

State of the Art Observations: Maritime Information Systems

Global Maritime Information Sharing
Symposium

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Where are we strong...

UNDERSTANDING



“Foundation for Command”



Now IT ALL
MAKES **SENSE**

“reason”

“context”

And where are we weak?



“existence”

“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

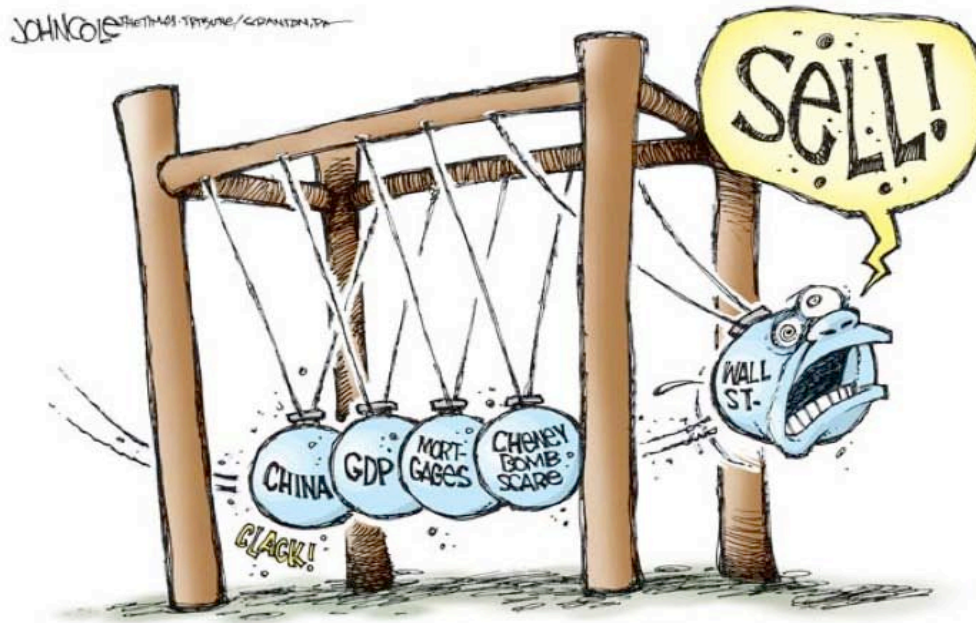
Restricted areas

High-risk passages

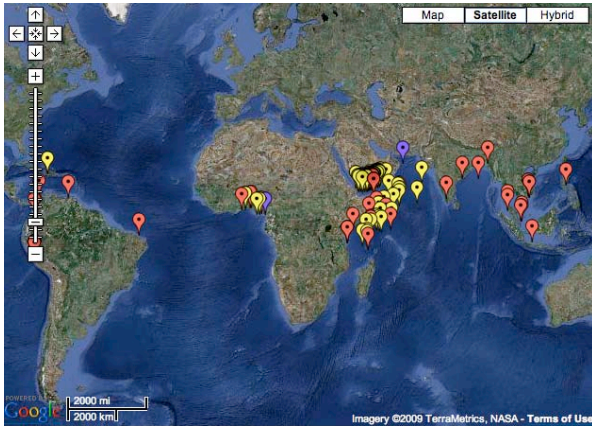
...

“WHY” is Complicated

Cause and Effect



“WHY” is Complicated



“WHY” is Complicated

Conceptually:

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

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 $F(x, y, z \text{ and } w)$?

*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:

