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human energy

Unmanned Aerial Systems (UAS) for oil spill response

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Chevron ETC-HES UAS project: oil spill response use-cases

Oil spill mapping & tracking

Mapping onshore impacts (e.g. reconnaissance, SCAT)

Situational awareness (e.g. monitor booming)

<u>Considerations:</u>

Timeliness of data; real-time vs post-flight analysis; tactical vs strategic use-cases

Access to air space, deconfliction, TFR's etc…

UAS data → actionable information for incident response

UAS within hierarchy of remote sensing assets

sUAS vs larger/long-endurance UAS for BVLOS ops

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Chevron UAS for oil spill response technology development + testing

UAS platforms, Beyond Visual Line of Sight (BVLOS) UAS testing

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some of the sUAS platforms we have tested

Lockheed Martin Indago 2

Electric multirotor – 32 inch diameter

40 minute endurance, 2.5 km range

Folds to small package for easy transport

Flexible sensor package: HD video, still camera, thermal

Launch and recover from land or from vessel (drone is not waterproof)

Aerovironment Puma

Electric fixed wing – 9’2” wing-span

3.5 hours endurance, 15 km range

Transported in large pelican case

Flexible sensor package: HD video, still camera, thermal, low-light camera

Launch from land or vessel, recover on land or from water (waterproof)

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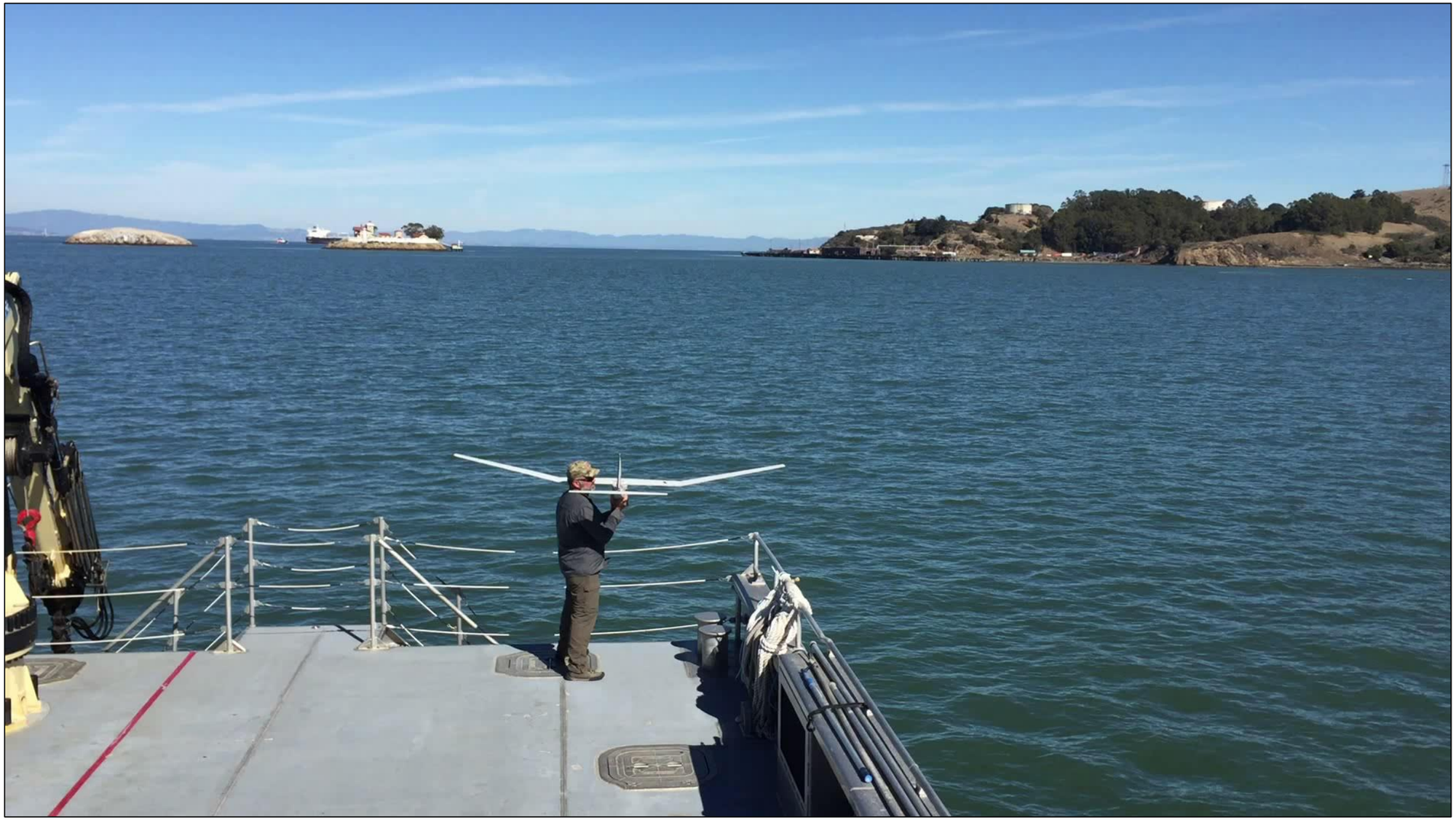
2016 Richmond SCAT test: Aerovironment Puma launch



