Cybersecurity and the Marine Transportation System

The Evolving Threat…Call to Action

"Cybersecurity is one of the most serious economic and national security challenges we face as a nation…"

- President Obama, February 2013

"All sectors of our country are at risk…the seriousness and the diversity of the threats that this country faces in the cyber domain are increasing on a daily basis."

- DNI Director Clapper, March 2013

"Cybersecurity is a matter of homeland security...we are all connected online and a vulnerability in one place can cause a problem in many other places…cybersecurity is one of our most important missions."

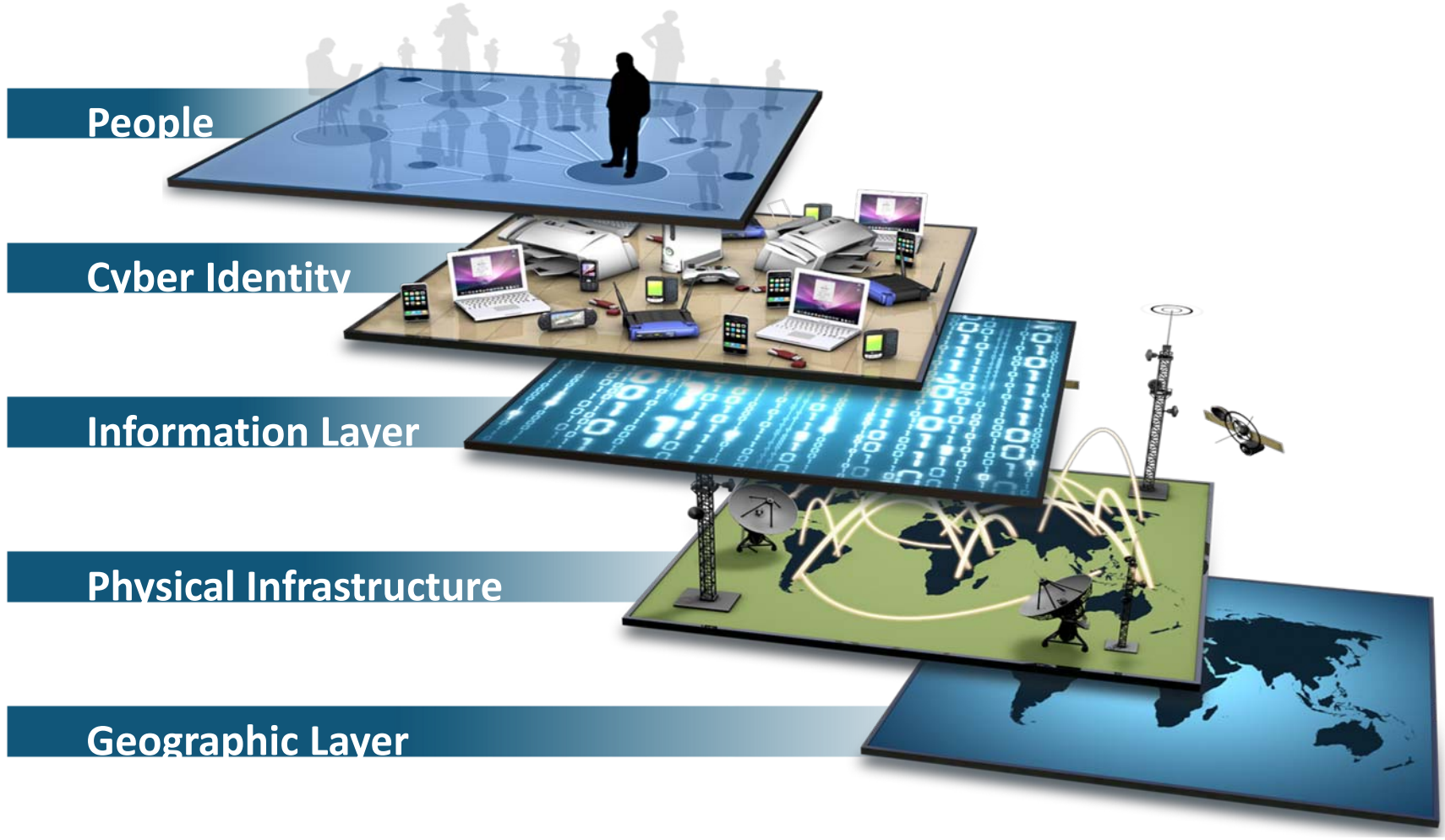
- Secretary Johnson, April 2014

"Cyber affects the full spectrum of Coast Guard operations…it cuts across every aspect of the Coast Guard. We all have a role in cybersecurity and protection of our networks, and we must treat them like the mission-critical assets that they are."

