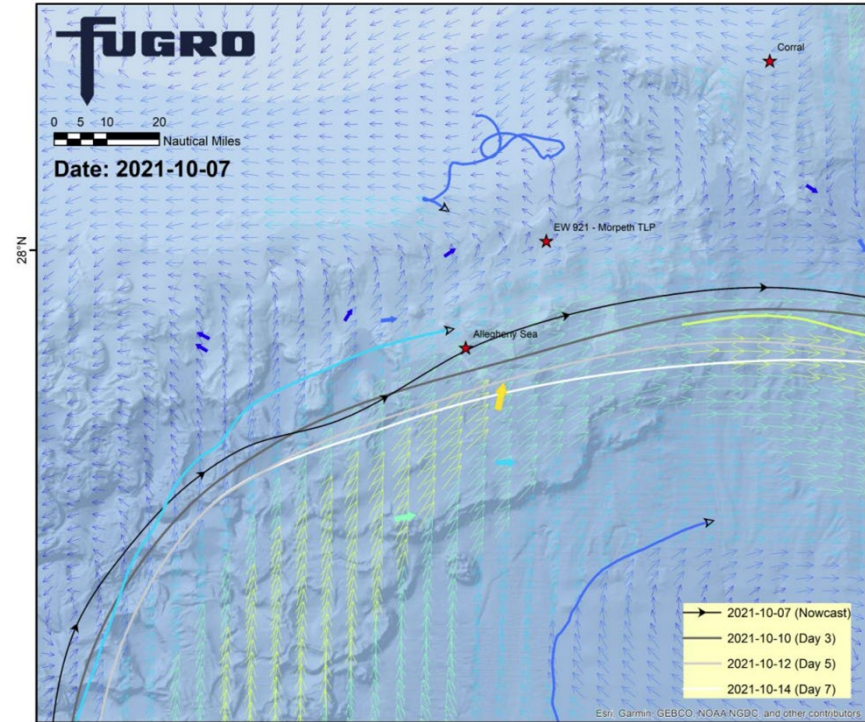
# Common Operating Picture
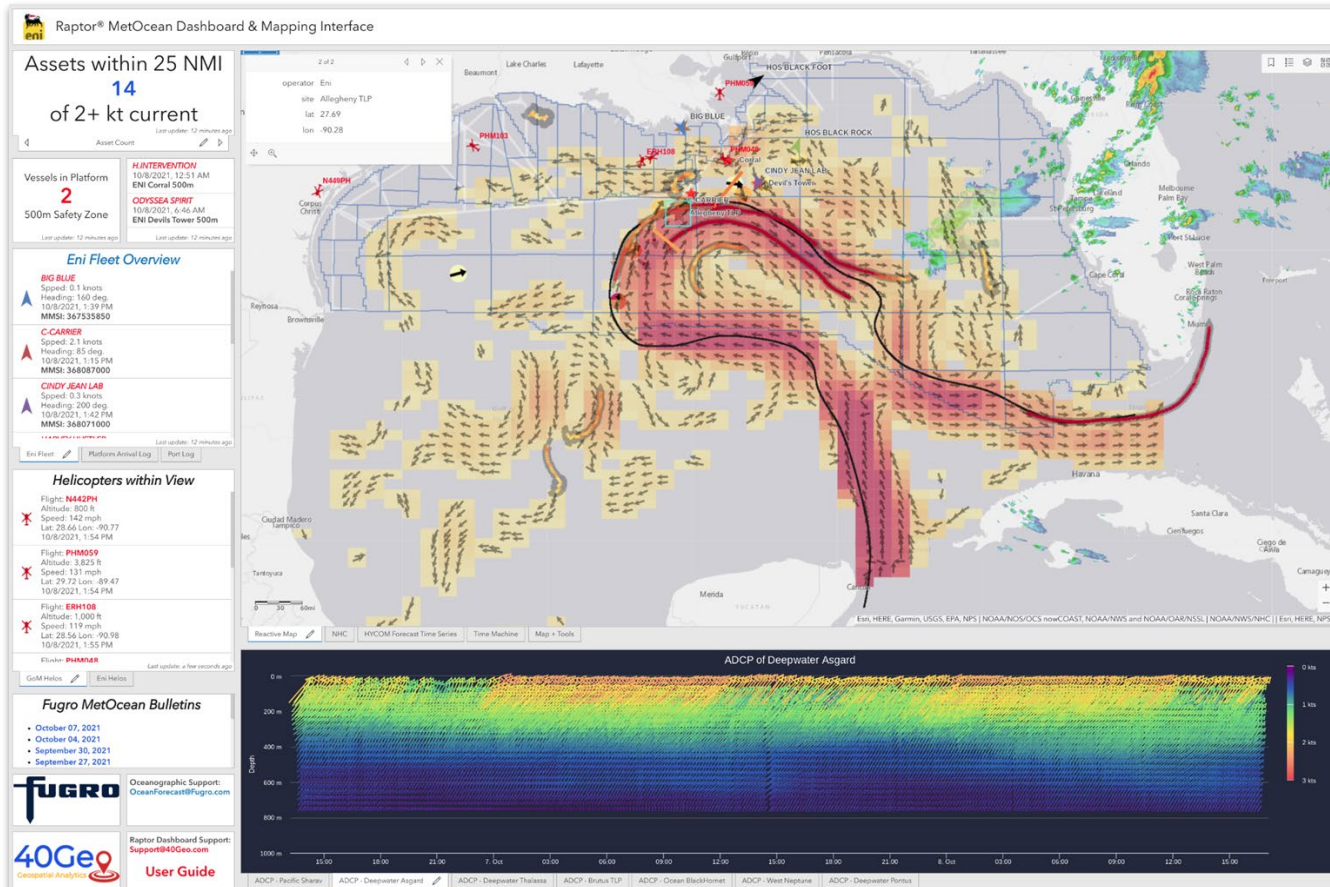
# Data Aggregation & Analytics



