Fototerra

TACTICAL AIRBORNE OIL SPILL REMOTE SENSING AND BEYOND…. SEA-SPIRES

Chevron

CALIFORNIA DEPARTMENT OF FISH & WILDLIFE

OSPR/Chevron Oil Spill Response Technology Workshop

February 26th – March 1st, 2019
Chevron Park, San Ramon, CA

The Needs

Since Deepwater Horizon multiple studies by Industry and Government have all led to the same conclusion: **Improved use of remote sensing is critical to oil spill response.** The conclusions suggested that for the oil responder community **an effective airborne platform is a must**.

The conclusions of several studies suggest that an effective remote sensing platform should feature:

- ✓ **MULTIPLE SENSORS FOR COMPLEMENTARITY/REDUNDANCY;**
- ✓ **CLASSIFICATION OF POLLUTANTS, NO FALSE-POSITIVE;**
- ✓ **IDENTIFICATION OF OIL TARGETS AS RECOVERABLE OR NON-RECOVERABLE;**
- ✓ **GEOREFERENCING THE TARGETS AND TRACKING MOVING OIL;**
- ✓ **EXPANSION OF THE OPERATING WINDOW TO LOW-LIGHT / BAD WEATHER CONDITIONS;**
- ✓ **REAL TIME INFORMATION - FOR TACTICAL AND STRATEGIC USE;**
- ✓ **DATA SUITABLE FOR THE COMMON OPERATING PICTURE AND FOR DECISION MAKERS;**
- ✓ **READINESS OF CREW AND PLATFORM.**

POSEIDON

The answer: Poseidon I entered in service in July 2016 participating in a program coordinated by BSEE and NOAA to assess new technologies for aerial remote sensing. Is currently fully operational.

Poseidon II will enter in service in late 2019.