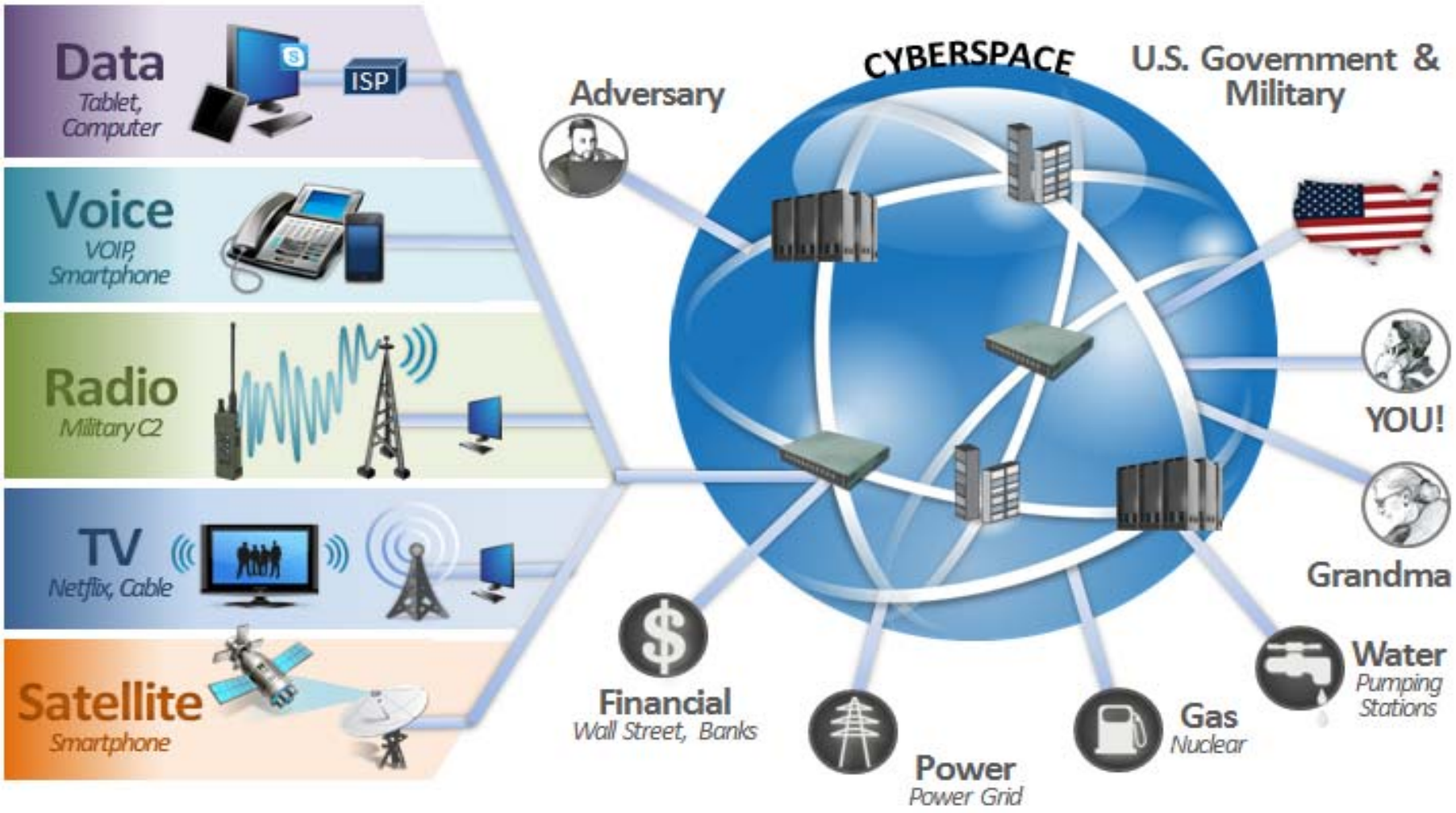
- Admiral Zukunft, September 2014

Homeland Security

The Cyber Environment



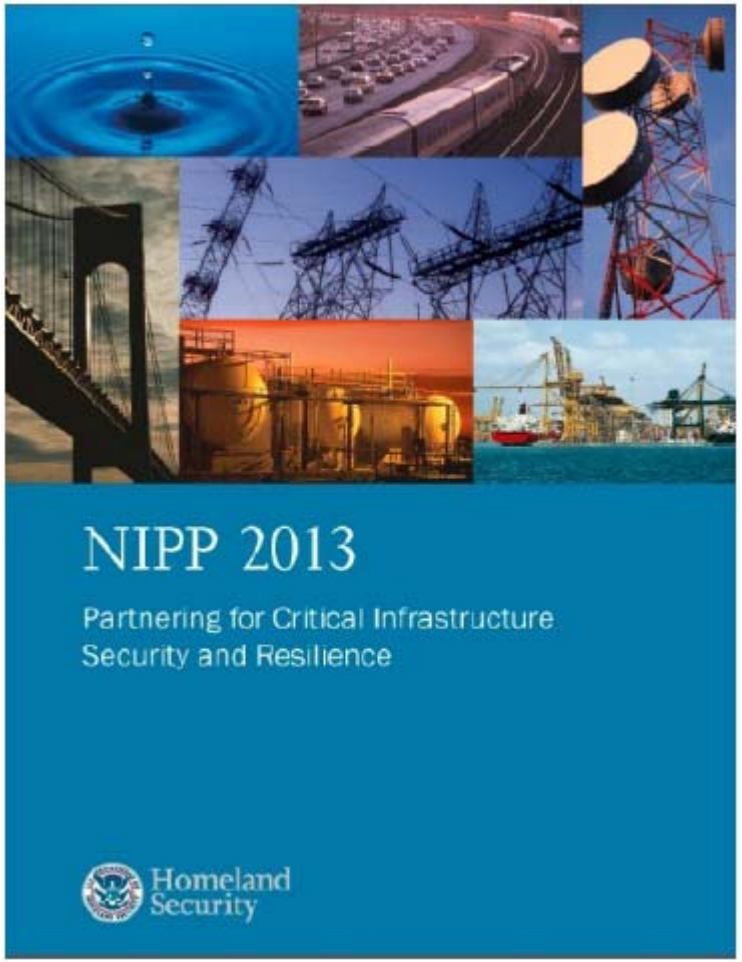
Convergence of Opportunities and Vulnerabilities



Maritime Critical Infrastructure

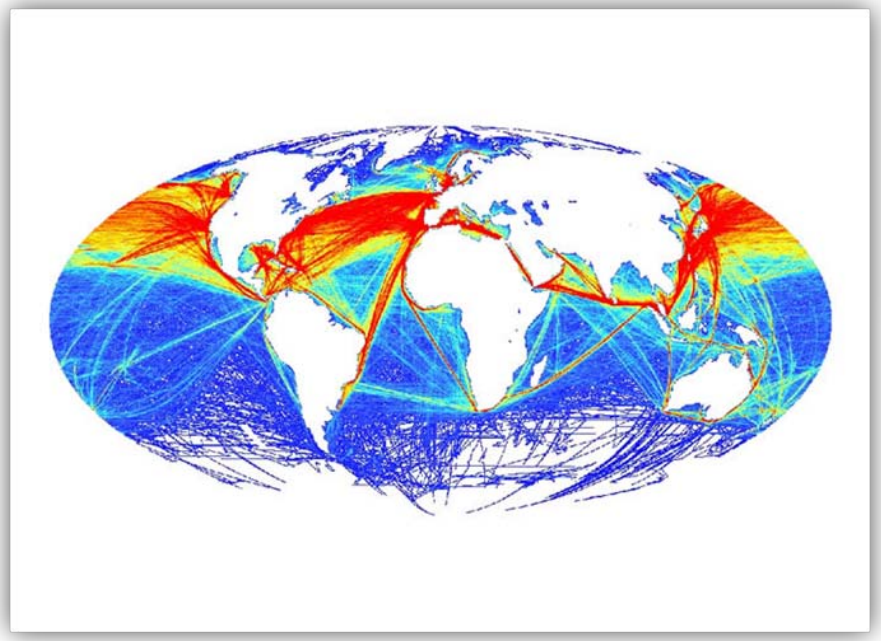
The Coast Guard is the Sector Specific Agency (SSA) for the Maritime component of the Transportation Sector

- 1 of the 16 Critical Sectors
- Collaboration with our partners in TSA and DOT
- Protect maritime sector from all threats (physical, personnel, and *cyber*)



Why the Maritime is Important

- 95% of all U.S. overseas trade through 360 ports
- $1.3 trillion in cargo annually



- 7,000 oceangoing vessels made 55,560 port calls annually
- Secure ports support Homeland Security and National Defense Ops

