State of the Art Observations: Maritime Information Systems

Global Maritime Information Sharing Symposium

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Where are we strong…

…

“existence”

“context”

“reason”

UNDERSTANDING

“Foundation for Command”

And where are we weak?

“Maritime activity is intentionally opaque and convoluted” …

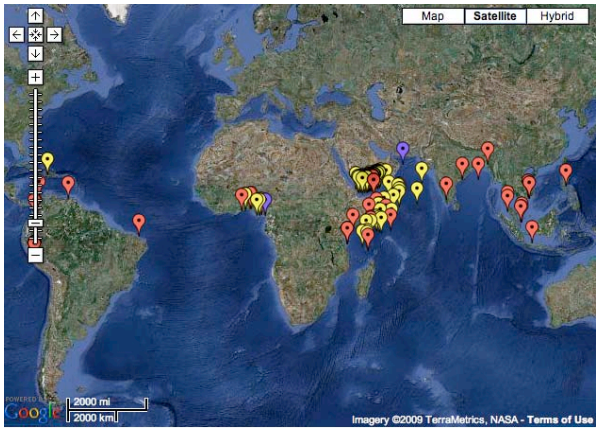
“Internal”
Flag
Owner
Cargo owner
Master
Crew
Agent
Insurer
Indemnity Club
Declared destination
Brief stops
Ship characteristics
…

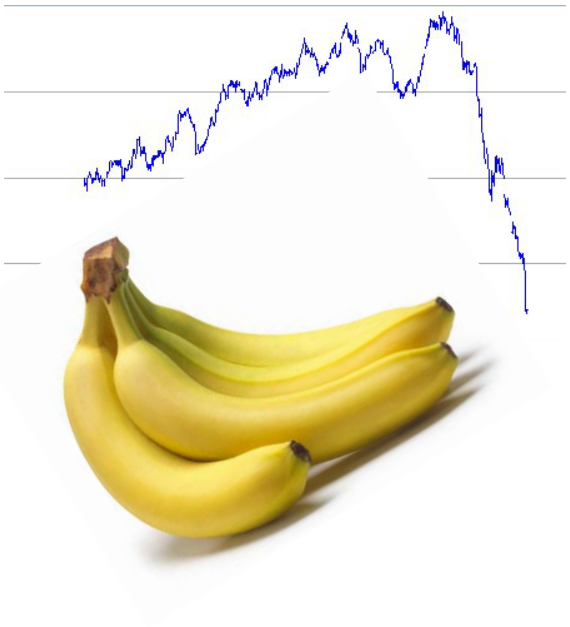
“External”
Weather
Price of commodities
Port costs
Exchange rates
Restricted areas
High-risk passages
…

“WHY” is Complicated

Cause and Effect

“WHY” is Complicated





“WHY” is Complicated

Conceptually:

$$F(x,y,z,\ldots)$$

Can you solve this knowing only “x”?

A Pooled Information Environment is absolutely

“WHY” is Complicated

Is it F(x,y,z) ?

… or is it F(x,y,z *and* w) ?

Modeling Maritime Activity is absolutely

“WHY” is Complicated

Vessels, Cargo, People, Infrastructure

are not enough.

External drivers include everything that determines

Profit or Loss

Commercial sector Knowledge is absolutely

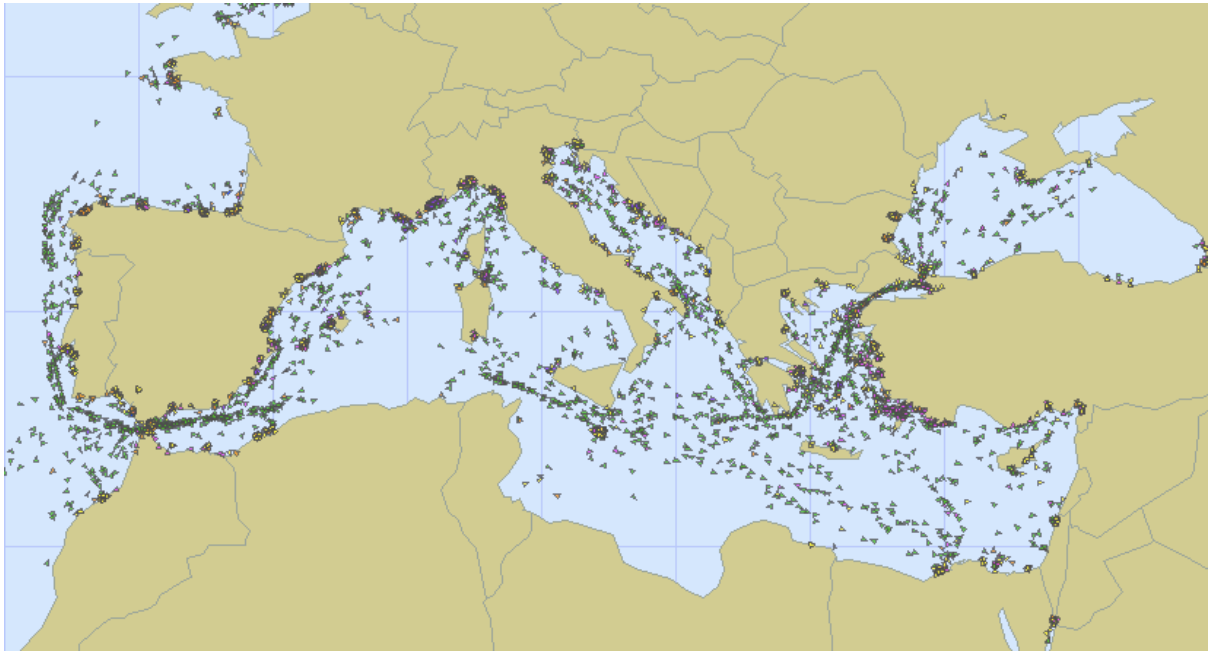
How are we doing?
Existence Data - availability

