Satellite Remote Sensing for Risk Mitigation
Interspill 2012

Agenda

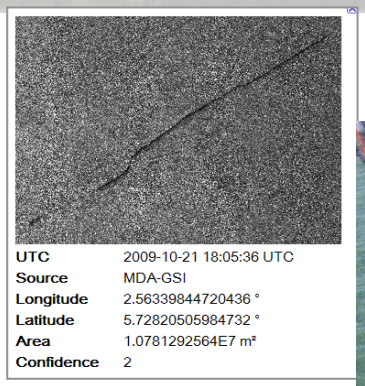
- **Offshore risks for oil and gas operators**
  - Oil on water – spills, third party sources, natural seeps
  - Unexpected/unwanted maritime traffic
  - Ice infested waters
- **Remote sensing tools for offshore**
  - Satellite sensors
  - Aerial sensors
  - Other data sources and the integration challenge
- **Mitigating risk using remote sensing**
  - Thinking operationally – beyond just imagery
  - Right tool for the job – let the business needs drive the solution
  - Examples and case studies

Decades of Monitoring & Surveillance Experience

Offshore Risks – Oil on Water

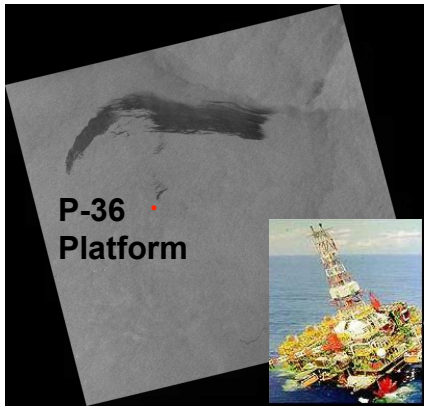
Third Party Sources

- Persistent problem, particularly near shipping lanes
- Can result in blame on operators
- “Opportunistic” dumping during spill events



Spills, Drilling Anomalies, etc.

- Impact on reputation/financials regardless of size
- Important to understand size, scope, movement of spill for rapid/effective response
- Understanding baseline conditions reduces risk



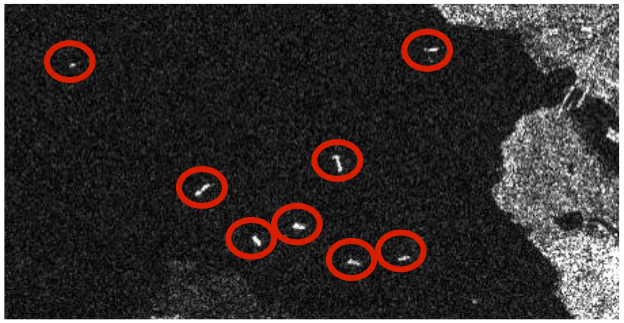
Natural Seeps

- Sometimes confused for operational/pipeline leaks
- Behaviour often predictable over time
- Risk + opportunity – potential exploration tool

Offshore Risks – Maritime Traffic

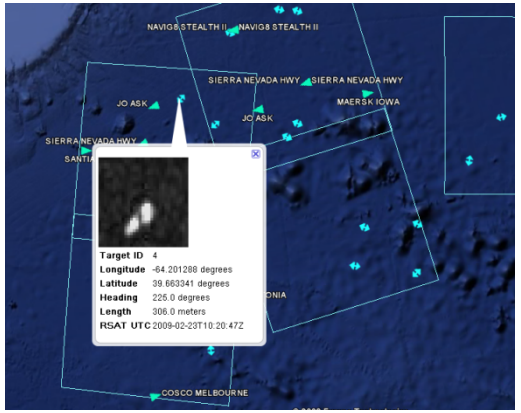
Unexpected Maritime Traffic

- Unregistered vessels (e.g., FPSO) in path of critical transit (e.g., seismic line)
- Drill ships on adjacent leases
- Delayed vessels/rigs



Unwanted Maritime Traffic

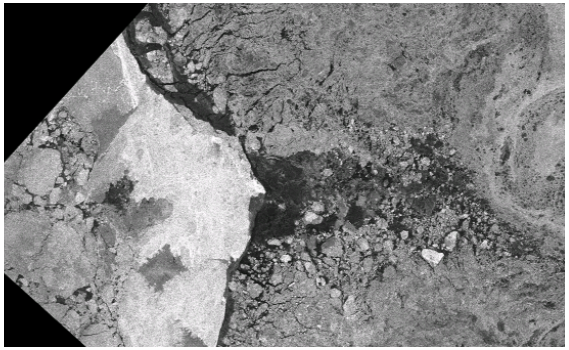
- Protest vessels targeting isolated offshore assets
- Terrorism and piracy – rigs and tankers
- Bunkering tankers
- Bilge dumping ships