Intermodal Touch-points

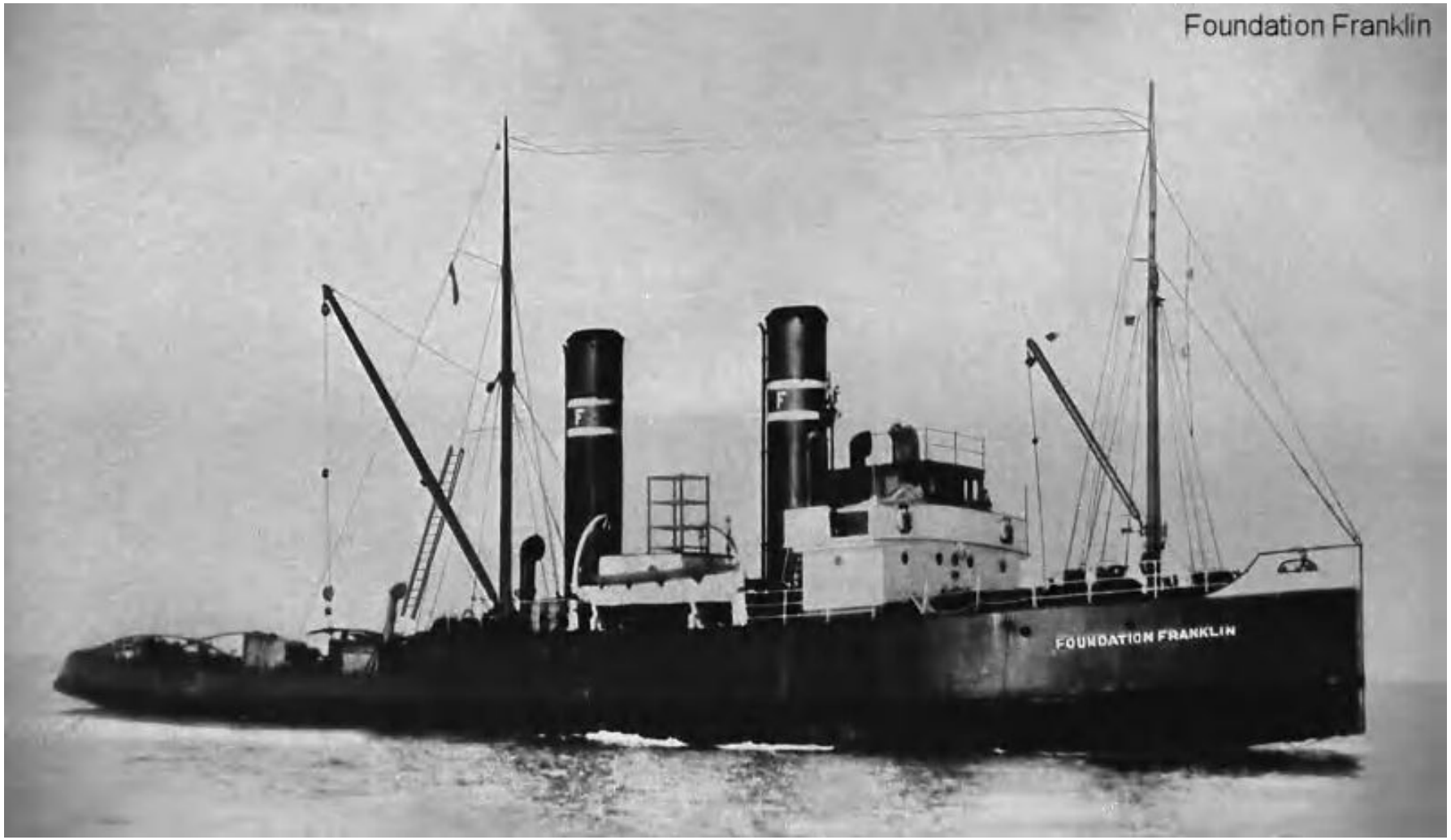
Maritime Disruptions on MTS have proven costly

- These incidents reflect cost of a maritime disruptions.
- These may not have been caused by a cyber-based failure, cyber incidents can have similar or greater consequences

