

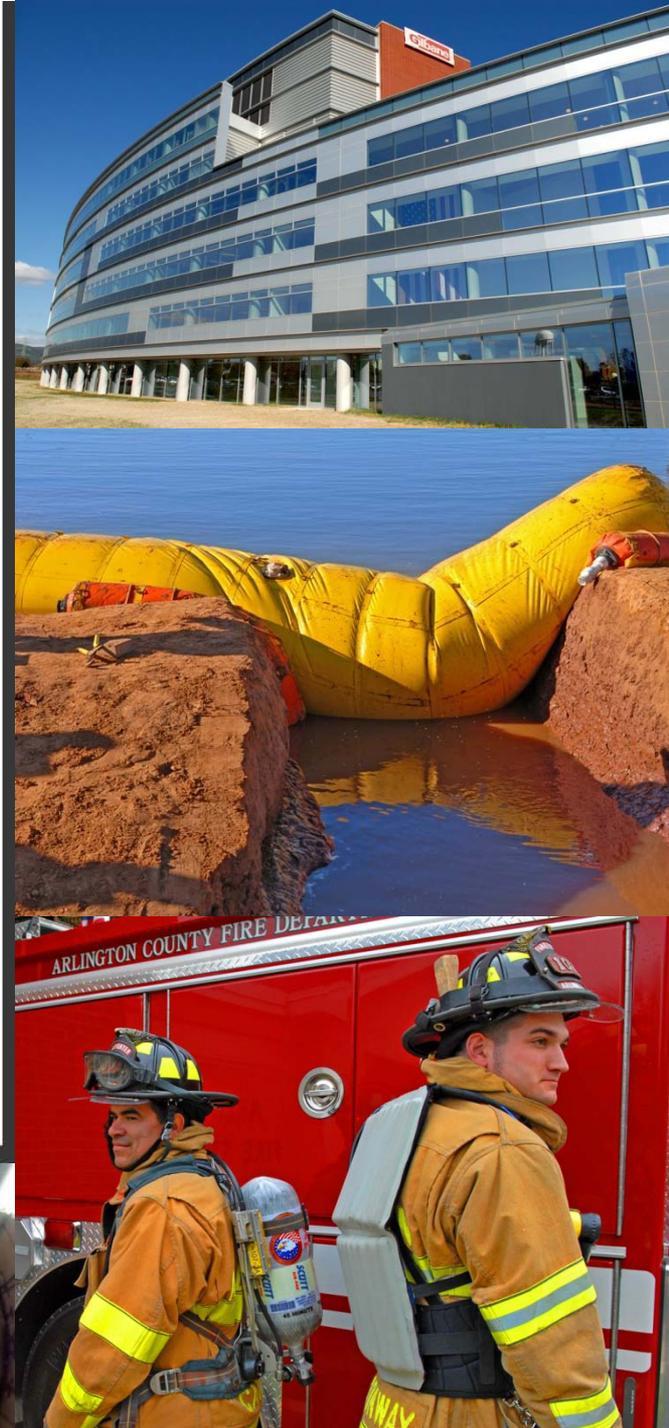
# 5<sup>th</sup> Annual University Network Summit

## Science and Technology Directorate

**Tara O'Toole, M.D., M.P.H.**

Under Secretary for Science and Technology  
U.S. Department of Homeland Security

March 31, 2011



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# Key Points

- DHS Missions are broad, complex, and dynamic
- Implications for S&T priorities, organization
- Strategic challenges for homeland security R&D
- Complex systems fail complexly



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# Quadrennial Homeland Security Review

## DHS Missions

1. Preventing Terrorism and Enhancing Security;
2. Securing and Managing Our Borders;
3. Enforcing and Administering Our Immigration Laws;
4. Safeguarding and Securing Cyberspace; and
5. Ensuring Resilience to Disasters.