Offshore Risks – Ice Infested Waters

Safety & Security

- Risk to growing Arctic teams from ice changes
- Challenging flight conditions – visibility/weather
- Ever-changing nature of ice in many Arctic areas



Operational Effectiveness

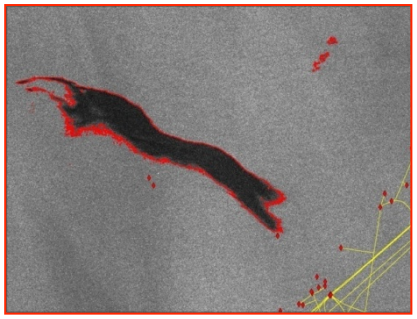
- Risk of stranding high-value assets
- Minimizing ice-related downtime
- Having the right vessels (ice class) in the right places

Incident Response

- Difficulty of responding in isolated northern locations
- Short daylight periods limit visibility
- Risk of getting response crews in, operational staff out

Key Remote Sensing Tools for Offshore Assets

Satellite Sensors



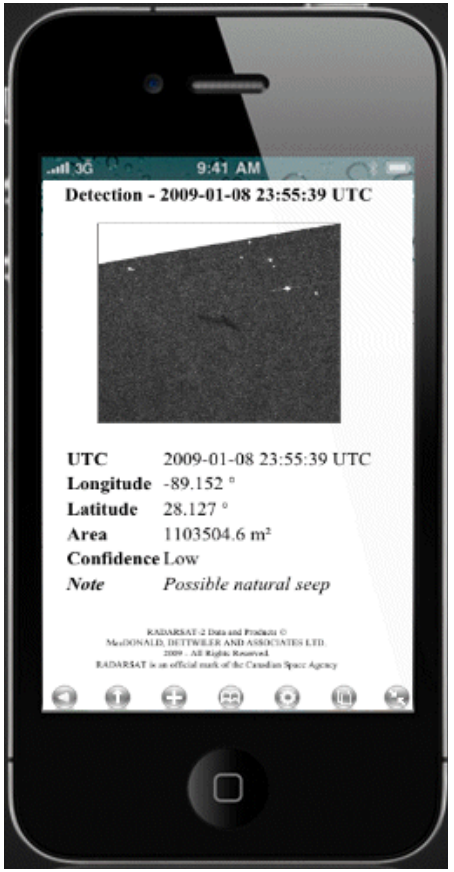
Synoptic view, periodic, SAR or optical imagery

