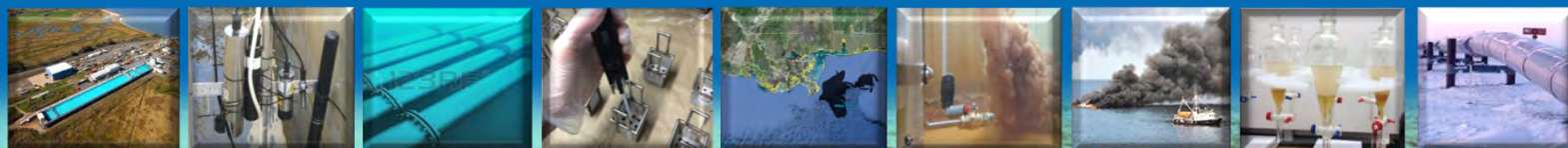# U.S. Oil Spill Monitoring Protocols: Review and Insight

CSAS Dispersant workshop 2021

Robyn Conmy

Disclaimer: The views expressed in this presentation are those of the author and do not necessarily represent the views or the policies of the U.S. EPA

Office of Research and Development
Homeland Security Research Program

- National Oil and Hazardous Substances Pollution Contingency Plan

  - 40 CFR Part 300 Subpart J (§ 300.900 - 300.920)

  - Alternative Response Technologies

  - NCP Product Schedule

- SMART Protocols

- Atypical Guidance Document

Key Question #18: Is there a difference in terms of what we need to monitor when using dispersants versus not?

U.S. SMART Guidance Document

- Monitoring program for *in situ* burning and dispersant operations

- Relies on small, highly mobile Strike Teams that collect real-time data using portable and easy-to-use instruments during response operations

- Monitoring data for Unified Command decision-making

  - Are ISB particulate concentrations exceeding the level of concern?

  - Are dispersants effective in dispersing the oil?

SPECIAL
MONITORING of
APPLIED
RESPONSE
TECHNOLOGIES

Developed by:

U.S. Coast Guard
National Oceanic and Atmospheric Administration
U.S. Environmental Protection Agency
Centers for Disease Control and Prevention
Minerals Management Service

Smoke rising from the *New Carissa*, February 1999. Photo by USCG

2006

U.S. SMART Dispersant Monitoring

- **Tier I:** A trained observer, flying over the oil slick and using photographic job aids or advanced remote sensing instruments, assesses dispersant efficacy.

- **Tier II:** Provides real-time data from the treated slick. Boat sampling team uses monitoring instrument to continuously monitor for dispersed oil 1m under the dispersant-treated slick. Water samples taken for lab analysis.

- **Tier III:** Expands the monitoring efforts by providing information on where the dispersed oil goes and what happens to it.

  - Instruments monitor at two water depths
  - Monitoring conducted in center of treated slick, many depths 1-10 m
  - Measurements of water temperature, pH, conductivity, dissolved oxygen, and turbidity.

OPEN WATER OIL IDENTIFICATION JOB AID
for aerial observation
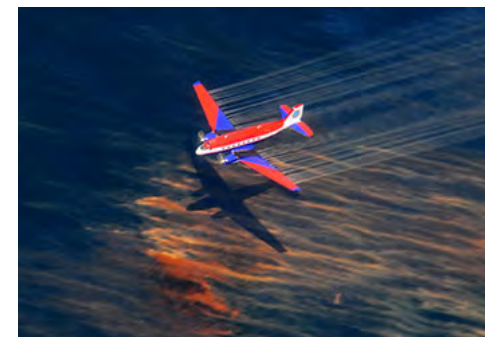
Atypical Guidance Document

- Developed by NRT in 2013 after *Deepwater Horizon* oil spill

- Living document envisioned to continue addressing monitoring challenges as they become necessary

- Establishes a DEMU for dispersant sampling and monitoring

- Current version, contains:

  - *Subsea Application Guidance* – generally applies to the subsurface ocean environment, focusing particularly on operations in waters below 300 meters and below the average pycnocline.