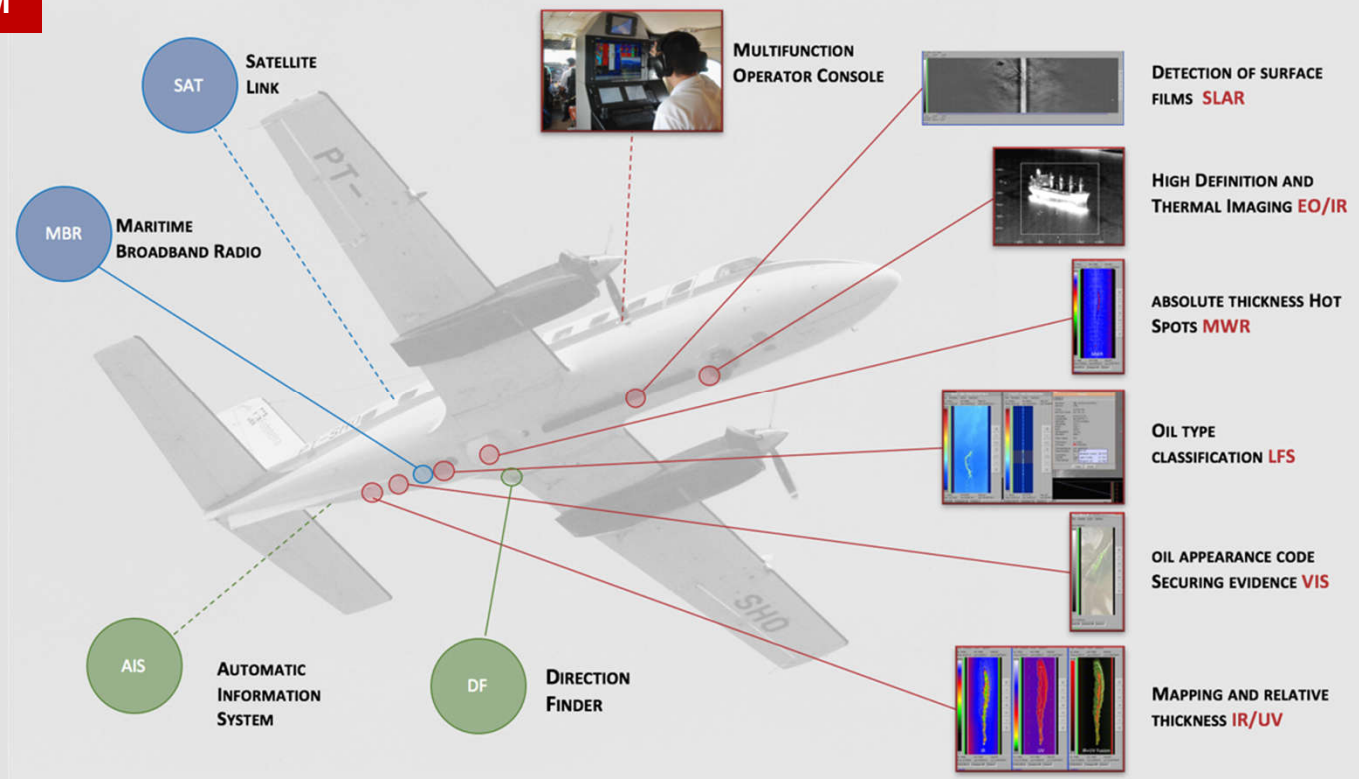
Intelligence on the Scene

POSEIDON MISSION SYSTEM

SENSORS

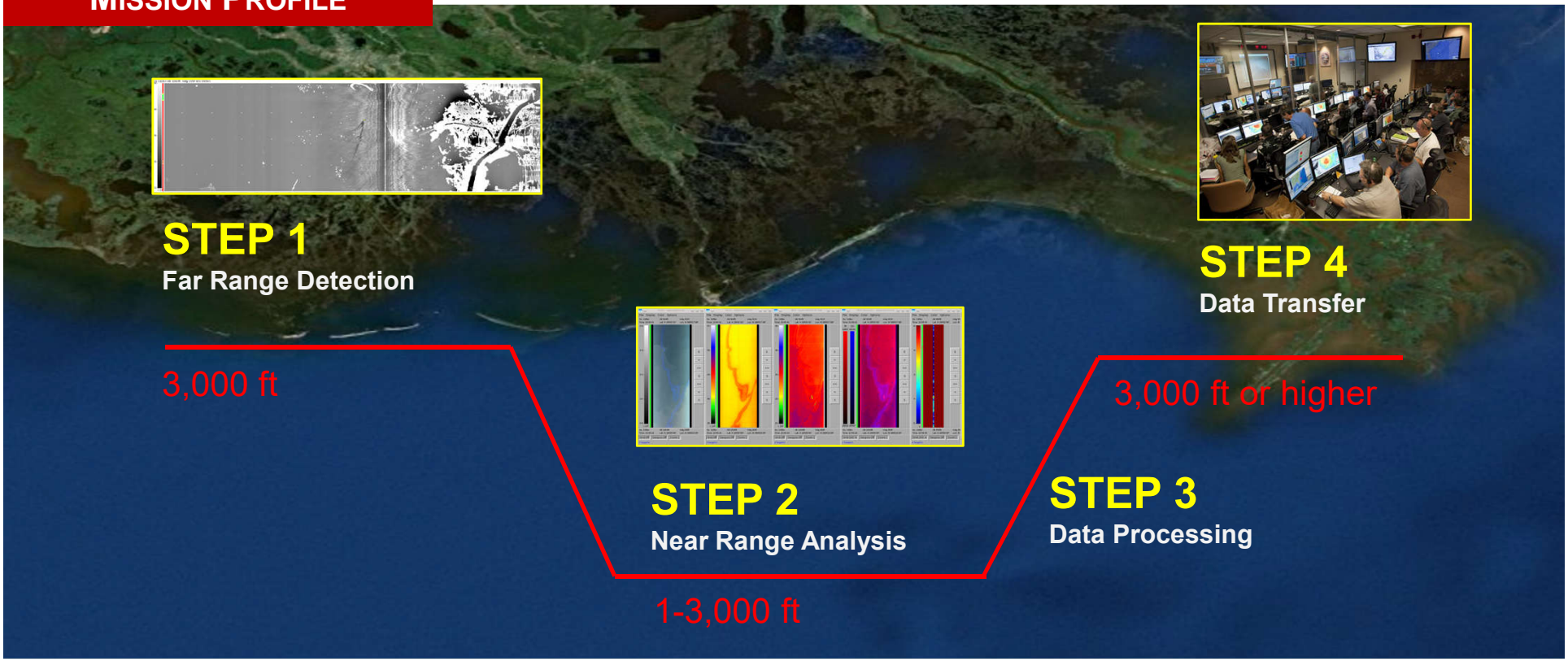
DATA PROCESSING

COMMUNICATIONS



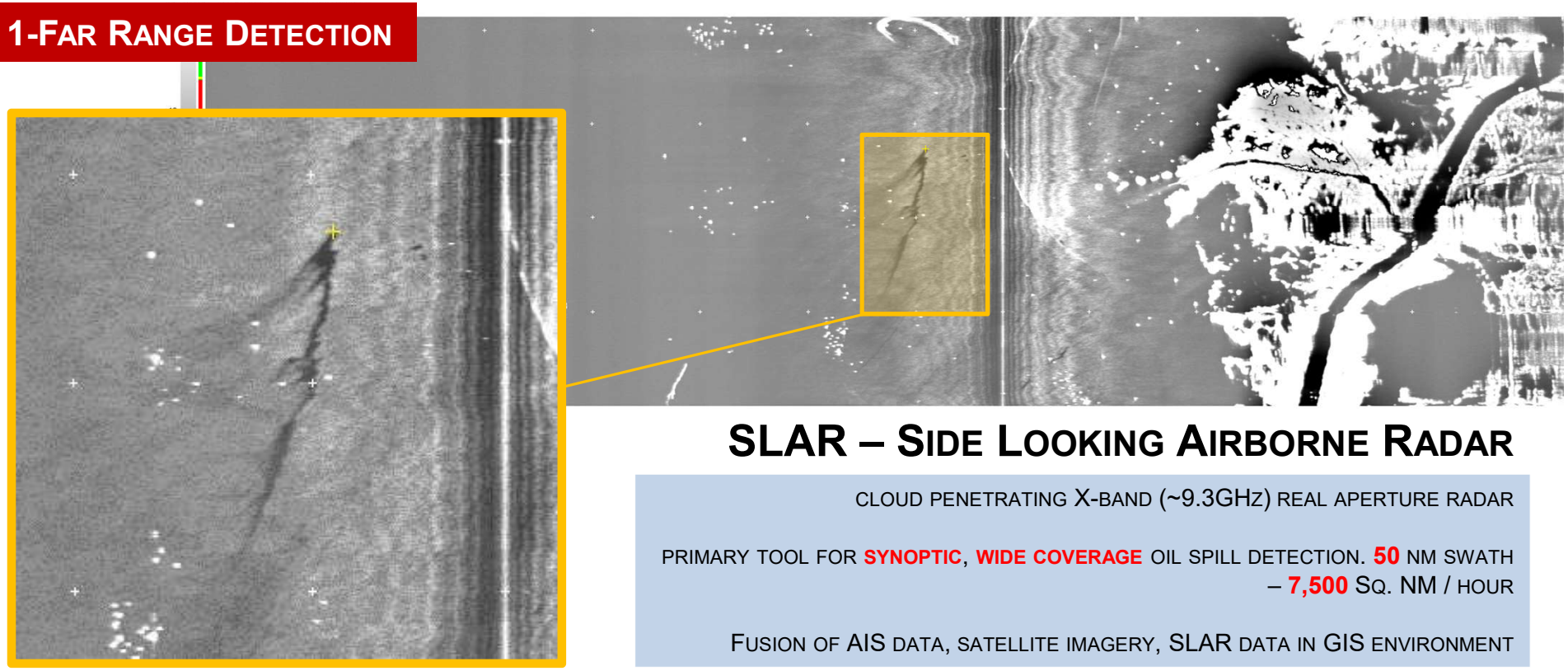
Intelligence on the Scene

MISSION PROFILE



Intelligence on the Scene

1-FAR RANGE DETECTION



SLAR – SIDE LOOKING AIRBORNE RADAR

CLOUD PENETRATING X-BAND (~9.3GHZ) REAL APERTURE RADAR

PRIMARY TOOL FOR **SYNOPTIC**, **WIDE COVERAGE** OIL SPILL DETECTION. **50** NM SWATH – **7,500** SQ. NM / HOUR

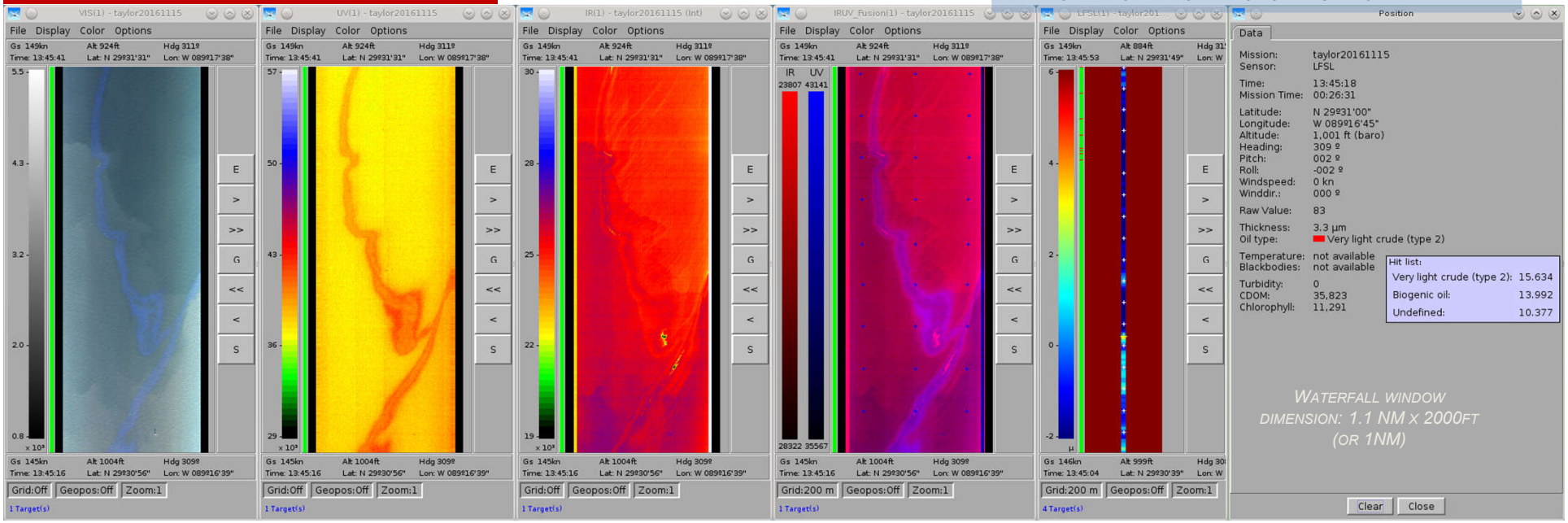
FUSION OF AIS DATA, SATELLITE IMAGERY, SLAR DATA IN GIS ENVIRONMENT

Intelligence on the Scene

2-Near Range Analysys

Accurate analysis of the Oil Spill

- Multiple sensors for complementarity/redundancy
- Each sensor detects specific features of the spill



VIS
Oil Appearance codes

UV **IR** Fusion **IR/UV**

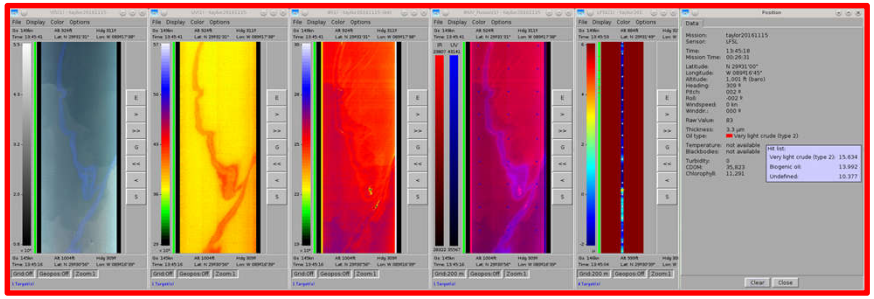
Sensitive above 0.01 µm layers (UV) and 2 µm layers (IR).
Mapping / Area / Position / Coverage % / Dimension / Relative Thickness / Drift / Spreading / Volume estimate

MWR
Absolute Thickness Measurement
50 µm to 3 mm

LFS
Oil Classification /Weathering
Absolute Thickness Measurement
0.1 µm to 20 µm

Intelligence on the Scene

3-Data Processing

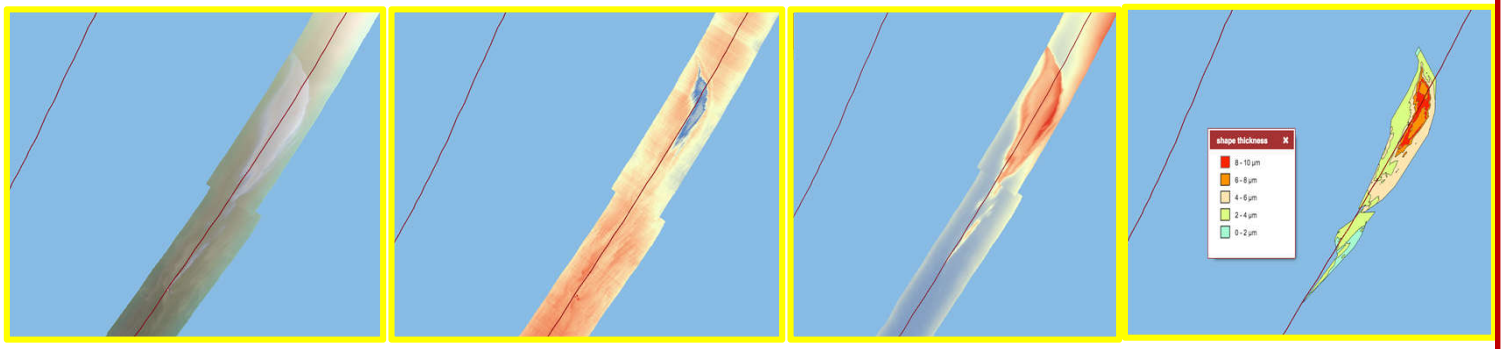


Responders need **INTELLIGENCE**

- Where?
- What Type?
- Actionable?
- How Much?
- How's moving?
- Map?

Data Analysis, Fusion and Georeferencing to generate INFORMATION

- ✔ Area (NM^2)
- ✔ Position (Lat, Lon)
- ✔ Coverage (%)
- ✔ Thickness Distribution (µm)
- ✔ Volume (Gal)
- ✔ Hot Spots
- ✔ Drift, Spreading (NM/h, NM^2/h)
- ✔ Oil Classification
- ✔ Georeferencing
- ✔ AIS data fusion