Aerial Sensors

Localized view, periodic or persistent, typically optical imagery & video

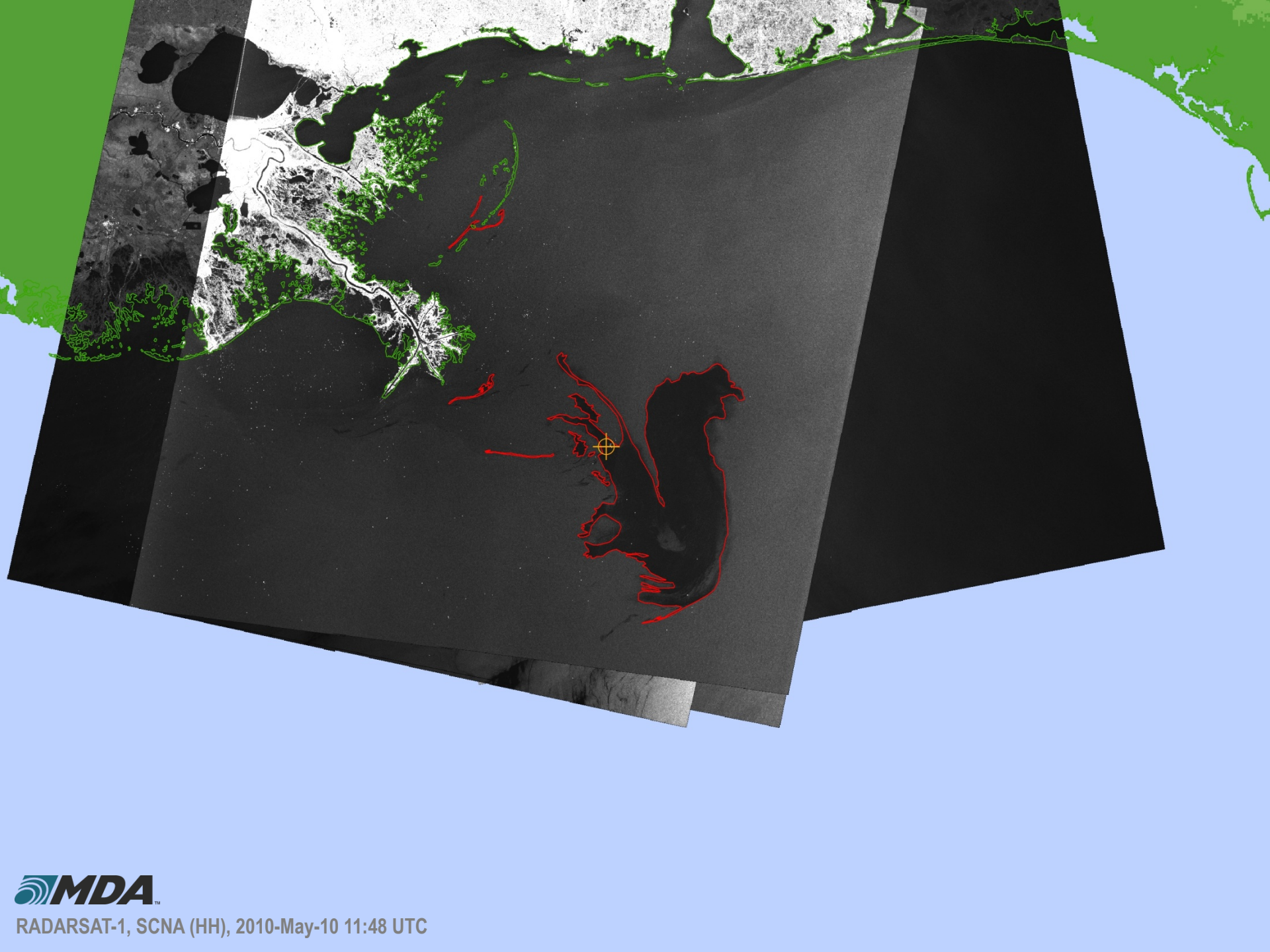
Remote Sensing Tools for Offshore Assets

- **Abundance of information from other sources often not connected to remote sensing**
  - ROVs
  - Ship/Rig Oil Spill RADAR
  - Metocean data & AIS
  - Modelling results
  - Response team observations
- **A key element of the solution for risk mitigation becomes information integration and dissemination**



The Power of RADAR – Offshore

- Satellite based RADAR provides wide area coverage – up to 90,000km^2 per report
- RADAR from space is all-weather day/night imaging that is different from optical satellite sensors
- The active pulse reacts with surface textures and provides information other methods can't
- In the offshore environment, key information available includes:
  - Oil on water detection
  - Ship and rig detection even at coarse spatial resolutions
  - Analysis of wind patterns – both speed and direction



