Fototerra

Airborne Oil Spill Remote Sensing: POSEIDON

RRT 6

REGION 6 Regional Response Team Meeting

November 8th, 2017

EPA Region 6 Training Center - Addison, TX

Airborne Remote Sensing

Learning Outcomes

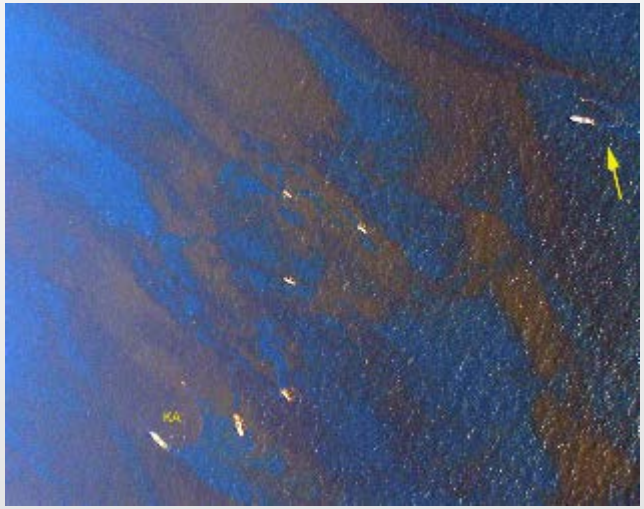
The Needs. Industry and Government Recommendations for effective Airborne Remote Sensing platforms. DWH aftermath.

Intelligence on the Scene. POSEIDON Mission System: Multi-Sensors Suite, Real Time Data Processing and Communications Network.

Key Advantages. Benefits for Emergency Response, Natural Resources Damage Assessment and Preparedness.

Missions Examples. Texas Coast Monitoring – Hurricane Harvey Assessment Flights

The Needs



GAP ANALYSIS - In the aftermath of Deepwater Horizon Spill, Industry, University, Governmental Agencies (*) got together in order to focus on needs for future technologies to improve oil observations to support a response. The conclusions suggested that for the oil responder community an effective airborne platform is a must, and should feature:

(*) Industry and Government Agencies include:
***API** - American Petroleum Institute*
***IGOP** – International Association of Oil & Gas Producers*
ICCOPR (USCG, NOAA, BSEE, etc.)

Need for:

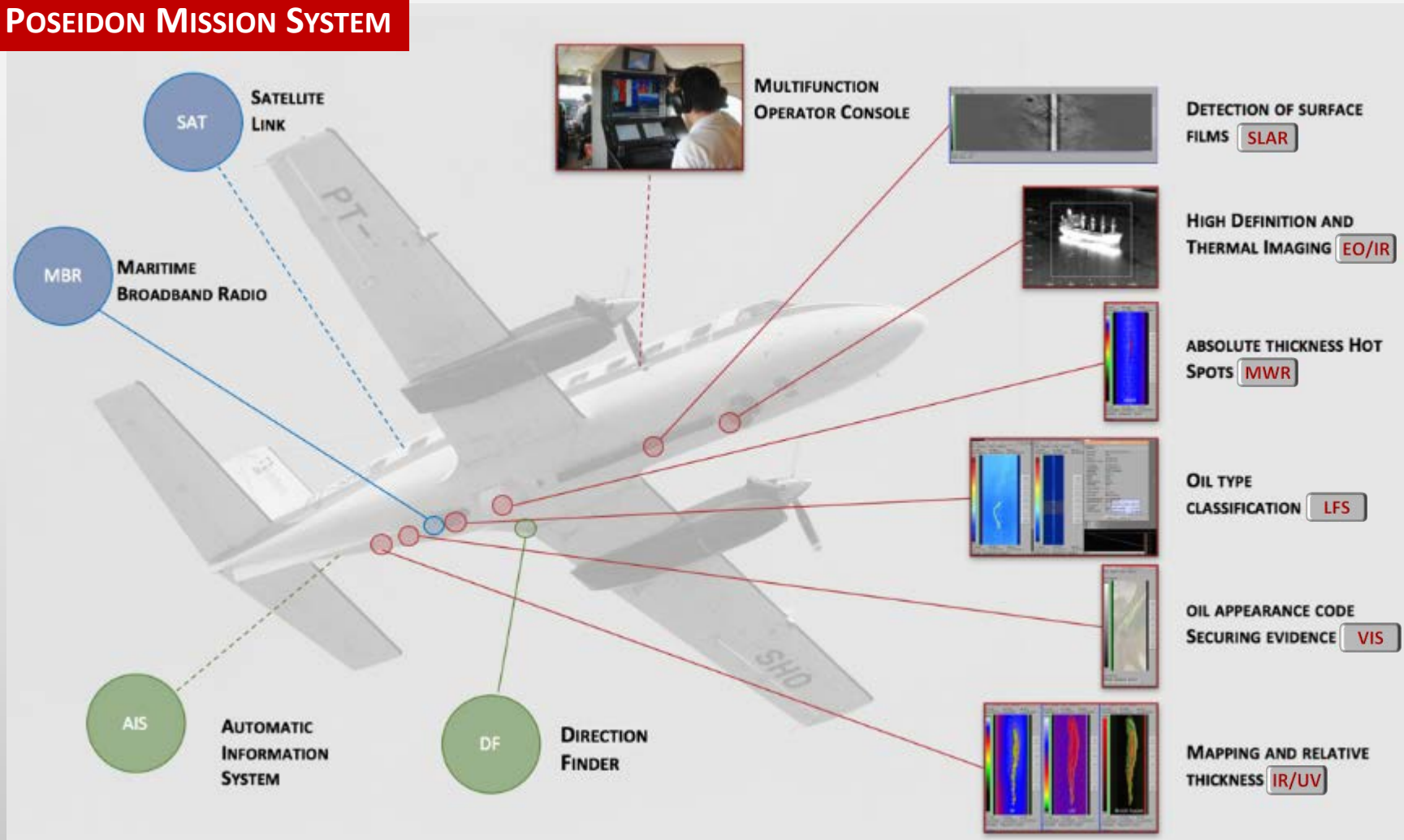
- Multiple sensors for complementarity/redundancy;
- Classification of Pollutants, no false-positive;
- Identification of oil targets as Recoverable or Non-recoverable;
- Georeferencing the targets and Tracking moving oil;
- Real time information - for tactical and strategic use;
- Data suitable for the Common Operating Picture;
- Expanding the operating window to low-light conditions;
- Readiness of Crew and Platform.

POSEIDON

Based in Houston, TX Poseidon entered in service in July 2016. Participating in a program coordinated by BSEE and NOAA to assess new technologies for aerial remote sensing.

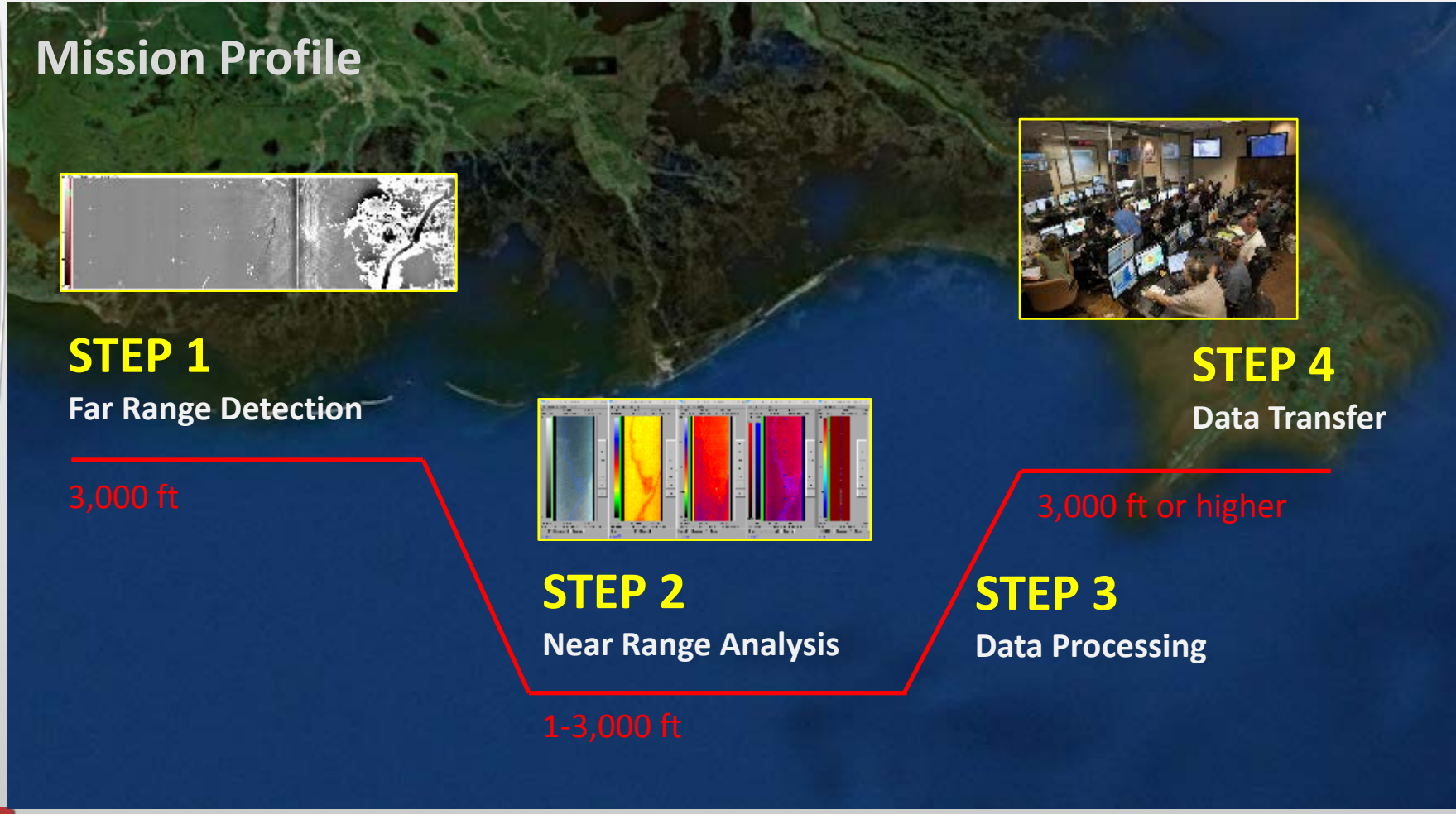
Intelligence on the Scene

Poseidon Mission System



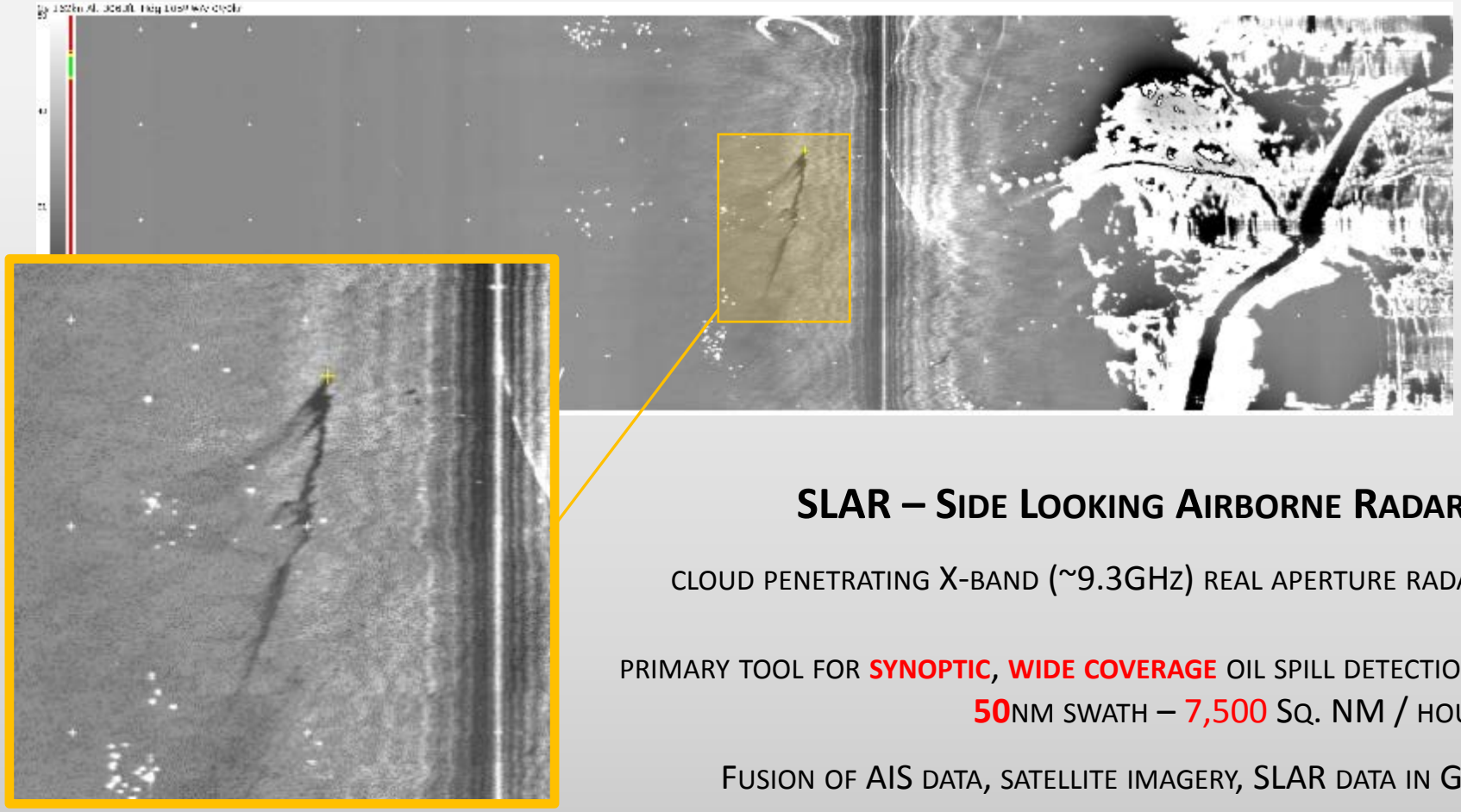
SENSORS | DATA PROCESSING | COMMUNICATIONS