  - *Prolonged Surface Application Guidance* – supplements and complements the existing protocols in SMART, where duration of dispersant application extends beyond 96 hours from the time of the first application.
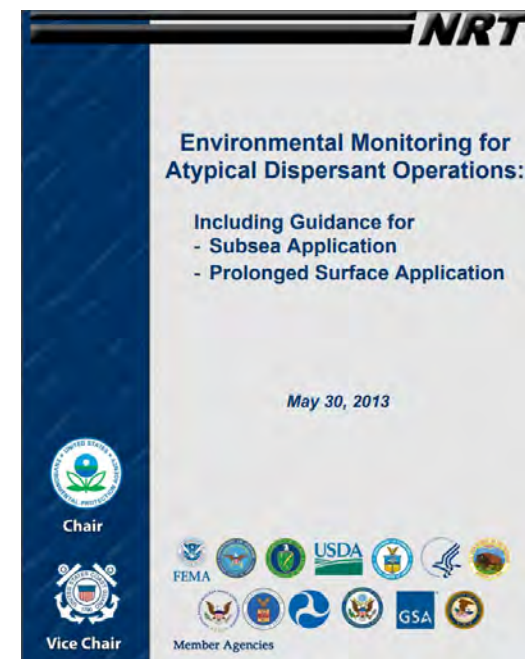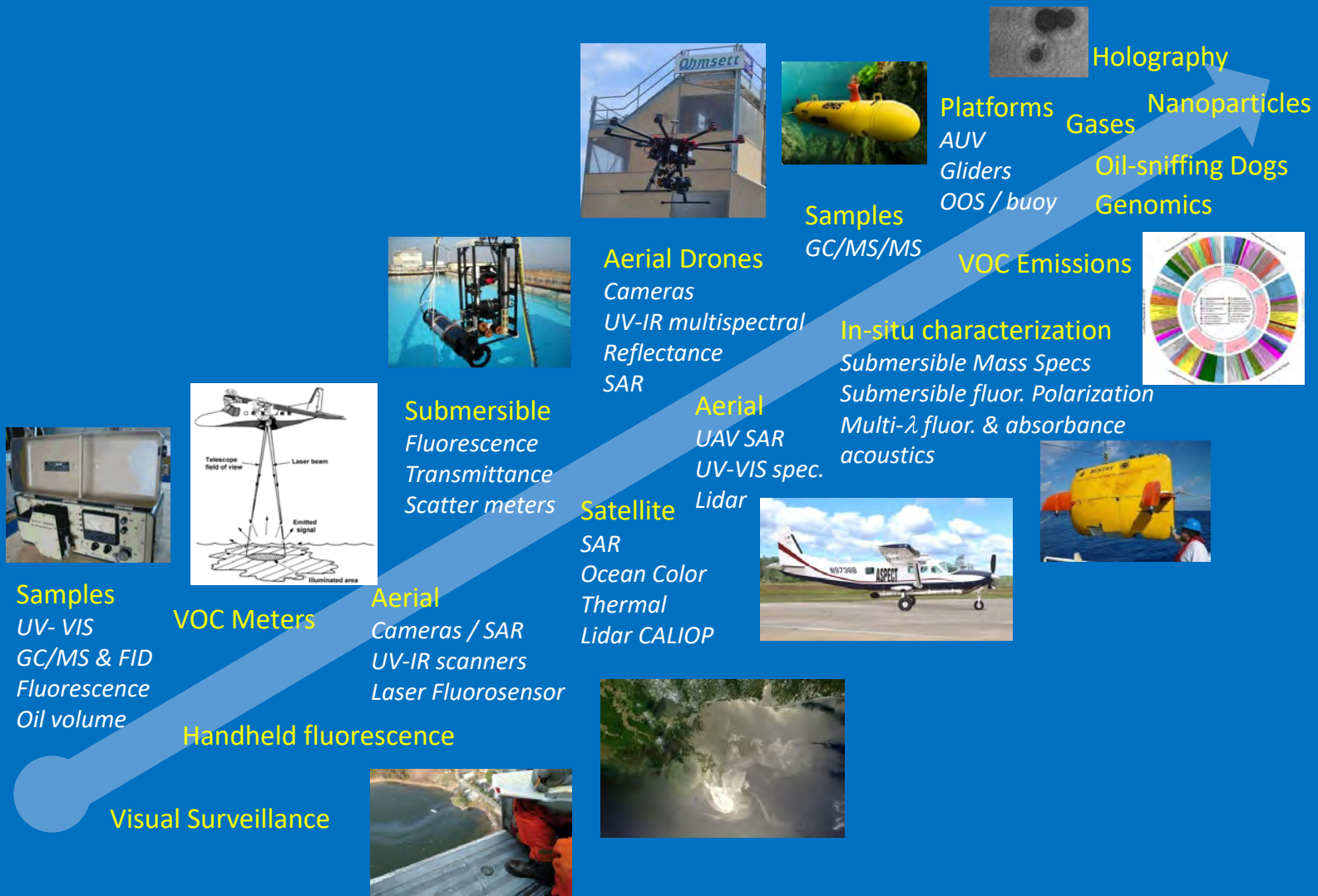

Key Question #19: How could the information learned through monitoring be used?