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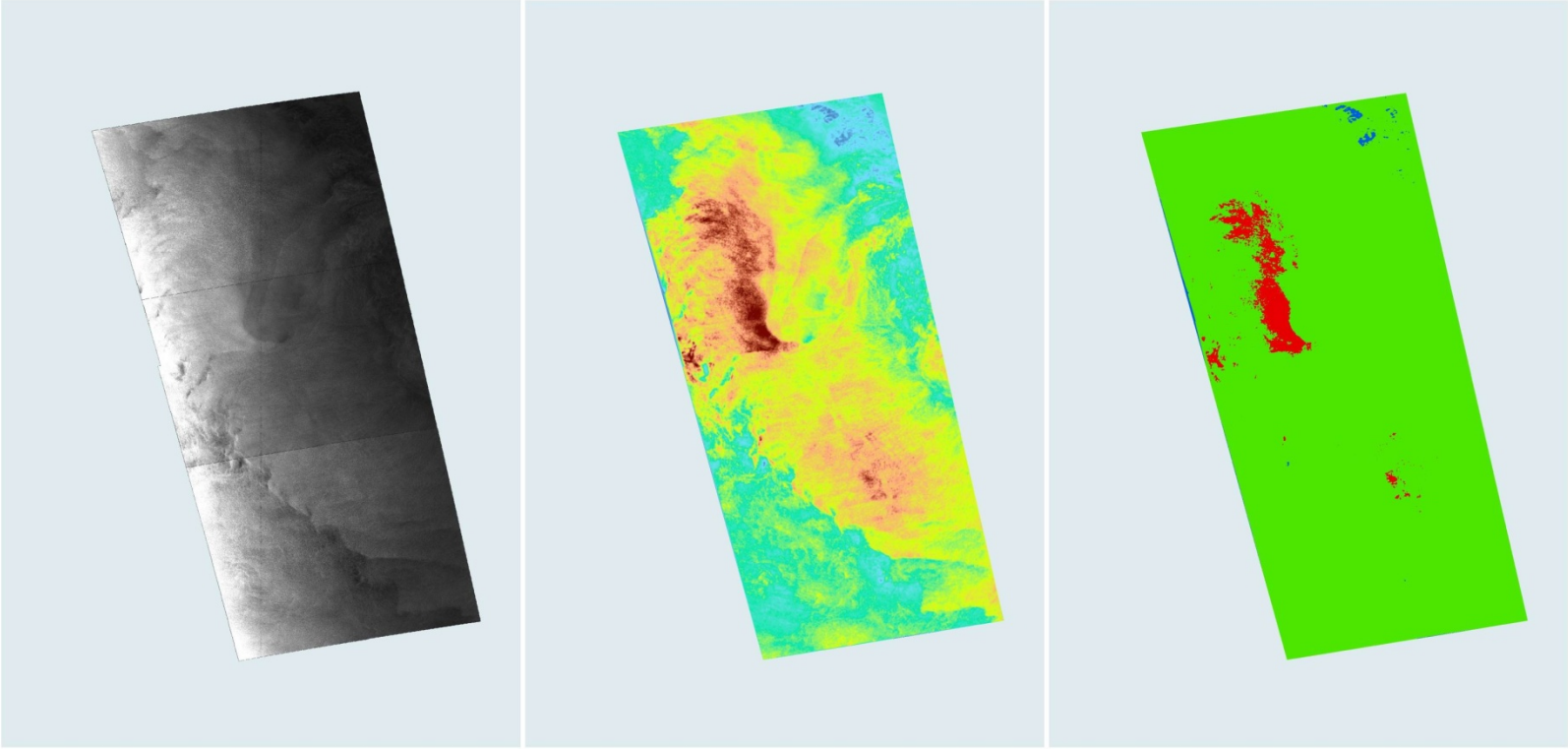
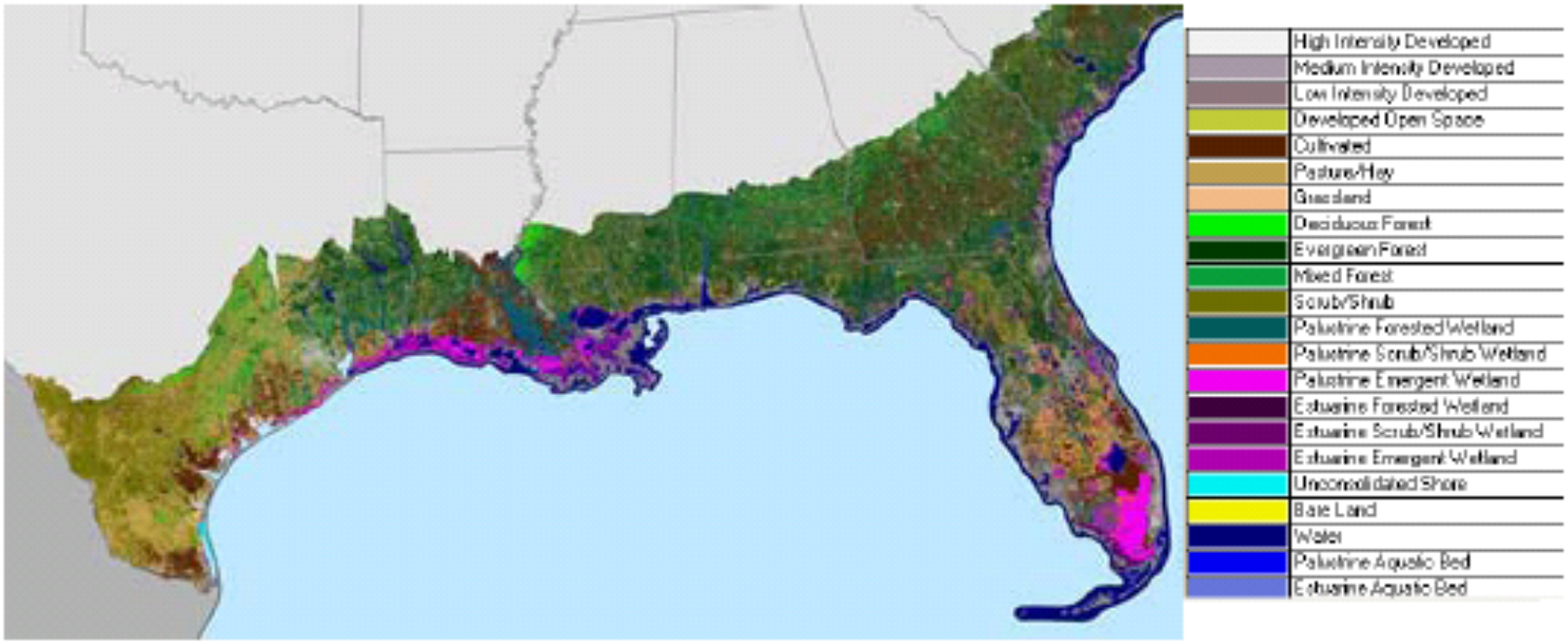
Wind Field Extraction From SAR