Visual Line Scanner | Infrared | Ultraviolet | Processed Thickness Map

INFORMATION

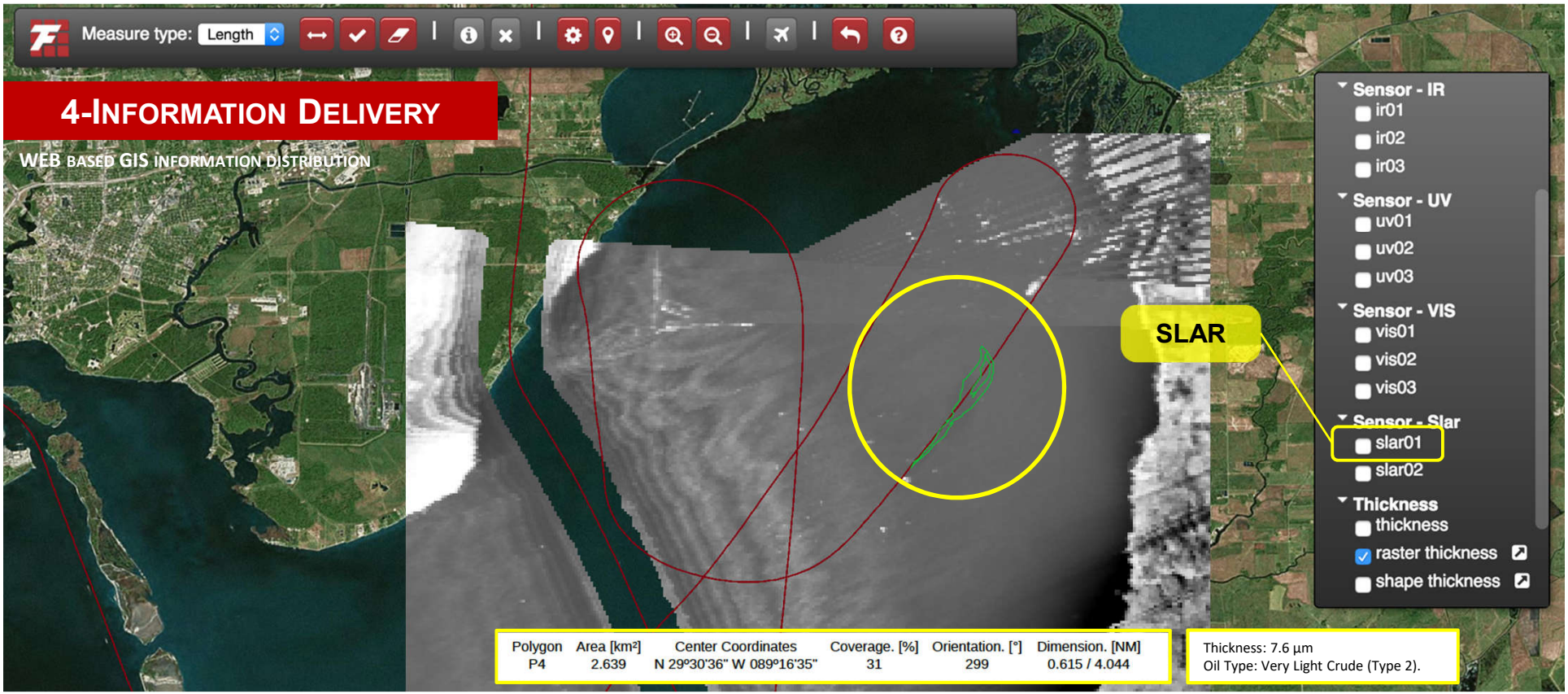
Intelligence on the Scene

4-Information Delivery

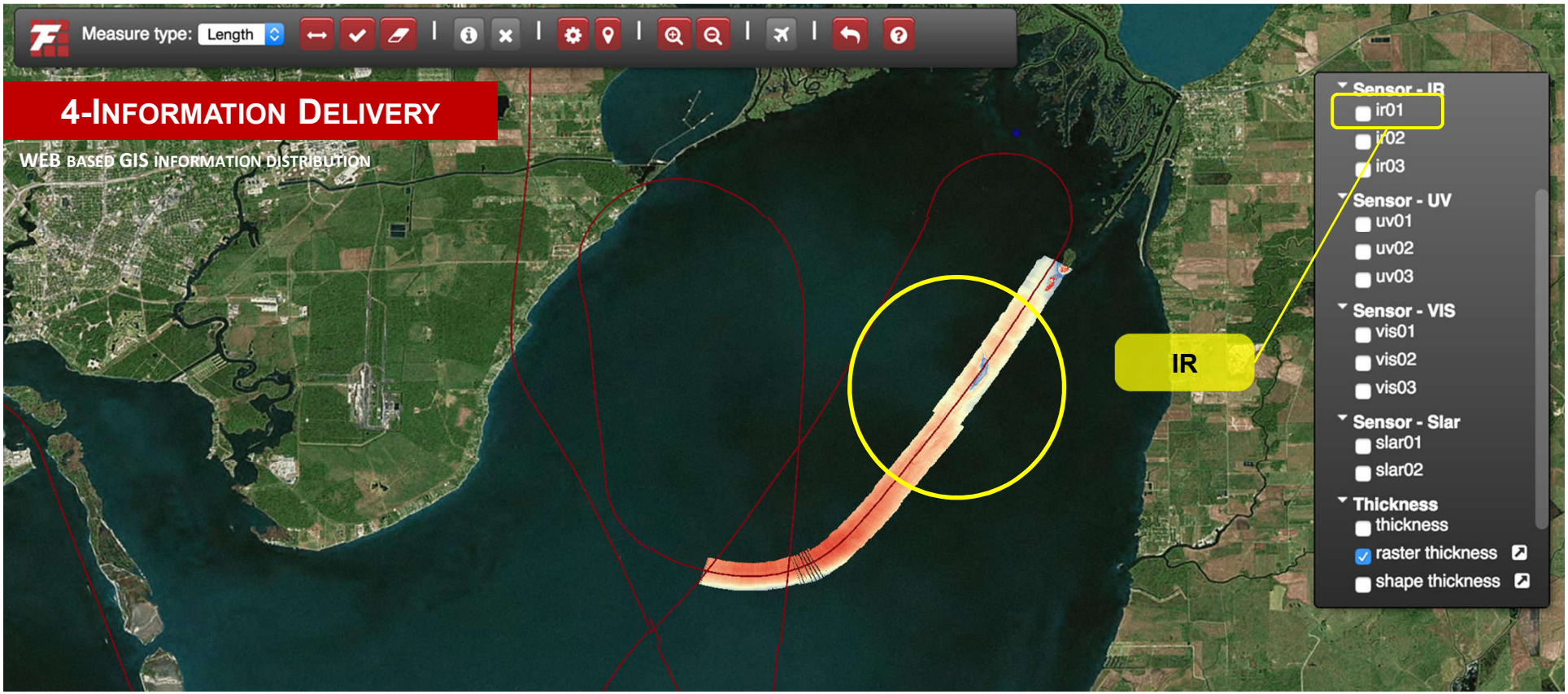
Communication Network

- **MBR** - High-speed and high capacity microwave digital radio link
  - 15 Mbit
  - Range 70 NM @ 3,000ft
- **Satellite link**

