Cost Effective Maritime Monitoring using Space Based Technology

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www.gfetw.org

www.mdacorporation.com
Agenda

• About MDA
• Overview of space based assets for maritime / illegal fishing monitoring
• Review of a comprehensive surveillance solution
Who is MDA?

- MacDonald, Dettwiler and Associates, Canadian-based MDA is a global communications and information solutions company
- Publicly traded (TSX:MDA) with 4500 employees, annual revenues ~$2 Billion USD
Key Information Needs - Maritime

Where are the vessels in my Area of Interest (AOI)?

What can you tell me about the vessels? (regardless of what they are reporting)

Which vessels are not self-reporting?

Which vessels may be a threat?

What else is happening in my AOI?
Surveillance of the Maritime Domain

Challenges

- *Immense* areas
- *Many* targets
- *Remote* locations
- *Limited* assets, *expensive* to operate

Impact

- No single data source or sensor can solve the problem
  - Each sensor has strengths and limitations
- Data from multiple sensors must be fused together
  - Create an effective Maritime Domain Awareness solution
- Adding new sensors increases efficiency of all assets
  - Rather than replacing existing assets
Space Based Assets

- **Satellite Automatic Identification System (AIS)**
  - Allows identification of *cooperative* vessels
  - Global and frequent coverage

- **Satellite Synthetic Aperture RADAR (SAR) Imaging**
  - Detection of cooperative and *non-cooperative*
  - All weather, broad area coverage

- Effective complement for traditional surveillance operations
  - Space can be a force multiplier, by providing coverage over and above aircraft of surface patrol vessels
  - More efficient use of assets, by directing them to the area of concern
  - Delivers an overall reduction in cost of operations (fuel alone!)
AIS – Automatic Identification System

• Originally designed as an anti-collision system
  – Required by IMO
  – All vessels over 300 GT (gross tonnage)
  – Must regularly transmit “AIS” message, including location, ID, flag, cargo, etc.

• Also receivable with land/aircraft sensors

• More recently, receivable by satellites (S-AIS)

• Limitations:
  – Can be turned off or “spoofed” for deceptive operations
    • 30 – 50% of vessels NOT transmitting (US / Canadian Navy Studies)
  – S-AIS poor performance in high vessel-density areas (new standards will address)
S-AIS Coverage: Costa Rica

- Actual frequency of coverage, Feb. 18 (9am – 5pm local time) for the Costa Rican Pacific Exclusive Economic Zone (EEZ)
- Almost hourly coverage from ~8 satellites
Satellite Imaging RADAR

- **Rapid Wide Area Coverage for Vessel Detection**
  - 250,000 km² imaged in under 1 minute

- **Routine access to remote or denied areas**
  - Independent of weather conditions (e.g., clouds, rain) or darkness
  - Repeatable and consistent acquisitions anywhere in the World

- **Detects all vessels**
  - Detection based on active imaging of target
    - Does not require vessel to be emitting a signal!
  - Size of vessel detected based on selected imaging parameters

- **World’s premier satellite for maritime surveillance – RADARSAT-2:**
  - Broadest coverage, global infrastructure, advanced technology
  - Used extensively by Canada, USA, European Governments
  - Operated by MDA
  - MDA also building 3 satellite follow-on mission, RCM

RADARSAT-2 Data and Products © MacDonald, Dettwiler and Associates Ltd. 2014 – All Rights Reserved. RADARSAT is an official mark of the Canadian Space Agency
RADARSAT-2 Coverage: Costa Rica

- Actual 5-Day coverage possible (February 18-22) shown
- 7 passes of satellite, 100% coverage achieved on 1 day during this 5 day period
- Typically used in conjunction with other higher values assets (e.g., aircraft, patrol vessels) to cue them efficiently
- If more imagery required, other commercial SAR satellites can be utilized
Global Maritime Domain Awareness and Threat Detection Solution
MDA BlueHawk – Surveillance Solution

- Comprehensive unclassified Maritime Domain Awareness solution
  - See beyond your aircraft patrol boundary limits
  - See predicted routes and historical tracks of ships
  - Share information with other team members, agencies, or governments
  - Deploy rapidly, with no IT investment or maintenance required