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2018 GOM / Port Fourchon SCAT test with Aerovironment Puma

- Example video stills from Puma i45 camera
- Able to identify small oil ‘simulants’ and wildlife decoys
- Live video feed pushed over WaveRelay node on Aerostat

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2019 Pascagoula SCAT test of hybrid multirotor/fixed-wing

- Aerovironment Quantix
- ~400 acres per battery (45 mins)
- High resolution visible and multispectral (NIR)
- One-click to fly
- Referenced quick-looks on tablet in minutes after landing

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Long-Endurance, Heavy Payload capable (LEHP) UAS for BVLOS operations

Arcturus Jump-20

- Vertical take-off and landing
- ~19 foot wing-span, 60lbs payload
- Endurance: 9-16 hours
- Range: 50+ miles
- Rated ceiling: 15,000’
- Advanced payloads including multiple imaging sensors and long-range comms

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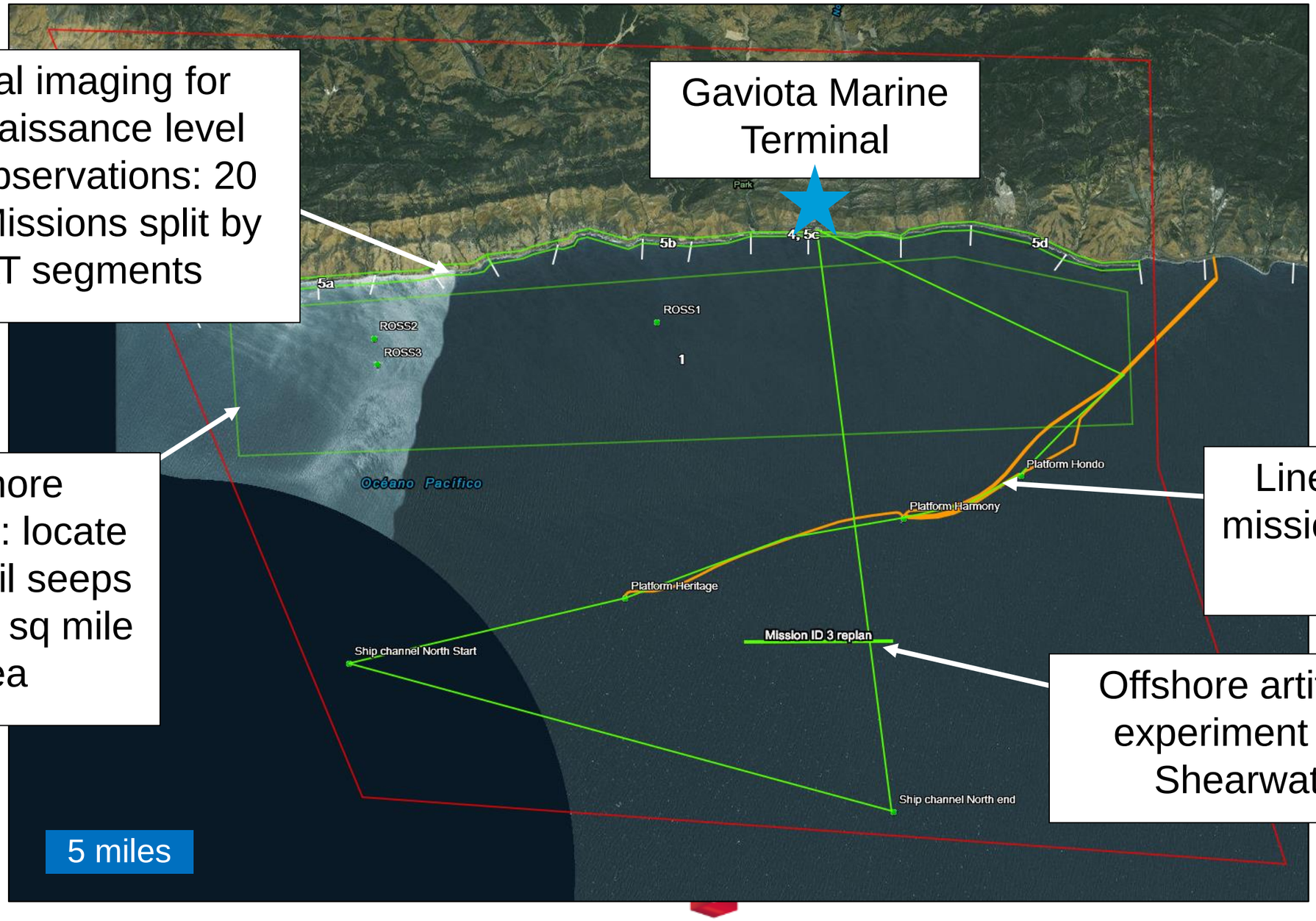
2017 Santa Barbara BVLOS LEHP UAS test

