

# Big Data Congress

## 6-8 November 2017

Maritime Security Panel  
Canadian Maritime Security  
Impact of Big Data

# Maritime Security and Big Data

- Maritime security
  - Canada – In Halifax, easy to understand Canada's connection and dependence on free access to the world's oceans
  - In Toronto, or Montreal , much less so!
  - Despite the lack of awareness of most Canadians, Canada is a true maritime nation
    - World's longest coastline on 3 oceans
    - Large ports on both coasts and on the St. Lawrence
    - With the exception of our trade with US, virtually all exports and imports travel by sea

# Canada's Ocean Estate



Map based on Wildlife Habitat Canada and Geo Insight ([www.whc.org](http://www.whc.org))

# Maritime Security and Big Data

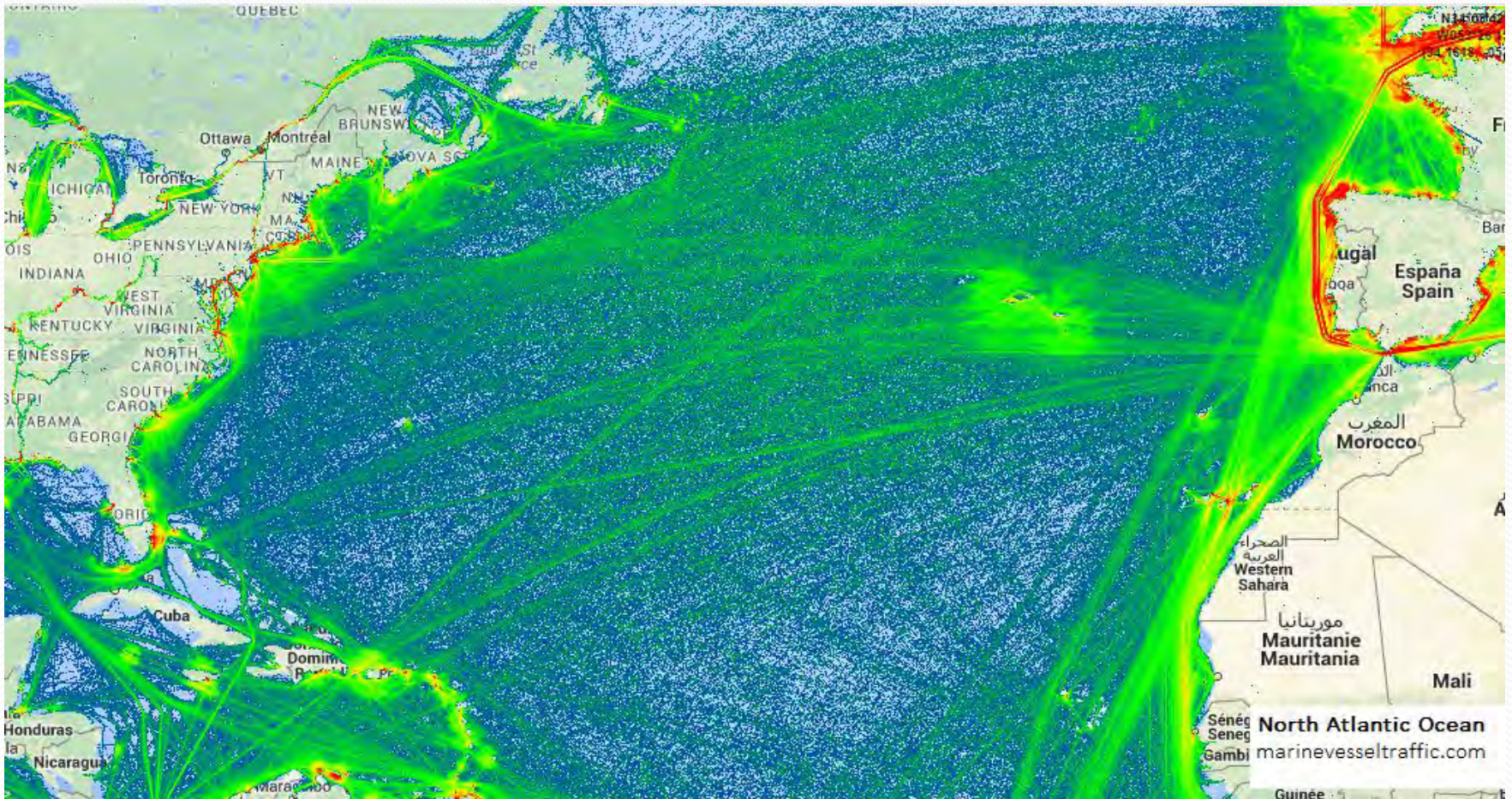
- Canada depends free access to the world's oceans for its security and prosperity
- According to some sources, 90% of the world's trade travels by sea including 2/3rds of world's oil
- Maritime commerce has quadrupled in last 4 decades with another doubling expected in next decade