Information Provided
- Web-based managed service for monitoring maritime environment:
  - Non-reporting “dark” vessels
  - AIS reporting vessels
  - Coastal and open ocean coverage
  - Oil slicks, weather, wind data

- Data Fusion & Exploitation:
  - Satellite RADAR
  - Satellite & terrestrial AIS
  - Vessel registry data (e.g., IHS Fairplay)
  - Other contextual data
Solution Overview

- **Easy** to use interface (Google Maps based)
- **Accessible** through secure internet portal
- **Query** based (time, area, and/or ship characteristics)
Querying

The unequal battle over West Africa's rich fish stocks
January 2014
By Thomas Fessy BBC News, Dakar

“...The Russian vessel's owners face a $800,000 (£486,000) fine - double the usual fee because the Oleg Naydenov is a "repeat offender", having been caught once before in the last two years.”

30 Day historical track

Period with no AIS
Finding Non-Reporting Targets

Yellow vessels are possible “dark targets”. These vessels are detected with satellite SAR, but have no matching AIS message.

Green vessels have been detected with satellite radar and correlated to an AIS message.

Red circles indicate Vessel of Interest watchlist.
Suspicious Self-Reporting

Vessel “Shadi” self-reports via AIS as being registered in Tanzania.

However, IMO registry shows it registered in Malta.

And controlled by Iranian interests.
32 vessels detected in a SAR imagery sweep
6 were ‘unidentified’ / had no AIS
Data Fusion (cont’d)

From the SAR image:

- Detected Contact Information
  - UTC: 2012-06-07 07:22:09 UTC
  - Age: 154 days ago
  - Latitude: 013°57.42 N
  - Longitude: 023°47.50 W
  - Heading (Est.): 210.0 °
  - Length (Est.): 245 meters
  - RSAT Beam Mode: SCWB
  - RSAT Pol. Mode: HH
  - ~12hrs vessel drifting

Potential vessel rendezvous?

7 NM

From the AIS data:

Historic info

- Lat/Long: 020°09'38 N / 023°21'11 W
- Time: 2012-06-09 10:57:55 UTC
- Age: 156 days ago
- Speed: 12.2 knots
- Heading: 227.0 °
- COG: 231.1 °
- ROT: 000.0 °

Current info, fused with SAR

- Detected Contact Information
  - Name: ZAHER 1
  - MMSI: 400046000
  - IMO: 7931996
  - Call Sign: CQVS
  - Flag: Lebanon
  - Type: Cargo
  - Length: 120 meters
  - Width: 21 meters
  - Lat/Long: 013°52'16 N / 023°42'11 W
  - Time: 2012-06-07 07:22:09 UTC
  - Age: 154 days ago
  - Speed: 12.0 knots
  - Heading: 216.0 °
  - COG: 221.3 °
  - ROT: 000.0 °
  - Status: Active
  - Cargo: 0
  - Action: 0
  - Destination: 0
  - ETA: 0
  - RSAT Beam Mode: SCWB
  - RSAT Pol. Mode: HH
An alert is triggered at 15:34 (2013-05-02) by Chinese patrol vessel Haijian 15, heading towards a geofence around the Senkaku area from the Chinese coast.

A geofence (in red) is established in a circle of radius 100km around the Senkakus.

The pink area indicates the predicted vessel route – heading toward the Senkakus. The blue small triangles indicate Haijian 15 will arrive at the Senkakus at around 00:15 (2013-05-03) (not shown).
MDA BlueHawk – A tool to aid monitoring and surveillance

Detect illegal fishing activities and react to protect national interests and preserve valuable fishing stocks

• Platform for identification of uncorrelated/unknown vessels
• SAR enables monitoring of large, remote areas
• SAR-based ship detection correlated with AIS or VMS
  – Used to detect vessels in restricted fishing areas
  – Near real-time data allows for immediate response and cueing of expensive assets
• Subscription based service (e.g., annual) with no capital infrastructure required
THANK YOU!
GRACIAS!
MERCI!

Geospatial Services Inc.