- Military Systems:

Global reach and local, generally *classified*
Defense oriented

How are we doing?
Existence Data - availability

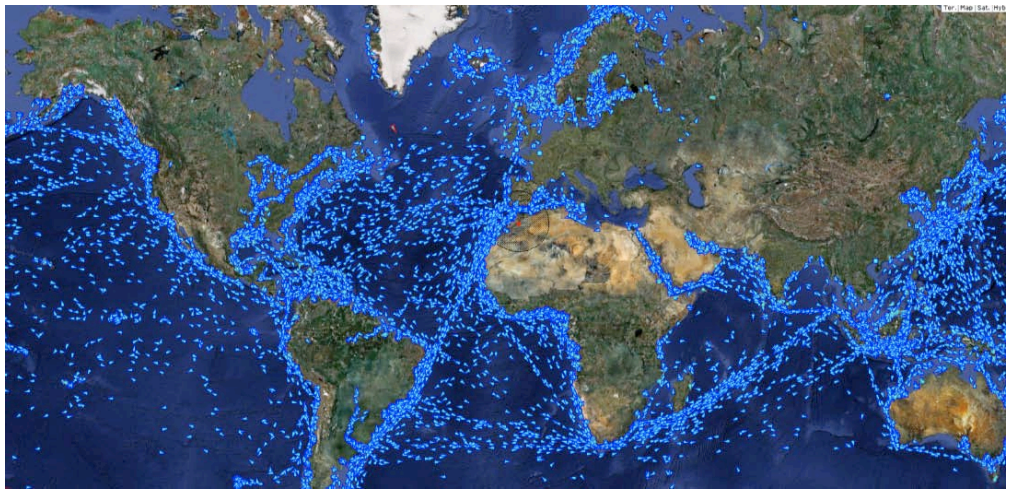
- Civil Systems



Shore-based, internationally *interdependent*
Safety and Security oriented

How are we doing?
Existence Data - availability

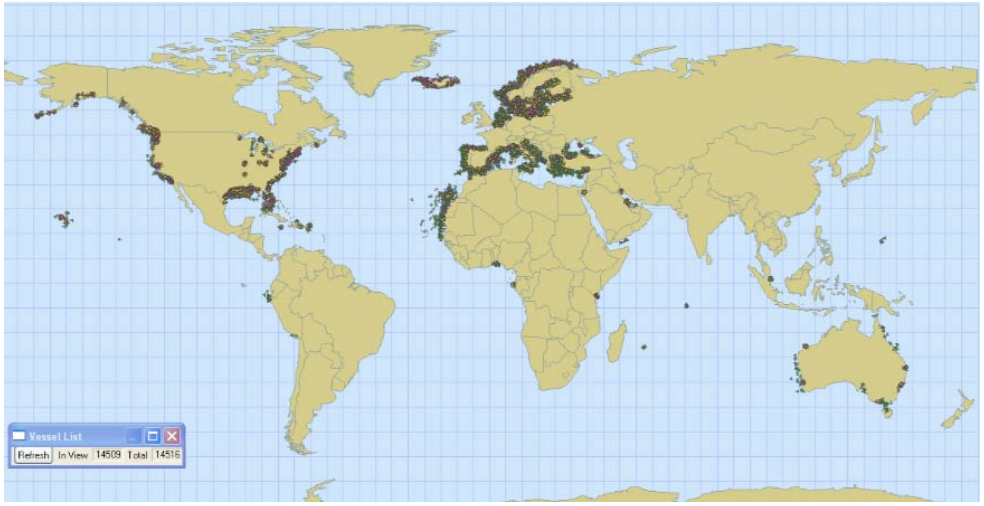
- Commercial Systems



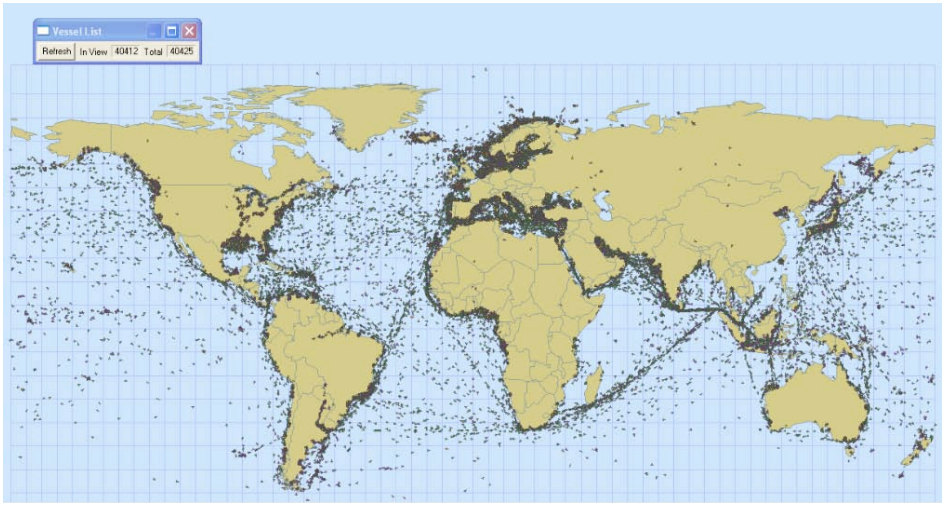
Courtesy of SpaceQuest

Global reach, internationally *independent*