SAR imagery provides wind speed and direction that supports operational oil on water analysis.



Optical Example – Shoreline Mapping

- Global shorelines can be, and have been, mapped and classified using optical satellite imagery
- Some key areas (e.g., Gulf of Mexico) are mapped regularly



MDA GSI Provides Detailed Shoreline Mapping of Coastal Areas

Mitigating Risk Using Remote Sensing

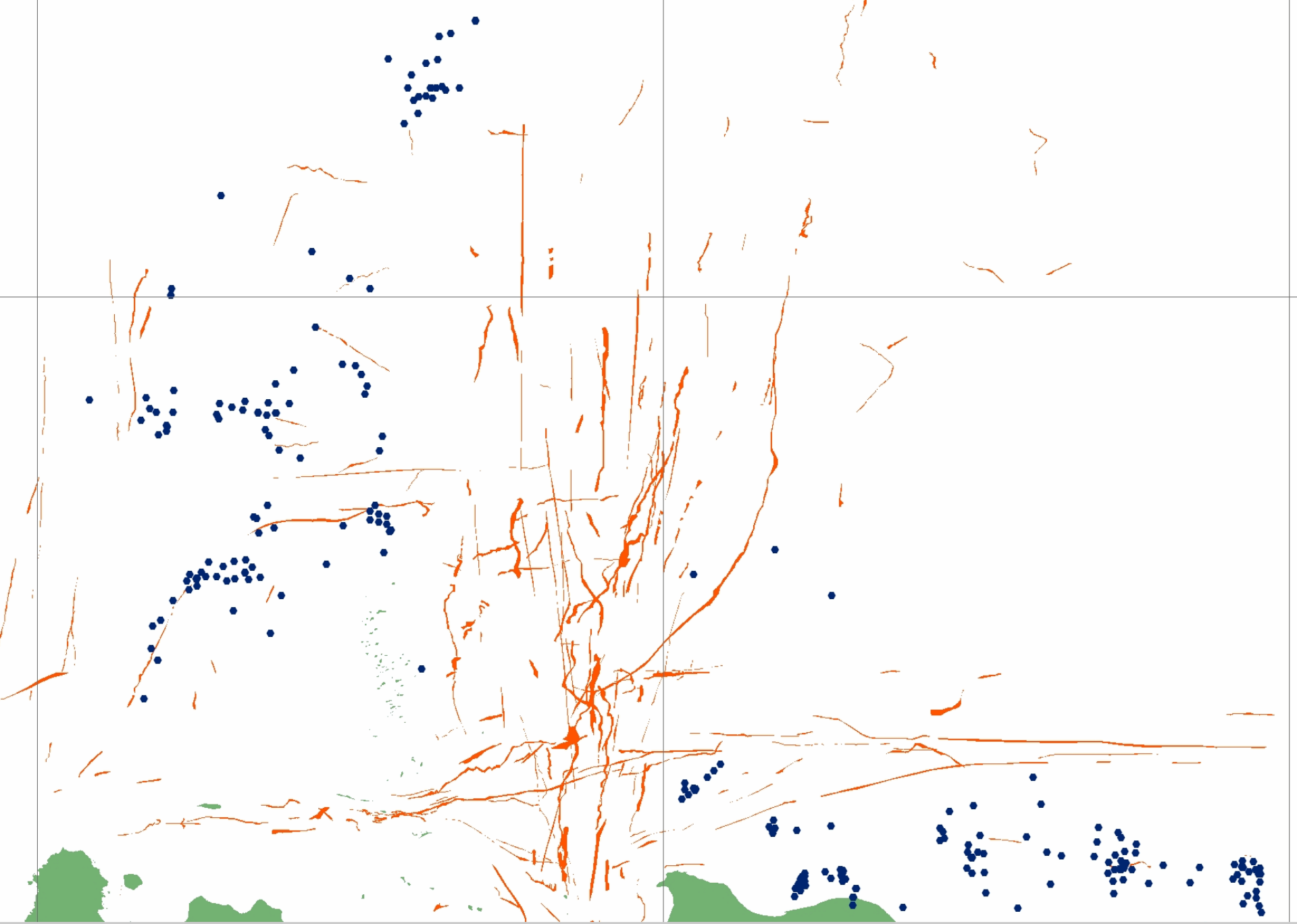
Think Operationally – Look Beyond Imagery