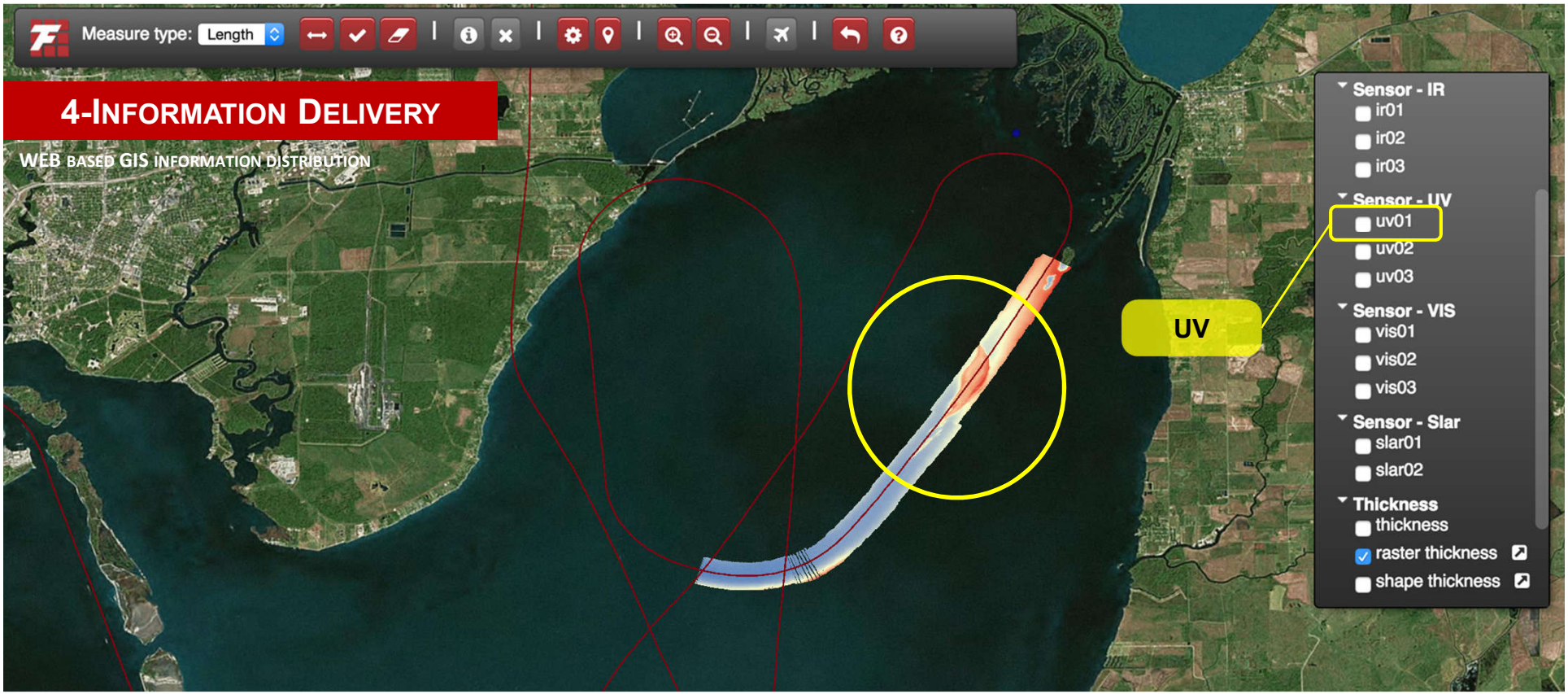
Intelligence on the Scene



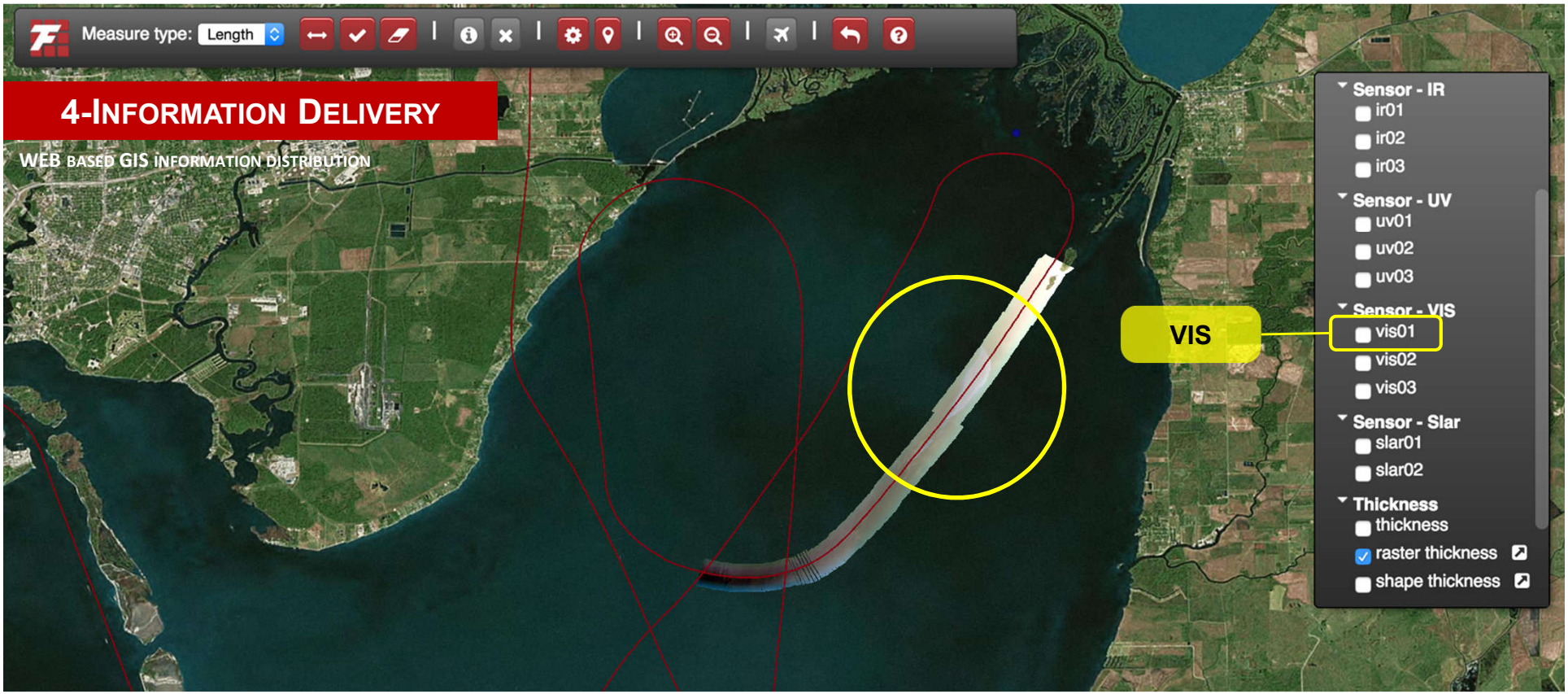
Intelligence on the Scene



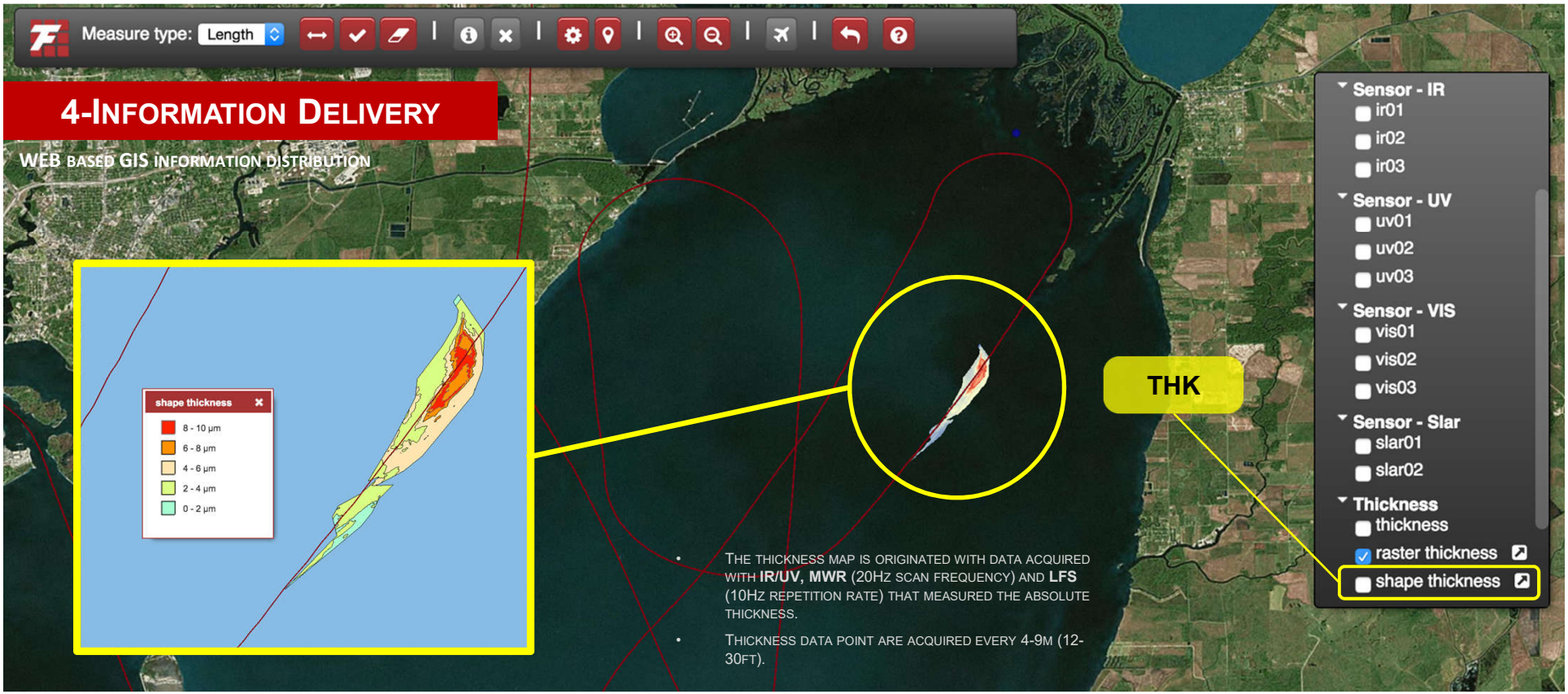
Intelligence on the Scene



Intelligence on the Scene



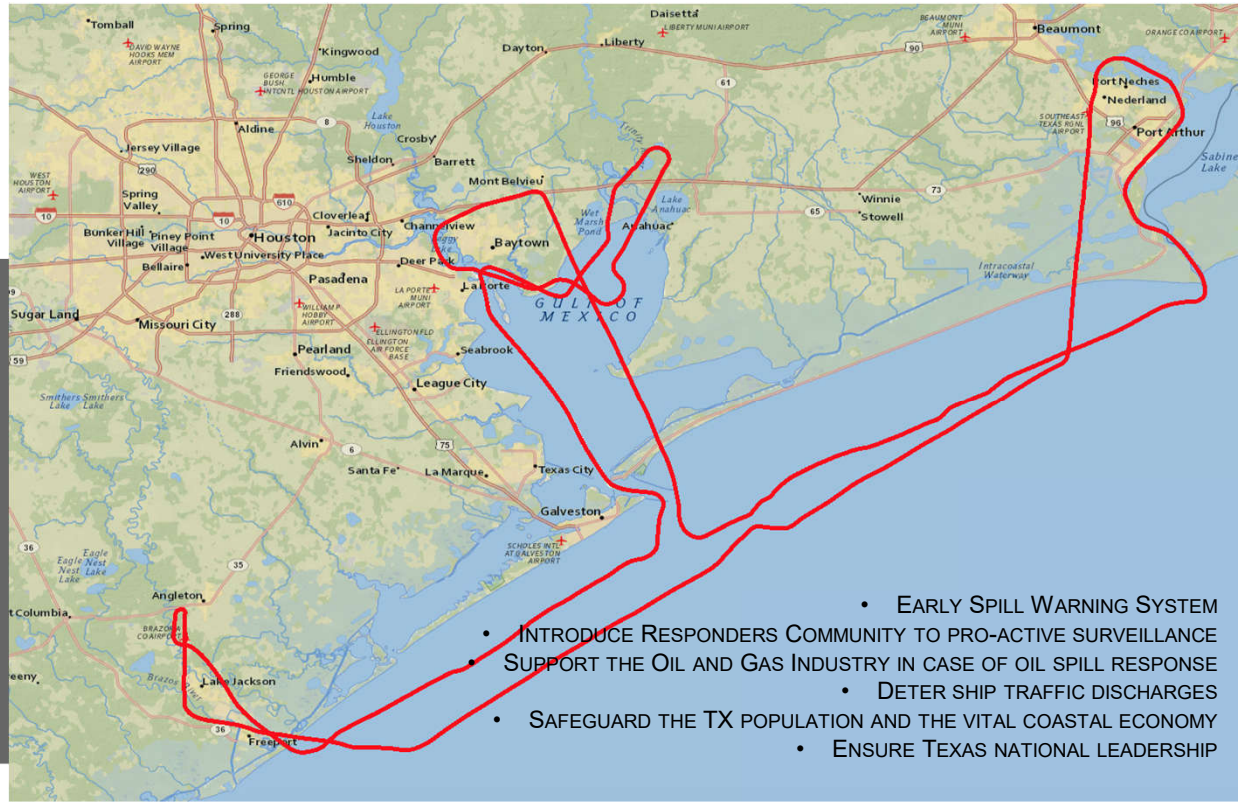
Intelligence on the Scene



Projects

COASTAL MONITORING

- Focus on East Texas – route of 300 NM – TGLO Region I and II
- Teams: Airborne (Fototerra), Oceanographic (Texas A&M), In-situ (TGLO), GIS (TGLO/Fototerra)
- Airborne Remote Sensing capabilities proven in a real scenario.
- Teams Coordination, Data/Voice Communication tested during the missions.
- Several Oil Spills Detected

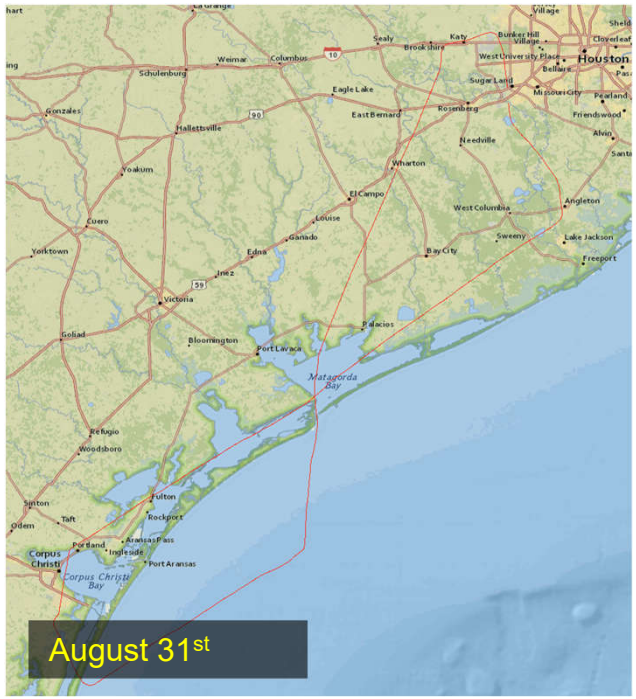


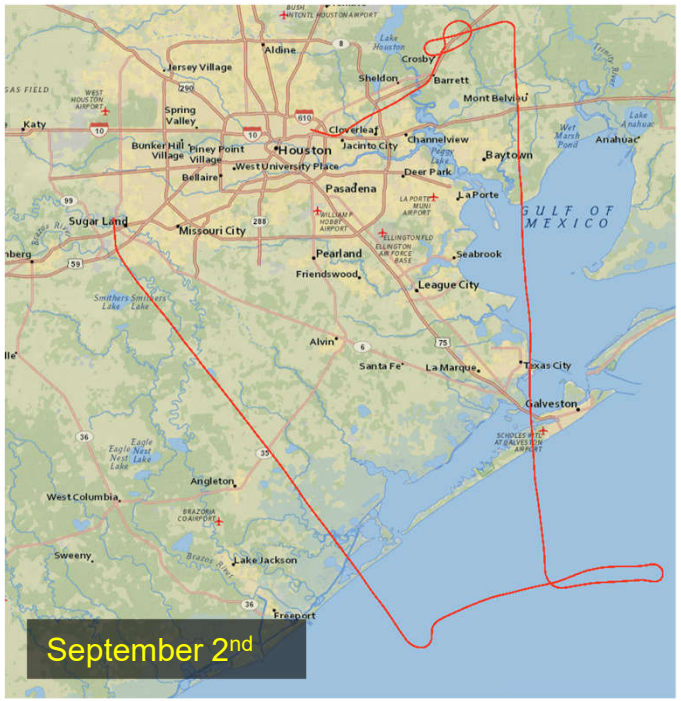
- EARLY SPILL WARNING SYSTEM
- INTRODUCE RESPONDERS COMMUNITY TO PRO-ACTIVE SURVEILLANCE
- SUPPORT THE OIL AND GAS INDUSTRY IN CASE OF OIL SPILL RESPONSE
- DETER SHIP TRAFFIC DISCHARGES
- SAFEGUARD THE TX POPULATION AND THE VITAL COASTAL ECONOMY
- ENSURE TEXAS NATIONAL LEADERSHIP

Projects

HARVEY DAMAGE ASSESSMENT

- 2 missions flown in the aftermath of Hurricane Harvey.
- Several findings reported to GLO and NOAA
- Coordination/ Communication
- Specialized Asset