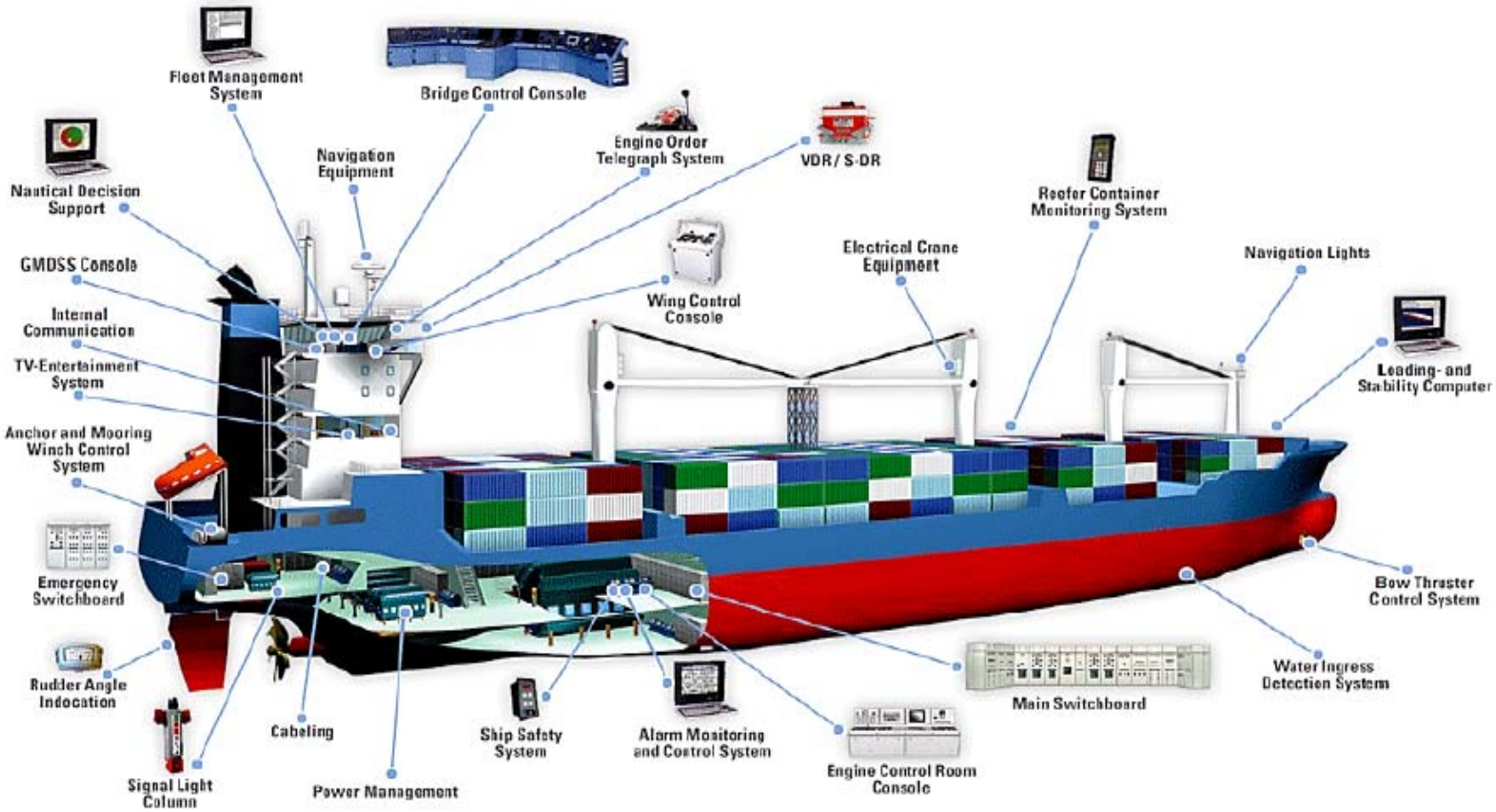
- **1989: Exxon Valdez, $7+ billion dollars**
- **2002: West Coast port shutdown, $11 billion dollars**
- **2010: Deepwater Horizon, $37+ billion dollars**
- **2013: USS Guardian, $300 million dollars**
- **2015: Port Labor Slowdown on West Coast**

(Containers and ships sit idle at the Port of Long Beach, Calif.)

Ships Then



Ships Now


Fleet Management System
Bridge Control Console
Navigation Equipment
Engine Order Telegraph System
VDR/S-DR
Nautical Decision Support
Reefer Container Monitoring System
GMDSS Console
Wing Control Console
Electrical Crane Equipment
Navigation Lights
Internal Communication
Loading- and Stability Computer
TV-Entertainment System
Anchor and Mooring Winch Control System
Emergency Switchboard
Bow Thruster Control System
Rudder Angle Indocation
Water Ingress Detection System
Main Switchboard
Cabeling
Ship Safety System
Alarm Monitoring and Control System
Engine Control Room Console
Signal Light Column
Power Management

Cargo Operations Then

Cargo Operations Now

Cargo handling equipment at the port/railway interface

Commercial Long-Haul Trucks

Port Security and Access Controls (physical, CCTV, gates, TWIC, ID cards)

Container Cranes (or liquid cargo handling systems at oil, chemical and LNG terminals) at vessel/port interface

Automated cargo handling equipment, vehicles and similar conveyances

Shore-based systems that directly support safe vessel operation and navigation:

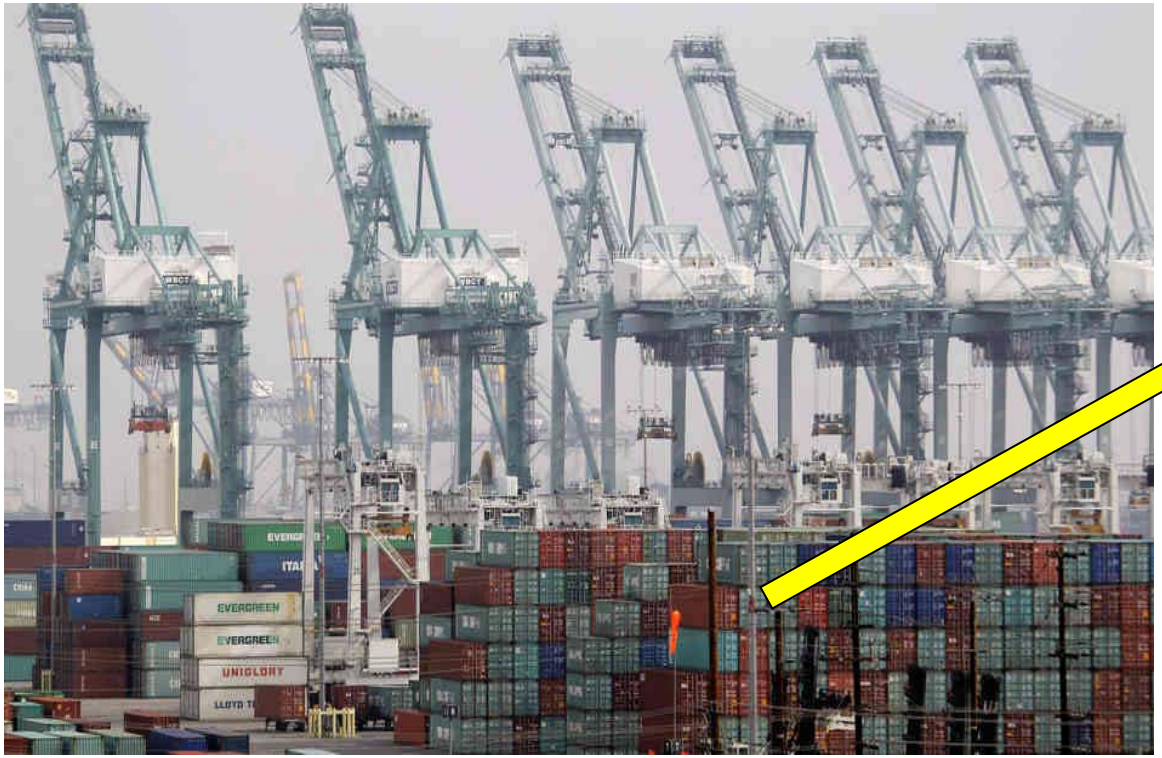
- GPS
- Lock operation
- Communications
- Maintenance and management
- Systems aboard USCG vessels, tugs, fire boats, port police
- Pollution response systems

Automated Cargo Container Tracking Systems

Terminal Operating Center (financial, communications, customs, security and other back office functions)