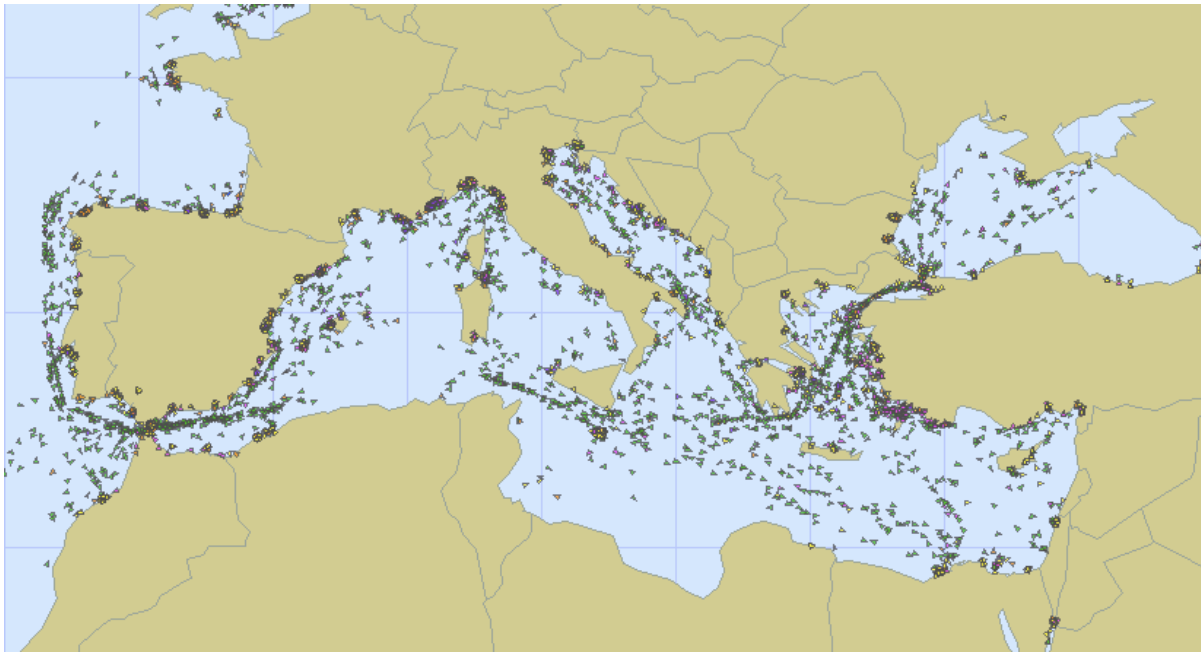


Global reach and local, generally *classified*
Defense oriented

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

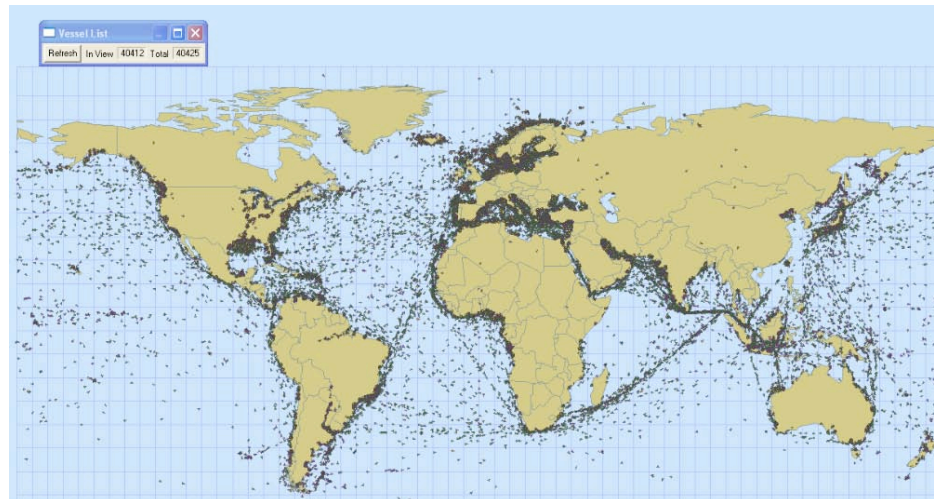
Global reach, internationally *independent*
Profit oriented