Coastal imaging for reconnaissance level oiling observations: 20 miles. Missions split by SCAT segments

Gaviota Marine Terminal



Offshore mapping: locate natural oil seeps over ~90 sq mile area

Linear surveillance mission over platforms + pipeline

Offshore artificial release experiment from NOAA Shearwater vessel

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UAS sensor and payload testing

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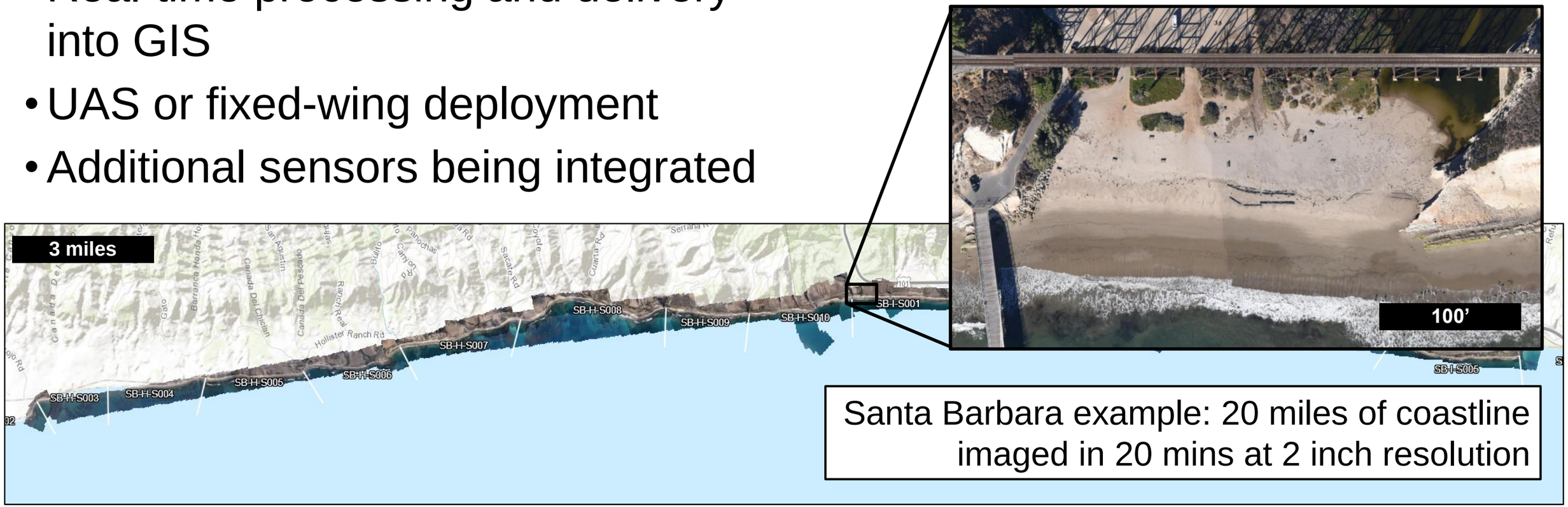
InstiMaps™ real-time multispectral imaging

- High resolution visible & thermal imagery
- Real-time processing and delivery into GIS
- UAS or fixed-wing deployment
- Additional sensors being integrated



Santa Barbara example: 20 miles of coastline imaged in 20 mins at 2 inch resolution