Profit oriented

Commercial Space – A Sea Change



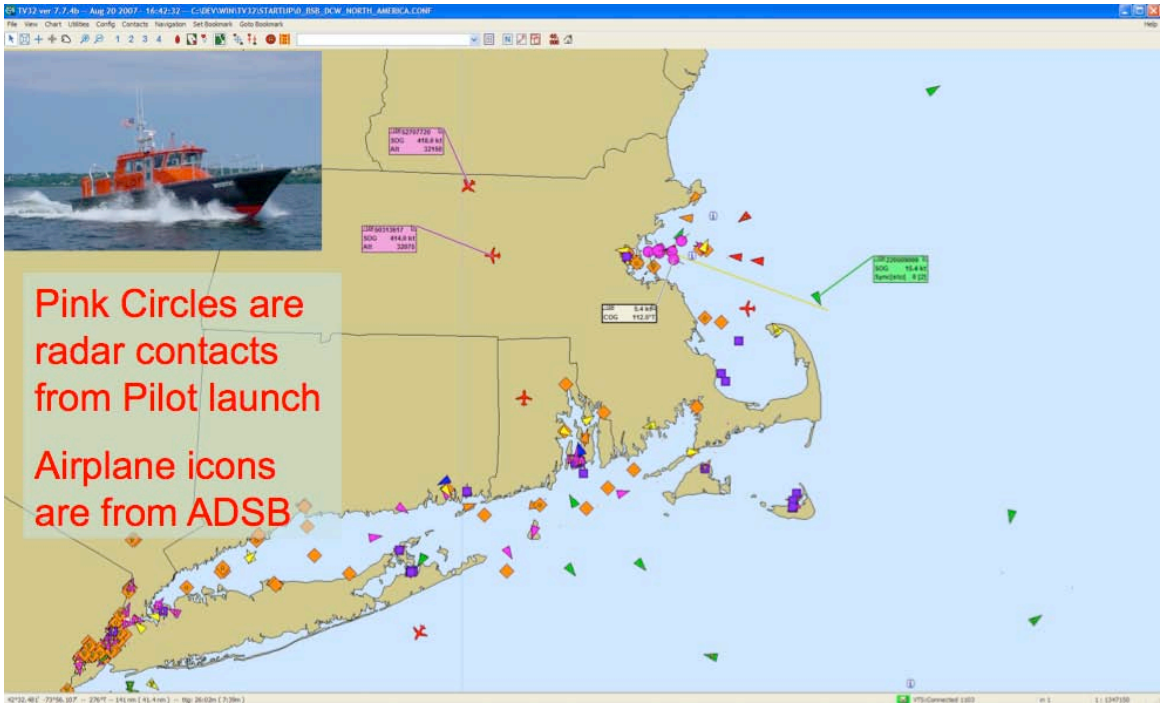
Shore-based AIS



Space-based AIS

How are we doing?
Existence Data – AIS and Radar

- Coastal AIS and radar

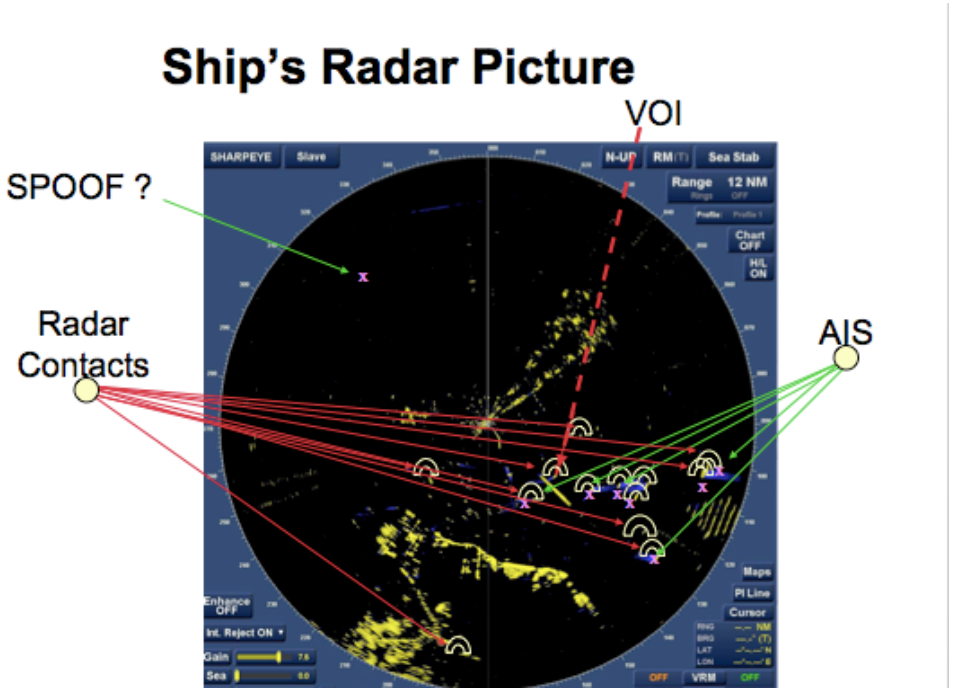


Courtesy of Volpe Center

Shore-based, limited Over the Horizon capability

How are we doing?
Existence Data – AIS and Radar

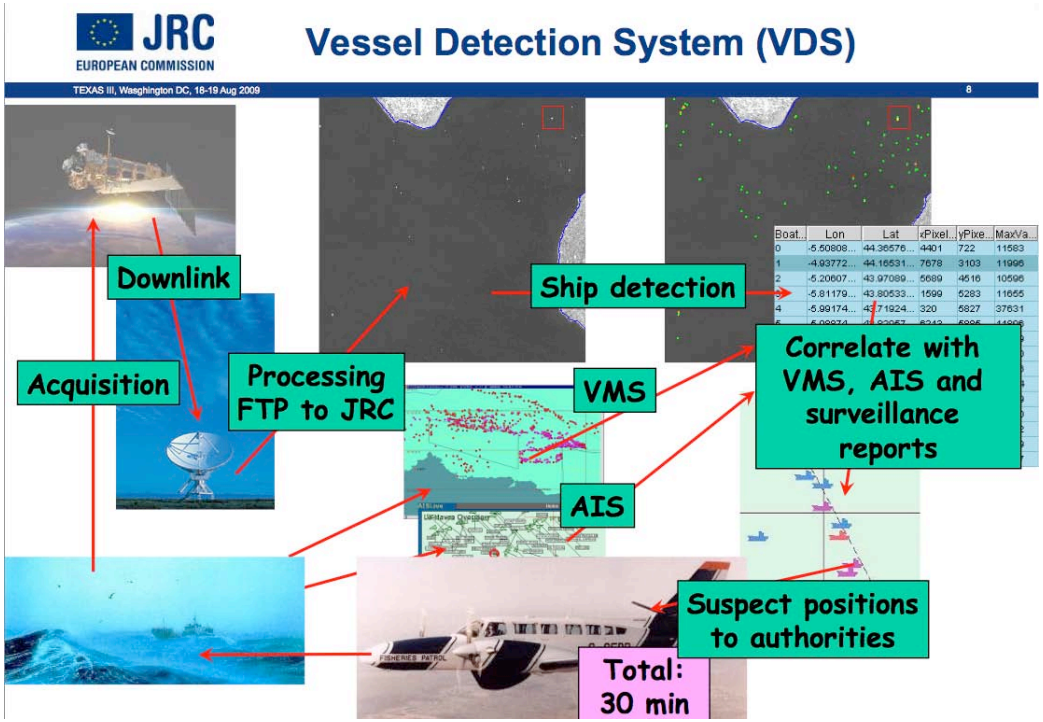
- Ships' AIS and Radar Contact Reporting