Commercial Space – A Sea Change



Shore-based AIS

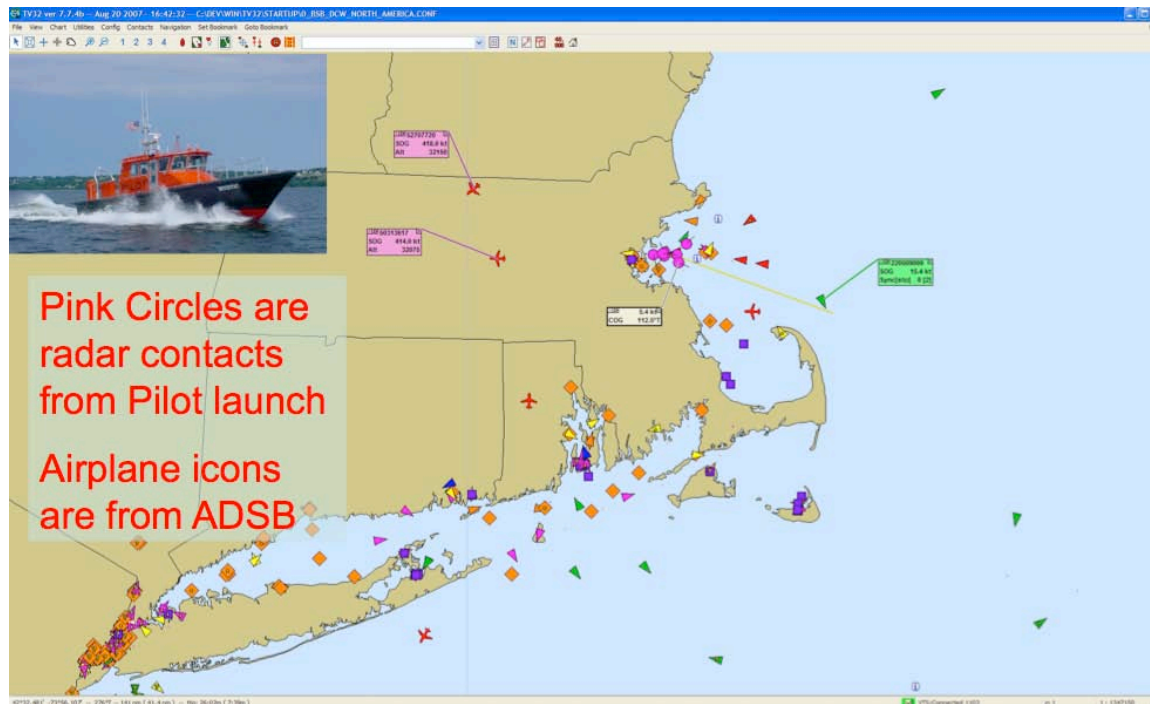
Space-based AIS



How are we doing?

Existence Data – AIS and Radar

- Coastal AIS and radar



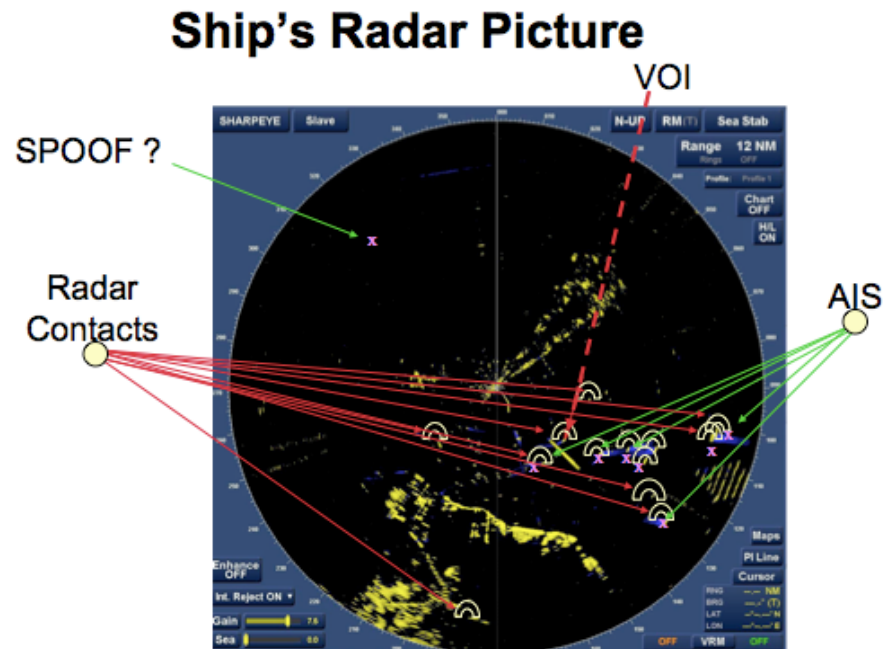
Courtesy of Volpe Center

Shore-based, limited Over the Horizon capability

How are we doing?