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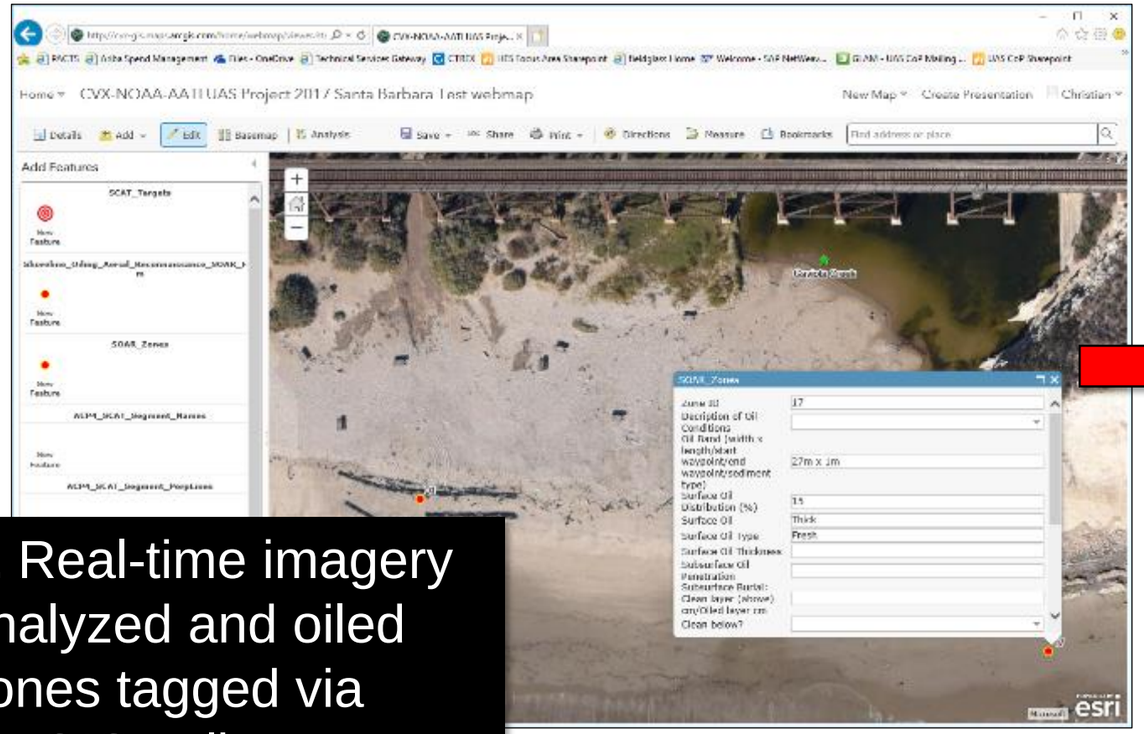
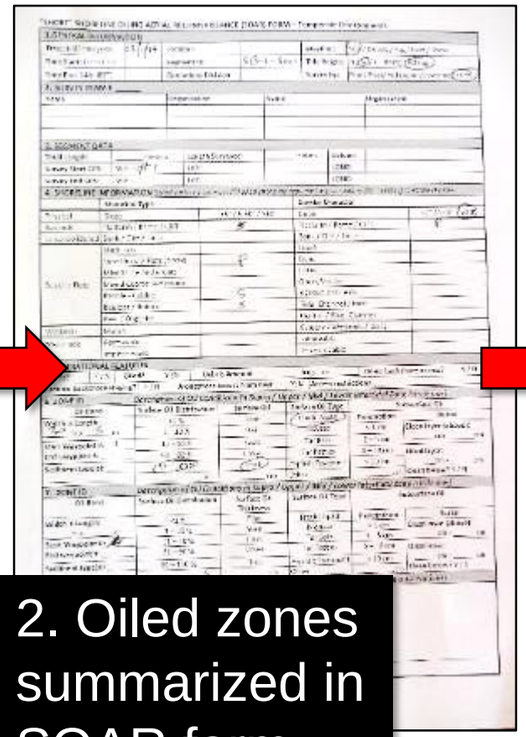
Shoreline Oiling Aerial Reconnaissance (SOAR) workflow

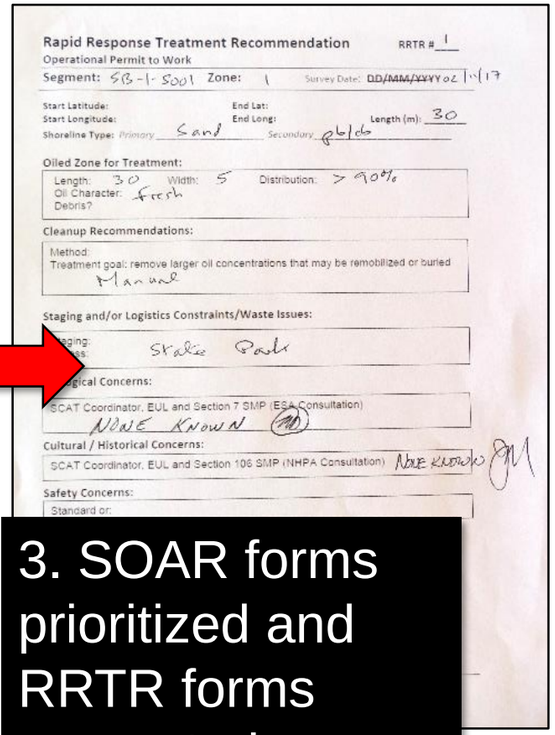
- Workflow for rapid reconnaissance
- Tested at Santa Barbara (2017), GOM (2018)
- ~45 mins from overflight -> RRTR form for ops



