



INFORMATION SYSTEMS

Oil Observing Tools: Spaceborne Radar

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Outline

- Spaceborne radar capability
- Data
 - Acquisition
 - Processing
 - Delivery
- Information products

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Spaceborne Radar Overview

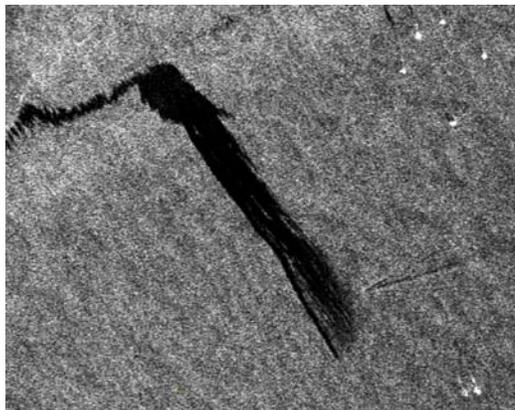
- Established tool for emergency response
- Globally accessible through multiple commercial missions
- Uniquely capable of providing the situational overview
 - Broad area coverage
 - Relatively low cost
 - Easy to deploy
 - Used for cueing other operational assets
 - All weather, day-night imaging

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Slick Detection

- Good understanding of slick detection which depends on:
 - Radar parameters
 - Environmental conditions
 - Oil characteristics
- Slick detection algorithms are used, but an analyst is usually required to:
 - Mitigate false positives
 - Apply contextual information (platforms, ships, etc.)
 - Assign confidence / classification levels

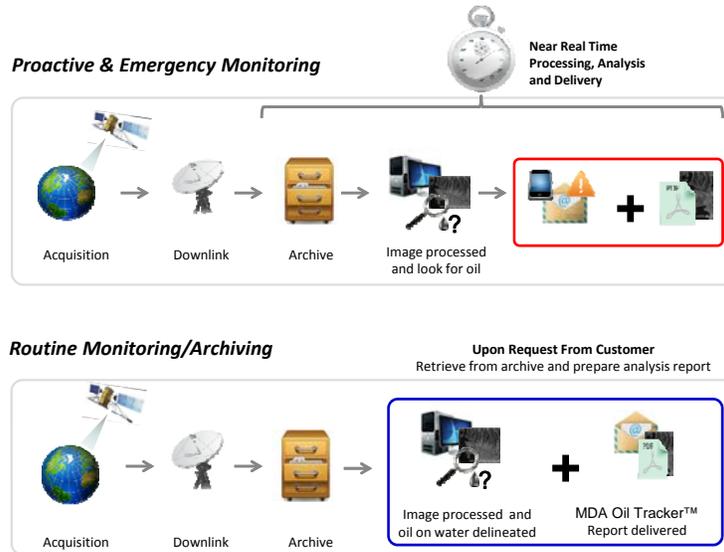


RADARSAT-2 image showing the Taylor energy slick. The oil appears as a dark tone and the offshore platforms appear as bright white targets.

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Data Delivery Workflow



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Data Acquisition

- Simulated incident in West Africa (December 5, 2014 at 08:24 UTC)
- Primary commercial sensors activated
- First available image from each sensor marked with ★
- The time is from the initial request for data to acquisition by the satellite
- On a different day or a different location, the results would vary



Satellite	Start
Cosmo-SkyMed-1	2014-Dec-05 17:16:14.115
Cosmo-SkyMed-3	2014-Dec-05 17:46:11.877
RADARSAT-2	2014-Dec-06 05:28:01.530 ★
RADARSAT-2	2014-Dec-06 18:06:21.620
Cosmo-SkyMed-1	2014-Dec-07 05:46:15.332 ★
TerraSAR-X	2014-Dec-07 06:03:34.945
Cosmo-SkyMed-1	2014-Dec-07 17:52:11.103
TerraSAR-X	2014-Dec-07 17:58:04.483 ★

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Data Downlinking, Processing, and Delivery

Direct Downlink

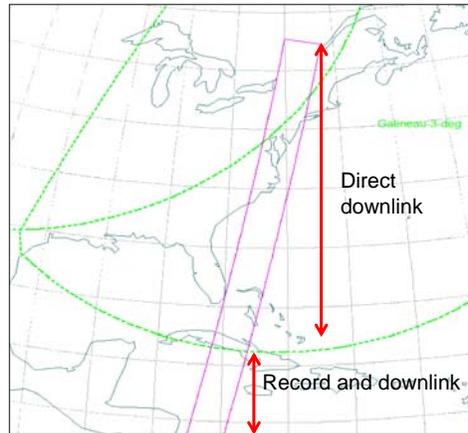
- satellite within ground station mask: acquire + downlink + processing < 2 hours