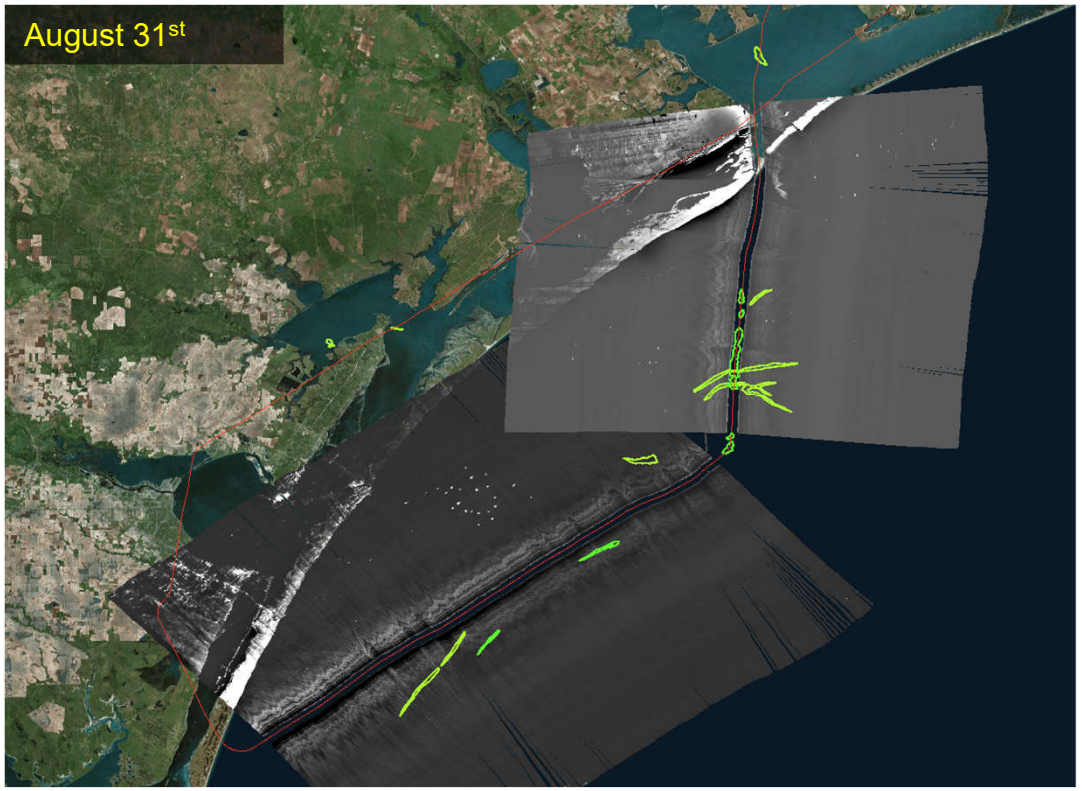




Projects

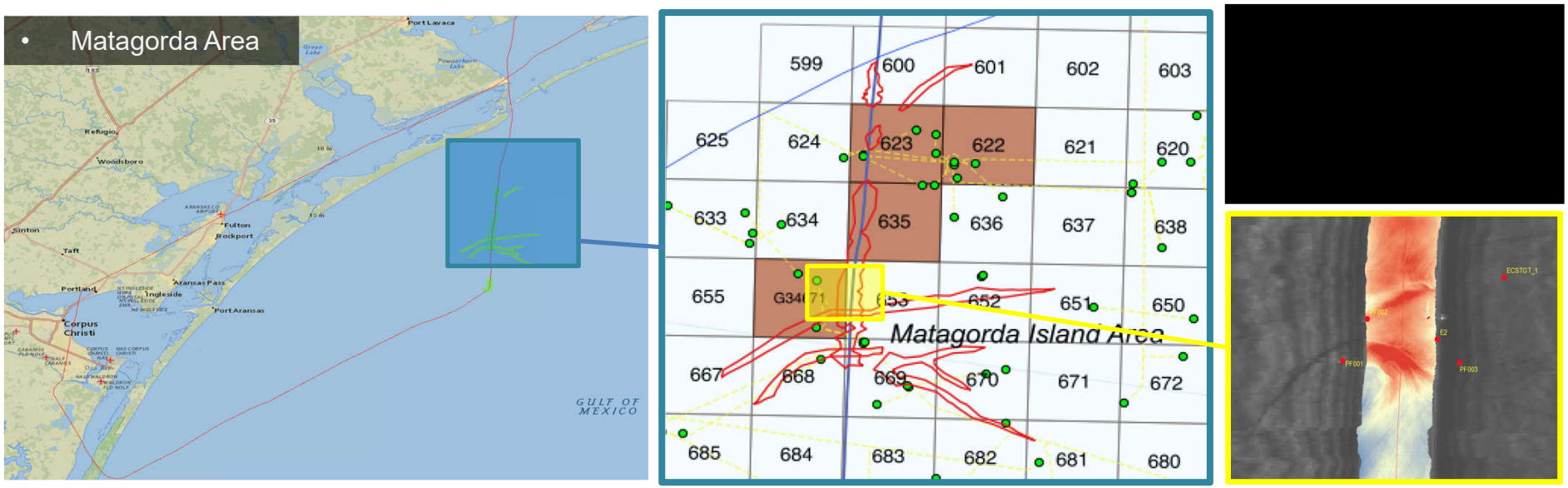
HARVEY DAMAGE ASSESSMENT

- Duration of the mission: 2h
- >10,000 Sq NM scanned.
- 12 target identified.
- 4 targets analyzed and confirmed as oil spill.
- HD Video of flooded area.



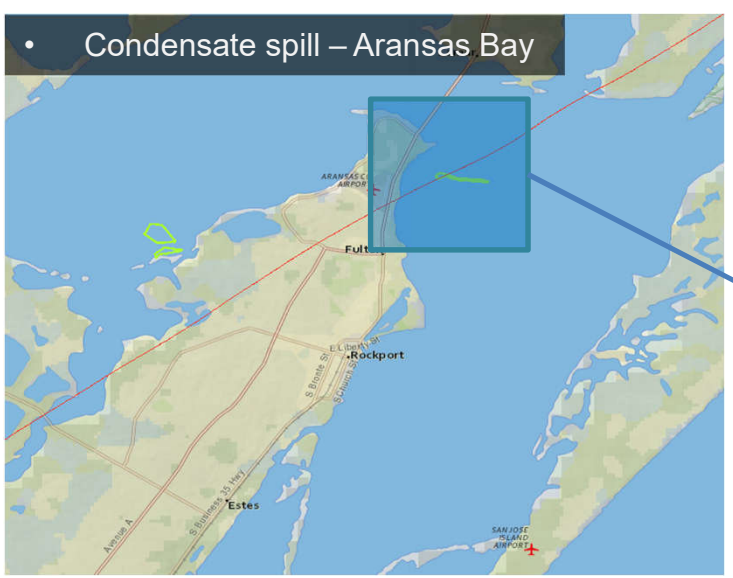
Projects

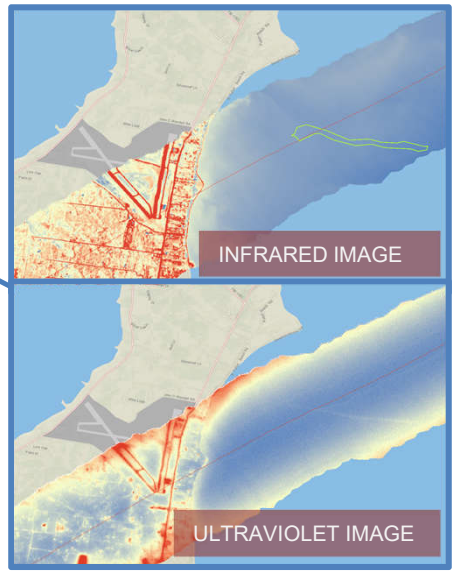
HARVEY DAMAGE ASSESSMENT



Projects

HARVEY DAMAGE ASSESSMENT

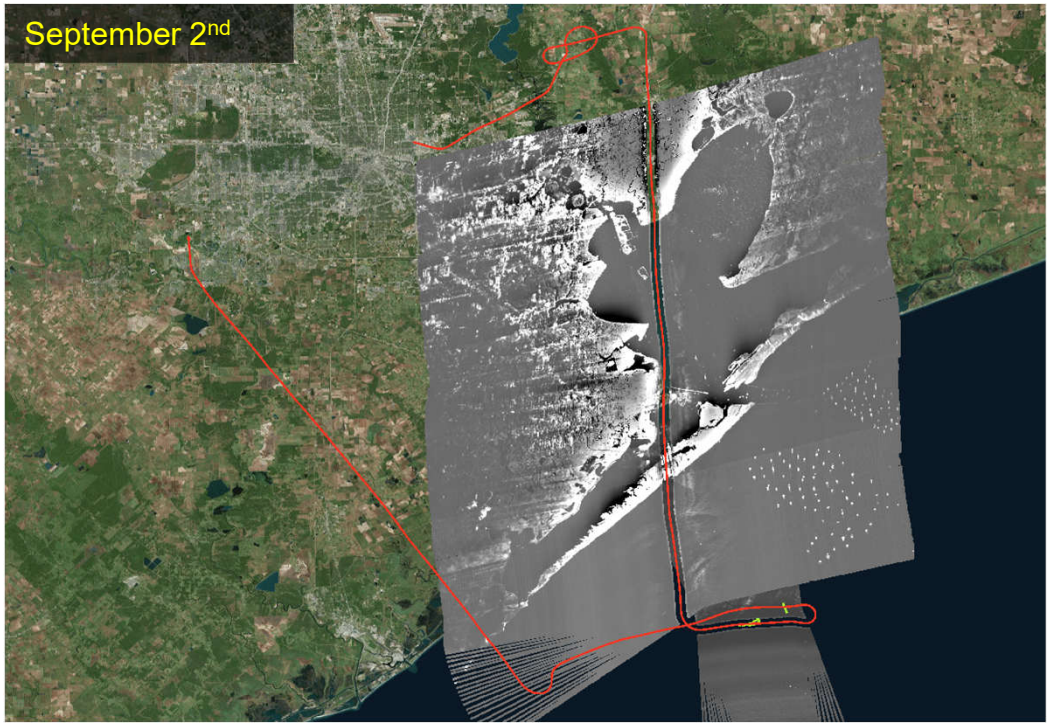




Projects

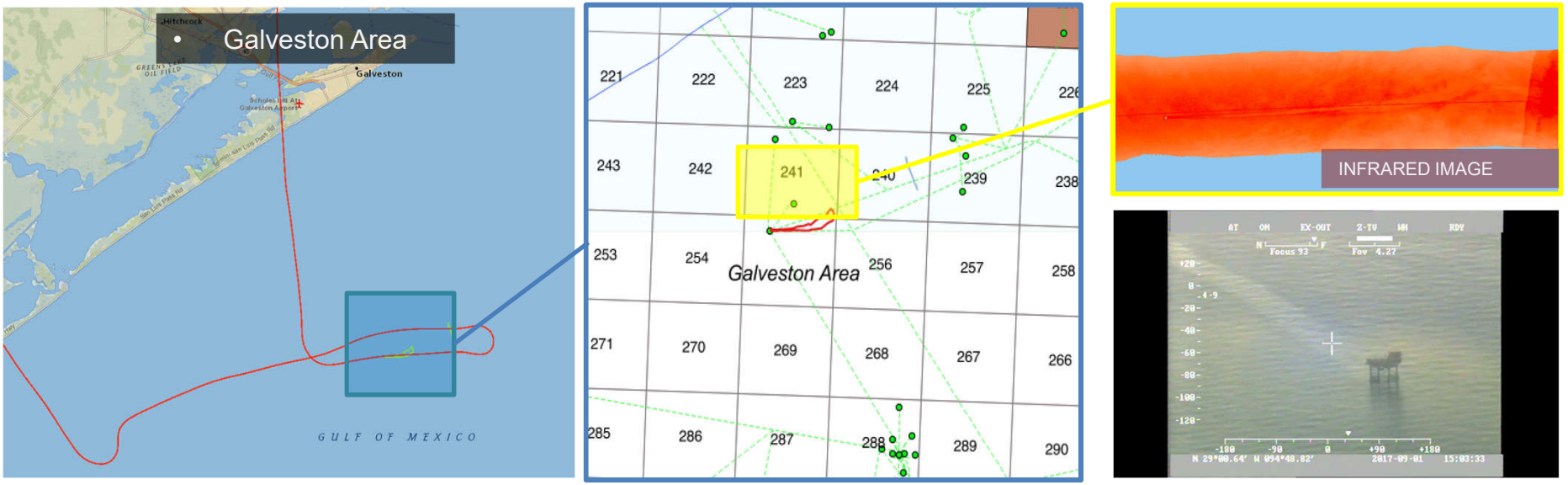
HARVEY DAMAGE ASSESSMENT

- Duration of the mission: 1h
- >5,000 Sq NM scanned.
- 2 target identified.
- 1 targets analyzed and confirmed as oil spill.
- HD Video of flooded area and Crosby Facility