1. Real-time imagery analyzed and oiled zones tagged via ArcGIS online



2. Oiled zones summarized in SOAR form



3. SOAR forms prioritized and RRTR forms generated

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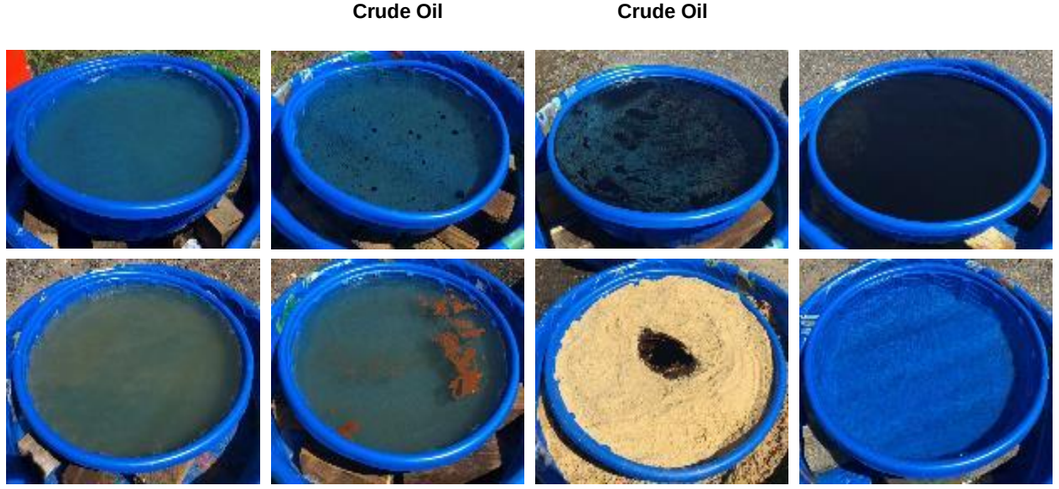
Polaris Pyxis™ oil imaging camera

- Polarizing thermal imager detect oil down to thick rainbow sheen; offshore + onshore
- Developed ‘go-kit’ integration for DJI M600
- One-click PDF report generation for oil detection



Visible Thermal eTherm

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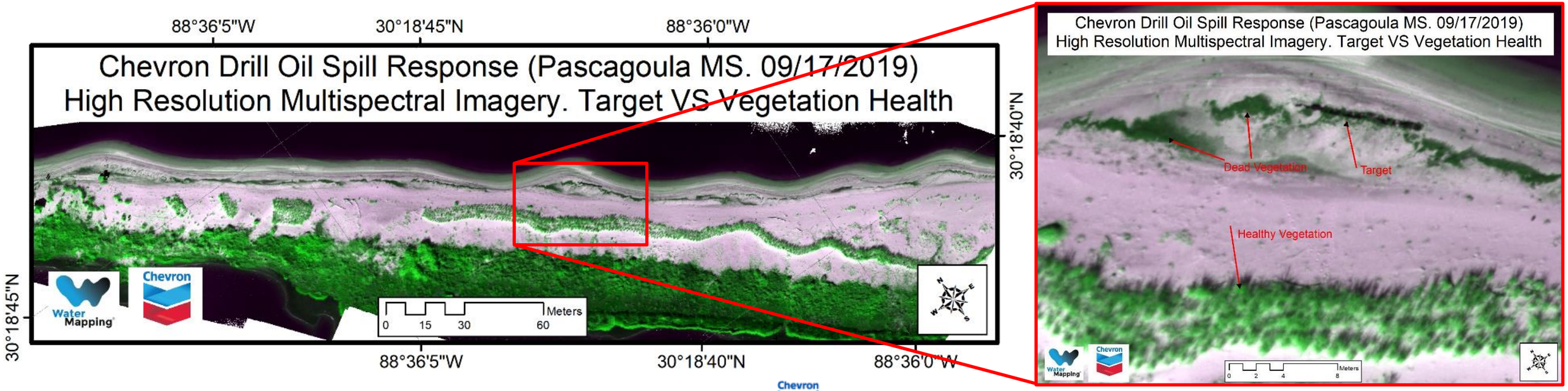
WaterMapping™ multispectral imager