Existence Data – AIS and Radar

- Ships' AIS and Radar Contact Reporting

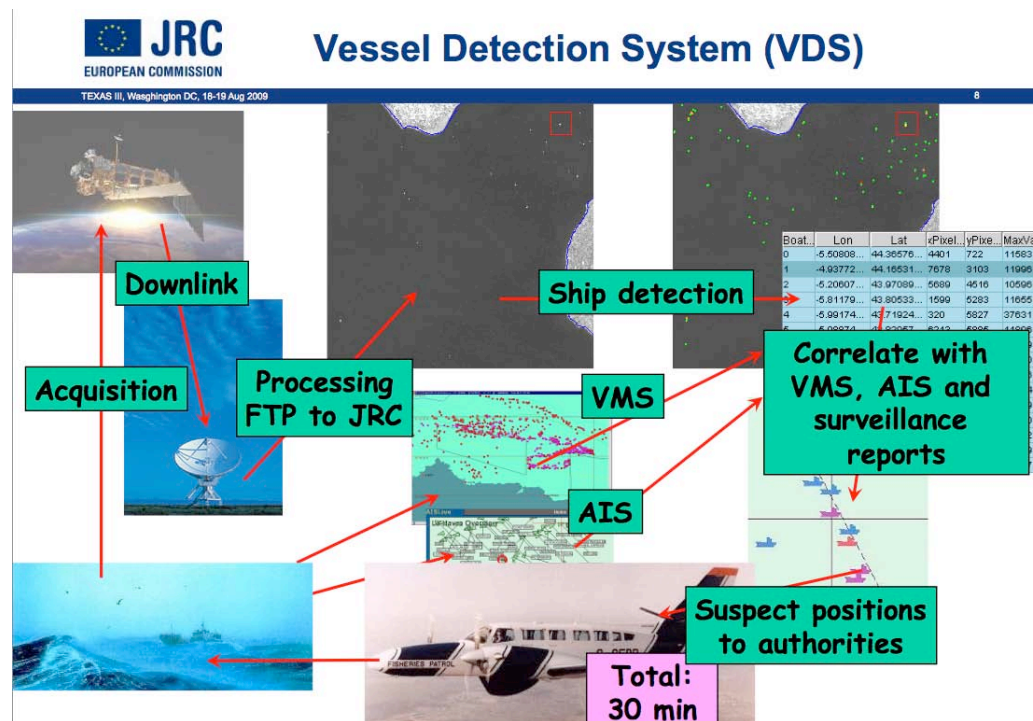


Extends reach of shore-based systems
Engages commercial sector

How are we doing?

Existence Data – AIS and Radar

- Space-based AIS and Synthetic Aperture Radar



Global reach

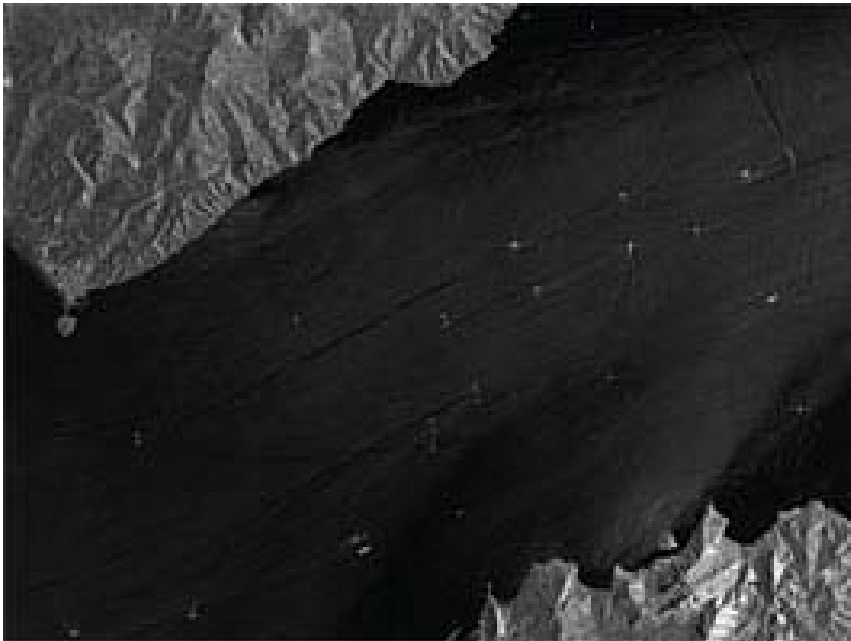
Wide area, useful for search and law enforcement