Projects

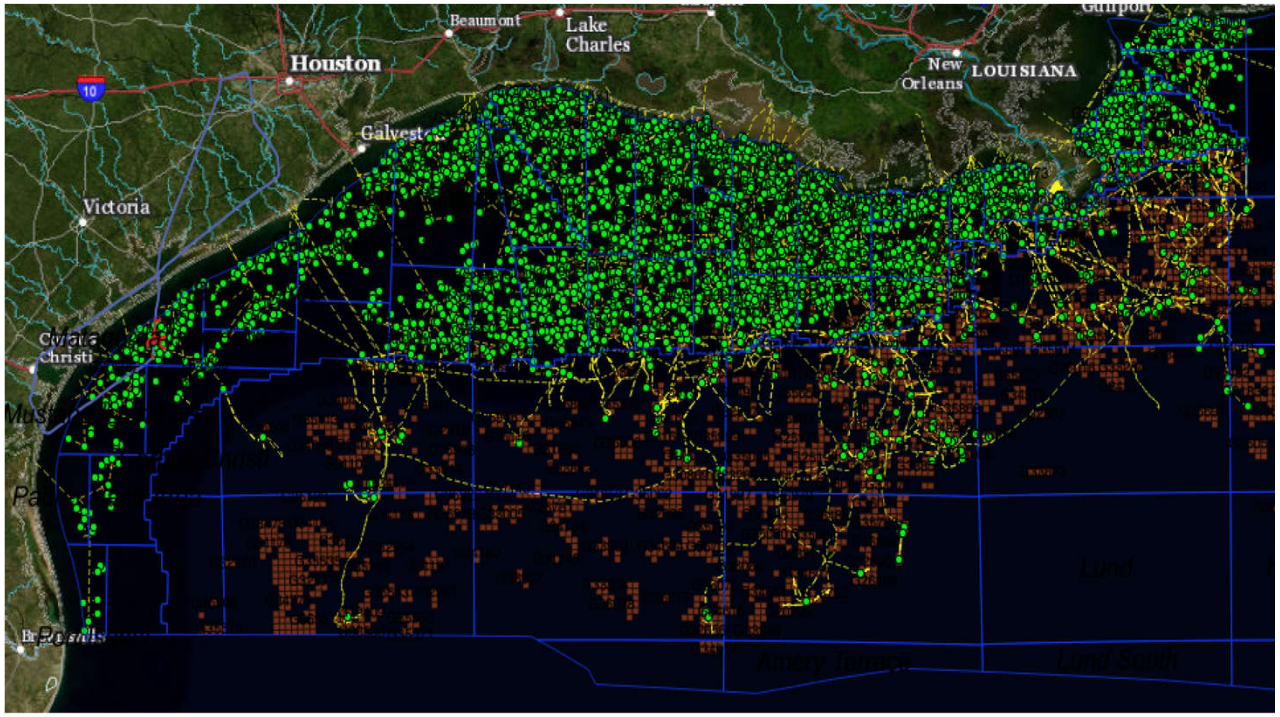
HARVEY DAMAGE ASSESSMENT



What's Next

THE GULF COAST IS EXTREMELY EXPOSED TO POLLUTION DUE TO EITHER ACCIDENTAL OR ILLEGAL DISCHARGE.

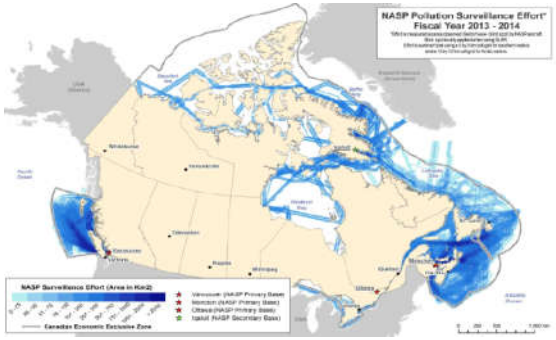
- Possible oil discharges can cause significant damages to local coastal economies and to the energy industry and impacts to natural wildlife.
- The current approach to fighting oil spills in our Country is focused on REACTION at the expense of EARLY DETECTION and PROACTIVE ACTION. DWH showed that didn't work. Idea is to **SHIFT FROM DISASTER RECOVERY TO RESILIENCY.**



Gulf of Mexico Oil Production: **1.5 – 1.6 millions of barrels per day , more than half billion of barrels per year.**

About **2 billions of barrels** per year are transported by vessels in the Gulf of Mexico area.

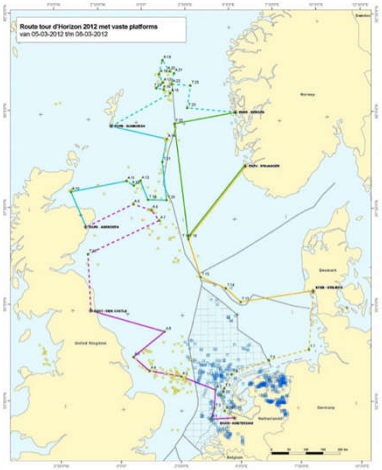
What Happen Around Us?



Transport Canada operates a National Aerial Surveillance Program of the Coastal Waters with more than **4,000 hrs** flown every year.

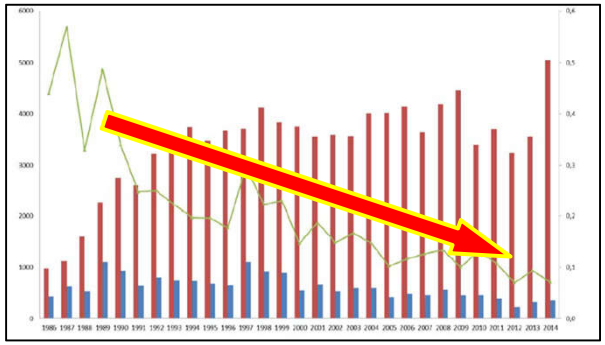
Brazil started in 2018 an intense program of coastal surveillance based on airborne remote sensing.

The **Bonn Agreement** is the mechanism by which nine Governments of the Greater North Sea, and the European Union, cooperate in dealing with pollution of the North Sea. About **4,000 hrs** flown every year

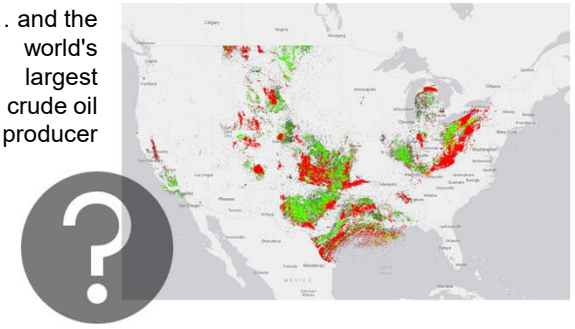


Reduction of number and consequences of the spills over the years

- *Early Stage Detection*
- *Training and familiarity*
- *Deterrent for Illegal Discharge*



… and the world's largest crude oil producer



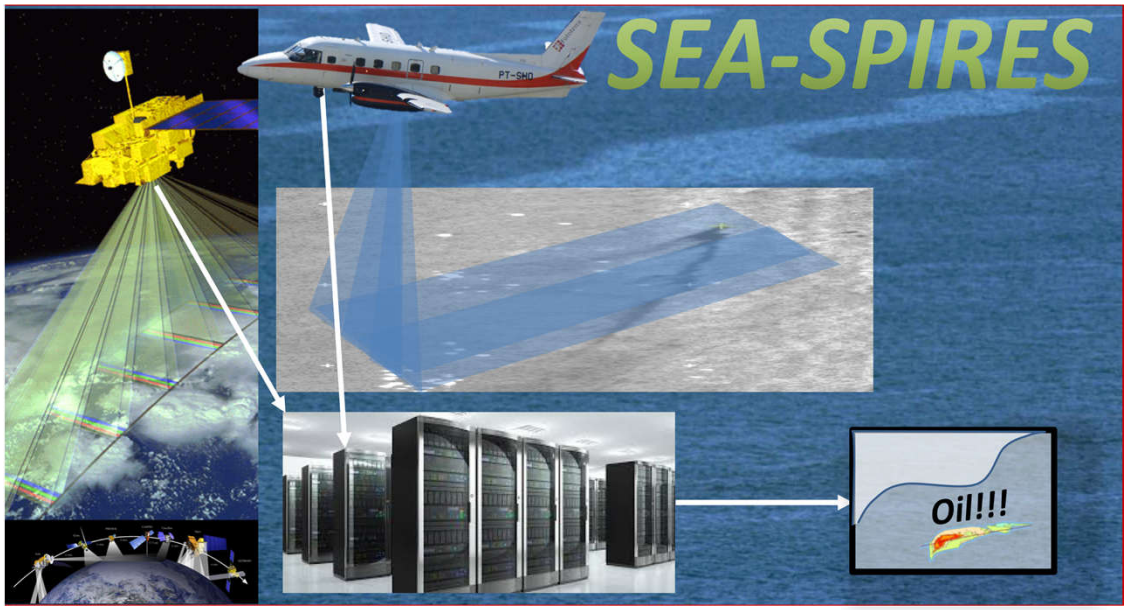
The answer SEA-SPIRES

Social Responsibility
Environmental Stewardship
Economic Prosperity

STAKEHOLDERS TAKING THE LEAD

SEA-SPIRES IS A PARTNERSHIP BETWEEN COMMERCIAL, AGENCIES, AND NON-COMMERCIAL STAKEHOLDERS THAT PROVIDES **INTEGRATED BEST AVAILABLE TECHNOLOGY** FOR OIL SPILL REMOTE SENSING ACROSS THE DISASTER CYCLE.