- High resolution multispectral; 5 band visible to near infrared with two thermal channels
- Near real-time GIS products
- Delineate wrack from oil for targeting SCAT



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Recent tests and drills

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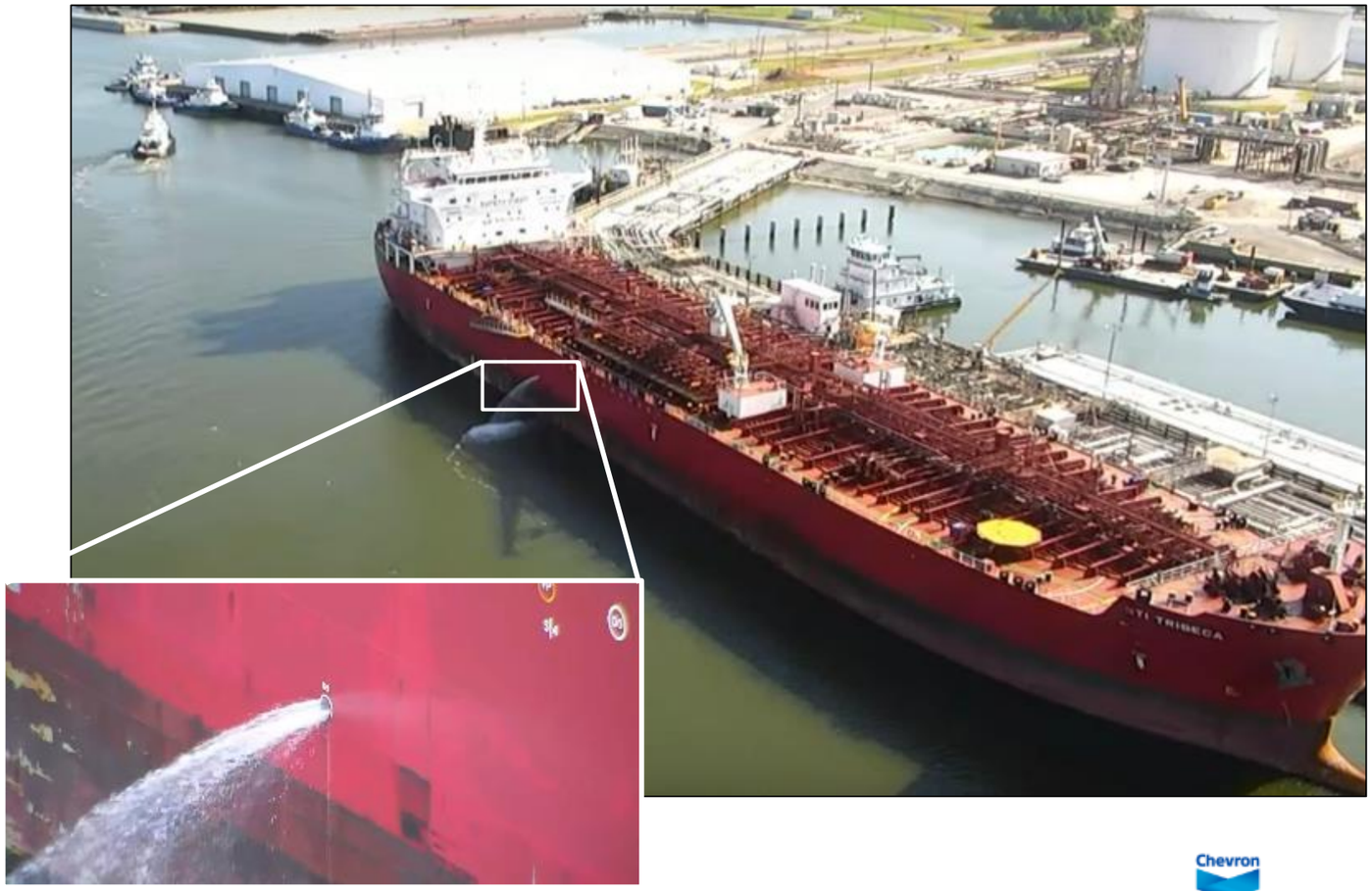
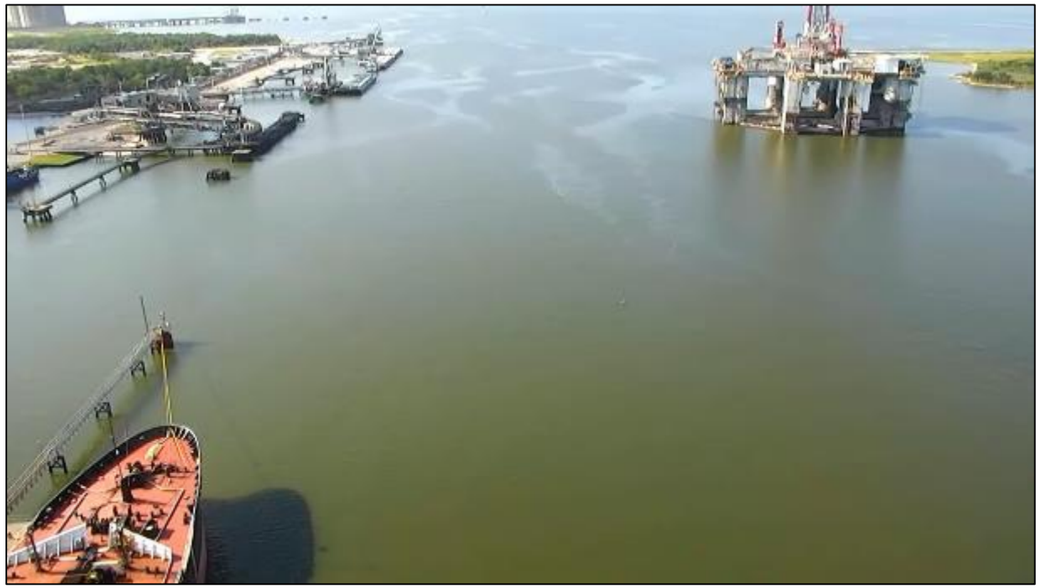
2019 rapid response drill at Pascagoula Refinery, MS