Intelligence on the Scene



Intelligence on the Scene

STEP 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.
50nm swath – 7,500 Sq. NM / hour

Fusion of AIS data, satellite imagery, SLAR data in GIS environment

Intelligence on the Scene

STEP 1 - Far Range Detection

EO/IR – Electro-Optical Infrared

- High Definition and Thermal Imaging
- Visual Assessment of the spill
- Navigation
- SAR support
- Natural Resource Damage Assessment

Intelligence on the Scene

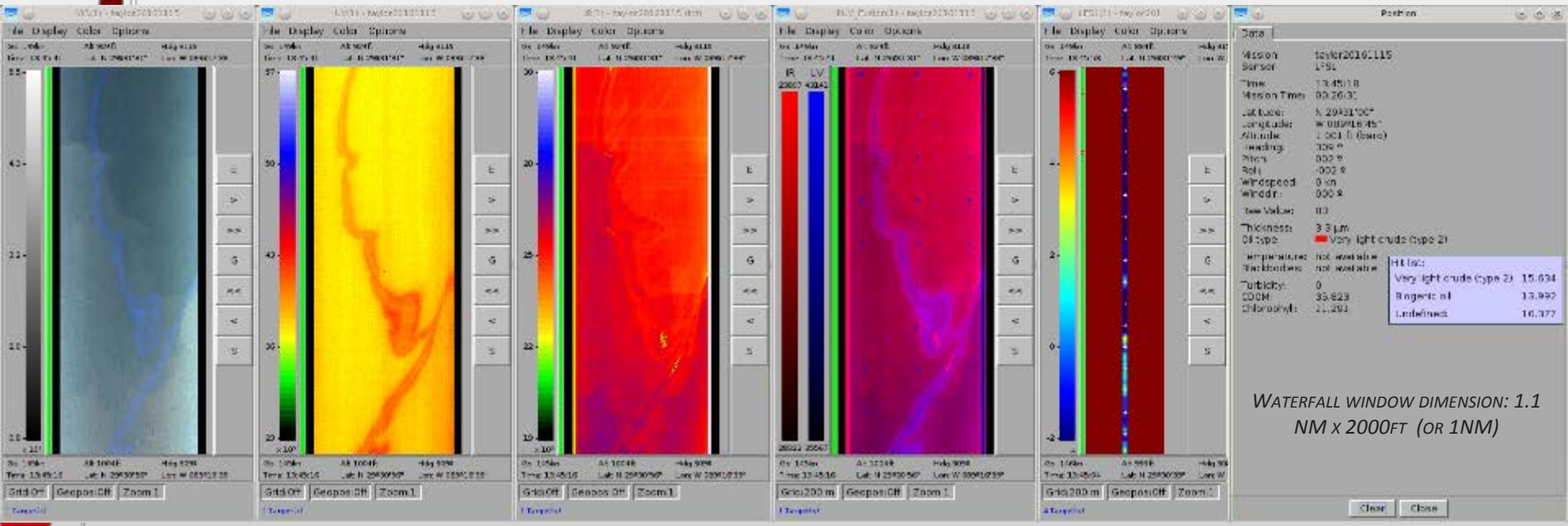
STEP 2 - Near Range Analysis

Accurate analysis of the Oil Spill

- Each sensor detects specific features of the spill for a precise target definition.
- Night and Day Spill Detection

- Thickness Distribution [µm]
- Volume [gal]
- Hot Spots
- Oil Classification
- Area

- Position
- Coverage
- Drift
- Spreading



VIS

Oil Appearance

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

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

MWR

Absolute Thickness Measurement

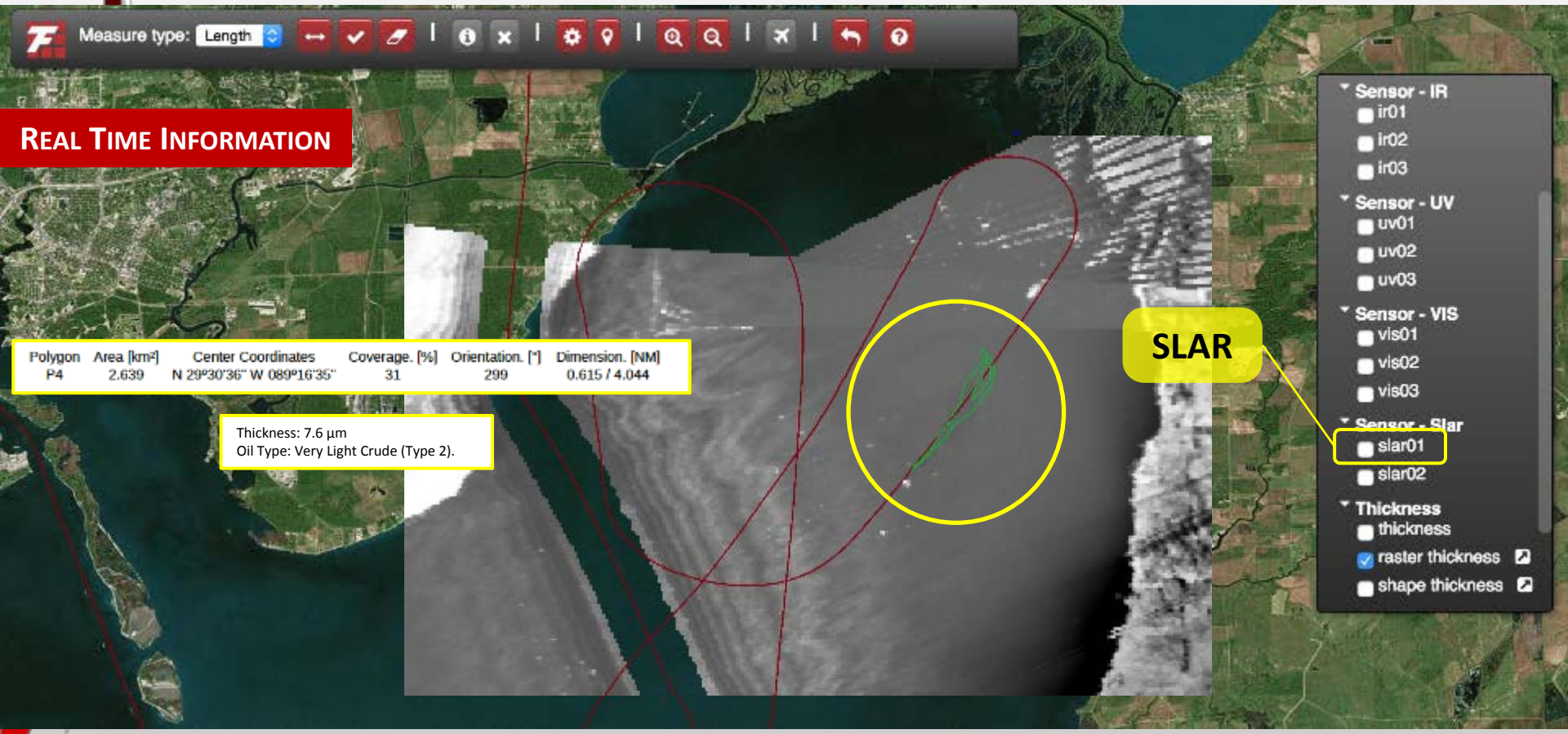
LFS

Oil Classification
Absolute Thickness Measurement
0.1 to 20 µm
Volume estimation

Intelligence on the Scene

STEP 3 – Data Processing

WEB BASED GIS DATA DISTRIBUTION



COMMON OPERATING PICTURE

UNDERSTAND THE SCENARIO

DECIDE THE ACTIONS

CONTROL THE RESULTS

Intelligence on the Scene

STEP 3 – Data Processing

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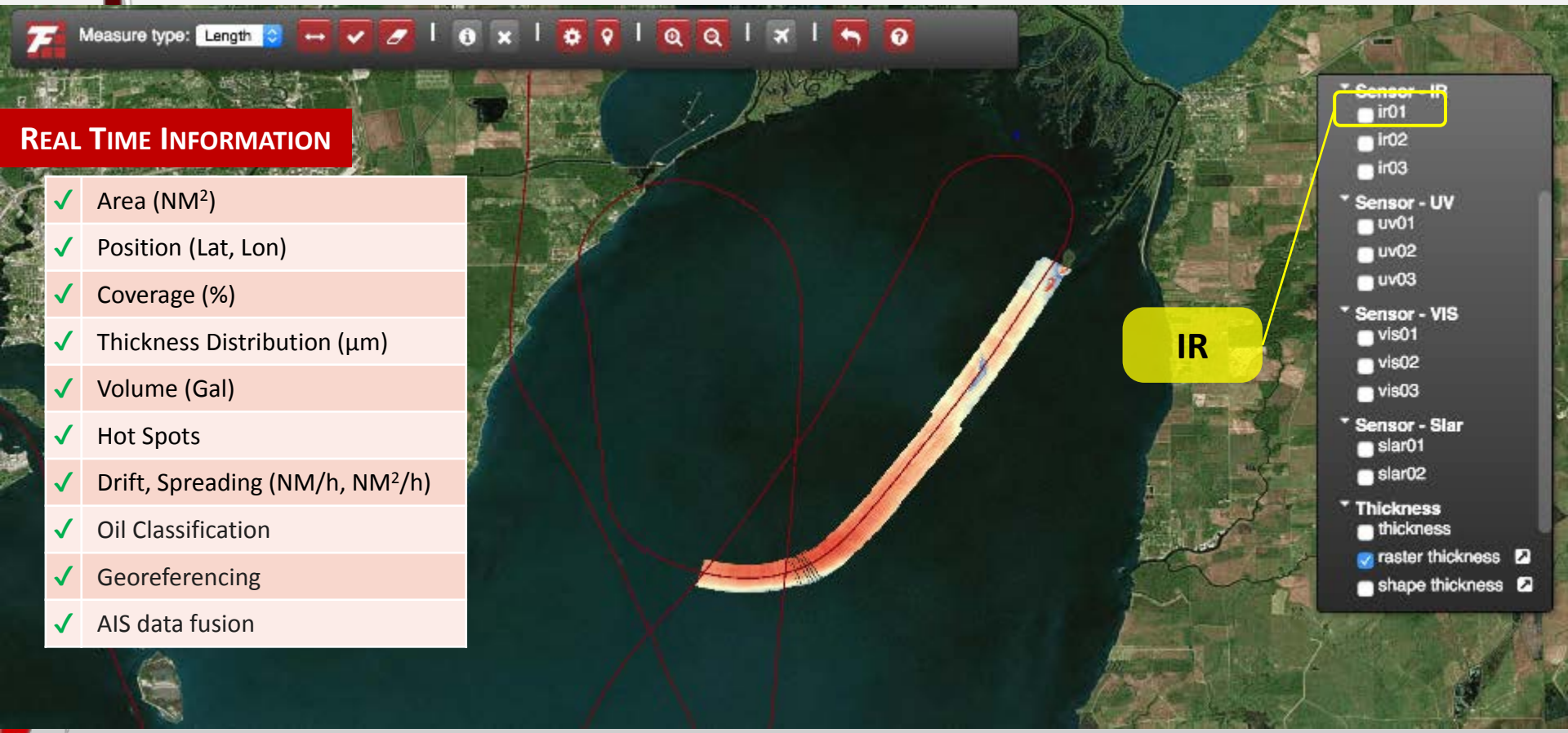