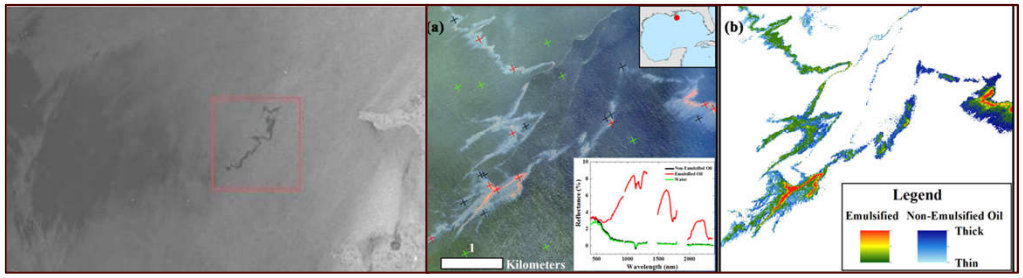
SEA SPIRES INTEGRATES SATELLITE DATA WITH AIRBORNE REMOTE SENSING DATA, CURRENT AND WIND DATA, VESSEL INFORMATION, AND HINDCAST/FORECAST MODELING IN THE SEA-SPIRES DECISION SUPPORT SYSTEM IDEMOSP (INTEGRATED DECISION MAKING FOR OIL SPILLS) PROVIDING INFORMED OUTPUT TO SUPPORT ACCURATE AND ROBUST DECISIONS ACROSS THE DISASTER CYCLE: EARLY DETECTION, MITIGATION, RECOVERY, RESILIENCY

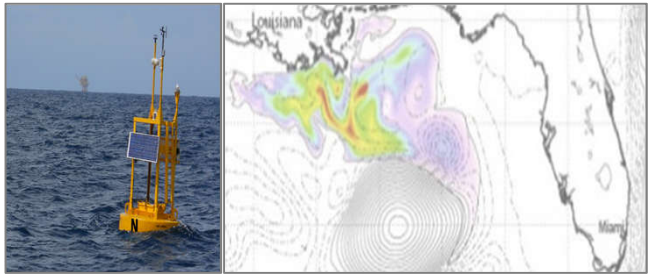


The SEA-SPIRES consortium is jointly led by Bubbleology Research International and Fototerra Aerial Survey, supported by Texas A&M University and University of South Florida.

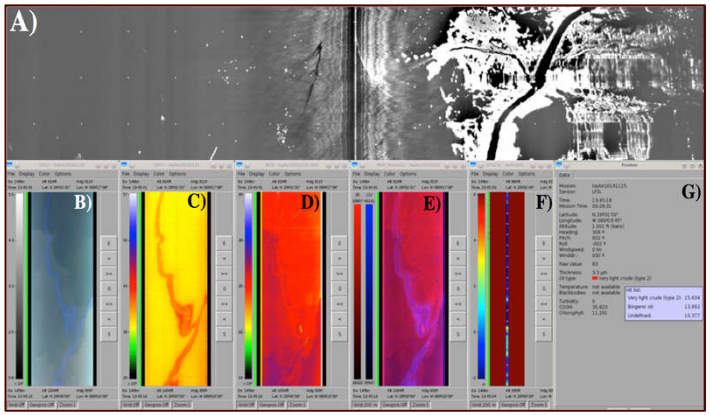
How SEA-SPIRES works

SATELLITE SEA-SPIRES acquires and analyzes repeat MODIS, COSMO-SkyMed SAR, Digital Globe, and other satellite imagery with unsupervised detection, mapping, and thickness algorithms. Data from all these sensors and their analysis are ingested into iDEMOS, which escalates or demotes anomalies, triggering actions or additional data requests, respectively.



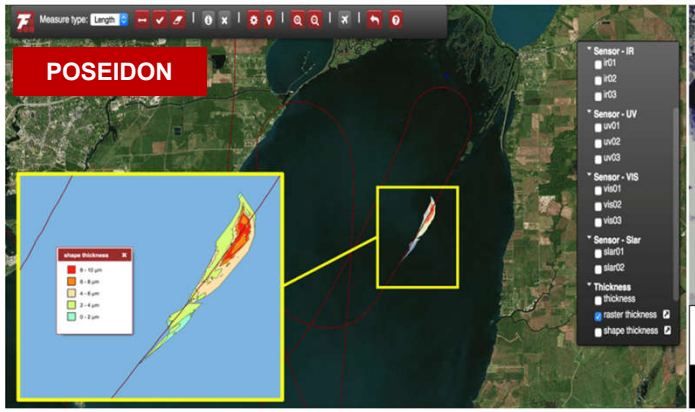


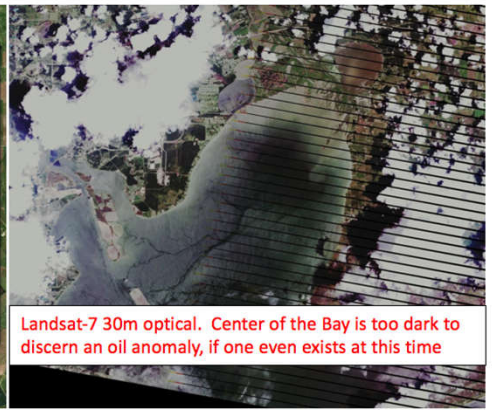
TRAJECTORY Automated hindcast modeling uses data from a network of oceanographic/meteorological sensors, buoys, HF radar, etc.,AIS vessel and infrastructure data to evaluate possible spills.



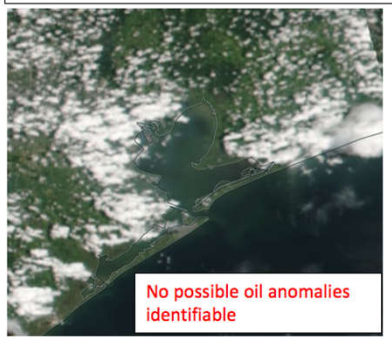
AIRBORNE POSEIDON flies the most extensive sensor suite in North America, providing the most effective and robust airborne solution for oil spill remote sensing bar none. Poseidon's Mission Control Unit (MCU) integrates sophisticated communication including a high-speed high-band microwave radio data link for network connections with incident command, response vessels, clients, and consortium members. Satellite and airborne data are integrated and disseminated in near real time (<30 min) in a GIS environment to support spill response decision-making.

How SEA-SPIRES works



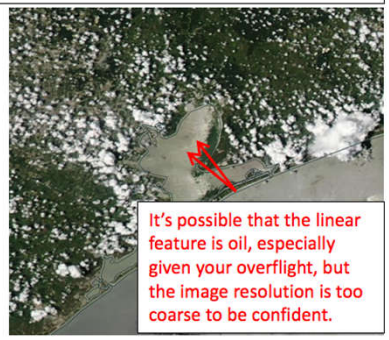


Satellite Imagery over Trinity Bay, TX



VIIRS – 375m resolution

MODIS Terra – 250m resolution



MODIS Aqua – 250m resolution

Key Advantages

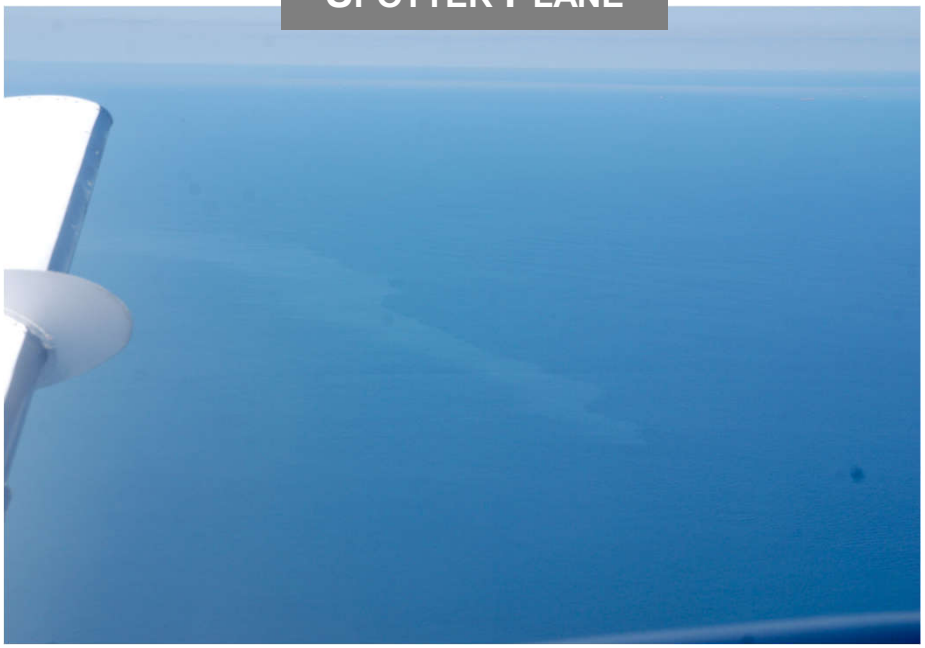
SPOTTER PLANE VISUAL ASSESSMENT VS. MULTISENSOR REMOTE SENSING PLATFORM

- INFORMATION?
- PRODUCTIVITY?
- WEATHER?
- CONSISTENCY OF DATA?
- DEFENSIBLE DATA?
- DATA TRANSMISSION?
- GIS? COP?

- **Still several years after DWH, visual assessment is the most common way to ASSESS (?) spills and SUPPORT (?) responders.**
- Based on Naked Eye / Digital Camera.
- Spotter plane, fixed or rotary wing, can be a blind $15,000/h asset.
- Often Vessels are deployed and stand-by (tens of thousand dollars per day).