Where is it?
How much?
What type?
Is it weathered / emulsified?
What slick thickness?
Where is it going?

Is it 'Actionable Oil'?

Samples
UV- VIS
GC/MS & FID
Fluorescence
Oil volume

VOC Meters

Handheld fluorescence

Visual Surveillance

Aerial
Cameras / SAR
UV-IR scanners
Laser Fluorosensor

Submersible
Fluorescence
Transmittance
Scatter meters

Satellite
SAR
Ocean Color
Thermal
Lidar CALIOP

Aerial Drones
Cameras
UV-IR multispectral
Reflectance
SAR

Aerial
UAV SAR
UV-VIS spec.
Lidar

Samples
GC/MS/MS

In-situ characterization
Submersible Mass Specs
Submersible fluor. Polarization
Multi-λ fluor. & absorbance
acoustics

VOC Emissions

Platforms
AUV
Gliders
OOS / buoy

Holography

Nanoparticles

Gases

Oil-sniffing Dogs

Genomics

DE Proxies Supplement Lab Analyses

Traditional DE

Percent oil mass dispersed

Shimadzu UV/Vis Spectrophotometer

Agilent GC/FID

DE Proxies

Indicators of oil dispersed
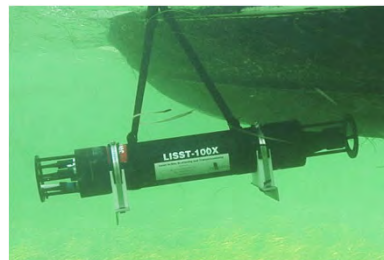
Sequoia LISST particle analyzer

WET Labs ECO fluorometer

Submerged Oil Detection

Dissolved

+

Particulate
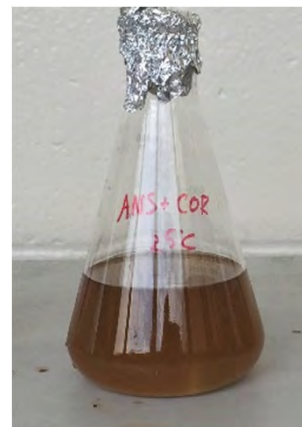
Sufficient monitoring requires ability to measure both fractions

Key Question #20: What data would be most beneficial to have in preparedness, in order to monitor and measure potential impacts?

Oil Droplet Size Continuum
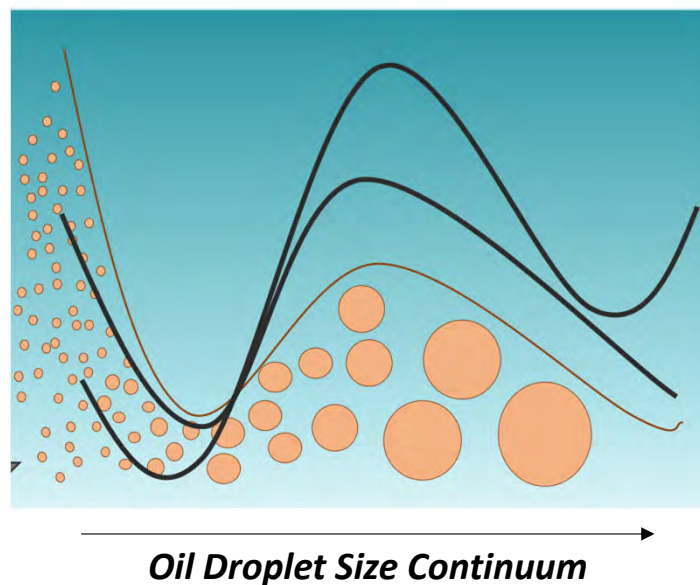
Converging Lines of Evidence Approach

Floating Oil
Naked Eye
Satellite
Aircraft
UAS

Submerged Oil

Dissolved
- Fluorescence
- Absorbance

Particulate
- Video Cameras
- Optical Backscatter
- Particle Size
- Imagers
- Acoustics
- Turbidity
- Transmissometers