Vessels of Interest: CINDY JEAN LAB

SPEED 0.50
HEADING 91
LAT 28.20
LON -88.74
COURSE 209
STATUS under way u... engine
TIMESTAMP 10/19/2021,... PM
SHIPNAME CINDY JEAN...
MMSI 368071000
IMO 9421398
CALLSIGN WDK4946
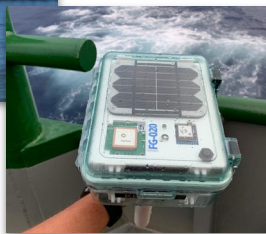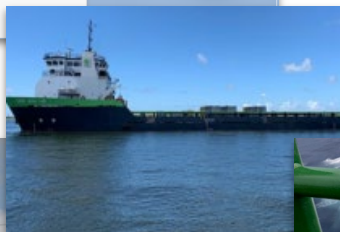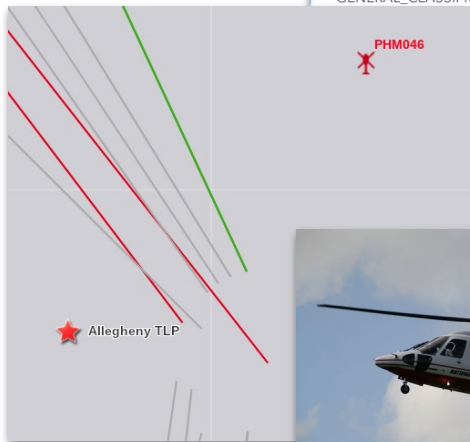SHIPTYPE 0
TYPE_NAME Passenger Ship
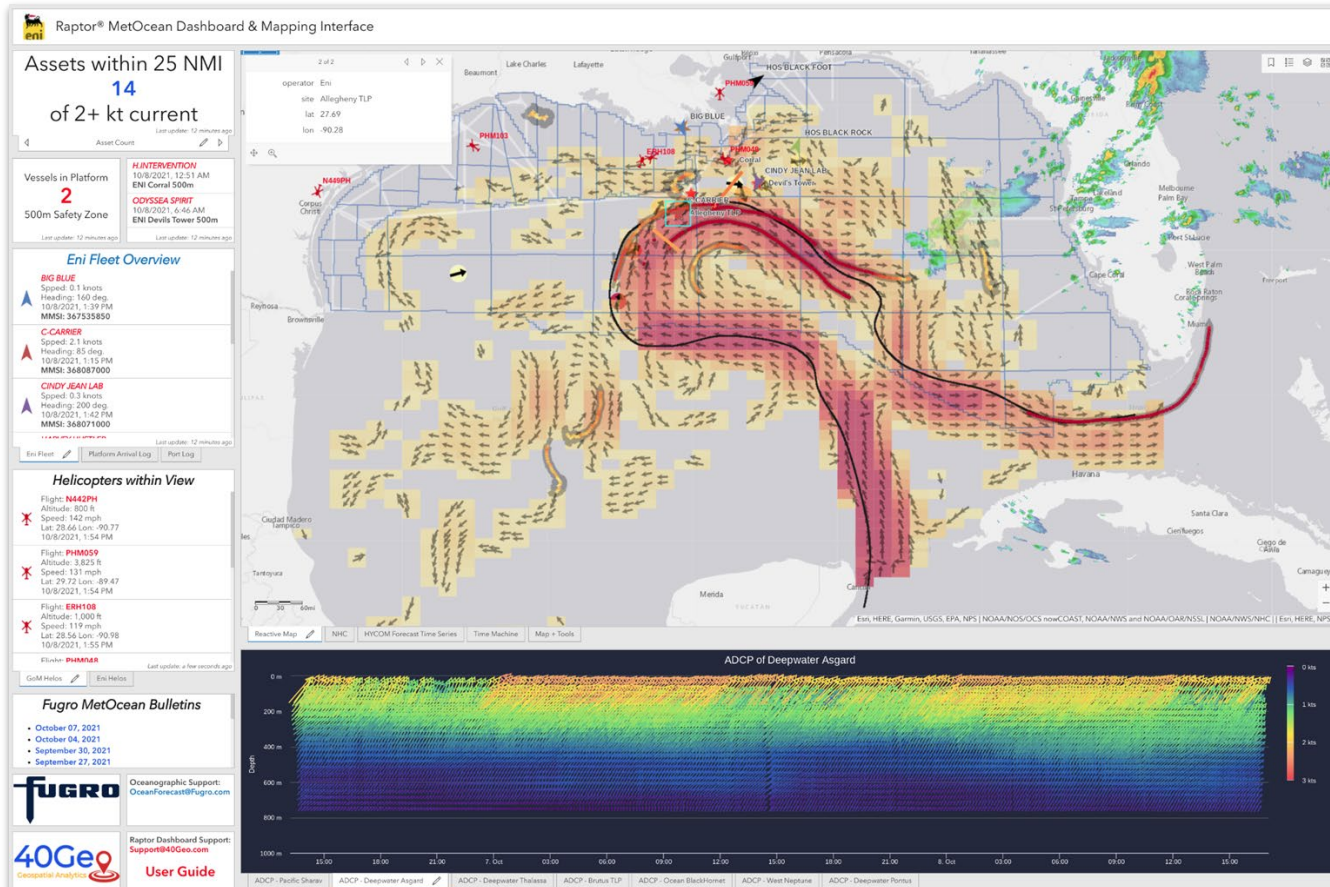GENERAL_CLASSIFICATION
...CATION
LENGTH 0
WIDTH 0