# Maritime Security and Big Data

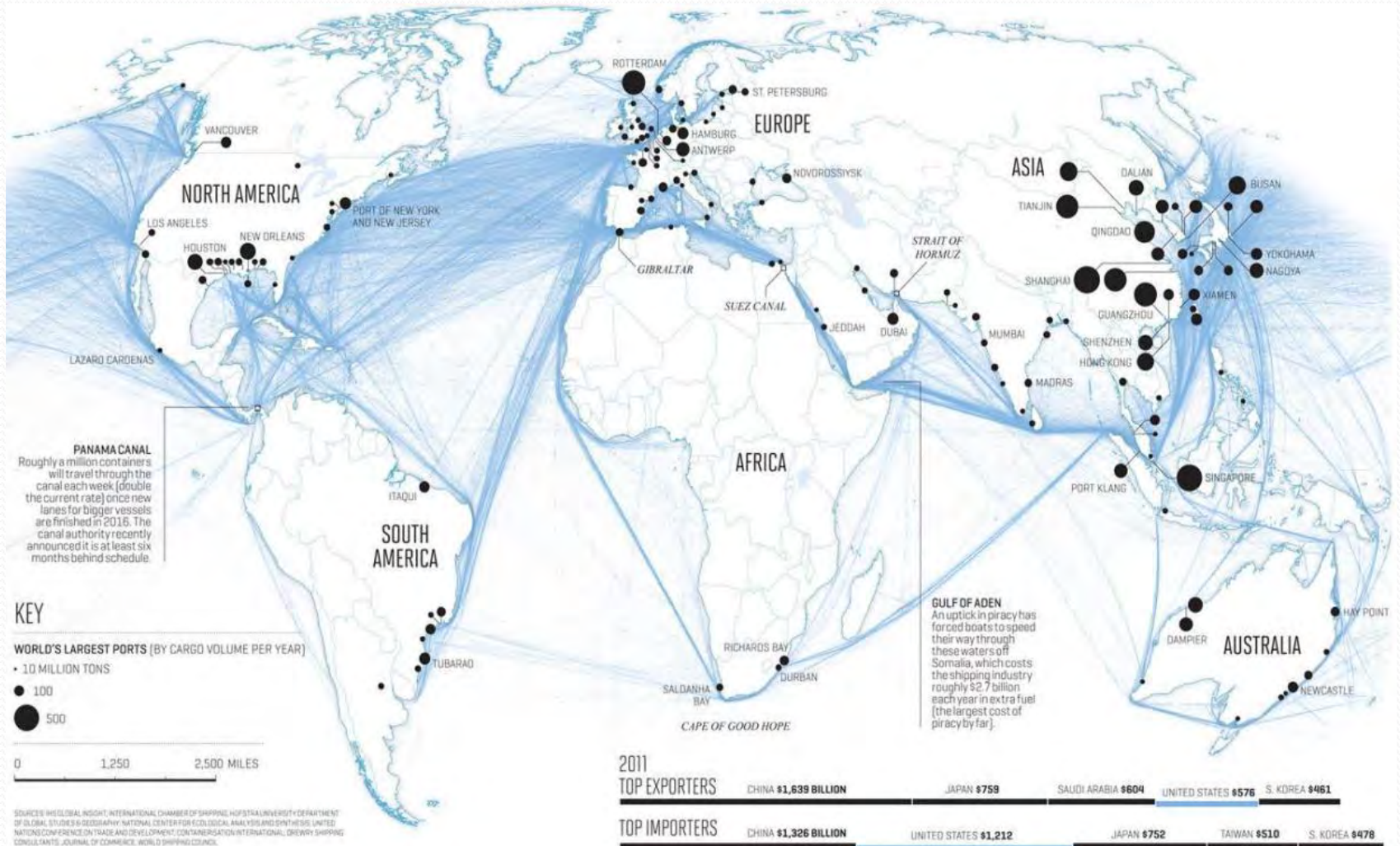
- Access to the ocean commons faces a number of challenges including:
  - Maritime geopolitics: Indian Ocean, South China Sea, and UNCLOS challenges
  - Diffusion of Maritime power with China's increased focus on its navy and with the resurrection of the Russian Navy
  - Climate change: Arctic warming
  - Demographics- Population centres on world oceans are growing
  - Access to energy
  - Globalization
  - Inability of some coastal states to exert control
  - Technology: Growth of Cyber and its potential impact on global shipping