REAL TIME INFORMATION

- ✓ 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

Intelligence on the Scene

STEP 3 – Data Processing

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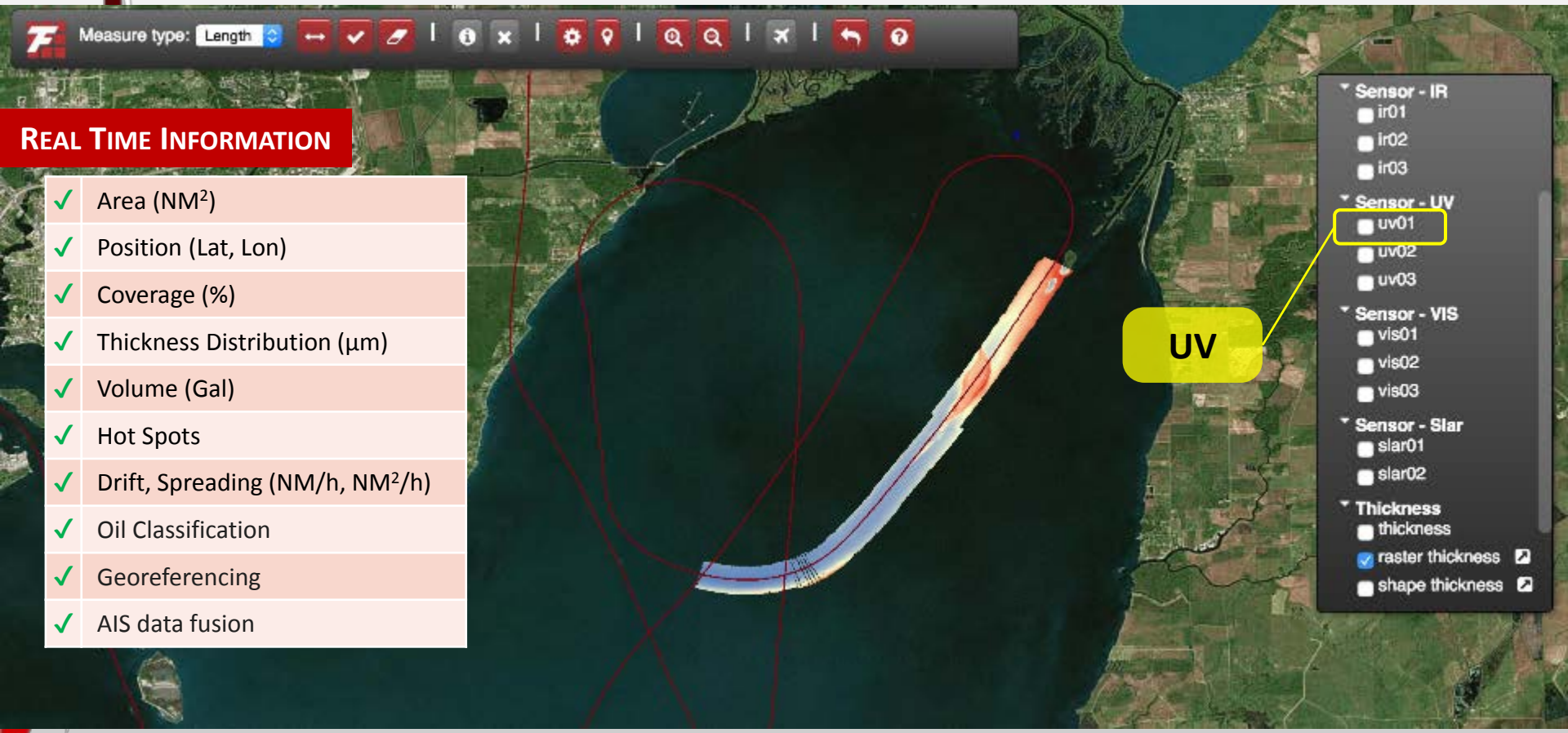

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Intelligence on the Scene

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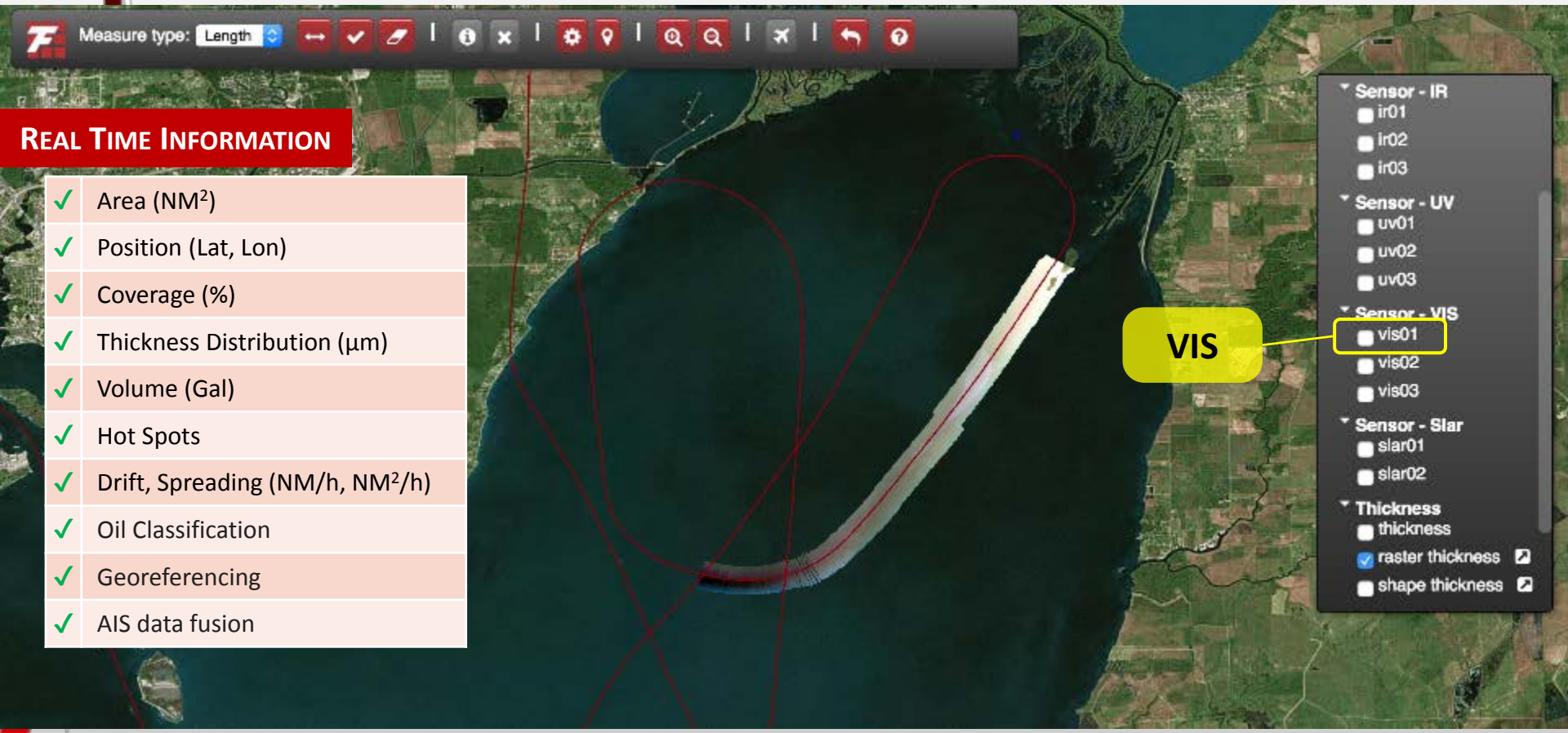

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Intelligence on the Scene

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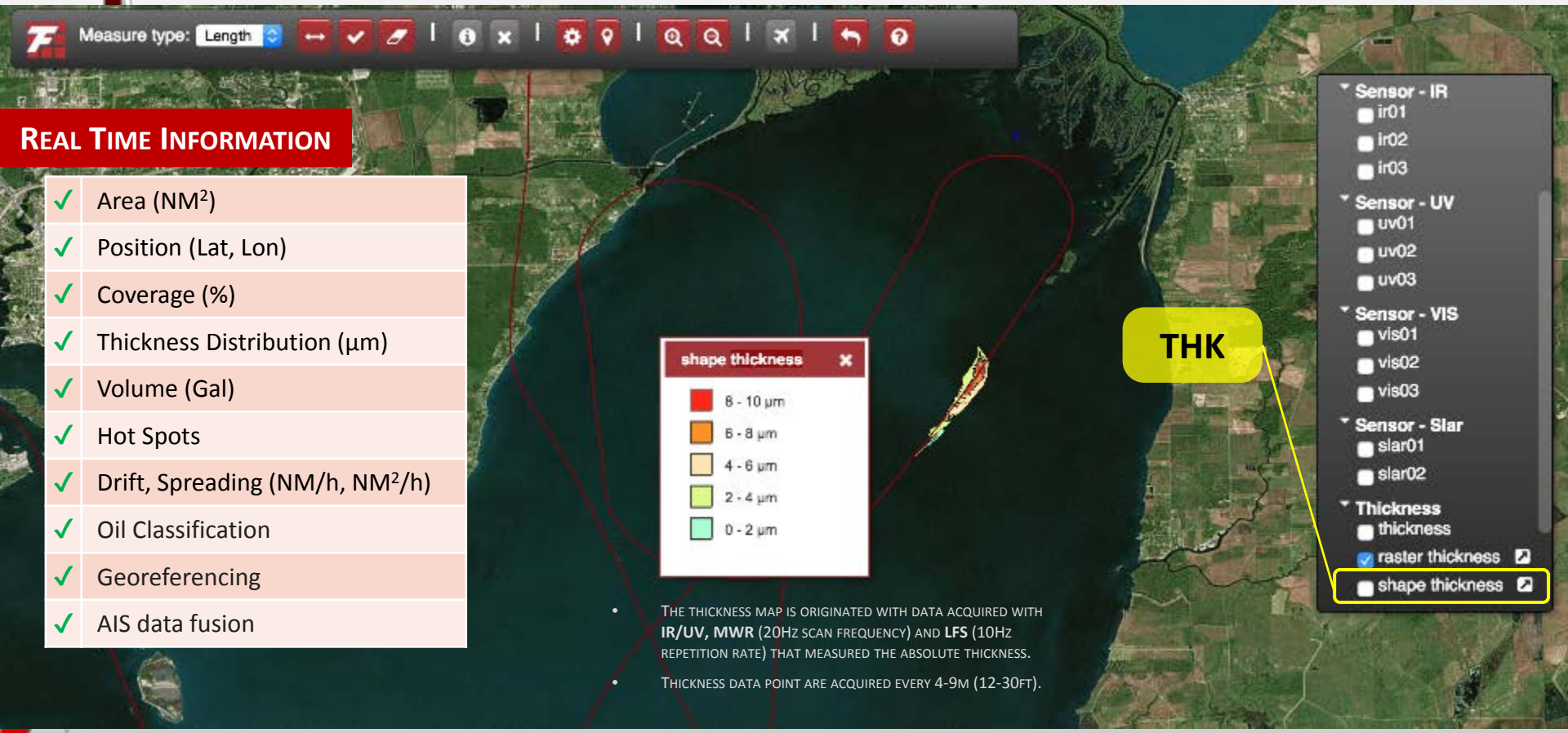

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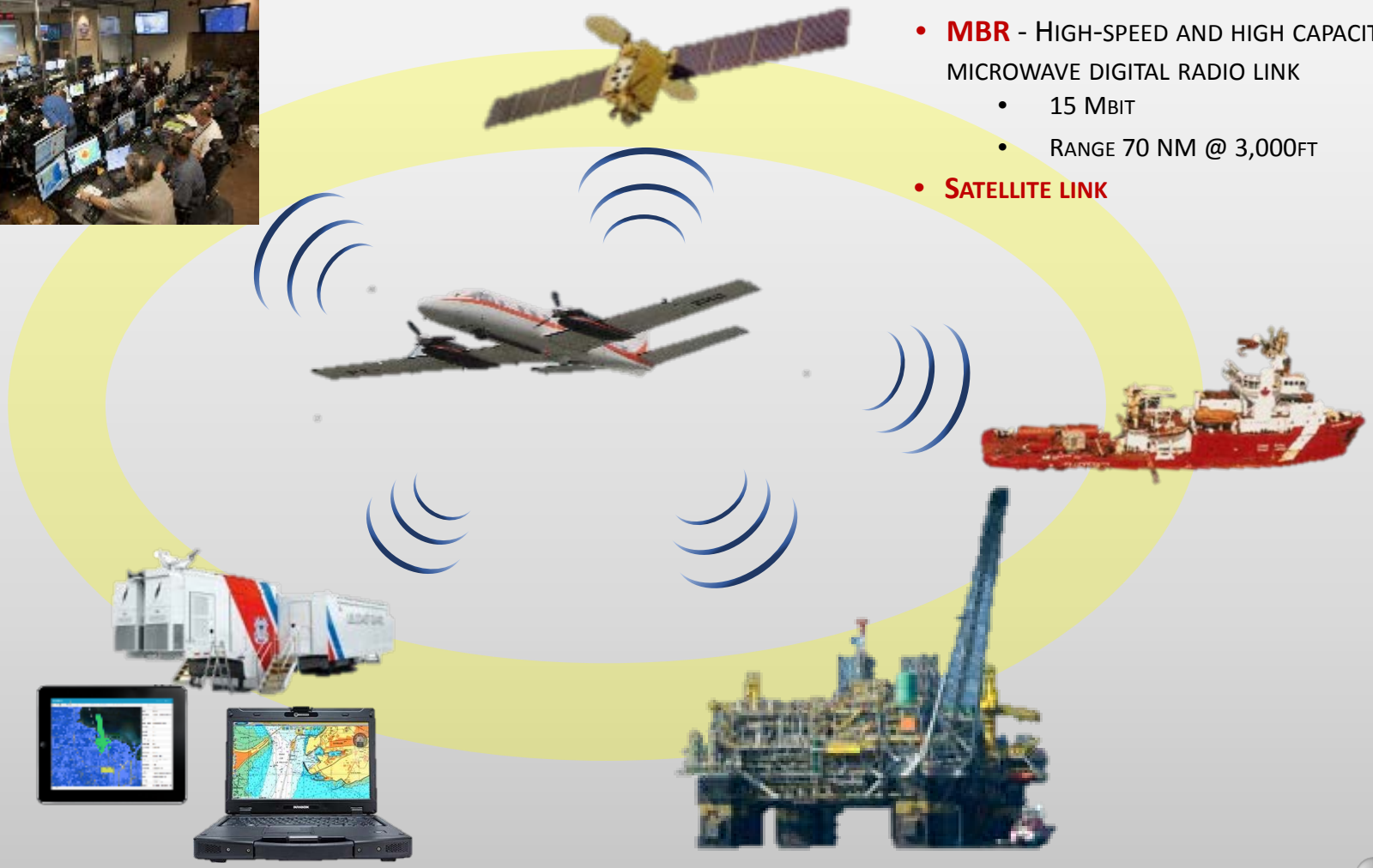
- THE THICKNESS MAP IS ORIGINATED WITH DATA ACQUIRED WITH **IR/UV, MWR** (20HZ SCAN FREQUENCY) AND **LFS** (10HZ REPETITION RATE) THAT MEASURED THE ABSOLUTE THICKNESS.
- THICKNESS DATA POINT ARE ACQUIRED EVERY 4-9M (12-30FT).