Extends reach of shore-based systems
Engages commercial sector

How are we doing?
Existence Data – AIS and Radar

- Space-based AIS and Synthetic Aperture Radar



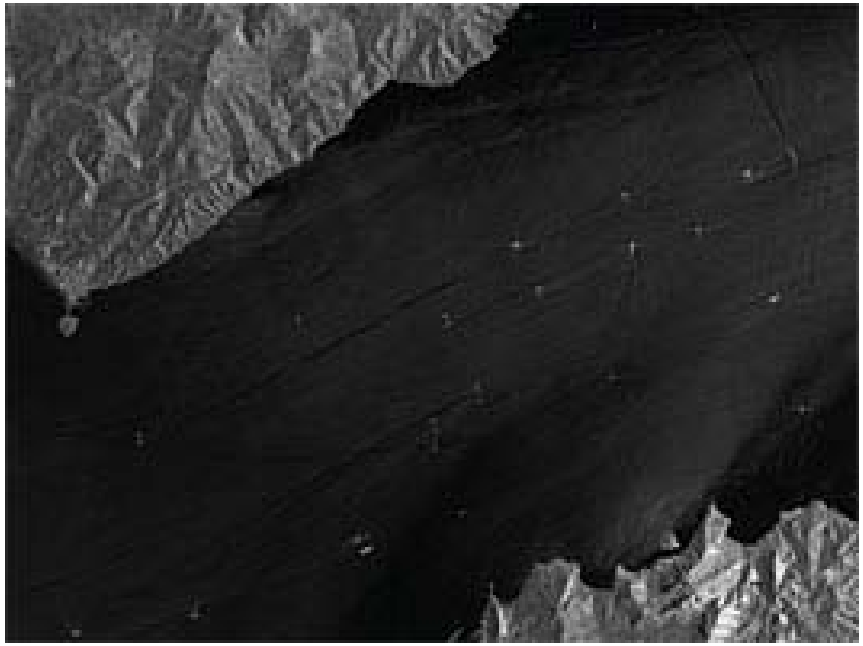
Courtesy of JRC

Global reach

Wide area, useful for search and law enforcement