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# DHS S&T Mission

*Strengthen America's security and resiliency by providing knowledge products and innovative technology solutions for the Homeland Security Enterprise*



# S&T Goals

**Goal 1:** Rapidly develop and deliver knowledge, analyses, and innovative solutions that advance the mission of the Department

**Goal 2:** Leverage technical expertise to assist DHS components' efforts to establish operational requirements, and select and acquire needed technologies

**Goal 3:** Strengthen the Homeland Security Enterprise and First Responders' capabilities to protect the homeland and respond to disasters

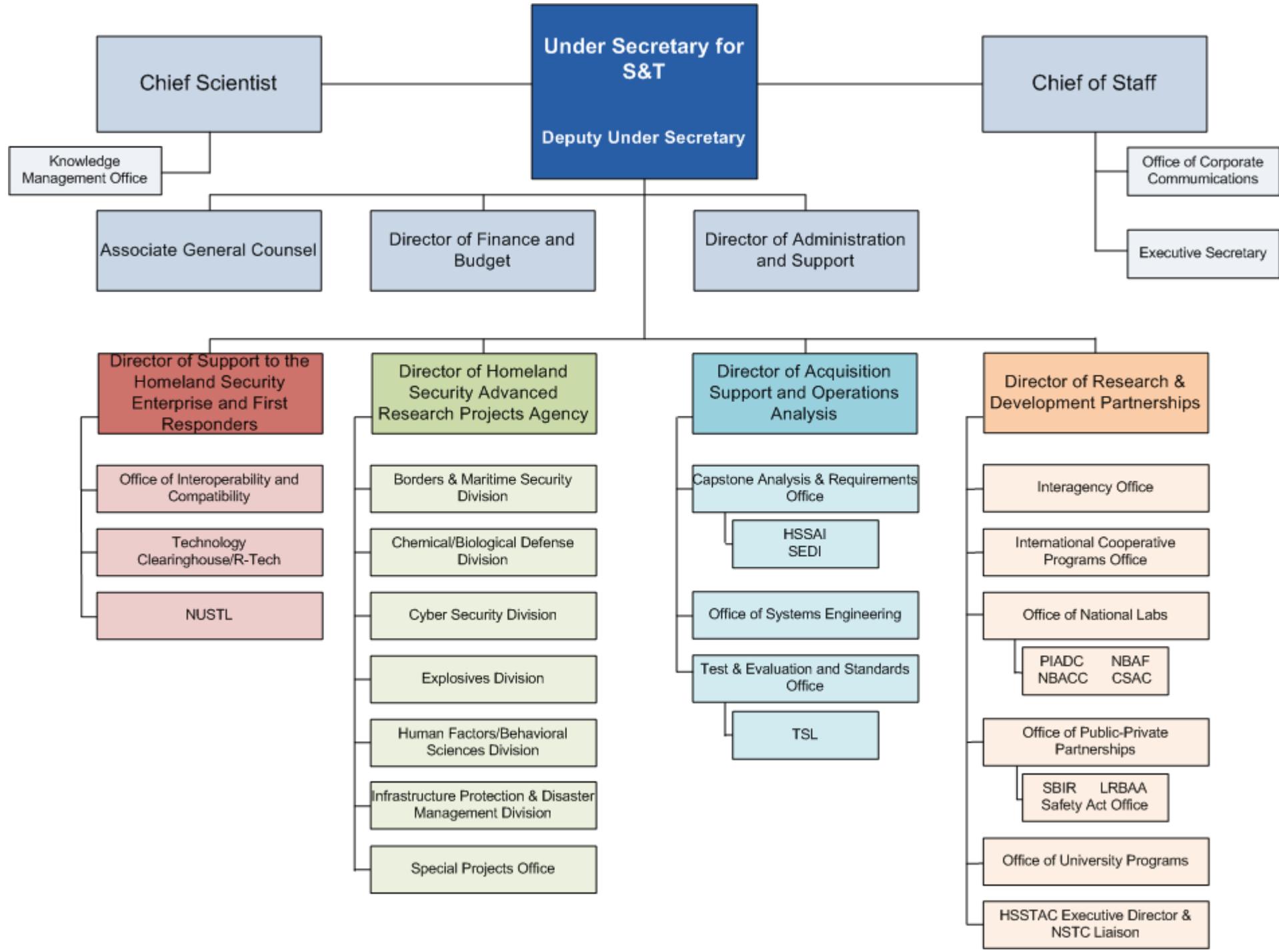
**Goal 4:** Conduct, catalyze, and survey scientific discoveries and inventions relevant to existing and emerging homeland security challenges

**Goal 5:** Foster a culture of innovation and learning, in S&T and across DHS, that addresses challenges with scientific, analytic, and technical rigor