Intelligence on the Scene

STEP 4 – Information Delivery

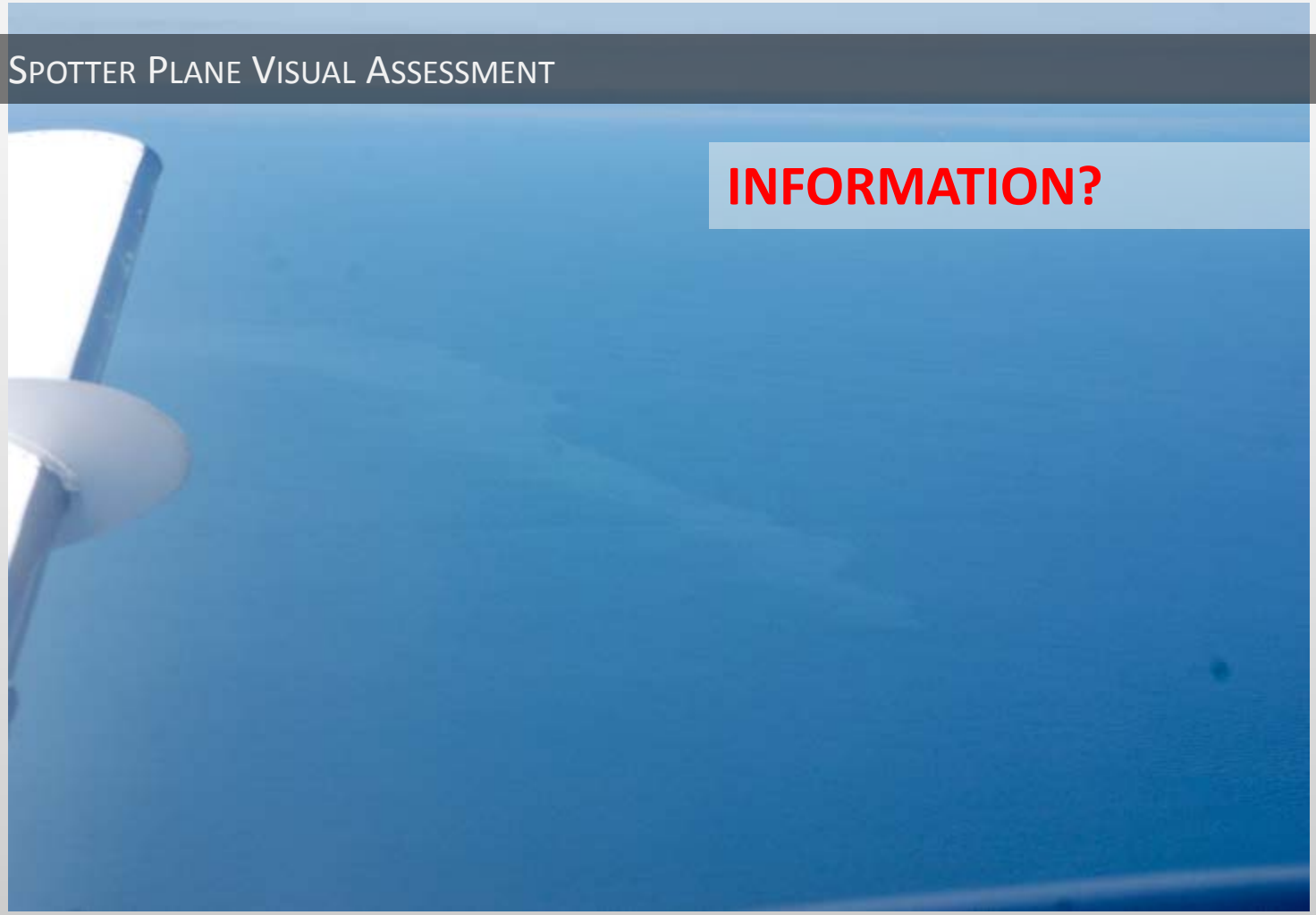
Communication Network

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



Key Advantages

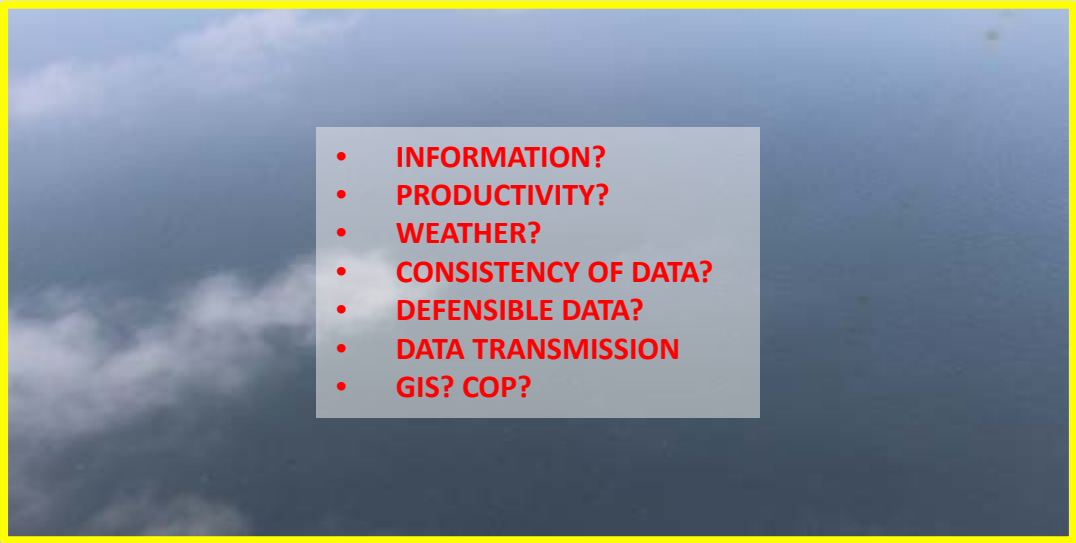
- Spotter Plane Visual Assessment



Key Advantages

- SPOTTER PLANE VISUAL ASSESSMENT

- Naked Eye (2 NM?);
- Digital Still & Video Camera;
- Expert Observer;
- Often Vessels are deployed and stand-by (tens of thousand dollars per day);
- Spotter plane, fixed or rotary wing, can be a $15,000/h asset, but the final result is the one here below:



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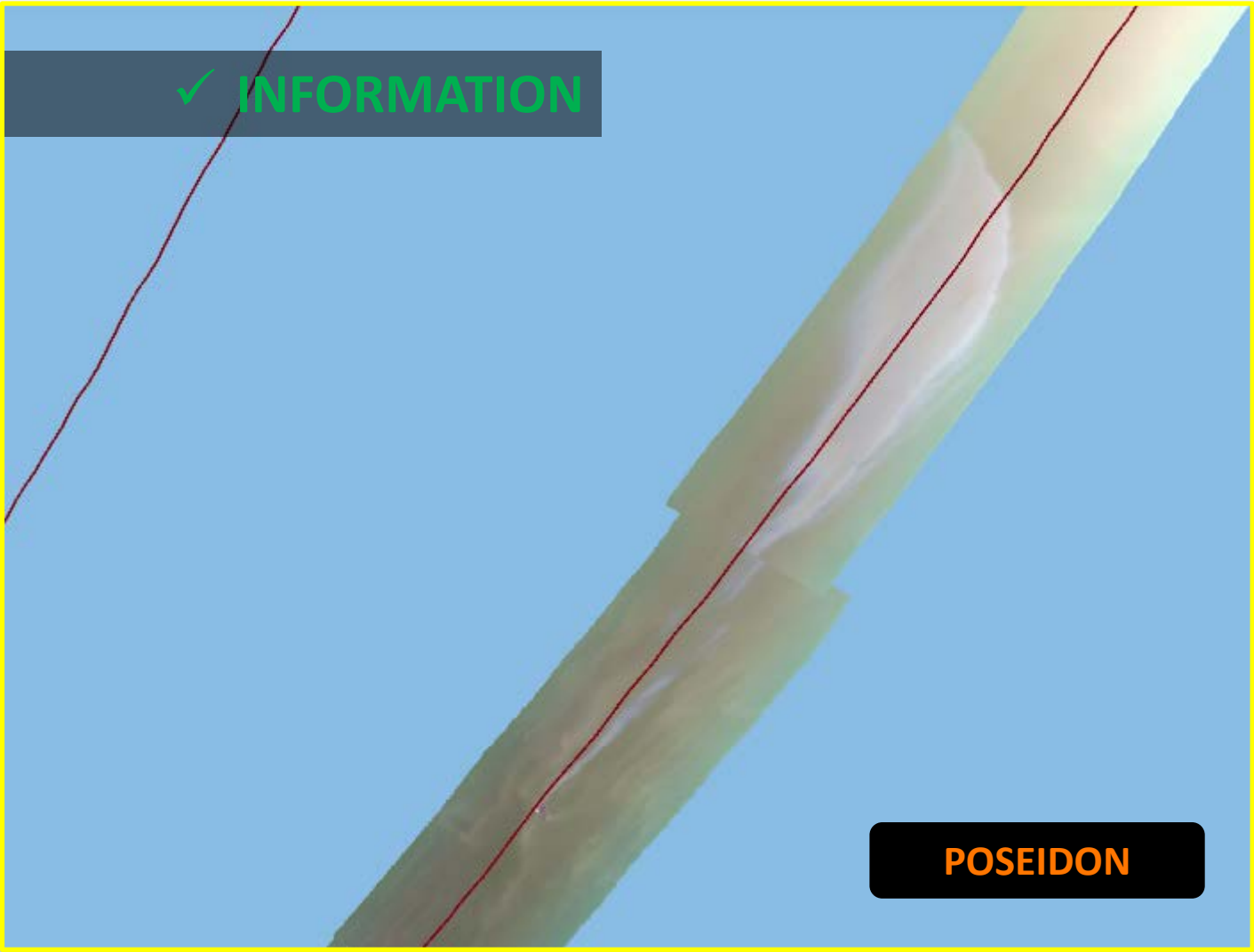