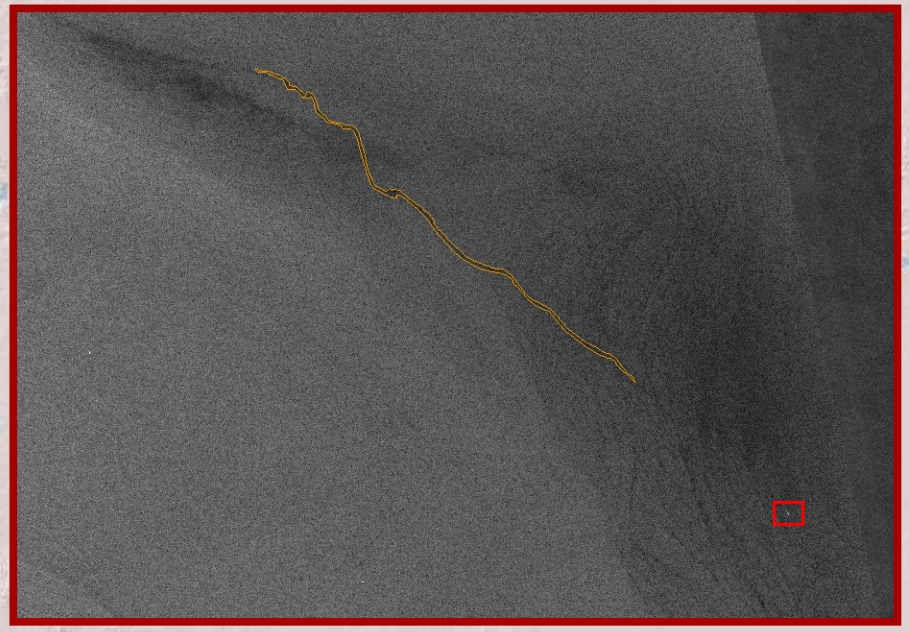
- 24/7 support direct to operational teams
- Web platforms for information integration
- Align with other HSSE needs (e.g., security)
- Extract information rather than just image pixels

Right Tools for the Job

- Satellites can't do it all…
- Bring together the right mix of information sources to solve the operational need
  - e.g., wide-area satellite imagery to cue aerial resources in routine monitoring (ISTOP in Canada)
  - e.g., combine wide-area view with local persistent (aerial, aquatic, vessel-based, etc.) monitoring for large spill response, security, or ice monitoring efforts