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# Evolution of Terrorist Attacks in Aviation

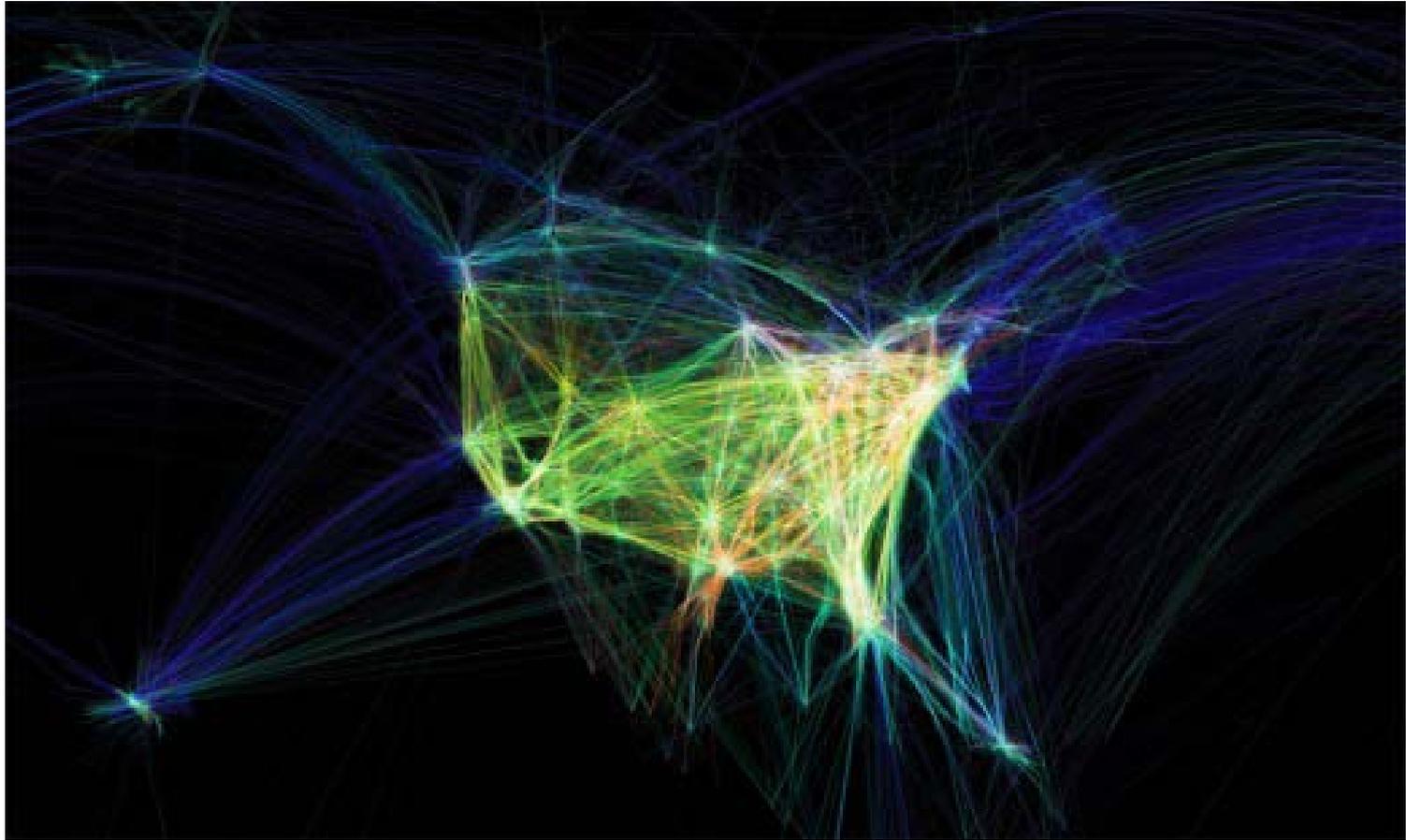
Time	Event/Threat	Vulnerability	Response
1970's	Hostage/Hijacking	Guns, weapons	Magnetometers
1988	Pan Am 103, Lockerbie	Bomb in baggage	Baggage scans
Sept 2001	WTC, PA, Pentagon	Box cutters, etc	TSA
Dec 2001	Richard Reid	Shoe bomb	Shoes removed
2004	Chechen suicide attacks	Vests	Pat downs, backscatter
2006	Heathrow liquids plot	Novel liquid bomb	Liquids ban
2009	Non-metallic body bomb	Body bomb in sensitive area	ETD, WBI, pat down
2010	Printer cartridge bombs	Explosives packed in cargo	Trace detection for cargo