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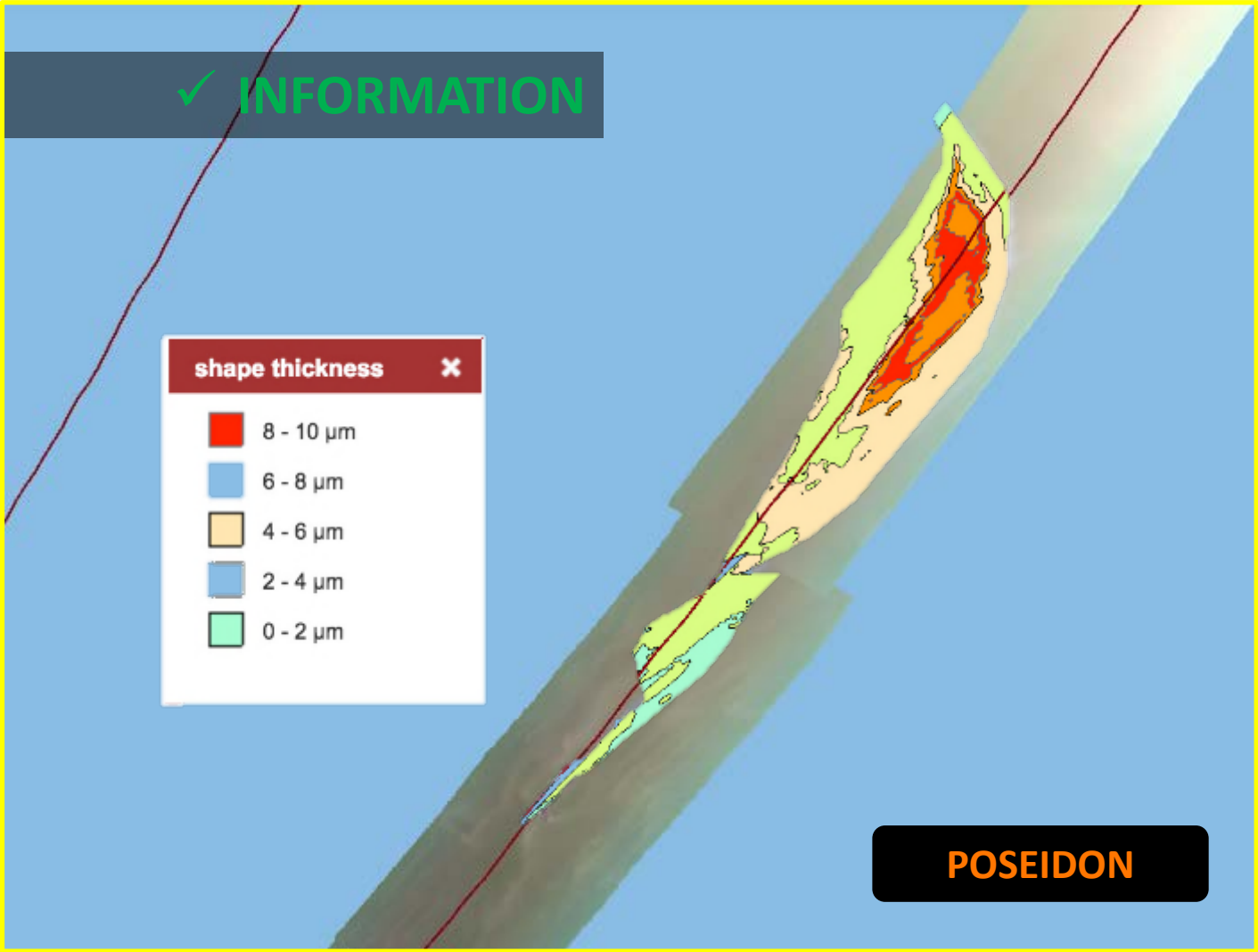

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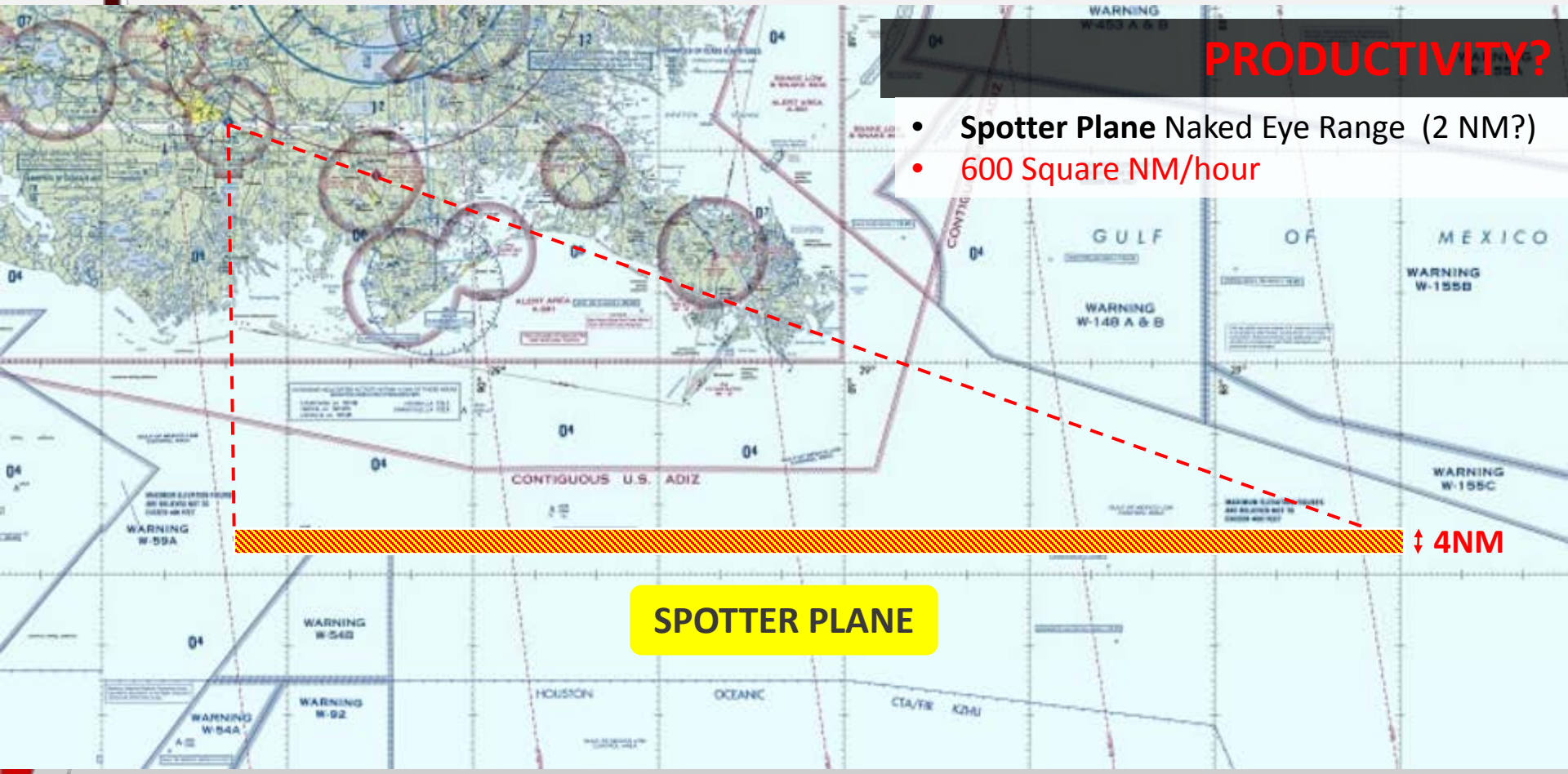

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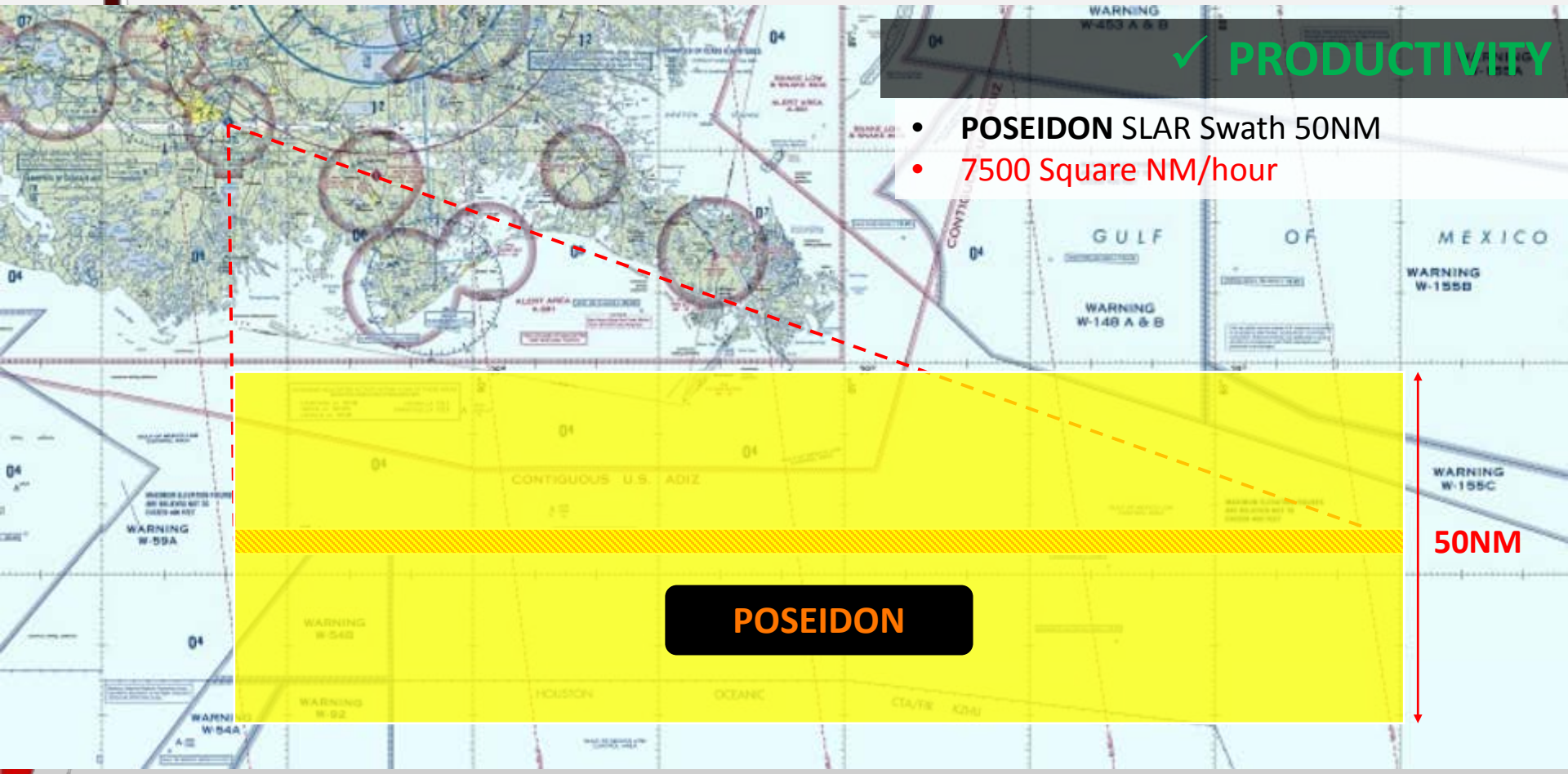
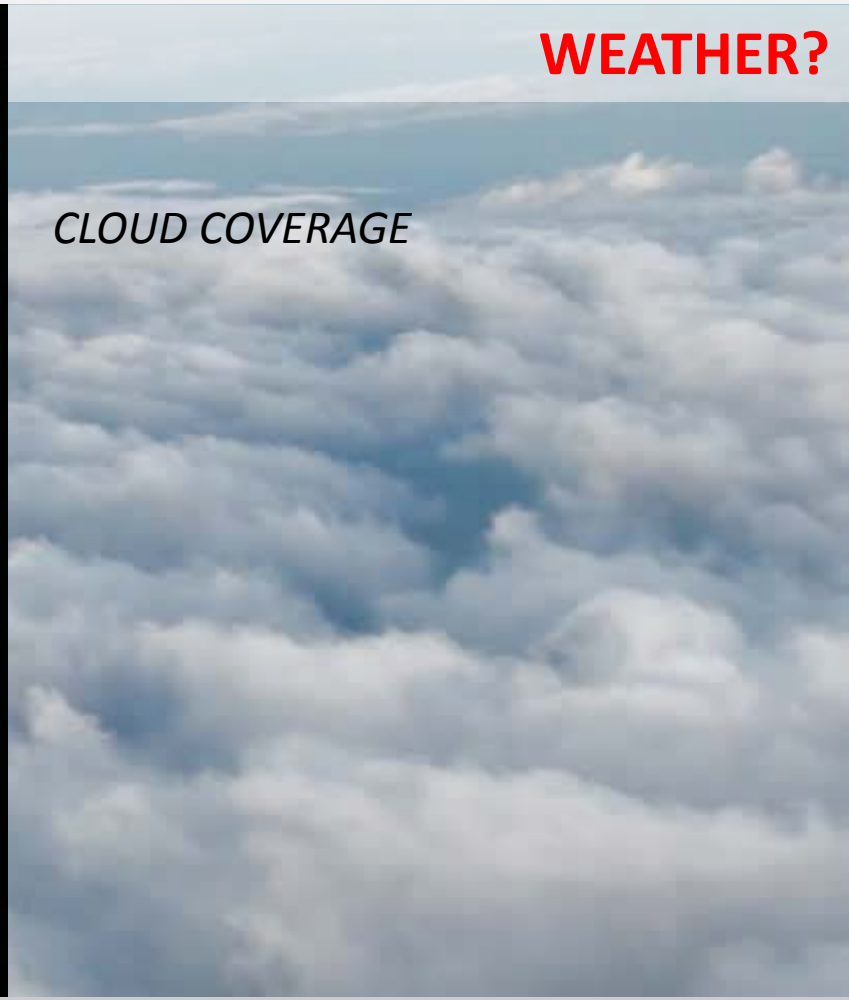


- More than **12 times more productive**
- Increases dramatically **efficiency** and **cost saving**