Discrete samples

Gasses
- Methane
- Dissolved Oxygen

Platform Appropriateness

Remotely Operated Vehicle

Autonomous Underwater Vehicle

Collab. with WHOI, NOAA, BSEE, USCG, Water Mapping Inc., CRRC

REMUS-600 AUV Field Trial
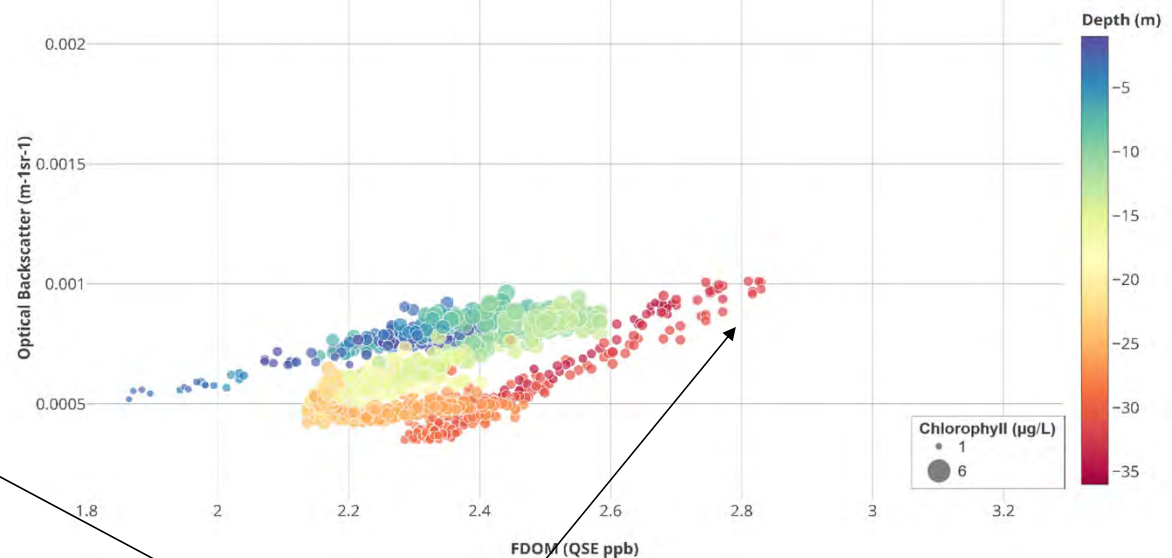