Record and Downlink

- satellite not within station mask: record + downlink + processing < 4 hours

Delivery

- < 15 minutes



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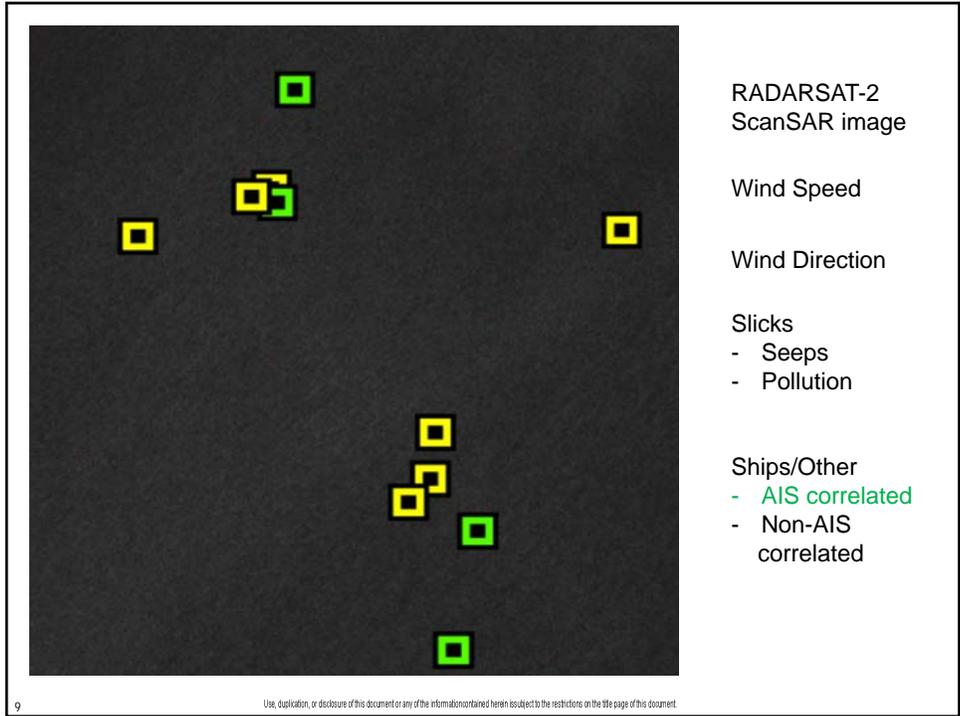
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Data Formats and Information

- Data formats:
 - Radar imagery → GeoTIFF
 - Plus many other format: PDF, JPG, SHP, KML, NetCDF, ...
- Information
 - Size of the spill (surface area)
 - Wind speed and direction (directly derived from the satellite imagery)
 - Locations of vessels and other local/regional infrastructure to aid in response management
 - Oil slick characteristics: *Sheen vs. emulsion*

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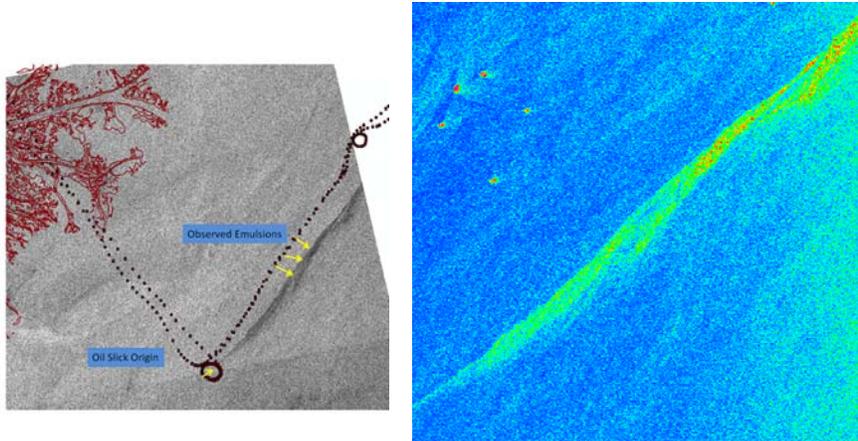
Data Integration and Common Operating Picture (COP)

- Oil spill information (e.g. GeoTIFF, shp, kml formats) can be integrated with other data sources into a COP.

Example of MDA OilTracker COP tool. Satellite products can be readily integrated into ERMA as well.

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Oil Sheen - Emulsion Discrimination



- RADARSAT-2 image showing the location of emulsified oil from the Taylor Energy slick based on aerial observations (left) and the detection of emulsified oil (red area) using the polarimetric entropy (right).

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Summary

- There is a good understanding of the benefits and limitations of spaceborne radar for oil spill response
- Data acquisition (typical)
 - Initial request to acquisition: 12 – 24 hours
 - Acquisition to downlink: 0 – 4 hours
 - Processing to information products: < 2 hours
 - Information products to delivery: < 15 minutes
- Information products derived from radar can be readily integrated with other data sources into a COP

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