Devil's Tower

CINDY JEAN LAB

PHM046

Allegheny TLP

# Common Operating Picture
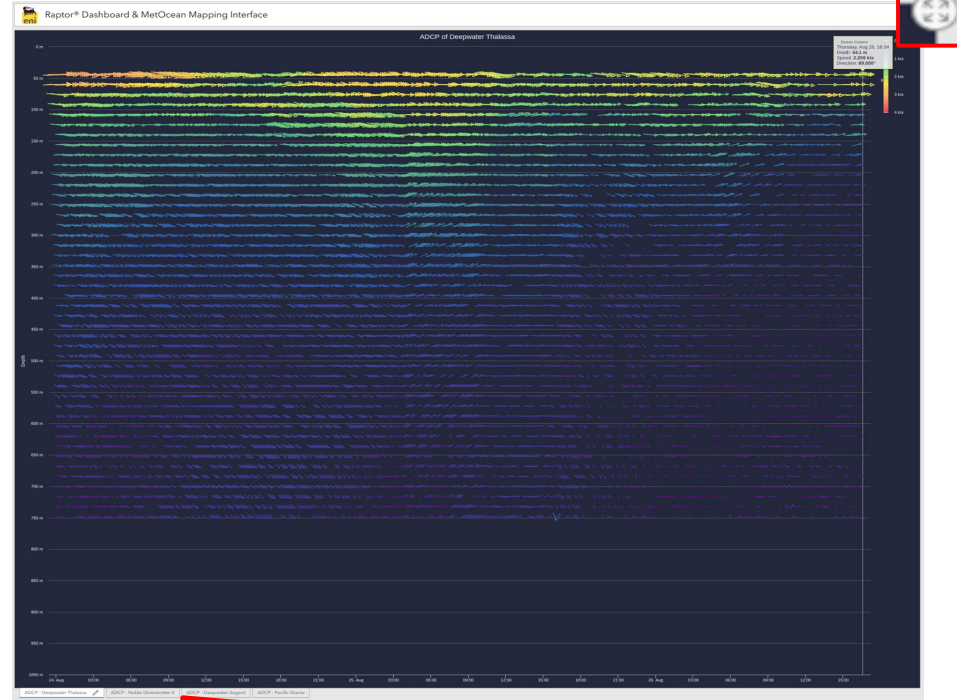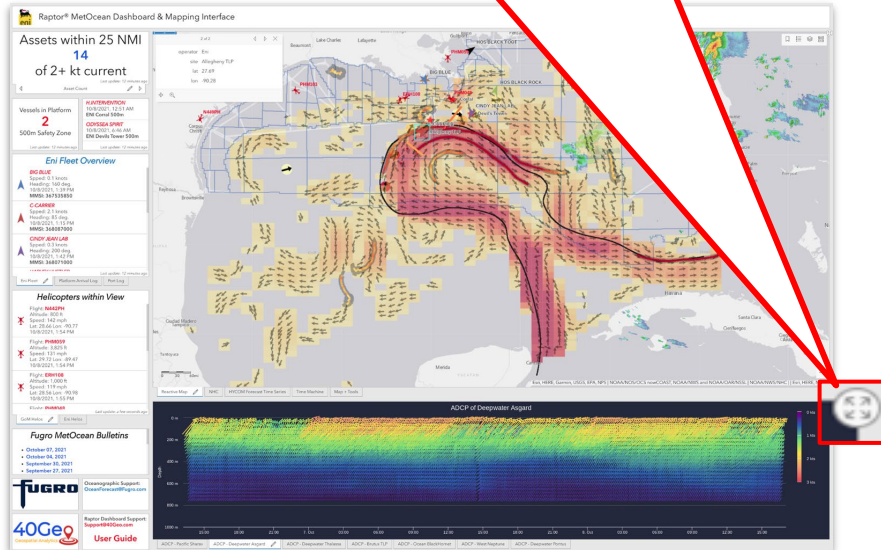
# Dashboard Analytics