Differing Perspectives on Security

Asset Owner's Perspective

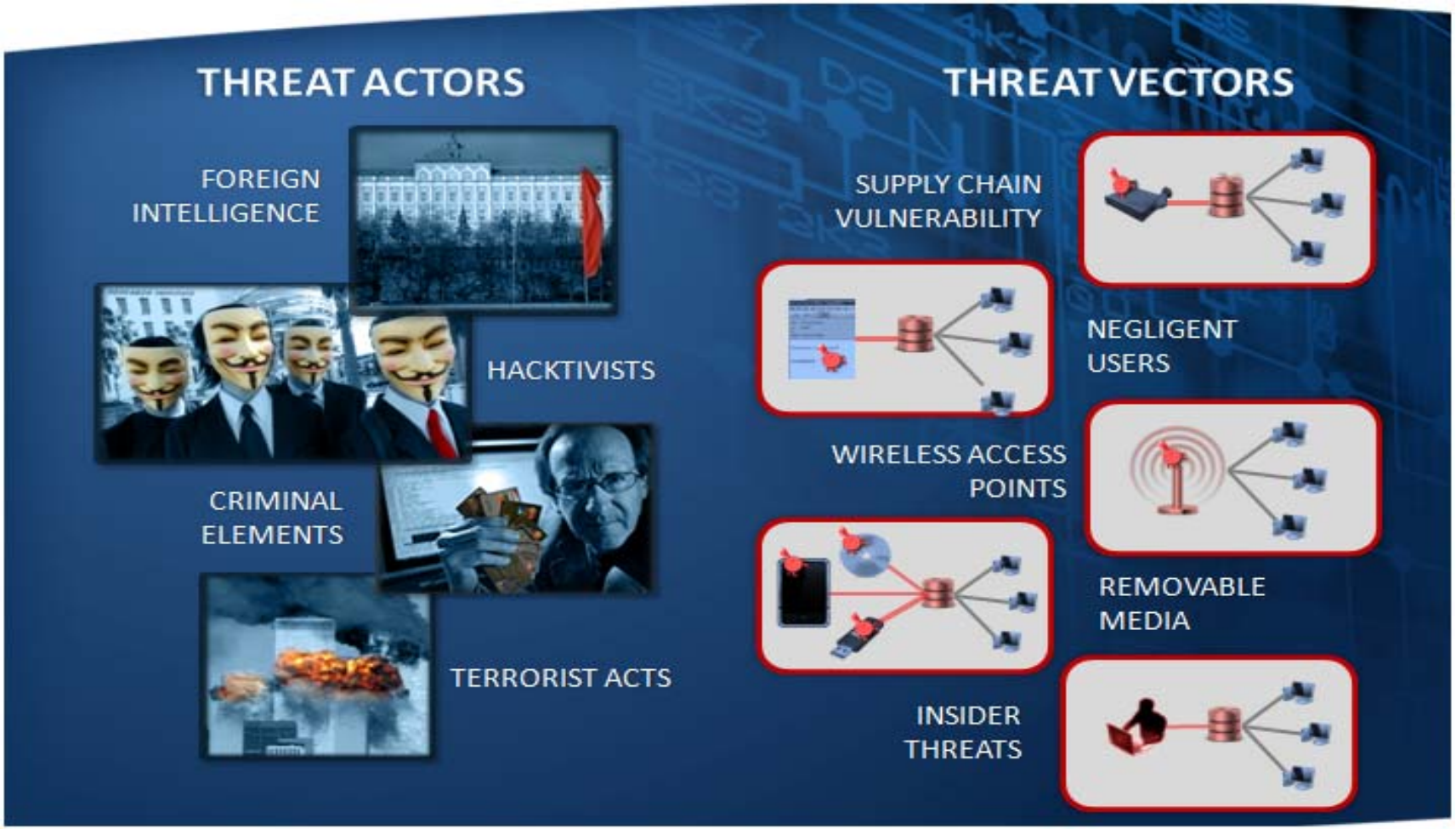


Cyber Threat Actor's Perspective

Types of Cyber Threats We are Facing

- Hackers/Intrusion Sets
- Phishing
- Social Engineering or Elicitation
- Malicious Code
- Watering Holes
- DDoS/SQL Injections
- Ransomware

Threat Actors



Hackers Used to Facilitate Drug Smuggling

By breaking into the offices of a harbor company, the criminals could install key-loggers to take control of computers

MODUS OPERANDI

Computers of container terminal were hacked so the containers that contained drugs could be monitored

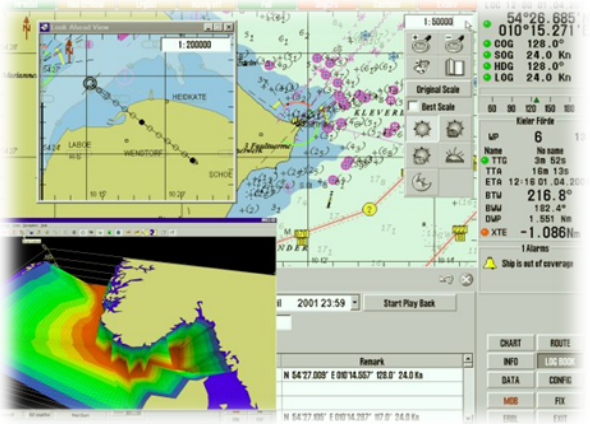
1044 kilos cocaine/1099 kilos heroin

By means of false papers and a hacked pin code, the drivers were able to pick up the container at a location and time of their choosing

ECDIS Vulnerabilities

Electronic Chart Display and Information System (ECDIS)

- Computer system usually installed on the bridge of a ship used for navigation
- Interconnected with numerous shipboard systems and sensors (AIS, NAVTEX, Speed Log, fathometer)
- Chart updates loaded via internet or CD/USB
- Penetration Testers found numerous security weaknesses including; ability to read, download, replace, or delete any file stored on the host server
- System could be penetrated directly or via one of the other systems linked to ECDIS



Source: CyberKeel 15 October 2014

Insider Threat – Malware via USB Device

What happened?

- Targeted attack against refinery
- Disgruntled employee loaded malware on company computers
- Impact to business systems
- Remediation required 3rd party assistance

Oil Rig Stability

What happened?

- Attacker managed to tilt floating oil rig off the coast of Africa
- Facility forced to shut down
- One week to identify cause and mitigate effects

Source: Reuters 23 April 2014

GPS Anomaly – Impact to facility operations

What happened?