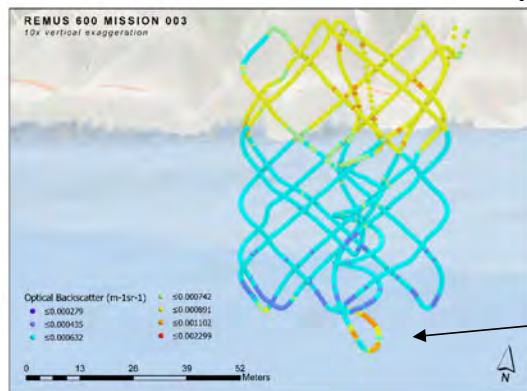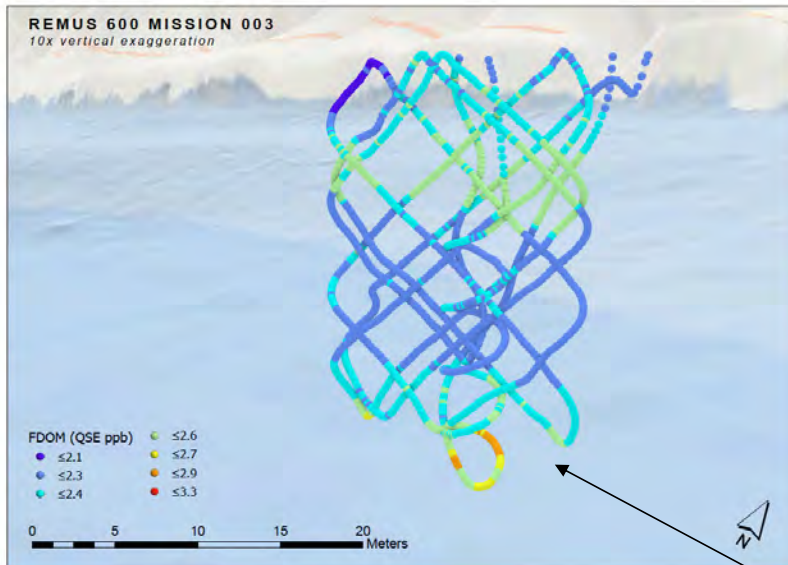
Sensors detected oil at 35 m
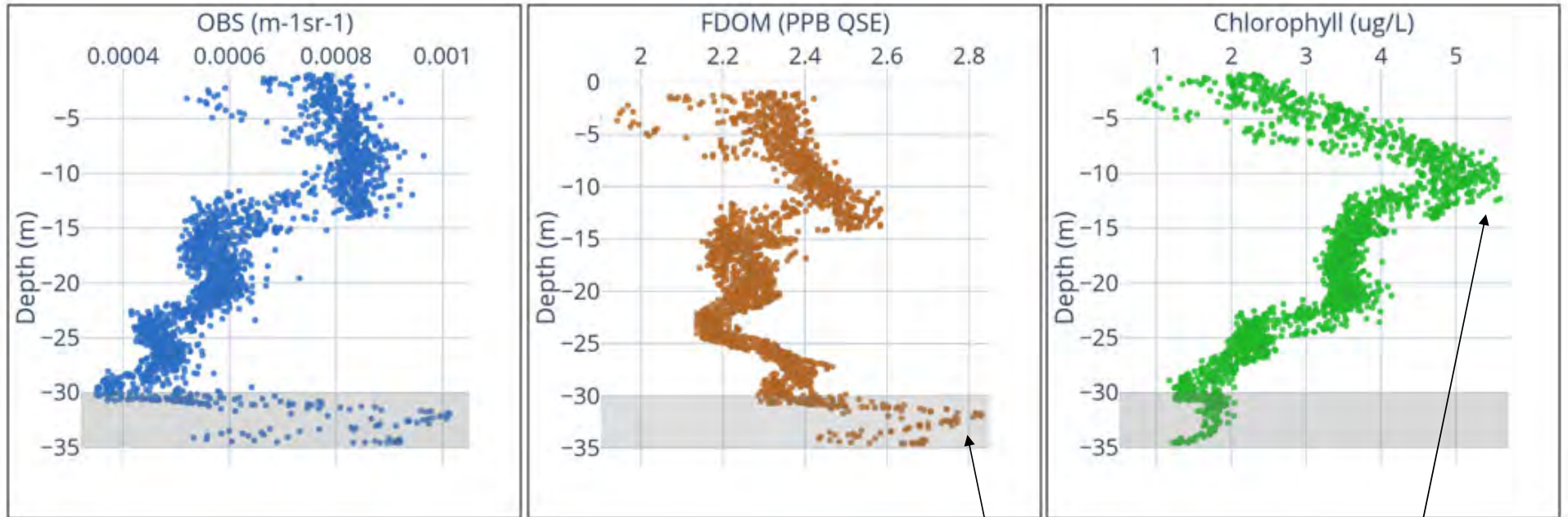
Holographic
images
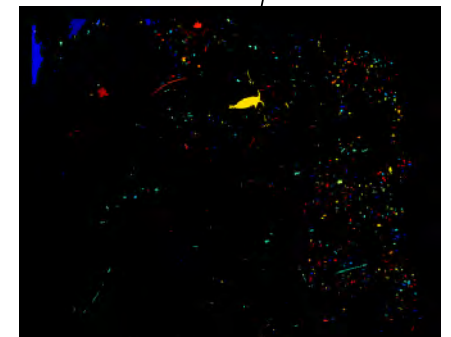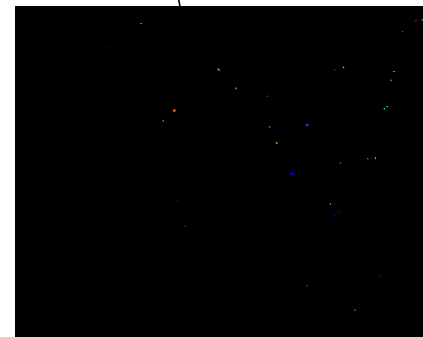
Modified DeepTrekker ROV