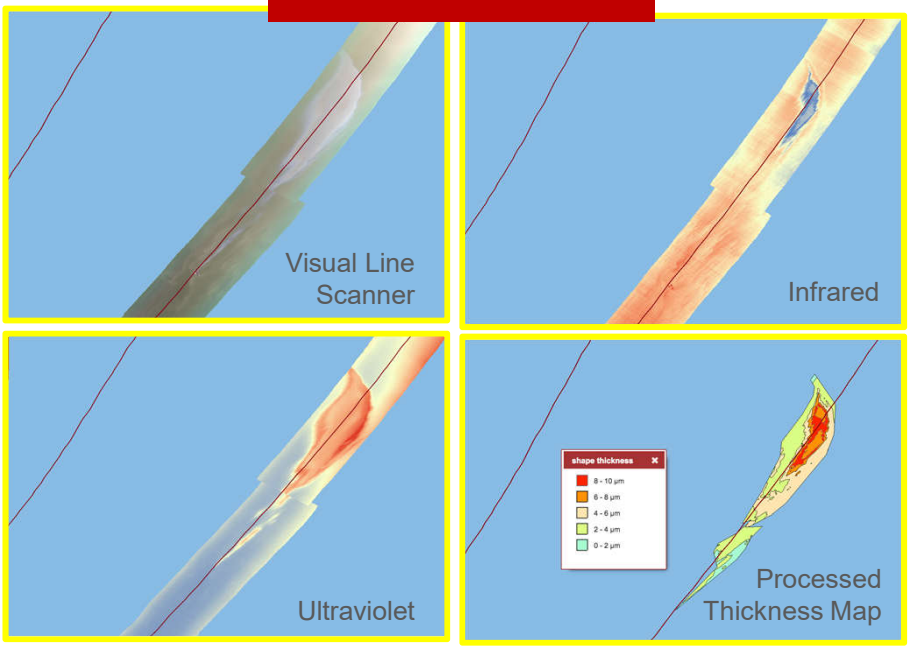
Key Advantages

SPOTTER PLANE



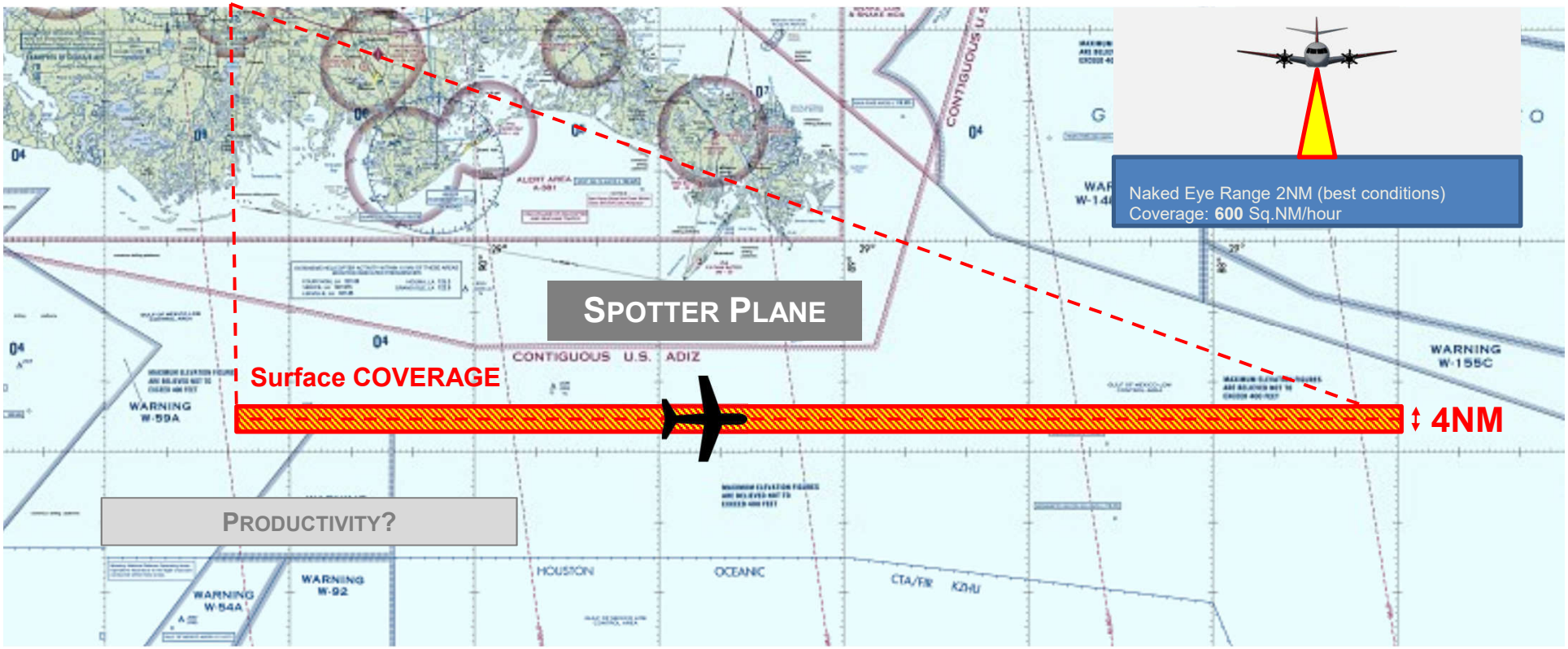
INFORMATION?

POSEIDON

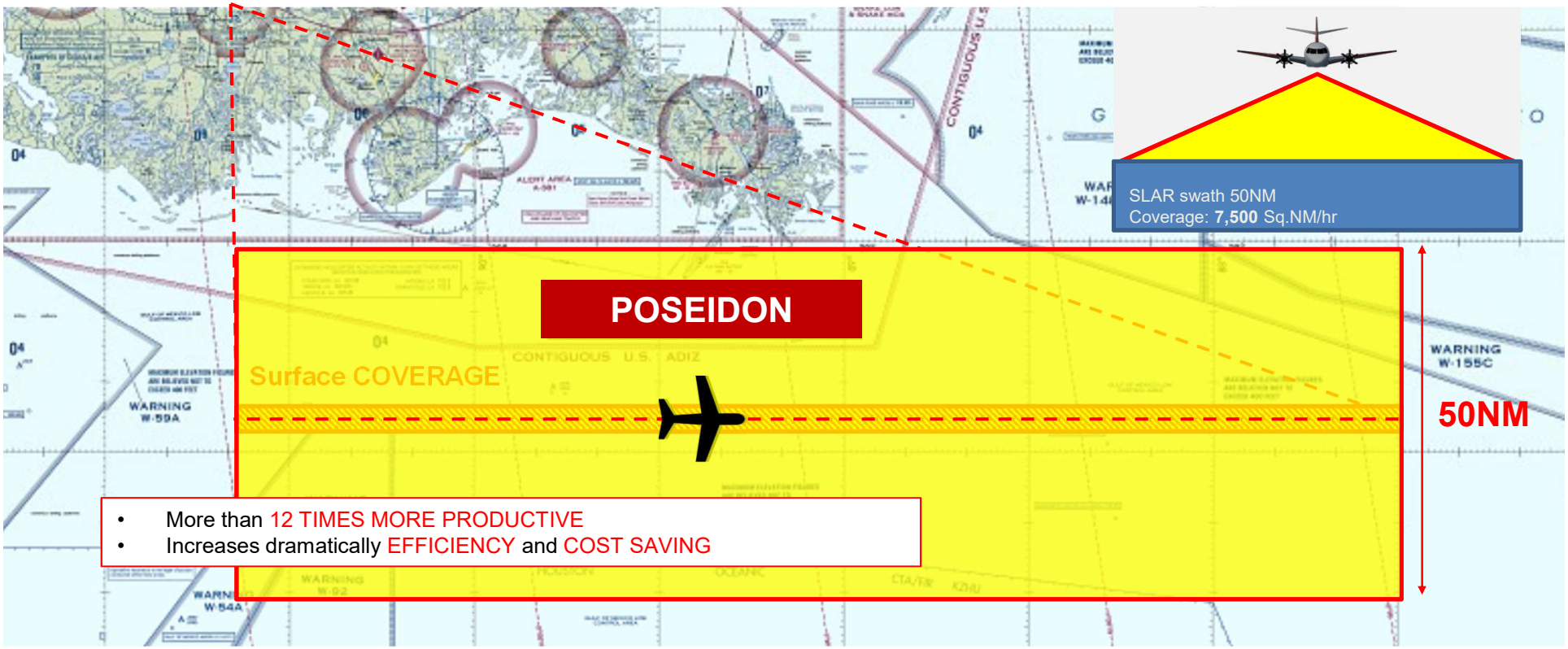


MULTISENSOR ENVIRONMENT enhances dramatically the capabilities to detect and analyze the spill.

Key Advantages



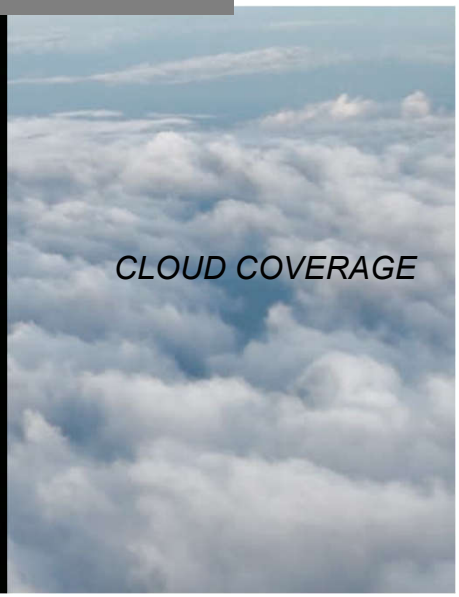
Key Advantages



- More than 12 TIMES MORE PRODUCTIVE
- Increases dramatically EFFICIENCY and COST SAVING

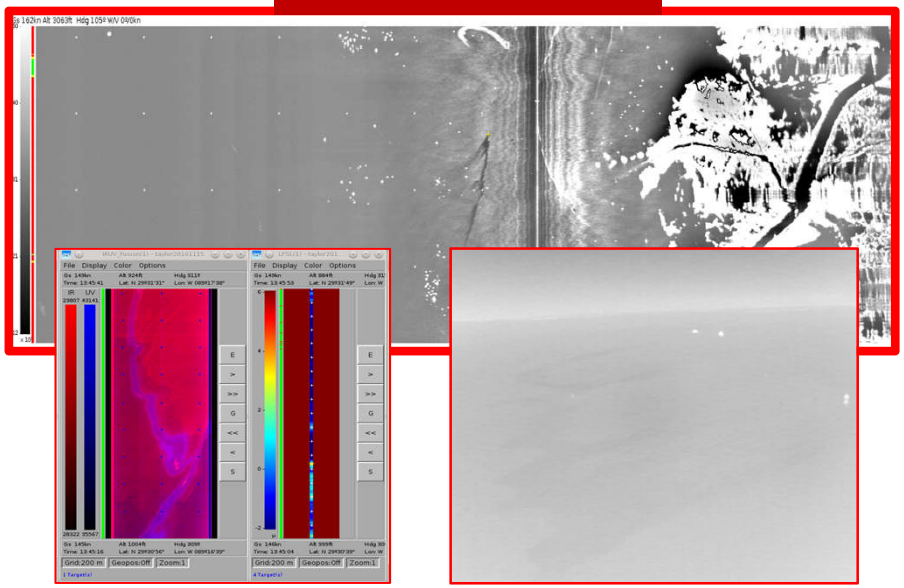
Key Advantages

SPOTTER PLANE



WEATHER?

POSEIDON



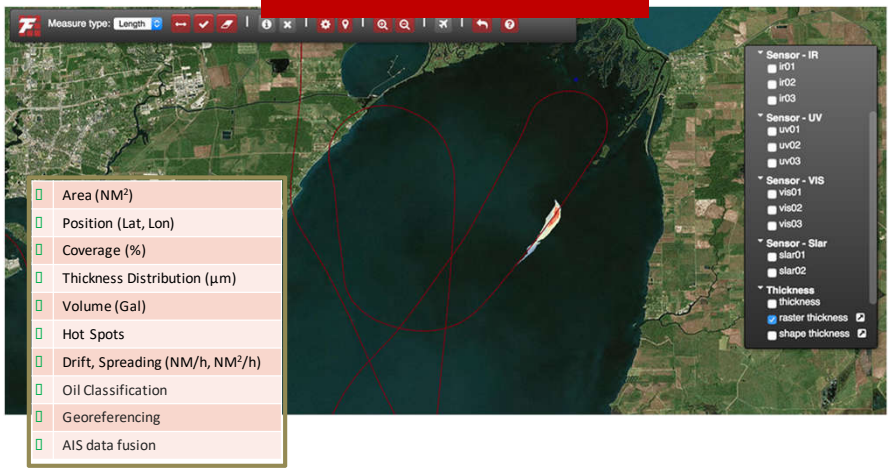
- ALL-WEATHER/coverage operations
- NIGHT Operations
- Expands the OPERATION WINDOW
- SLAR / IR / EO/IR / MWR / LFS

Key Advantages

SPOTTER PLANE

COMMON OPERATING PICTURE?

POSEIDON



- REAL TIME DATA TRANSMISSION
- QUANTITATIVE INFORMATION
- GEOREFERENCED DATA / GIS
- EFFECTIVE PLATFORM FOR THE DECISION MAKERS
- DEFENDABLE DATA
- WEB BASED DATA DISTRIBUTION


THANK YOU !
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