# Map Features
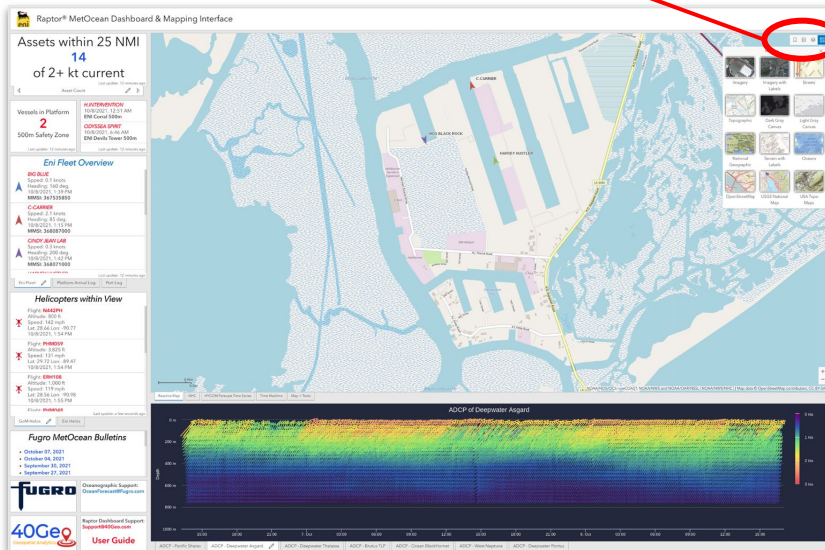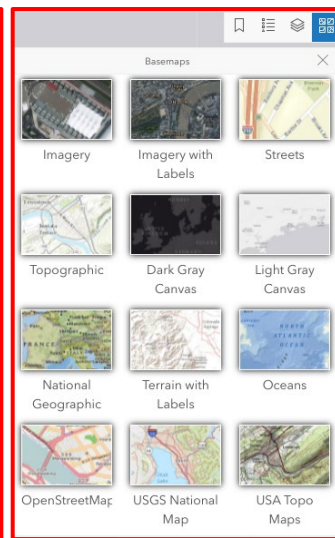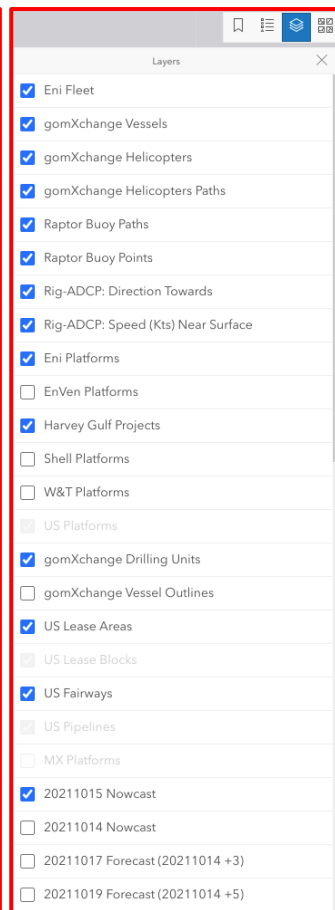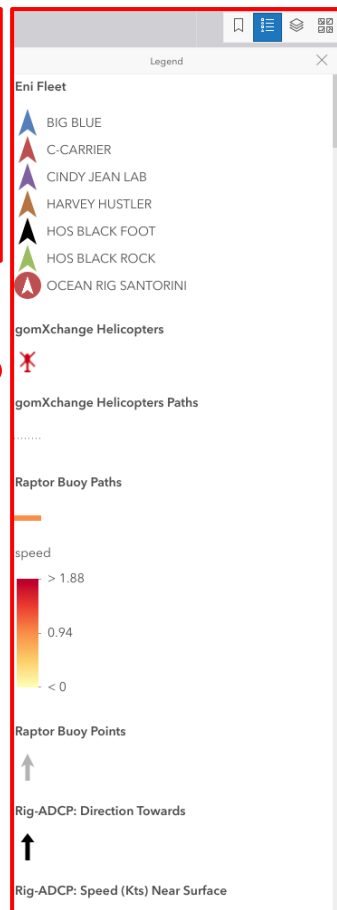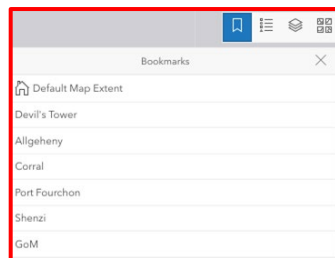
# Dynamic Mapping + Live Video + Vessel Analytics
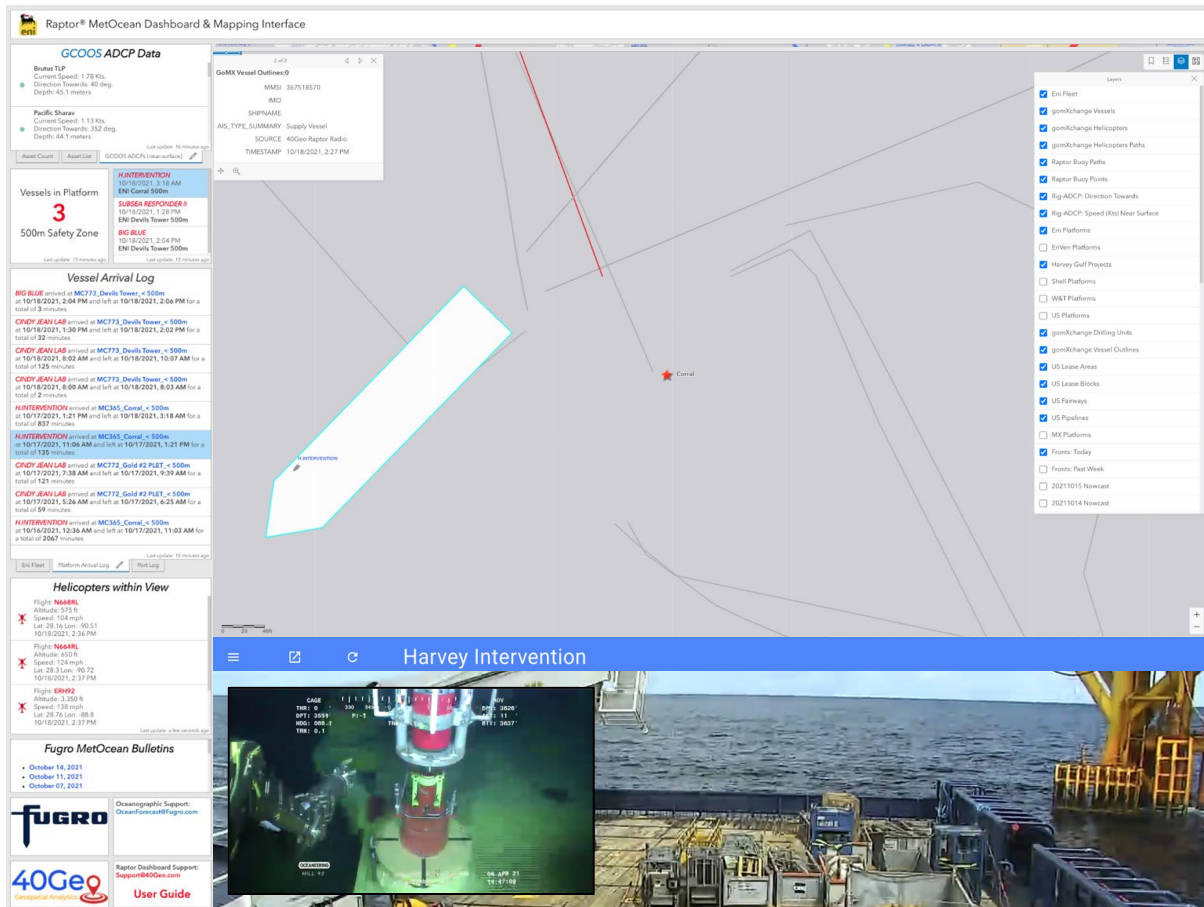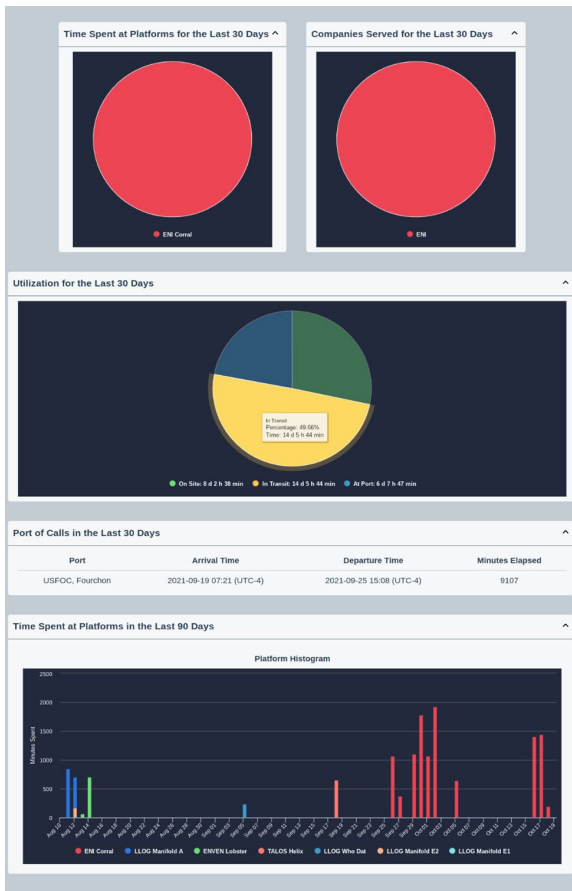
# Data Rich Environment