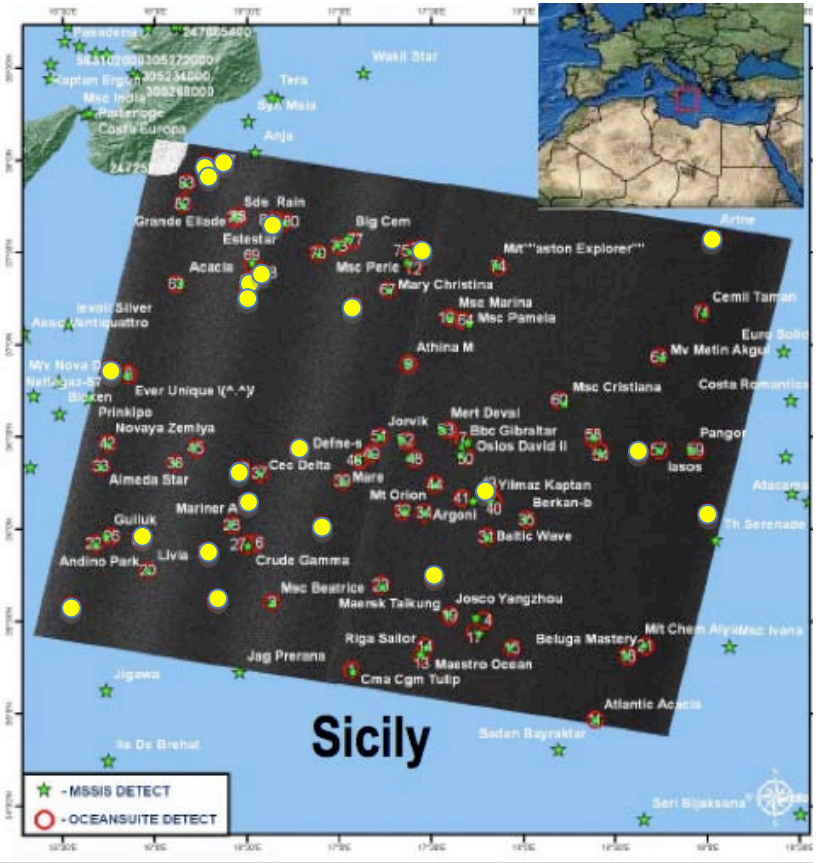
Commercial Space
A Tool for Governance

Space-based SAR



Courtesy of TerraSAR

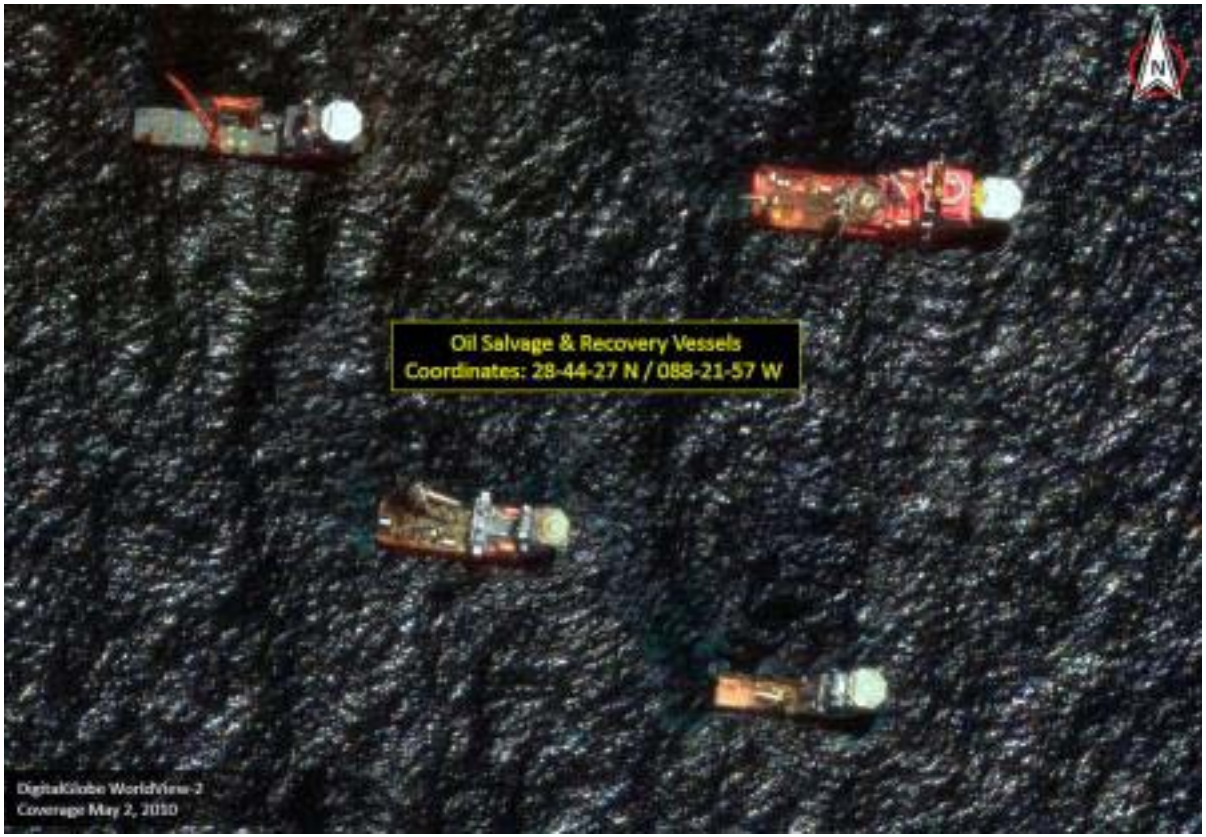
Space-based AIS and SAR



Courtesy of MDA

New types of Existence Data

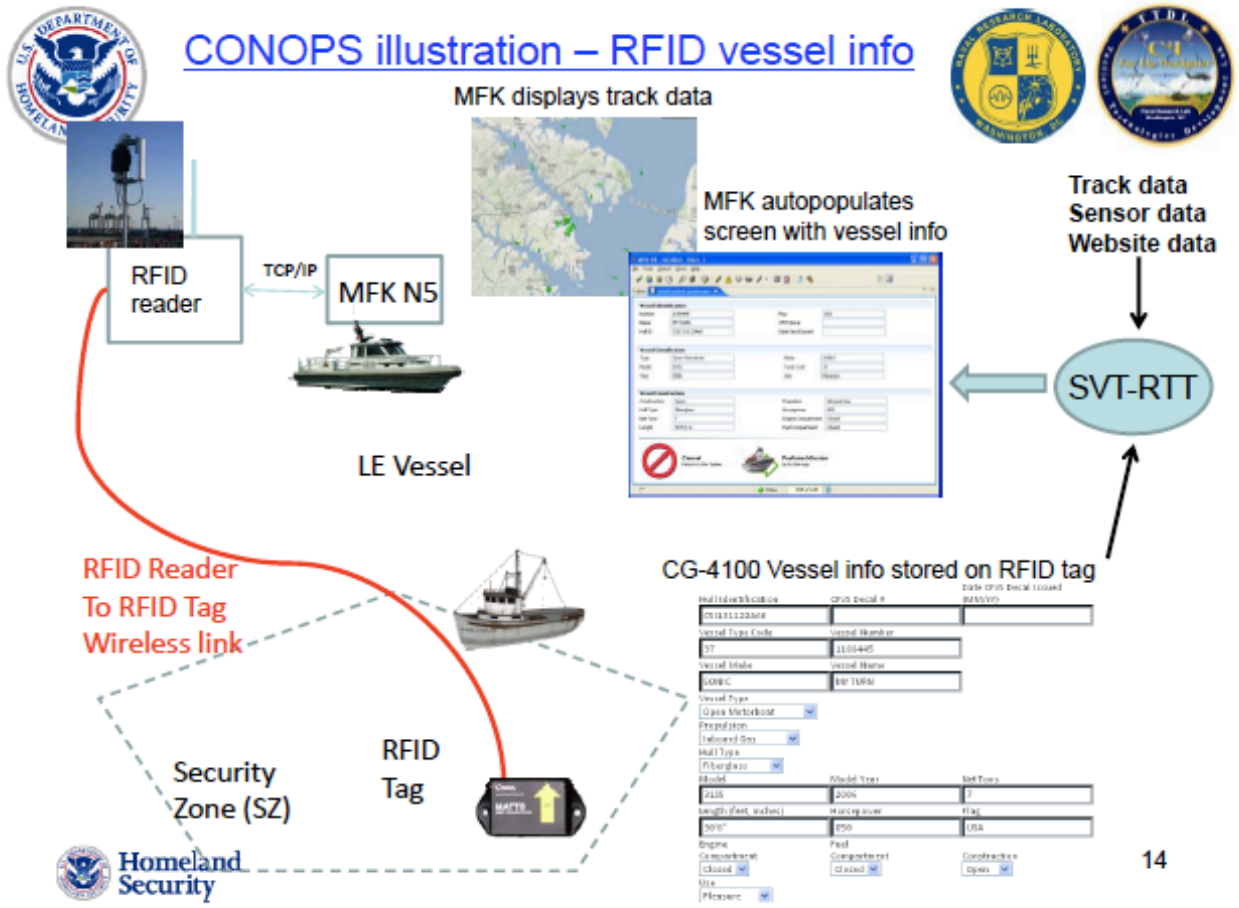