- Fluorescence
- CTD
- Camera
- Sampler

Water Mapping, Inc
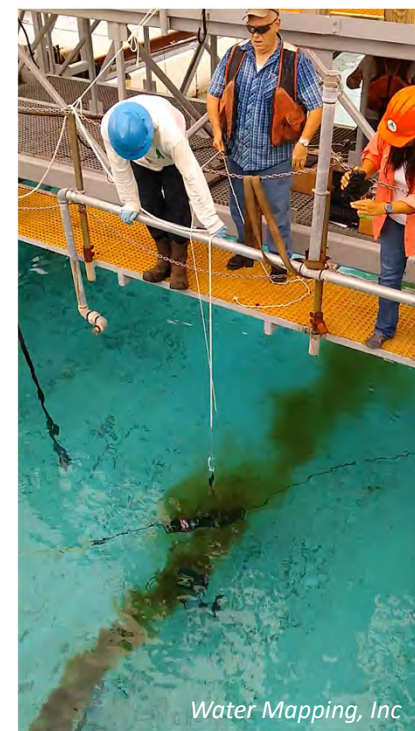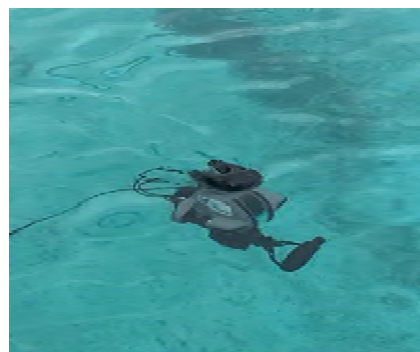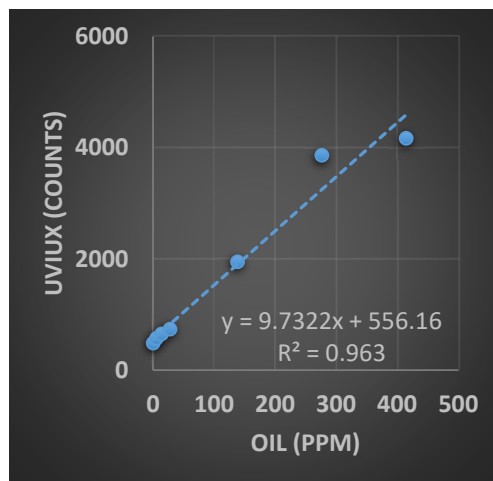
ROV Development

TOR Question #3

What are the key considerations or recommendations for environmental monitoring after dispersant use?

- *S*calability and flexibility
- Converging lines of evidence approach
- Tiering of datastreams
- Monitoring protocols for dispersant use and without

Collaborators & Partners

- **Interagency Partners**
  - NOAA, BSEE, BOEM USCG, USACE, NRL
  - ICCOPR
  - National Response Team S&T Committee
  - National Academies of Science

- **Academic & NGO Partners**
  - Water Mapping
  - GoMRI, NJIT, WHOI, USF, UC
  - Ohmsett
  - CRRC

- **International Partners**
  - Canadian MPRI
  - DFO Canada BIO
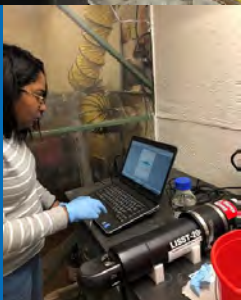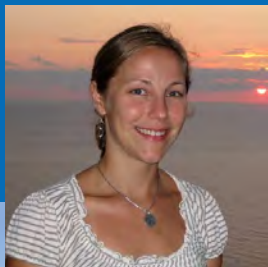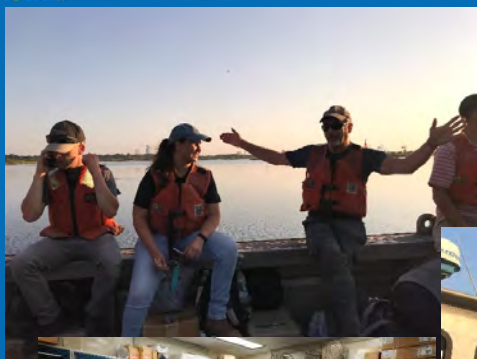 - Canadian NSERC
  - EPPR-PAME

- **In House PTSI Contractors**
  - Devi Sundaravadivelu
  - Robert Grosser
  - Andrea Burkes
  - Emma Huff
  - Raghu Venkatapathy

EPA
United States
Environmental Protection
Agency

Thank you

Office of Research and Development
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