Nearby Rig -ADCP data (in profile) are provided as a timeseries.
- Clicking top right button expands window.
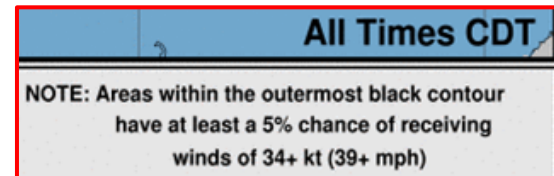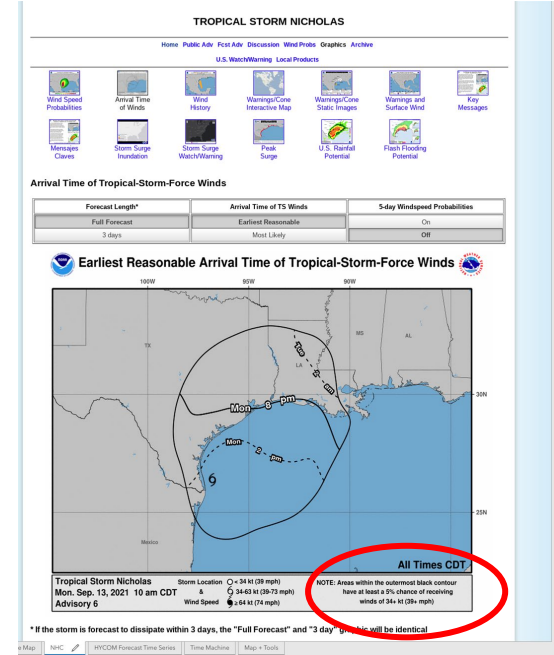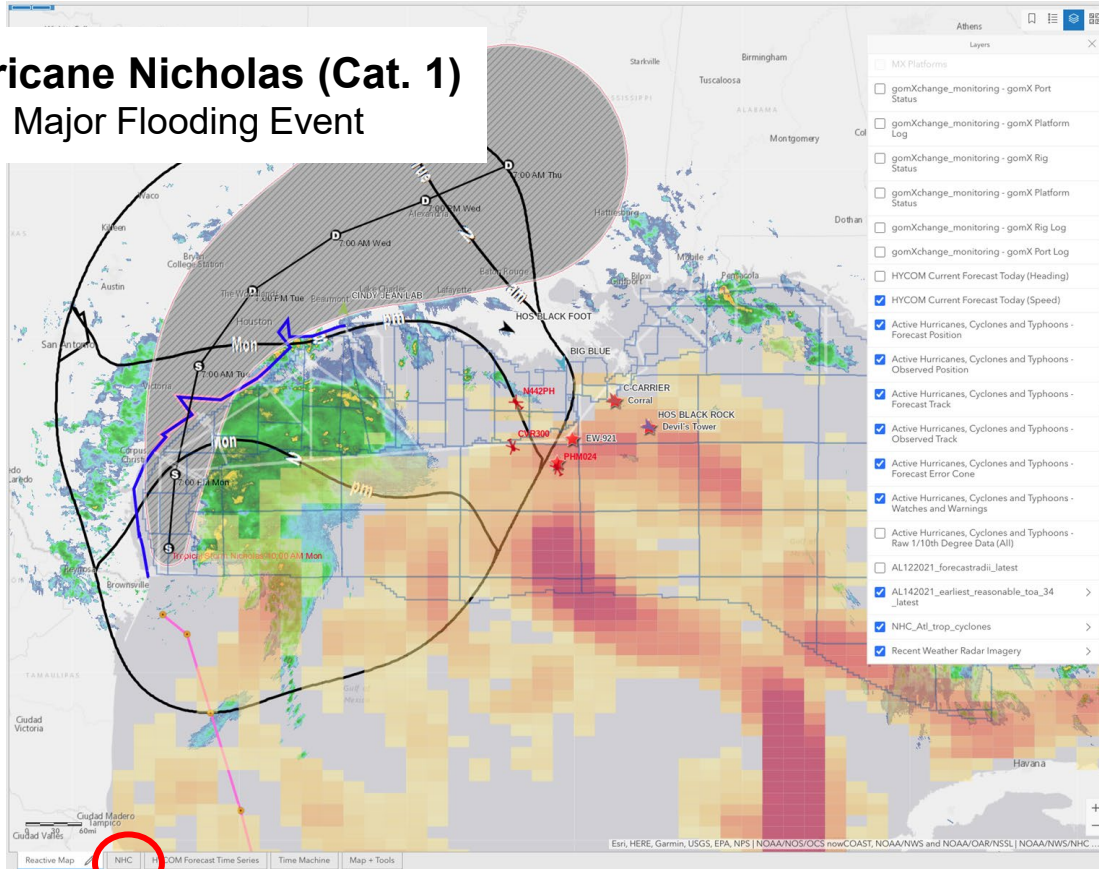- Clicking on the top right button will return the interface to standard configuration.