Key Advantages

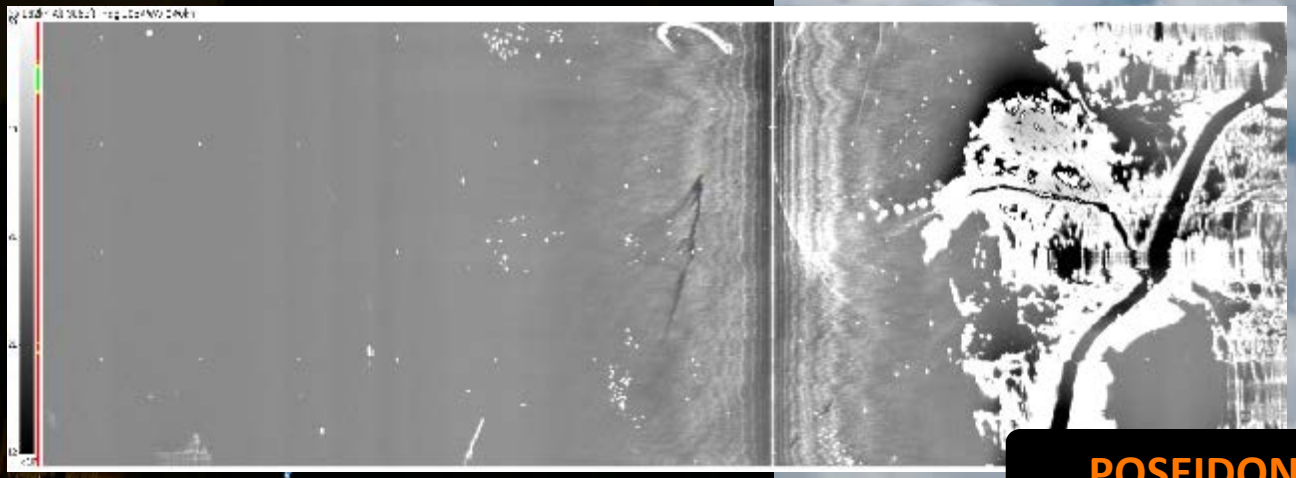


Key Advantages

✓ **WEATHER**

NIGHT CONDITION

CLOUD COVERAGE



POSEIDON

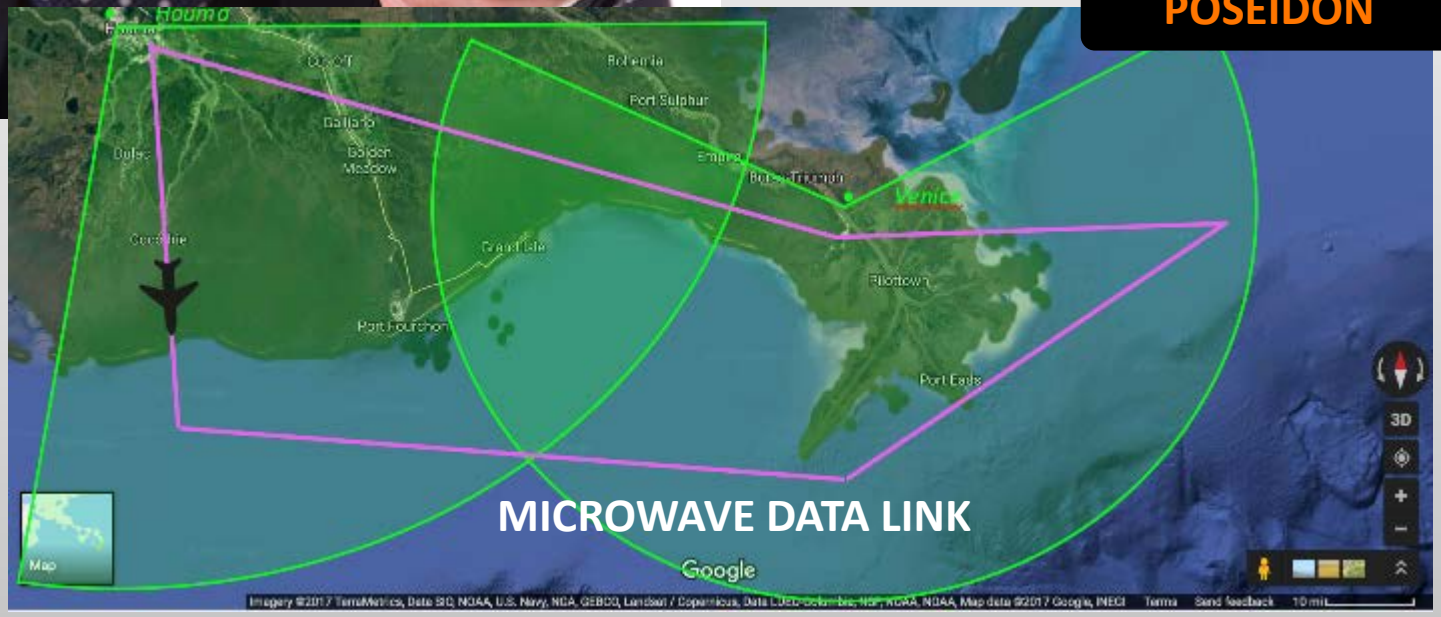
- All-weather/coverage operations
- Night Operations

- SLAR / IR / EO/IR / MWR / LFS

Key Advantages

DATA TRANSMISSION / GIS / COP ?

POSEIDON



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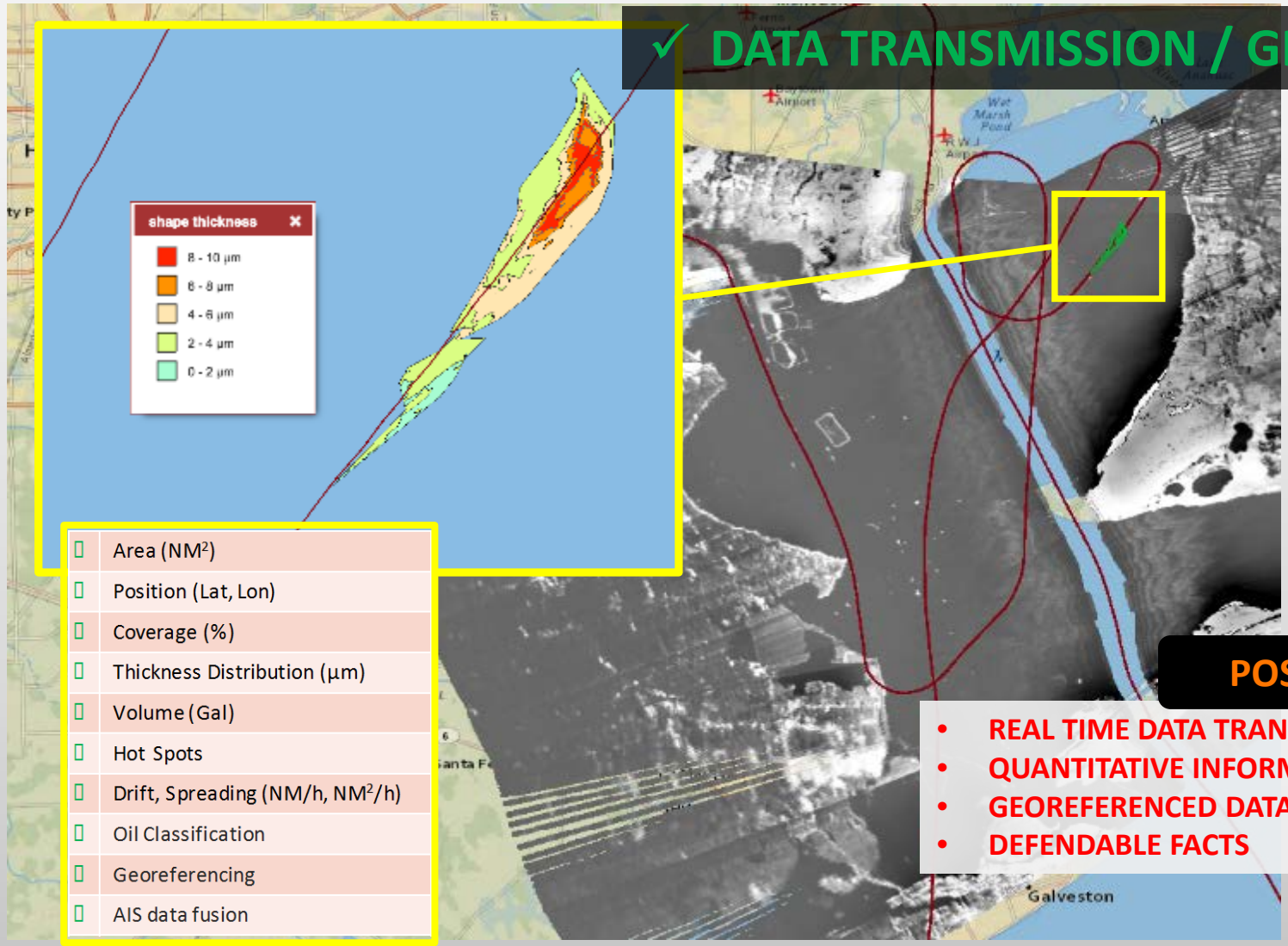

✓ DATA TRANSMISSION / GIS / COP

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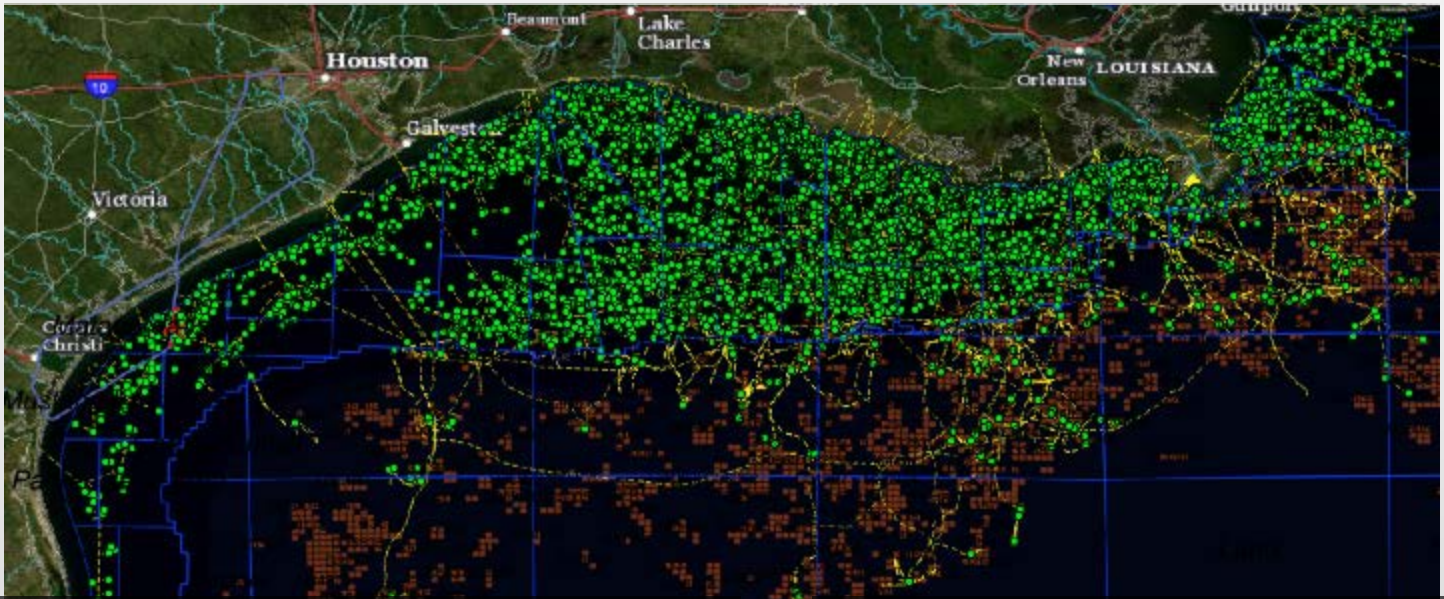
POSEIDON

- REAL TIME DATA TRANSMISSION
- QUANTITATIVE INFORMATION
- GEOREFERENCED DATA / COP
- DEFENDABLE FACTS

Current Projects

Coastal Monitoring

The Gulf Coast is extremely exposed to pollution due to either accidental or illegal discharge.