Case Studies & Examples





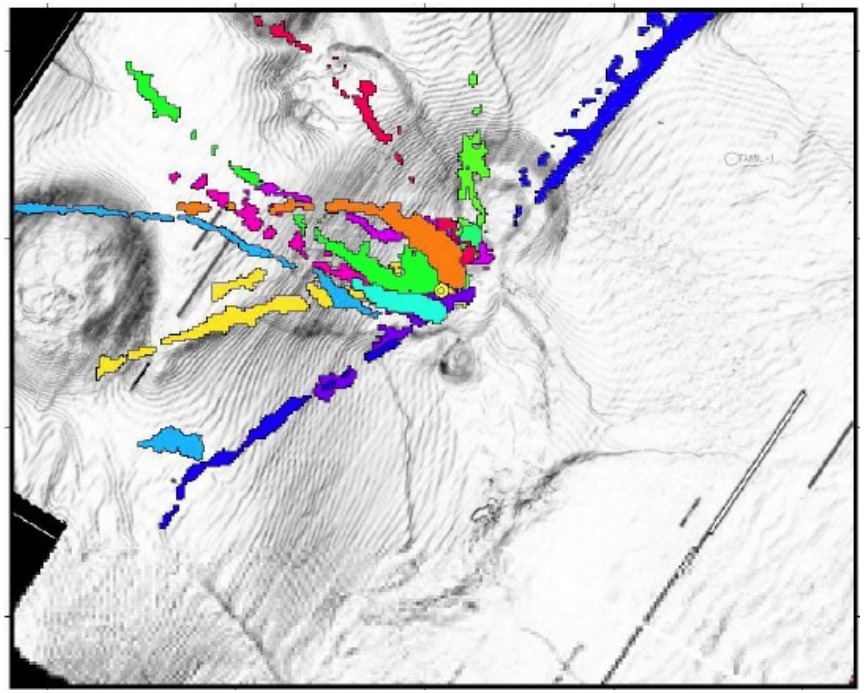
RADARSAT-2 April 11, 2009

Gulf of Mexico

Ship separated from slick but wake visible and ties vessel to likely release

Operational Best Practices – PEMEX

MDA has a long history providing oil-on-water monitoring in the Gulf of Mexico for PEMEX (Petróleos Mexicanos), a state-owned petroleum company in Mexico.



Primary Application:

Imagery is used primarily to detect and monitor oil slicks for production monitoring, vessel discharge assessment, and exploration activity. Consistent wide area coverage monitors platform HSE performance.

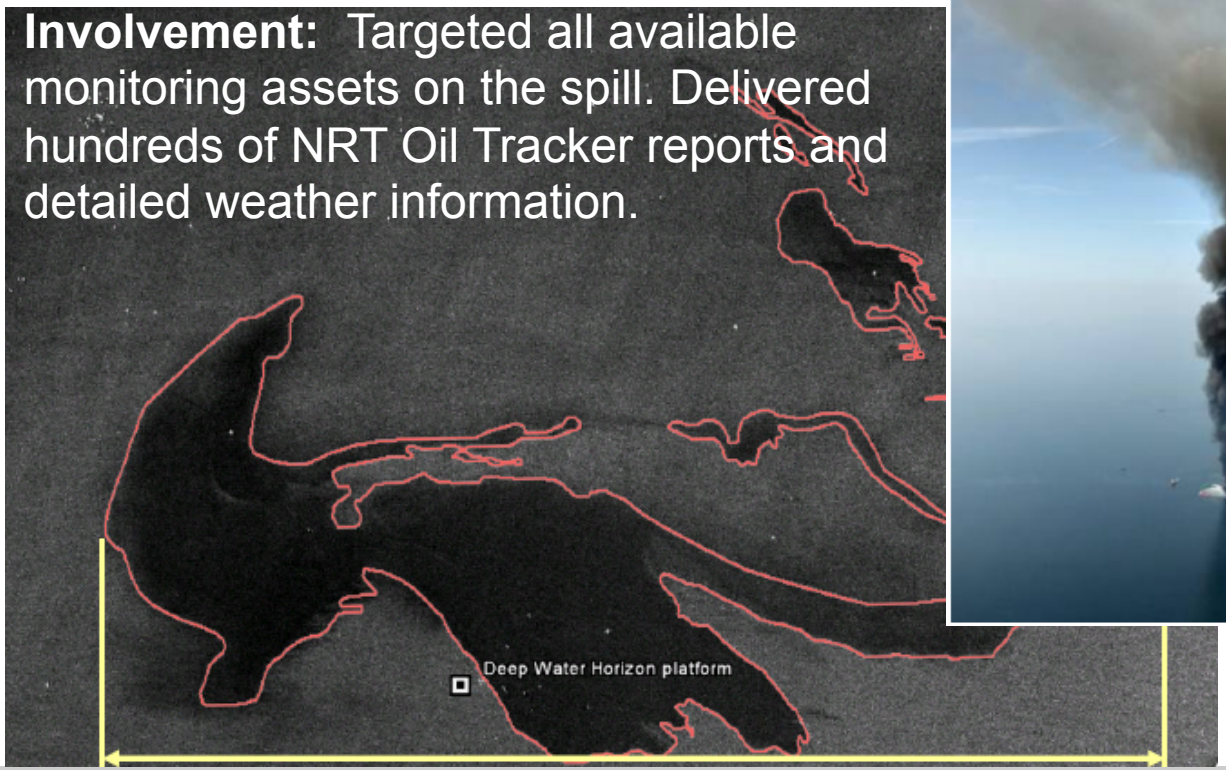
Outcomes: Reduction in platform releases, increased understanding of natural seep impact on natural areas, improved reaction to illegal dumping.