Wide area / High resolution optical imagery



Courtesy of DigitalGlobe

New types of Existence Data

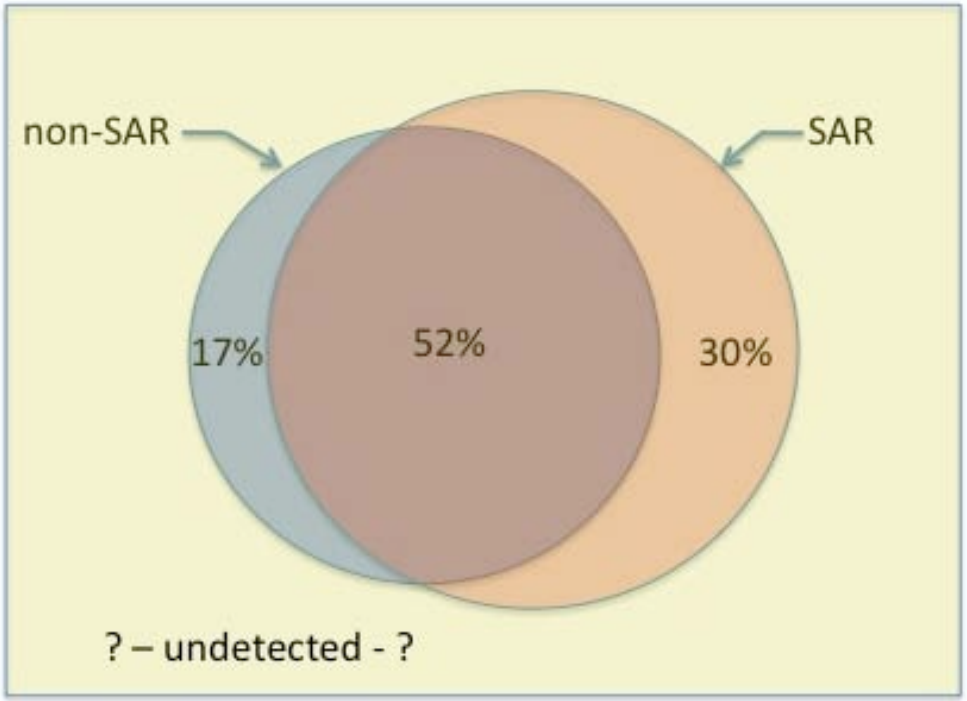
RFID for Small Vessel Tracking



How are we doing?
Existence Data

What's the question? …

which vessels should we know about?