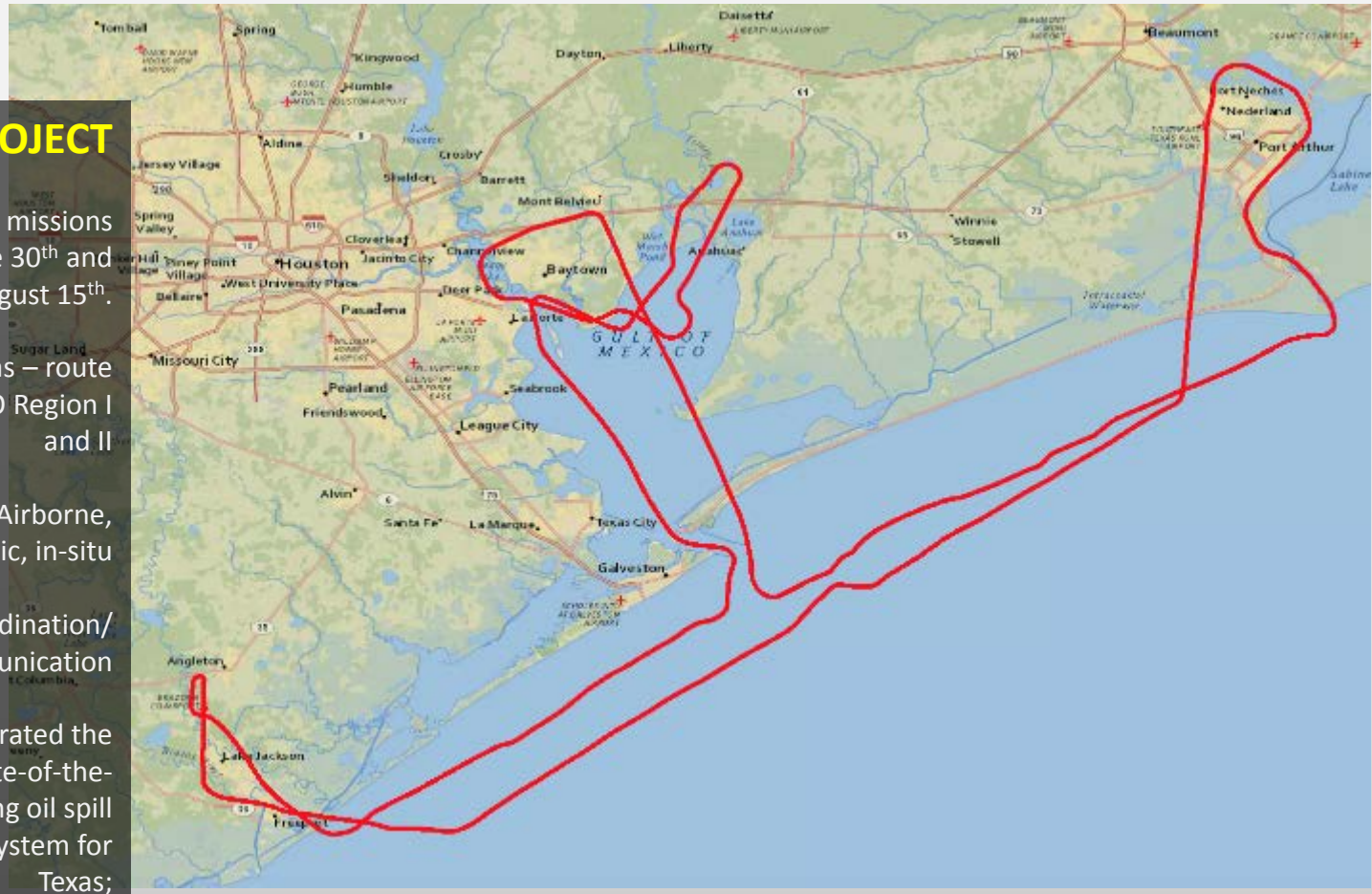
Gulf of Mexico Oil Production: **1.5 – 1.6 millions of barrels per day , more than half billion of barrels per year.**

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

- Possible oil discharges can cause significant damages to local coastal economies and to the energy industry (BP 40B$, public image) 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. We look for pro-action, readiness.
- Protect Texas coast against oil discharges is one of the tasks of Texas GLO.
- Texas response infrastructures and Industry and Government Response team need to guarantee 24/7 readiness

Current Projects

APPROACH

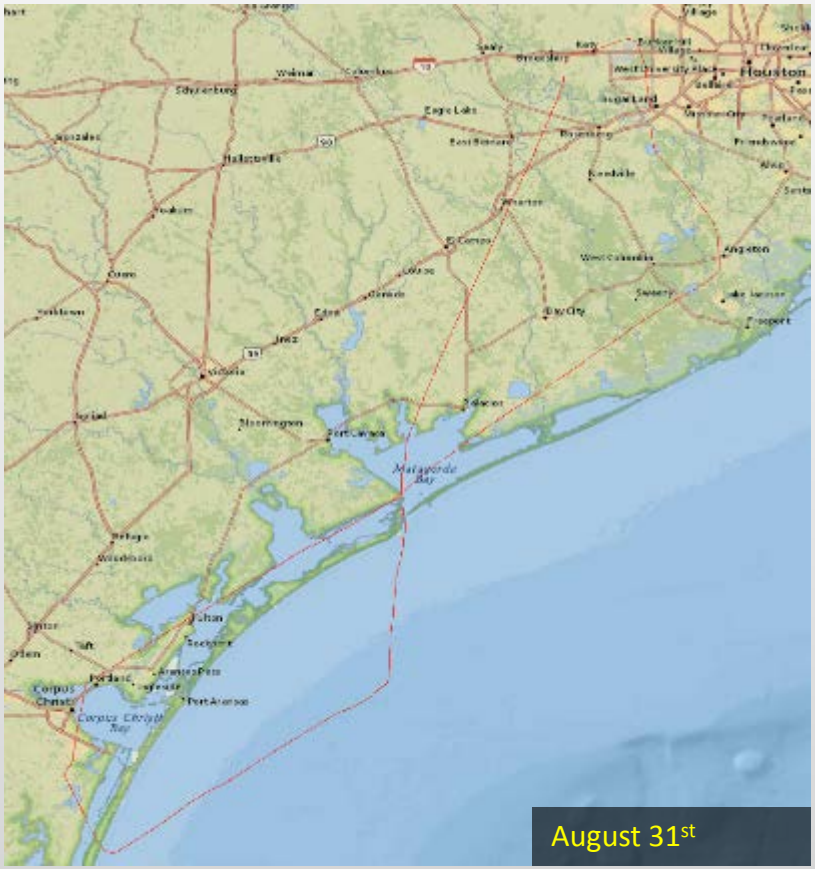


PILOT PROJECT

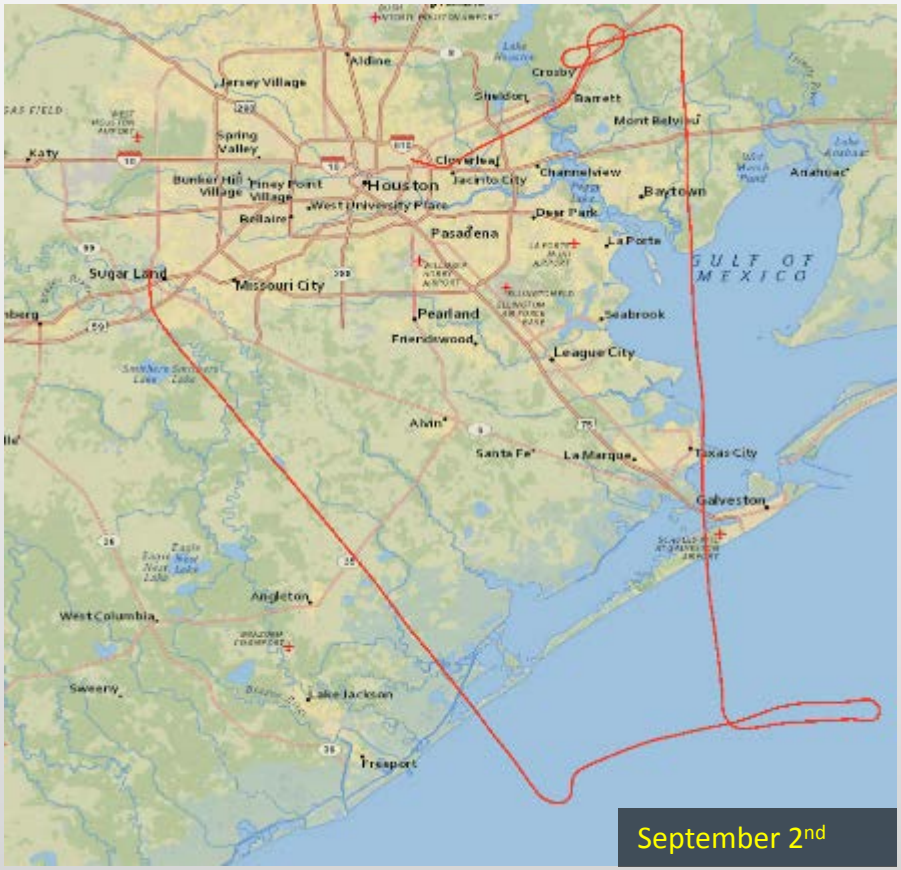
- Total of 5 missions between June 30th and August 15th.
- Focus on East Texas – route of 300 NM – GLO Region I and II
- Teams: Airborne, oceanographic, in-situ
- Teams Coordination/ Communication
- Demonstrated the feasibility of state-of-the-art early warning oil spill remote sensing system for Texas;