Case Study – Macondo, Gulf of Mexico

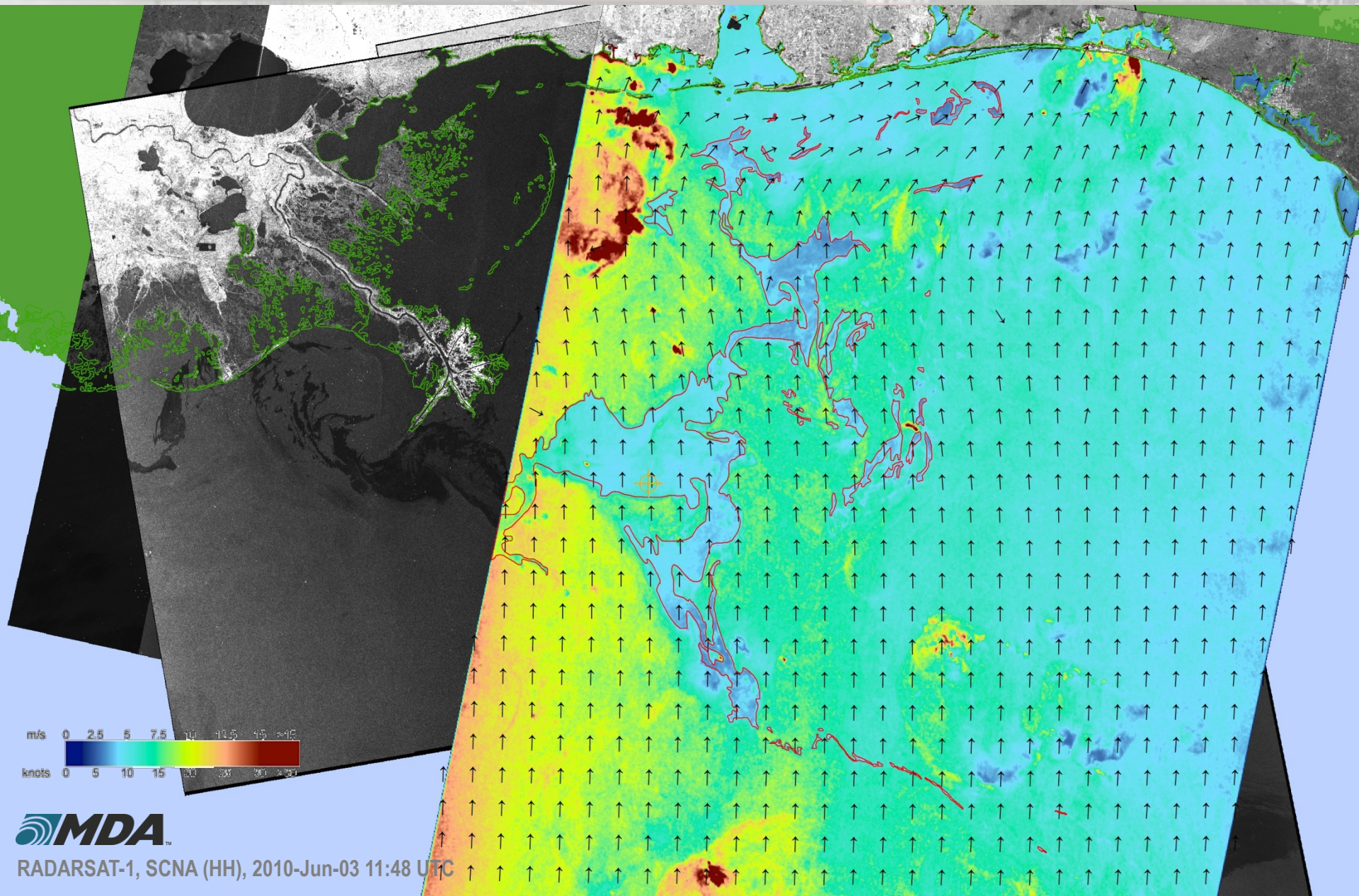
MDA played a substantial role in the response to the Deepwater Horizon incident and subsequent oil spill.

MDA provided advanced wide-area analysis directly to BP extremely quickly (often less than one hour after imaging)

Involvement: Targeted all available monitoring assets on the spill. Delivered hundreds of NRT Oil Tracker reports and detailed weather information.



Macondo: Wide Area Information-Rich Picture



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Summary

- **Offshore operators face a number of risks**
  - Over broad areas around operational assets
  - Risks include reputational, financial, HSSE impacts
- **Satellite remote sensing supports risk mitigation**
  - All-weather remote monitoring with broad area coverage
  - SAR and optical sources provide different information
  - Both proactive and reactive programs support operations
- **Integrated approaches are important**
  - Leverage remote and in-situ data sources
  - Provide a “common operating picture” driven by operational needs
  - Satellite monitoring is one part of the solution

Thank You

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