Courtesy of JRC

Commercial Space

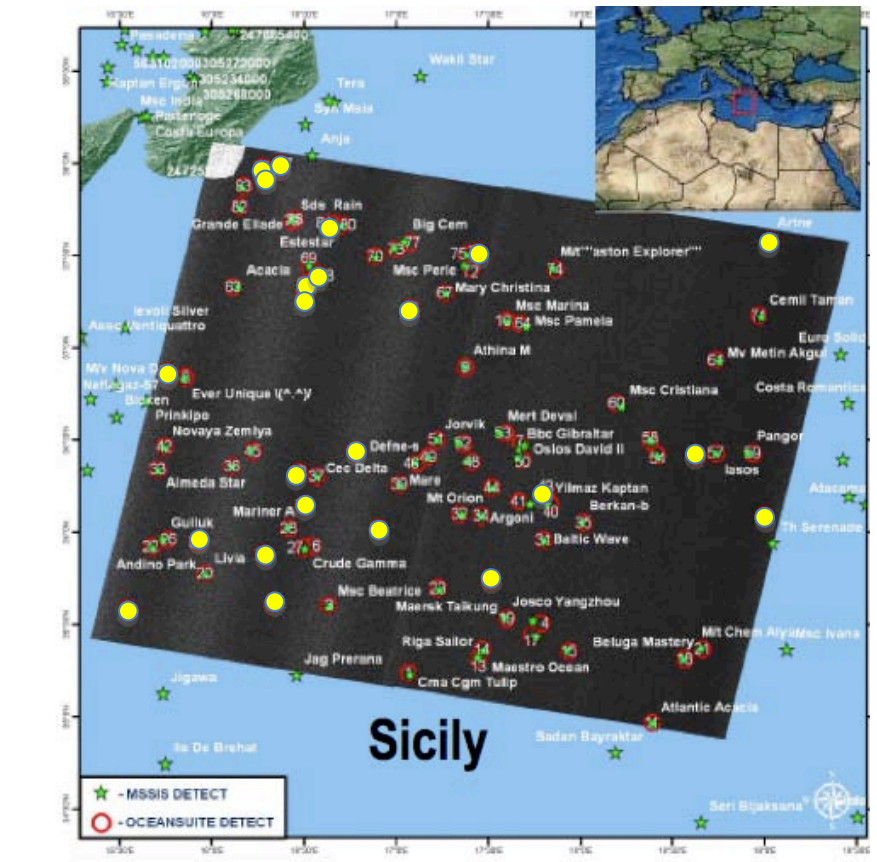
A Tool for Governance

Space-based SAR



Courtesy of TerraSAR

Space-based AIS and SAR



New types of Existence Data

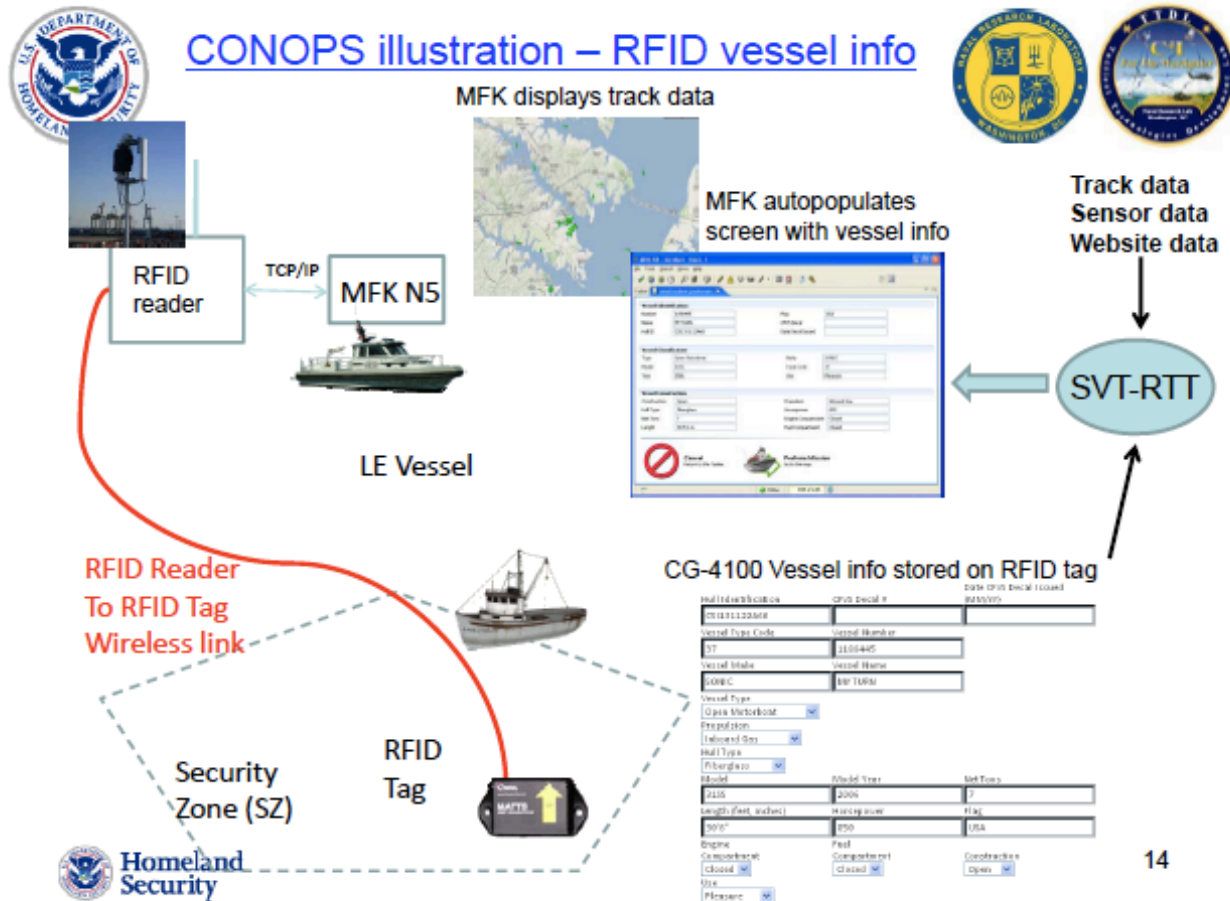
Wide area / High resolution optical imagery