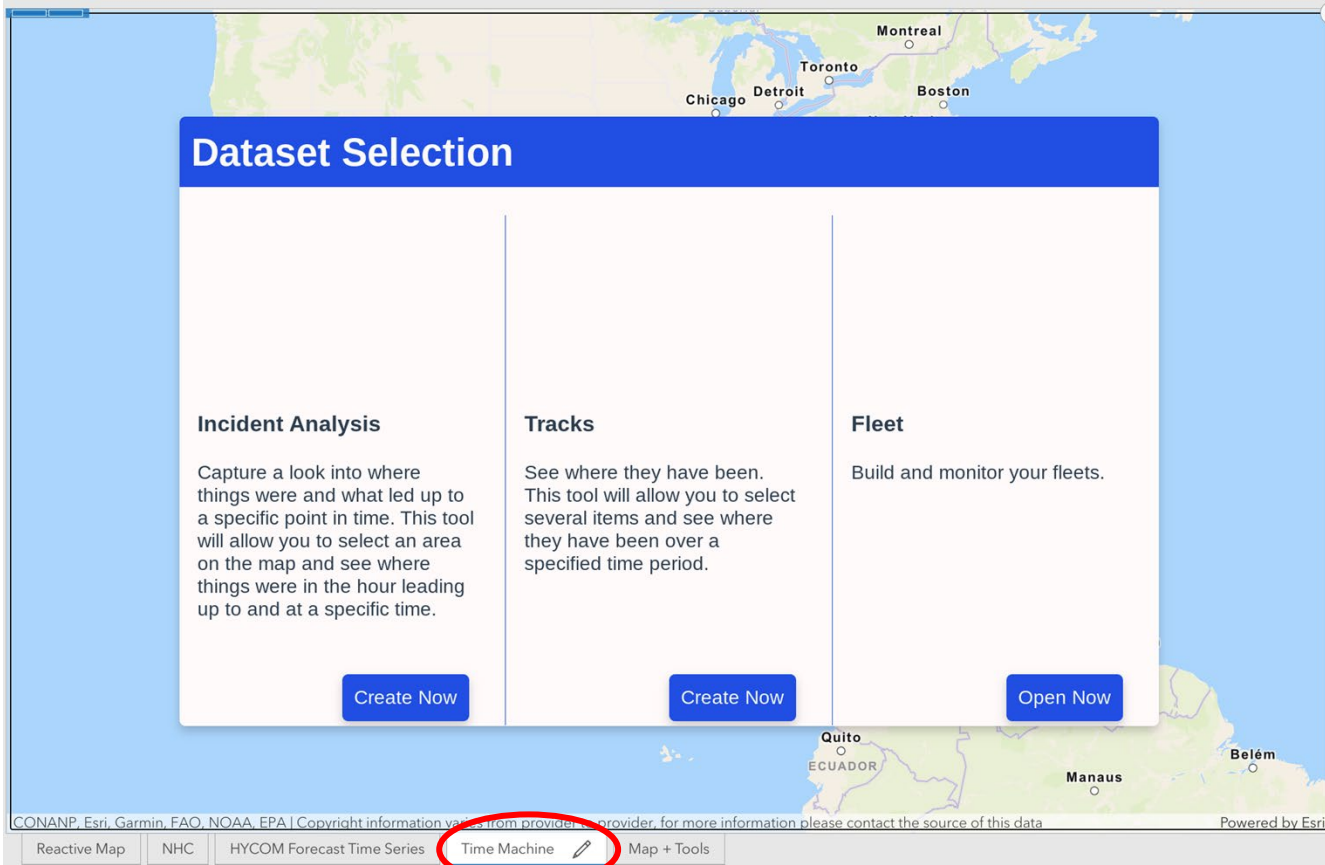Tabs across the bottom of the window display ADCP data from other rigs.

# Source Data



**Hurricane Nicholas (Cat. 1)**
- Major Flooding Event

# AIS Data

# AIS Data – Incident Analysis



GLOBETROTTER II

MC547 Who Dat
Mississippi Canyon

Devils Tower

DEEPWATER PONTUS

Mars
Ursa
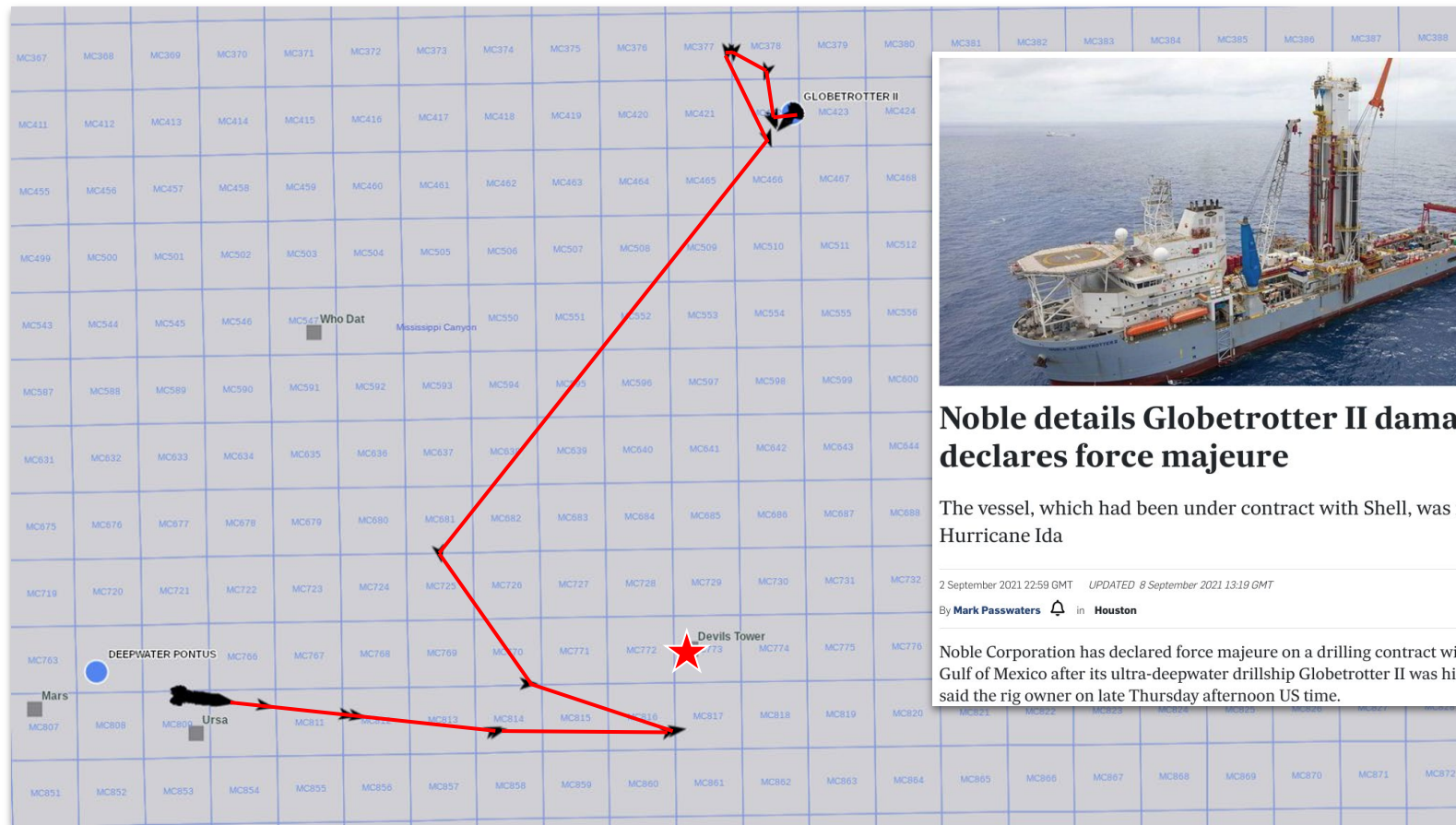
## Noble details Globetrotter II damage, declares force majeure