How are we doing? Information

- *Current Focus:*

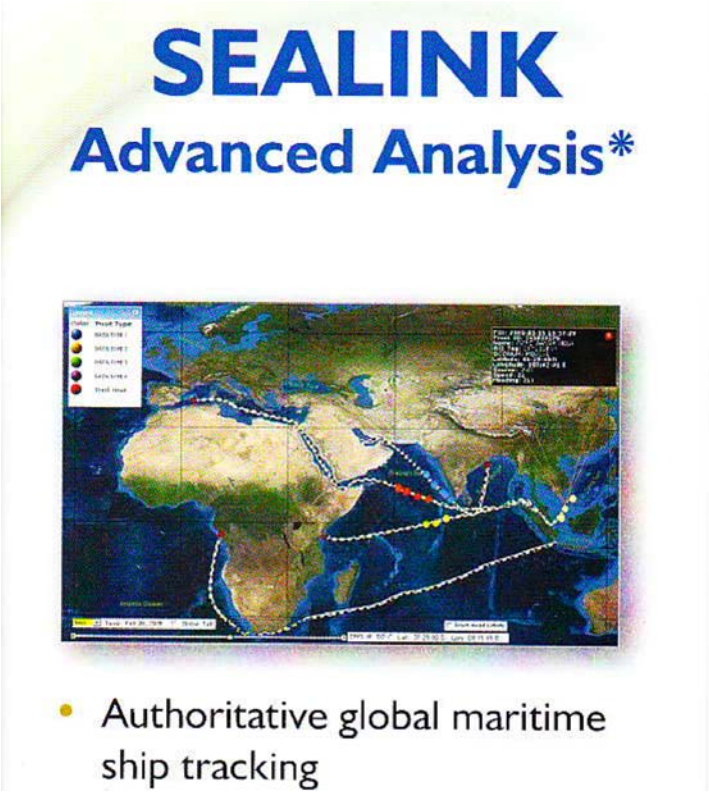
  Multi-source track fusion

- *Future Understanding:*

  Associated Information, Behavior, and Network Relationships

How are we doing?
Track Fusion

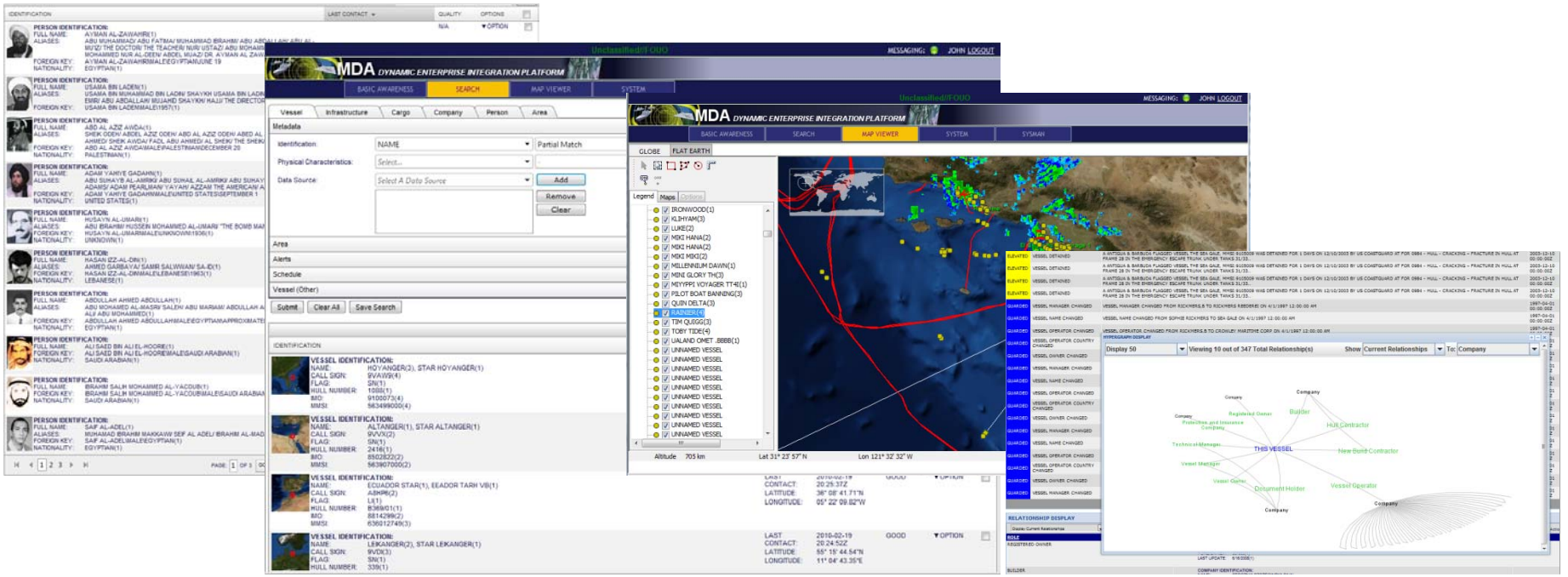
SeaLink Advanced Analytics



Courtesy of ONI

How are we doing?
Associated Information

Dynamic Enterprise Integration Platform



Scale*: Centralized storage and computing*

Subject Matter Expertise: *Centralized R&D*

How are we doing?
Associated Information
Information Integration Pilot

Scale*: Distributed Storage and Computing*

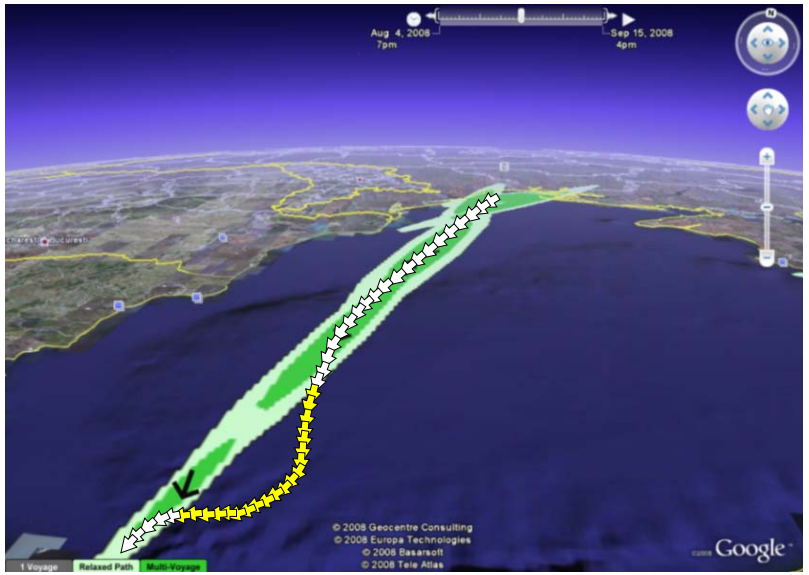
Subject Matter Expertise: *Modular Analytics*