- Unannounced test of local CVX UAS pilot
- Notification to UAS in air: 34 minutes
- Initial situational awareness of incident





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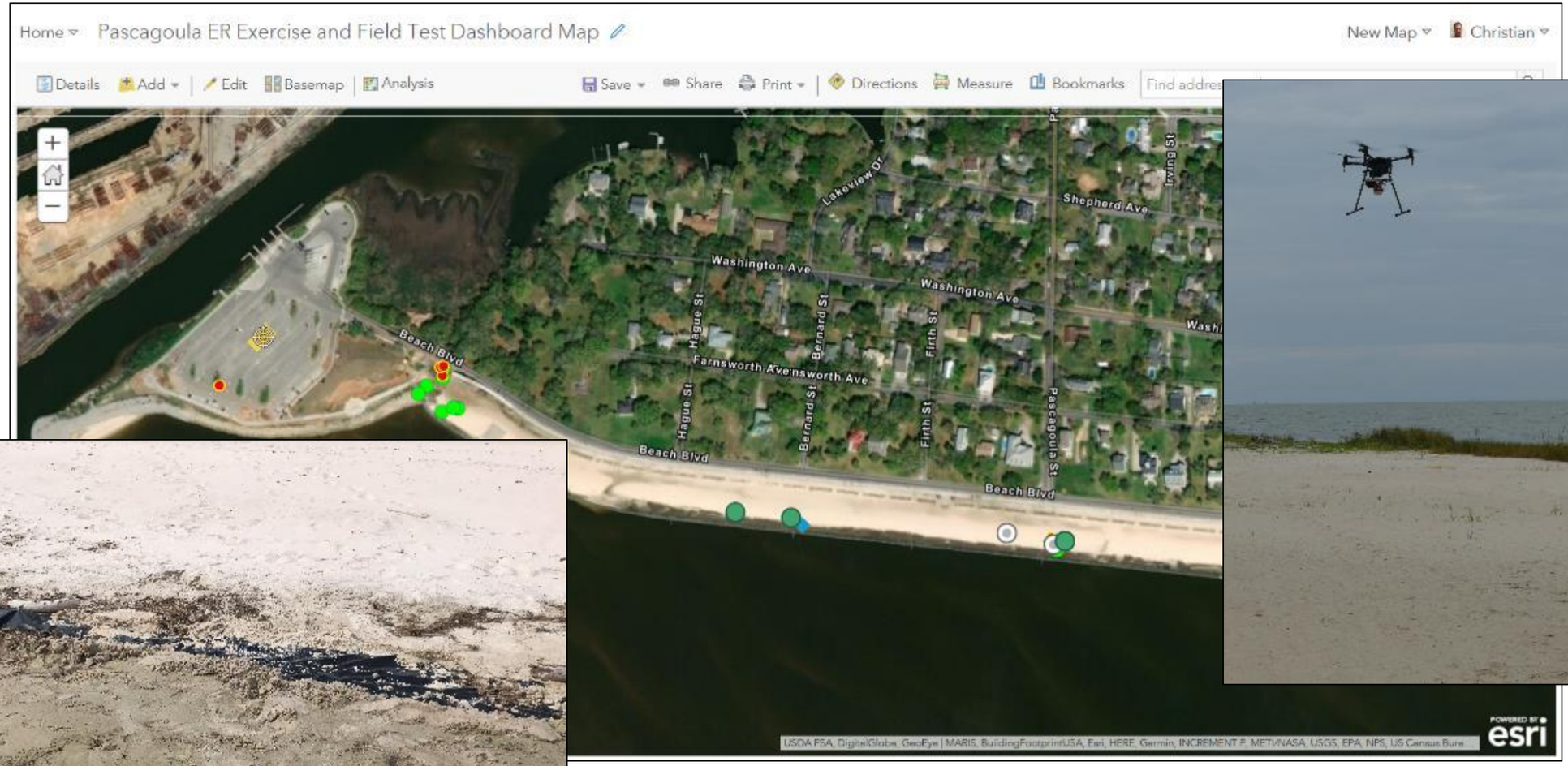
2019 UAS/SCAT drill: Pascagoula Point + Round Island