# Maritime Security and Big Data

- What all this have to do with Big Data ?
  - AIS tracks in the Atlantic



# Maritime Security and Big Data



# Maritime Security and Big Data

- Maritime Security in Canada- Very much a shared responsibility between a number of departments and agencies including:
  - Transport Canada- Overall policy coordination for Maritime Security
  - Department of National Defence- RCN- Monitors and controls military activities in EEZ, territorial seas, assists OGD in fisheries, drug interdiction, responds to terrorist threats, and SAR
  - RCMP – overall responsibility for National security



# Maritime Security and Big Data

- Shared responsibility :
  - Canadian Border Services Agency- Controls national borders including maritime
  - Canadian Coast Guard- Canada's Maritime Safety agency, aids to navigation, vessels and capabilities to DFO
  - Canadian Security and Intelligence Service- Intelligence gathering on maritime threats
  - Public Safety Canada- Coordinates activities of CSIS, RCMP and CBSA, national enforcement and policing activities
  - Ports Canada- Administers ports across the nation working with local port authorities

# Maritime Security and Big Data

- Shortly after 9/11, GOC established Interdepartmental Maritime Security Working Group, chaired by Transport Canada
- Since 2001, maritime security rests on four main elements:
  - Domain Awareness: surveillance and awareness of ships, people and cargo within marine areas;
  - Responsiveness: cooperation with all relevant police forces and security agencies to disrupt, intercept and apprehend would-be terrorists and/or their devices;
  - Safeguarding: enhancement of the physical security of marine infrastructure and other critical infrastructure in or around marine areas and enhancement of personnel security within marine areas;
  - Collaboration: harmonization with stakeholders of security frameworks, information sharing and coordinated approaches to marine security

# Maritime Security and Big Data

- With so many agencies involved in maintaining maritime security, managing data has become a big issue.
- Main tool is the Recognized Maritime Picture (RMP)- Plot compiled to depict Maritime activity
- DND manages RMP compilation through the Maritime Security Operations Centres (MSOC) located on the Atlantic, Pacific and on the Great Lakes

# Maritime Security and Big Data

- RMP compiled from multiple sources:
  - Automatic self-reporting positional systems (AIS)
  - Vessel traffic management systems (CCG)
  - Air patrol surveillance systems (DND, DFO and others)
  - High frequency surface radars,
  - Electronic intelligence systems,
  - Radar space systems (Radar Sat 2)
  - HF direction finding sensors
  - Allied nations such as US, UK and NATO

# Maritime Security and Big Data



*Figure 2: Unclassified example of the Recognized Maritime Picture (RMP) off the coast of Nova Scotia, Canada. Green indicates land while blue indicates ocean. Each contact is indicated using a symbol and descriptive text.*

# Maritime Security and Big Data

- Issues:
  - Fusing data from multiple sources while trying to use and interpret data in an intelligent manner
  - Too many tracks from different sources that represent the same target. Human intervention needed for accurate identification
  - Data privacy when collected from variety of sources
  - Data protection
  - Multiple stakeholders
  - Ownership of data products
  - Interdepartmental cooperation (Lack)
  - Differing data protocols
  - Displaying of data

# Maritime Security and Big Data

**VOLUME:**  
Petabytes of  
data

## 5 Vs of Big Maritime Data

**VALUE:**  
Ship maintenance  
predictions  
Oil spill location  
accuracy

**VARIETY :**  
Historical Data  
Routes and travel  
incidents  
Weather Buoys  
and wave data

**Velocity:**  
Real time streaming  
data  
Ship Routes and  
trajectories  
Weather  
observations

**Veracity:**  
Duplication  
Ambiguous  
data

# Maritime Security and Big Data

- Maritime Data Architecture Requirements:
  - Recognition of multiple stakeholders
  - All data sources stored in the cloud
  - Need to manage:
    - Data security
    - Privacy
    - Access control
    - Data analytics
    - Data visualization
    - Data integration
    - Query processing
    - Multiple applications
    - User Interfaces



# Maritime Security

Sources

# Maritime Security and Data

- Following sources consulted for this presentation:
  - Royal Canadian Navy: LEADMARK: Canada in a new Maritime World. Ottawa, 2016
  - Laura Kinney: Canada's Marine Security. Canadian Naval Review, Vol 4, Winter 2009
  - Ionna Latral, et al: A Big Data Architecture for Managing Oceans of Data and Maritime Applications. Zenodo. <http://doi.org/10.5281/zenodo.833359>. June 2017
  - Christof Claramont, et al: Maritime Data Integration and Analysis: Recent Progress and Research Challenges. Open Proceedings, 2017