The vessel, which had been under contract with Shell, was impacted by Hurricane Ida

2 September 2021 22:59 GMT   UPDATED  8 September 2021 13:19 GMT

By **Mark Passwaters**   in   **Houston**

Noble Corporation has declared force majeure on a drilling contract with Shell in the US Gulf of Mexico after its ultra-deepwater drillship Globetrotter II was hit by Hurricane Ida, said the rig owner on late Thursday afternoon US time.

# Map Tools
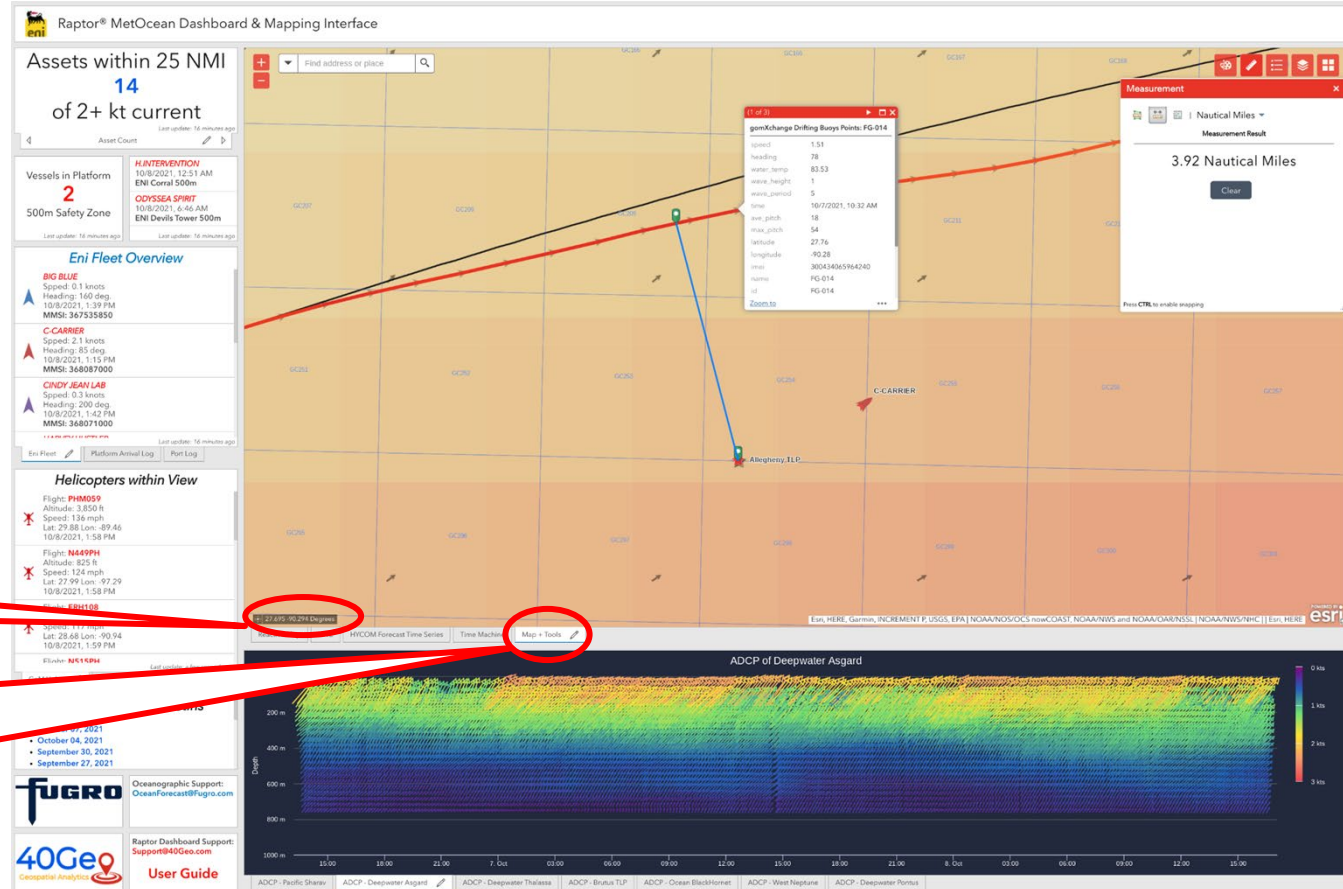