- GPS disruption lasting for over 7 hours
- Disruption caused two ship to shore cranes to cease operations due to lack of position data
- Operation of two additional cranes degraded

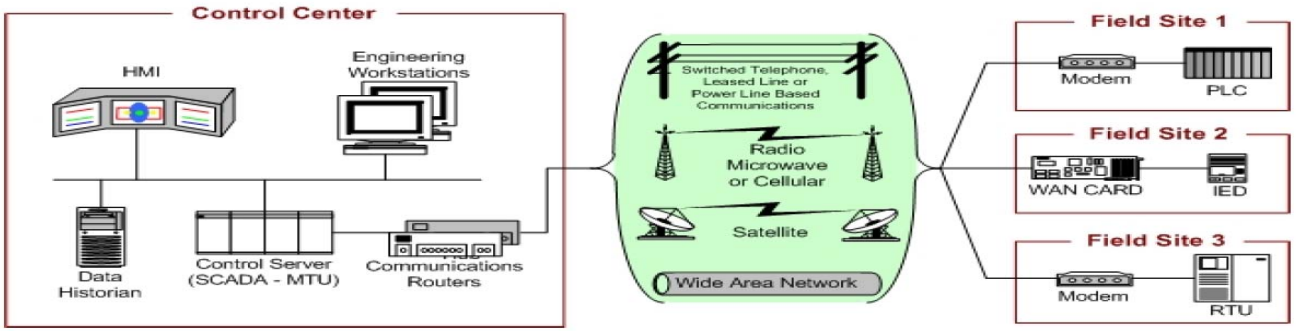
Industrial Control Systems (ICS)

BlackEnergy

- Sophisticated campaign
- Ongoing since at least 2011
- Highly modular
- Targets human-machine interfaces (HMI)
- Modules search out network-connected file shares and removable media for lateral movement

Havex

- Remote Access Trojan
- Multiple infection vectors (phishing, website redirects, watering hole attacks on ICS vendor websites)
- Targeted energy and oil sectors
- ICS/SCADA scanning



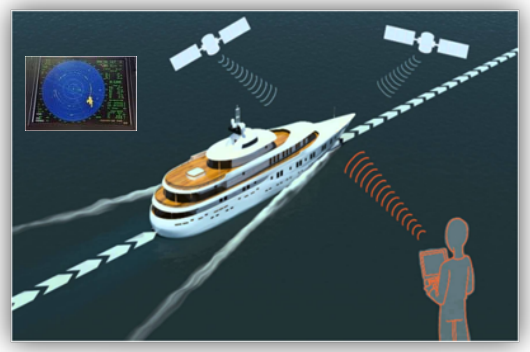
Types and Impacts of Exploiting ICS

- **Direct physical damage to affected equipment and systems…**
  - by exploiting an ICS, the controlled mechanism can fail with catastrophic results, damaging a single piece of equipment, interrupting a larger system, or disabling or destroying an entire ship.
- **Small-scale, local disruptions…**
  - which damage or interrupt individual systems or single ships within a single organization, without widespread impact beyond the affected function or service.
- **Injury or death to operators, passengers or the general public.**
  - An incident can affect an single operator or a larger number of crewmembers or bystanders. Targeted attacks on a safety-critical safety can result in a fire or explosion that injures or kills hundreds.
- **Catastrophic disruptions to the transportation system.**
  - A vessel sunk in a shipping channel, an explosion at an oil or LNG facility, sabotage to canal locks, or a series of mishaps involving cargo container cranes in critical ports can have long-term impacts to the safety, stability and reliability of elements of the transportation system.

Volpe, 2013

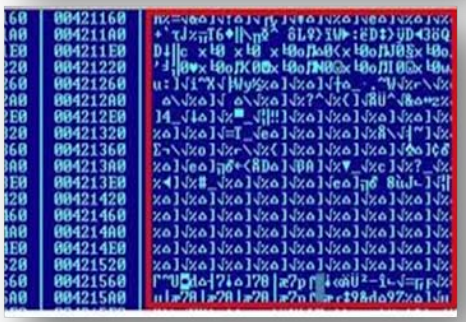
GPS Spoofing

- University of Texas at Austin “Proof of Concept”
- Attacker transmitted spoofed GPS signal
- Signal overrode civilian GPS
- Obtained control over primary/back-up GPS (no alarms on radar, gyro, or compasses)
- “Attacker” gained navigational control of ship and redirected course



Final Thought...Saudi Aramco

- National oil company of Saudi Arabia
- One of the largest producers of oil in the world
- Targeted cyber attack
- Data destroying malware
- 30,000 computers turned into paperweights



What would your organization do if all of your company's computers stopped working?

ACT
Achieving Cybersecurity Together

"It's our Shared Responsibility".







Homeland Security