- Combined drill of sUAS imaging with field SCAT using mobile apps + ESRI ArcGIS Online COP
- Imagery used to task field SCAT teams using ArcGIS Online WorkForce app



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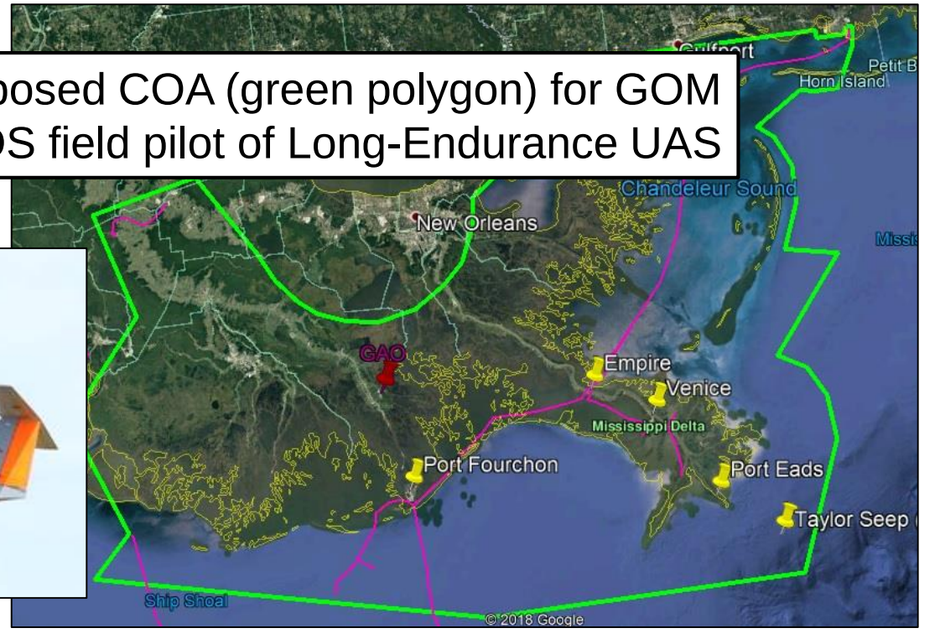
current / future work

- Software + workflows: e.g. UAS for SCAT tools
- Further use-case development
- Sensors + UAS integration; e.g. hyperspectral, gas detection
- 2020 Gulf of Mexico Beyond Visual Line of Sight LEHP UAS pilot
- Support for drills and UAS integration into ICS
- Build UAS into response plans

FLIR MUVE C360 multi-gas detector

Proposed COA (green polygon) for GOM BVLOS field pilot of Long-Endurance UAS



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thanks, questions?

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Acknowledgements:

- Andrea Steffke, Irma Caraballo Alvarez, Tod Rubin, Nathan Marx: Chevron
- Ed Owens: Owens Coastal Consultants
- David Yoel, Nathan Ernst: American Aerospace Technologies Inc
- Matt Dorsey, George Graettinger: NOAA
- Judd Muskat: CA OSPR
- Eric Thompson: Aerovironment
- Oscar Garcia: WaterMapping
- Justin Vaden, David Chenault: Polaris

Arcturus Jump 20 flying over the Santa Barbara Channel during BVLOS testing in September 2017

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