Current Projects

Harvey Damage Assessment



August 31st

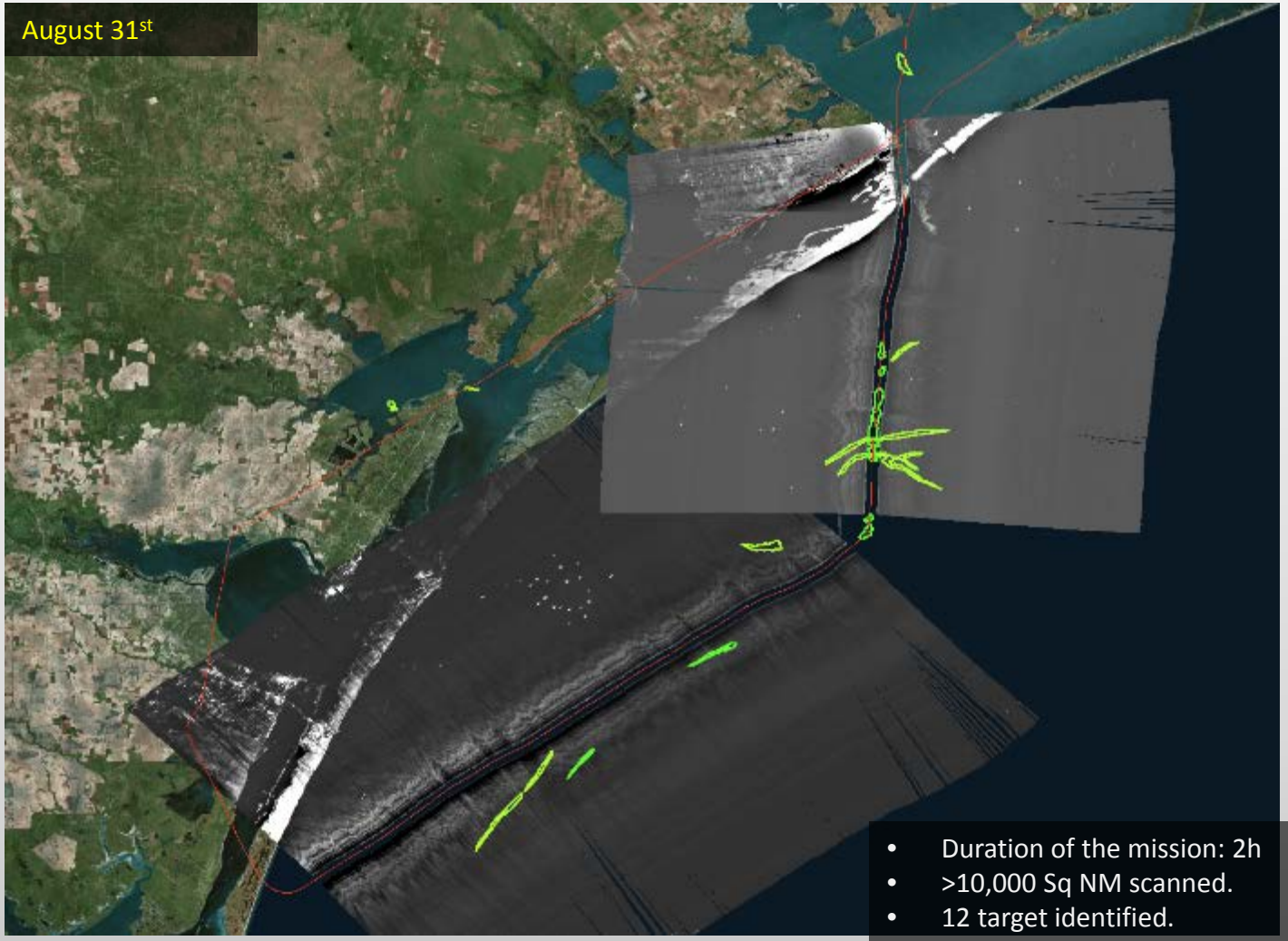


September 2nd

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

Current Projects

Harvey Damage Assessment

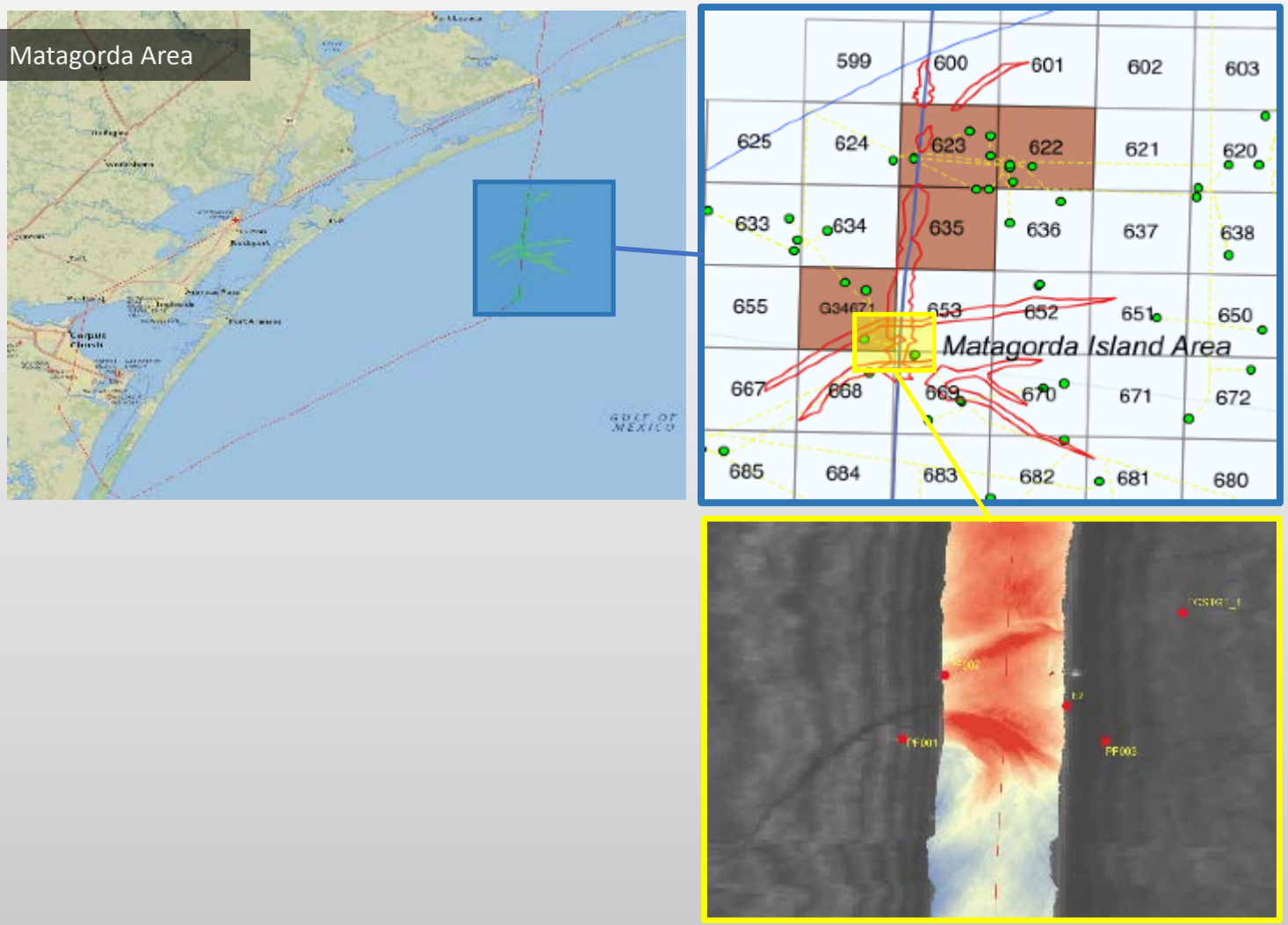


- Duration of the mission: 2h
- >10,000 Sq NM scanned.
- 12 target identified.
- 4 targets analyzed and confirmed as oil spill.
- HD Video of flooded area.

Current Projects

Harvey Damage Assessment

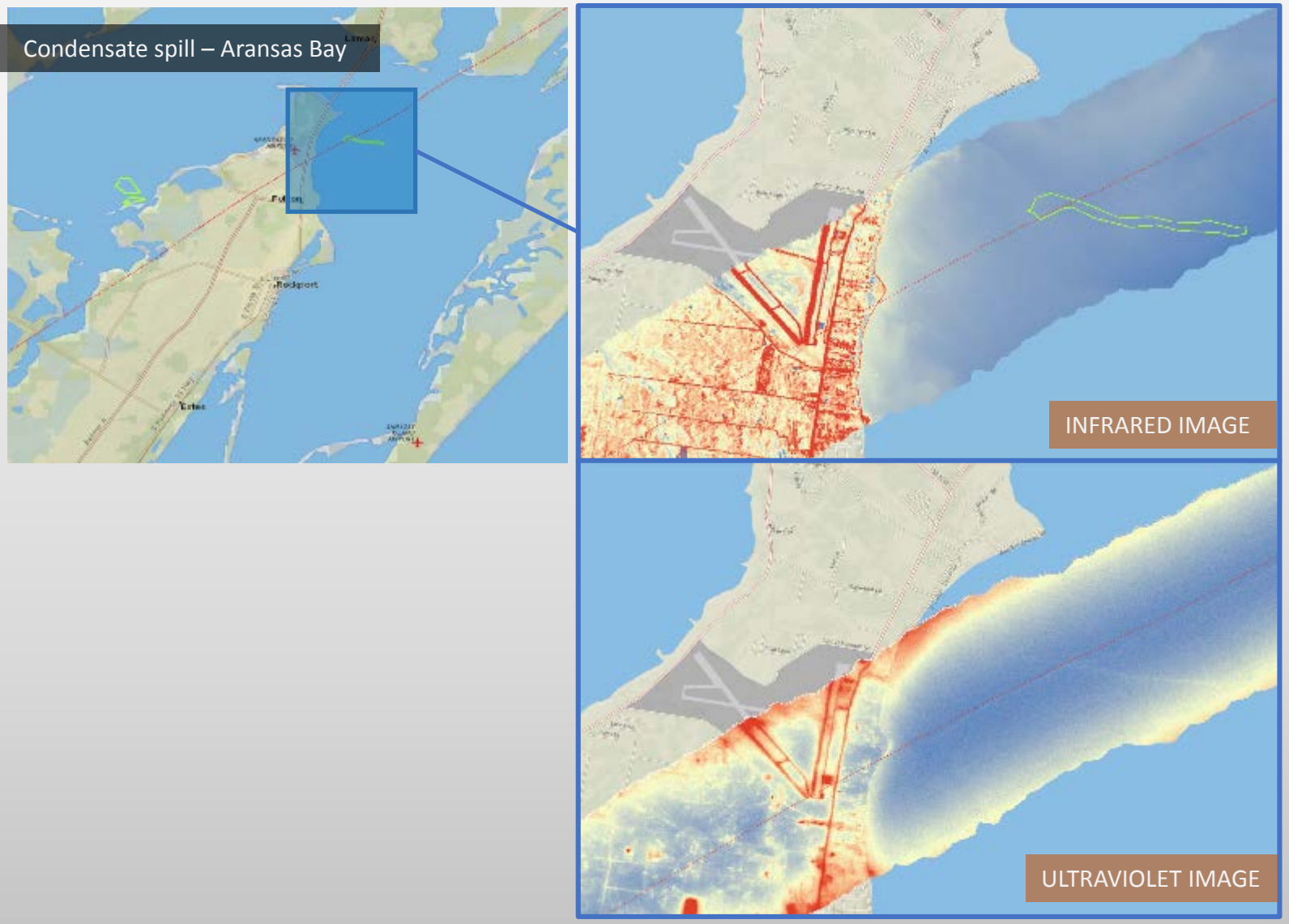
- Matagorda Area



Current Projects

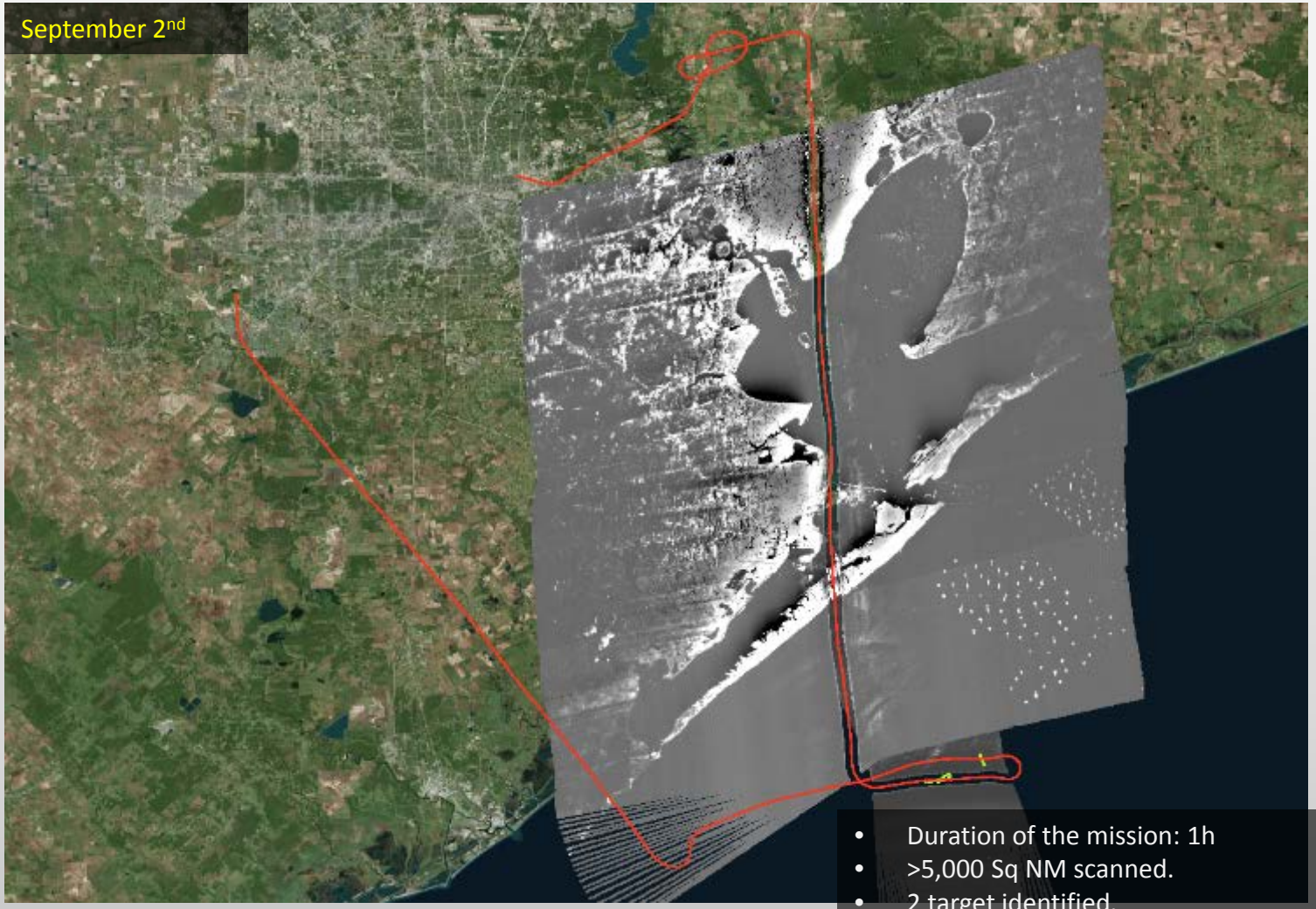
Harvey Damage Assessment

- Condensate spill – Aransas Bay



Current Projects

Harvey Damage Assessment

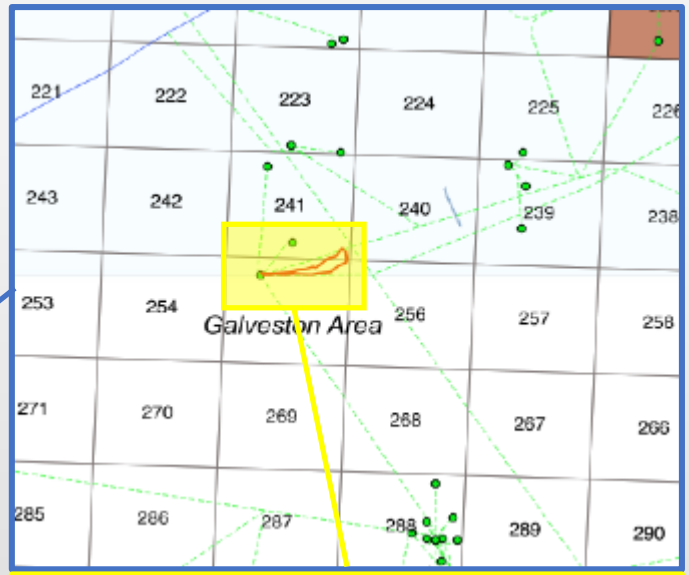


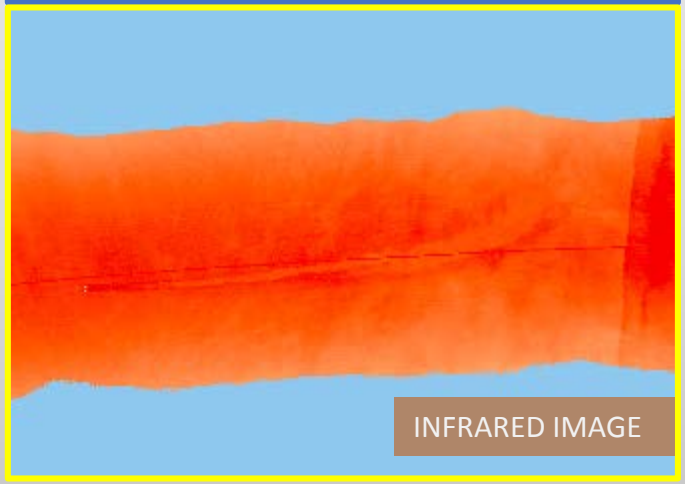
- Duration of the mission: 1h
- >5,000 Sq NM scanned.
- 2 target identified.
- 1 targets analyzed and confirmed as oil spill.
- HD Video of flooded area and Crosby Facility

Current Projects

Harvey Damage Assessment

- Galveston Area





THANK YOU !

Alessandro Vagata | *Director of Operations – Fototerra Aerial Survey LLC*
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