Courtesy of DigitalGlobe

New types of Existence Data

RFID for Small Vessel Tracking



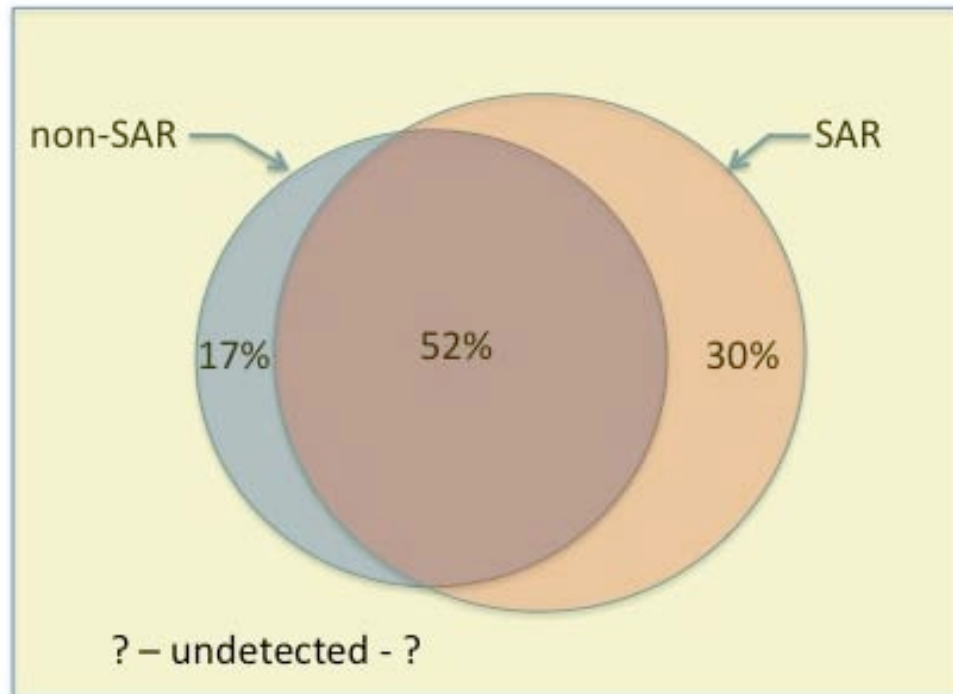
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How are we doing?

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:*

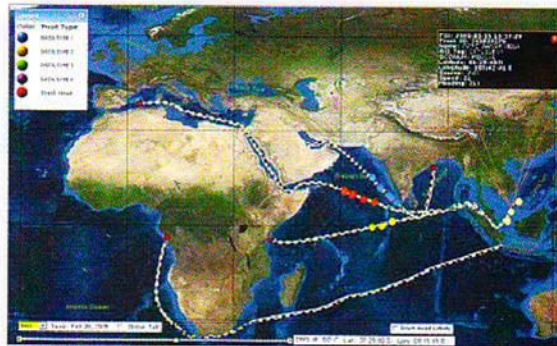
Associated Information, Behavior, and
Network Relationships

How are we doing?

Track Fusion

SeaLink Advanced Analytics

SEALINK Advanced Analysis*



- Authoritative global maritime ship tracking

How are we doing?

Associated Information

Dynamic Enterprise Integration Platform

The screenshot displays the MDA Dynamic Enterprise Integration Platform interface. The main window features a map viewer with a globe and flat earth options, showing a map of the Indian Ocean region with various vessels plotted. A legend on the left lists vessel types such as IRONWOOD(1), KHYAM(3), LUGAZI, MDK HANA(2), MDK HANA(2), MDK HANA(2), MILLENNIUM DAWN(1), MNI GLORY TH(2), MEYPPS VOYAGER TT 4(1), PILOT BOAT BANGKOC(2), QIN DELTA(3), TH QLOSG(2), TOBY TIDE(4), UNLAN ONET BBBB(1), and UNNAMED VESSEL. The interface includes a search bar, a list of search results, and a relationship diagram on the right side. The relationship diagram shows a central node labeled 'THIS VESSEL' connected to various other nodes representing different roles and entities, such as 'Company', 'Registered Owner', 'Bujior', 'HUB/Connector', 'New Bond Contractor', 'Vessel Operator', 'Detached Hostler', 'Vessel Register', 'Vessel Manager', 'Vessel Operator Country', and 'Vessel Owner'. The diagram also shows connections to 'Company' and 'Vessel' nodes.