Measure area & Distance

Layer Selection
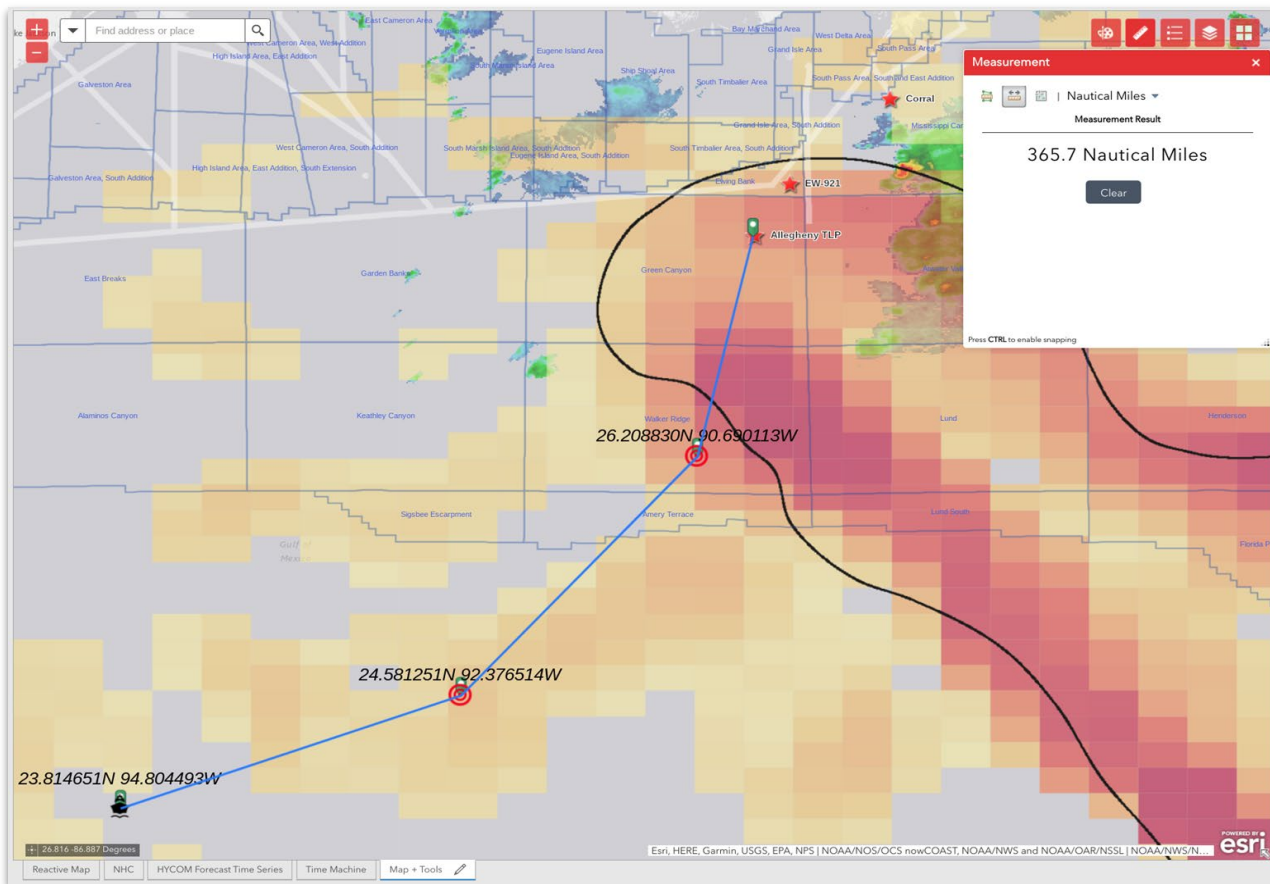
Annotation

Map Background

Layers Legend

Longitude & Latitude of cursor
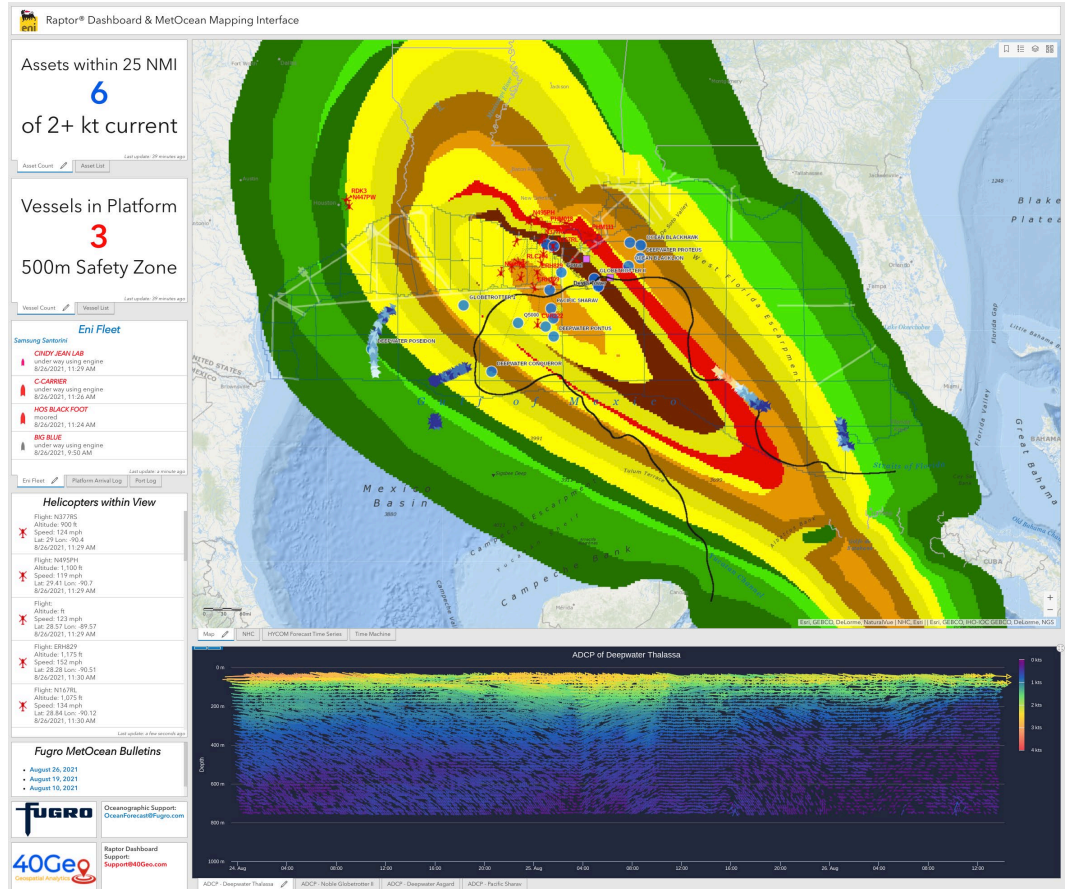
Map + Tools*

*is *not* Dashboard 'reactive'

# Map Tools   – Plan & Communicate

# Summary



**Common Operating Picture**

*delivers*

**Maritime Domain Awareness**

*creates*

**Actionable Intelligence**

# Data, Analytics, Visualization

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