How are we doing?
Behavior

Predictive Analysis for Naval Deployment Activities

PANDA

PREDICTIVE ANALYSIS FOR NAVAL DEPLOYMENT ACTIVITIES



Scale*: Tens of thousands of ships*

Subject Matter Expertise: *Learned from identified tracks*

Key Enabling Technologies

Cloud storage promotes:

- Information sharing
- Huge span of available information

Cloud computing promotes:

- High volume, high speed analysis
- Machine-to-machine interagency sharing

Widget technology promotes:

- modeling with increments of knowledge
- wide engagement for developing algorithms

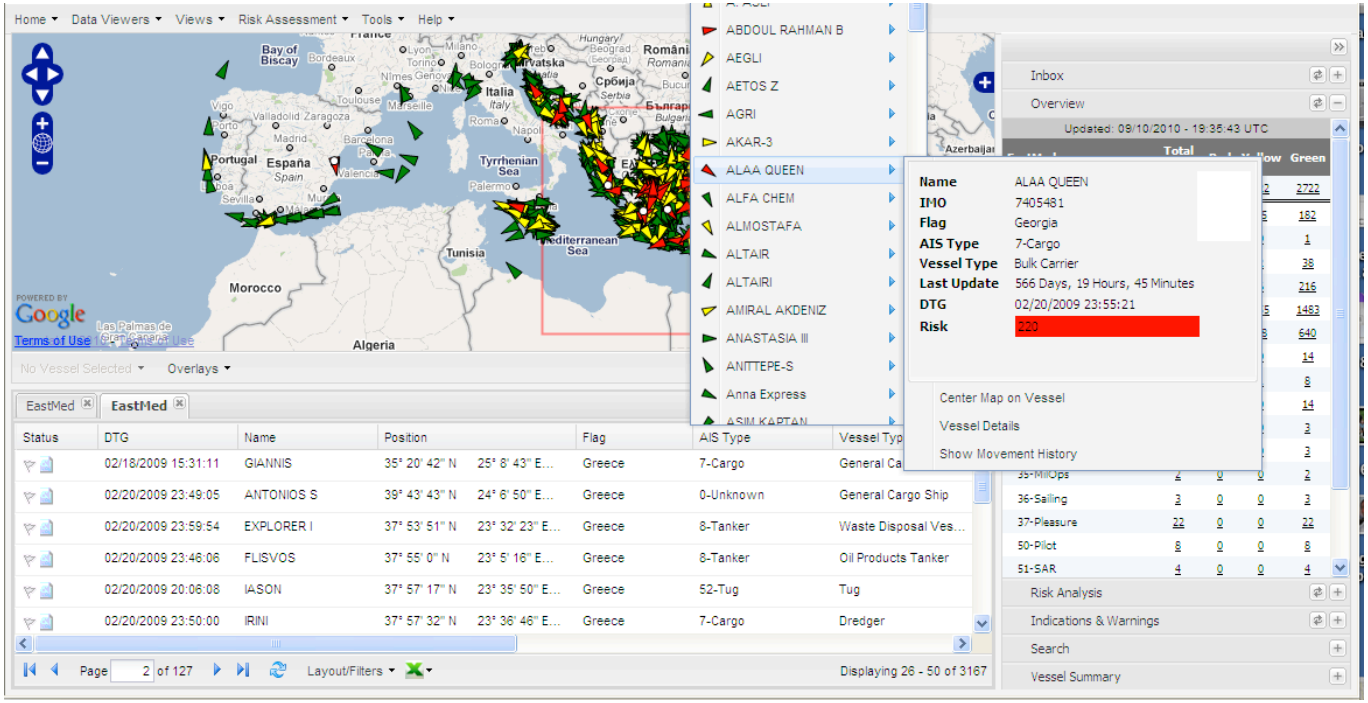
Attribute-based Access Control promotes:

- sharing with responsible data stewardship

How are we doing?

Knowledge

Computer Assisted Maritime Threat Evaluation System

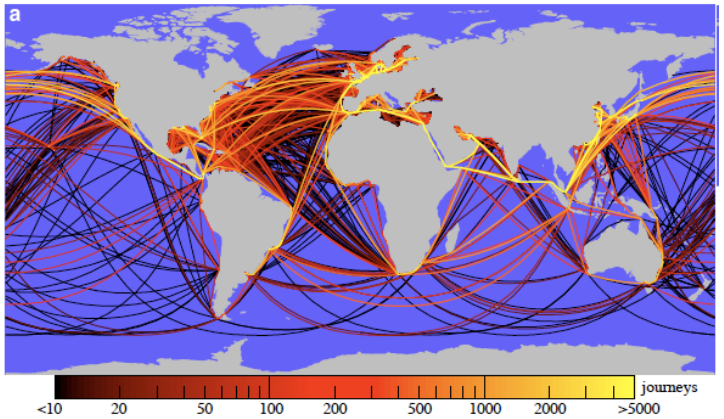


Rules-based threat Assessment

How are we doing?
Knowledge

Government Research: Using context to update normal behavior or explain reasons for deviations: "Context-based Prioritization"

Academic Research: for example: "The complex network of global cargo ship movements"



Summary

- DATA: we're doing well with cooperative vessels, getting better at non-cooperative vessels and related information
- INFORMATION: we're doing well at track fusion and correlating related data with vessels
- KNOWLEDGE: we're just beginning to develop high-speed, high-volume algorithms for sense-making

Summary

WHAT WE NEED:

- More Types of Data in a Pooled Information Environment
- Models for Maritime Activity and a Knowledge Framework
- Commercial Partners' Knowledge

Discussion