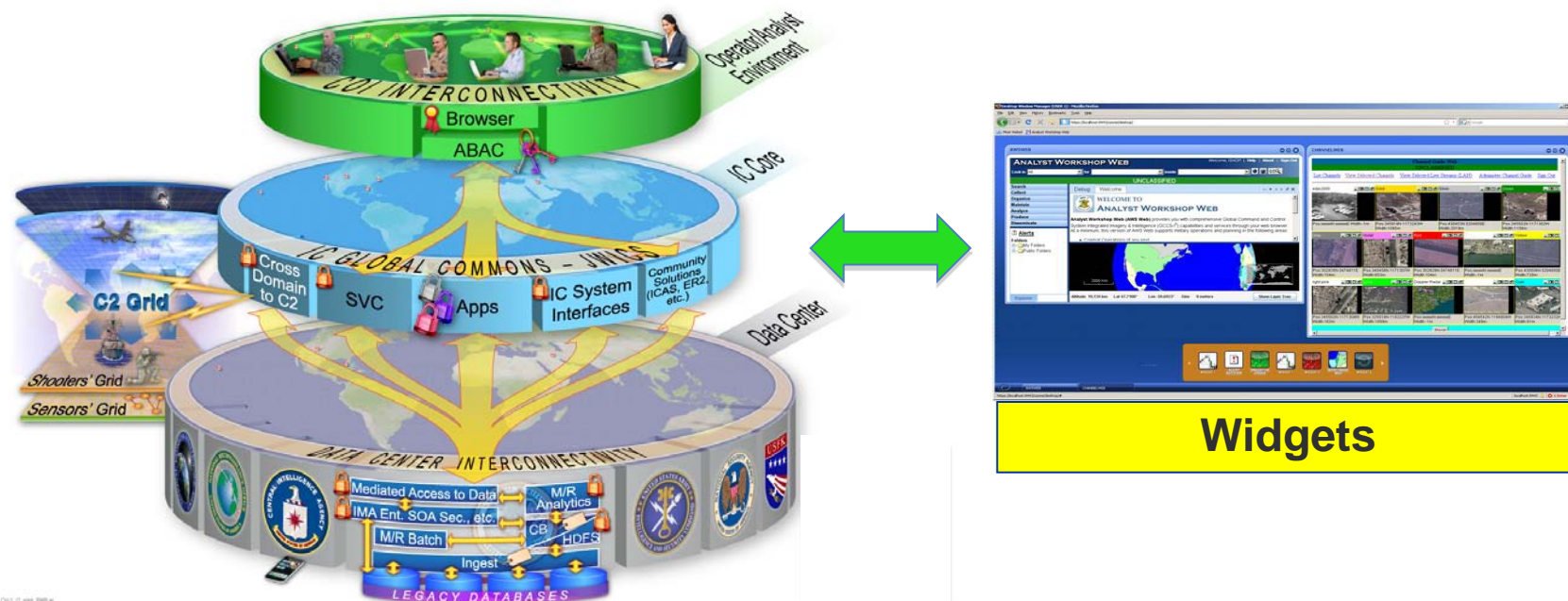
Scale: *Centralized storage and computing*

Subject Matter Expertise: *Centralized R&D*

How are we doing?

Associated Information

Information Integration Pilot

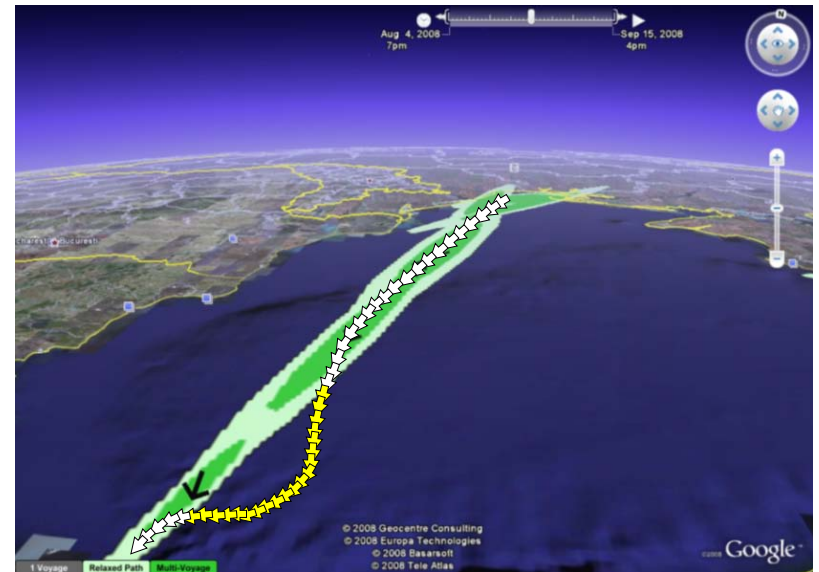


Scale: *Distributed Storage and Computing*
Subject Matter Expertise: *Modular Analytics*

How are we doing?

Behavior

Predictive Analysis for Naval Deployment Activities



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

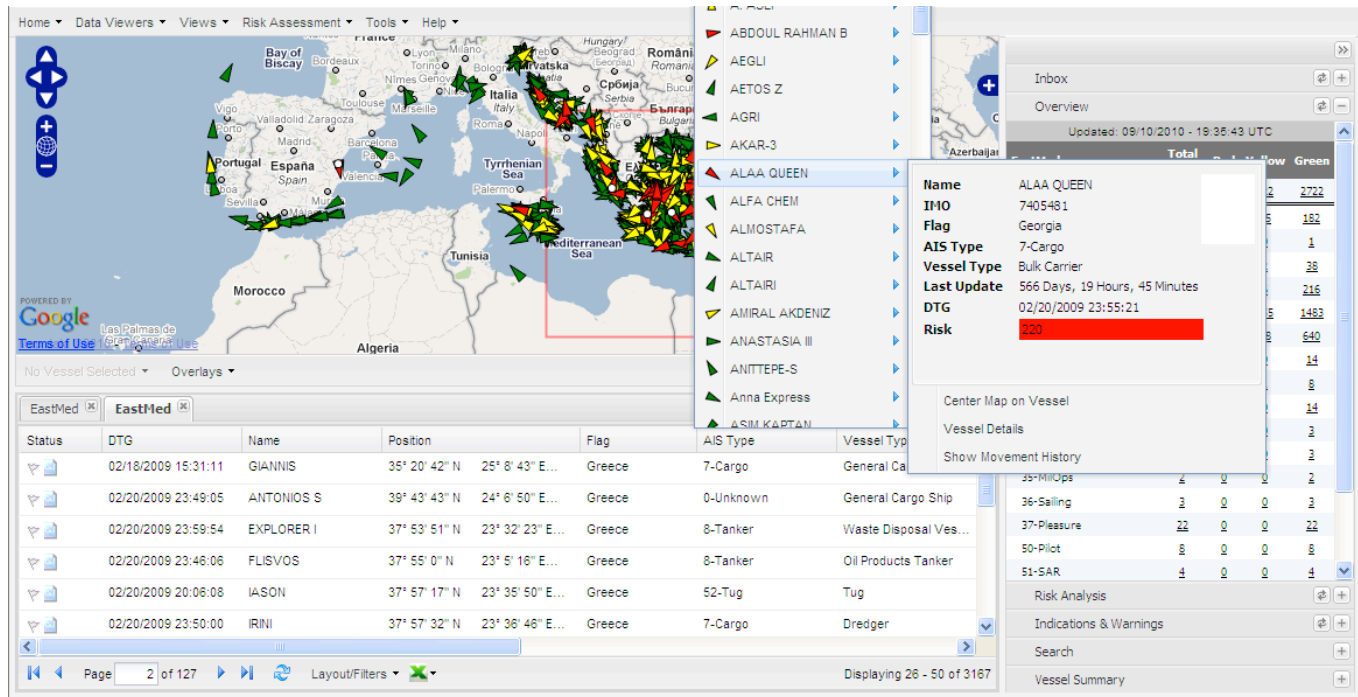
Attribute-based Access Control promotes:

- sharing with responsible data stewardship

How are we doing?

Knowledge

Computer Assisted Maritime Threat Evaluation System



Rules-based threat Assessment

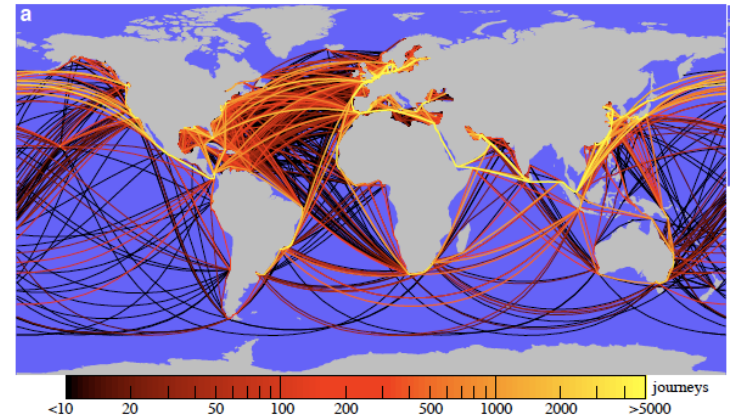
How are we doing?

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