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# US Airline Flight Density



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*Sources:Koblin*

# Worldwide Airline Flight Density

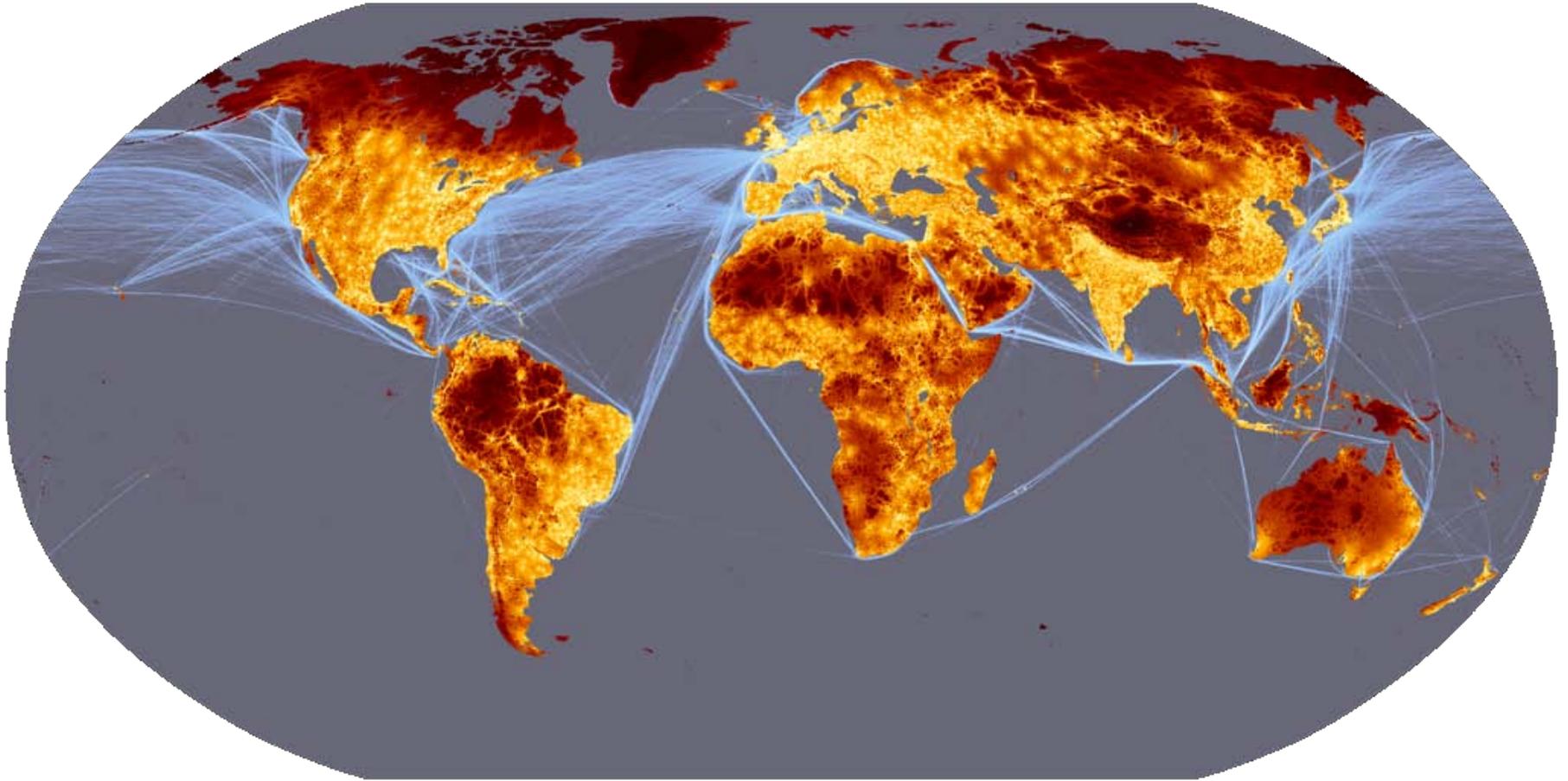


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*Sources: Sullivan*

# Worldwide Land and Sea Shipping Density

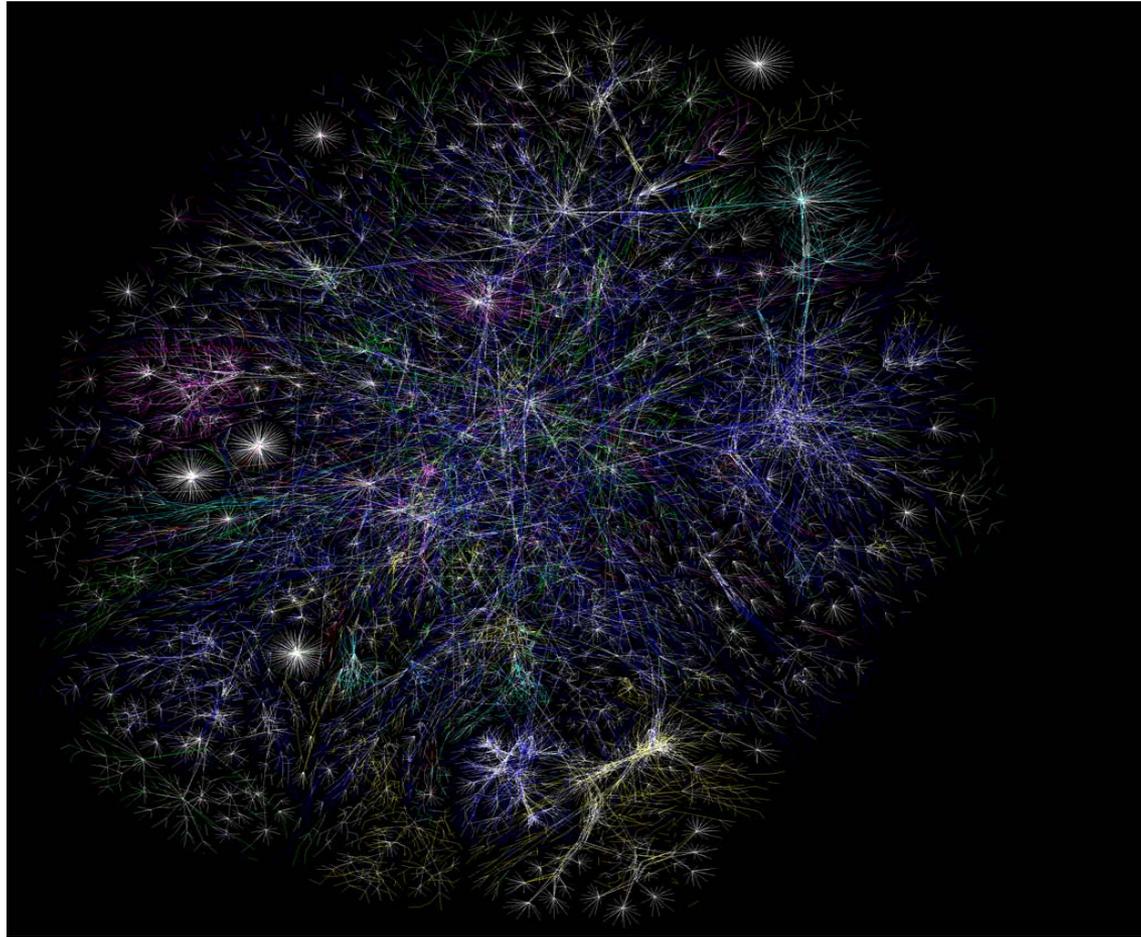


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*Sources: Uchida, Nelson*

# Visualization of the Internet



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*Sources: OPTE Project*

# Complex Systems Fail Complexly

“In complex industrial, space, and military systems, the normal accident generally (not always) means that the interactions are not only unexpected, but are *incomprehensible* for some critical period of time.”

- Charles Perrow, *Normal Accidents*, 1984



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# Deepwater Horizon



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*Sources: Reuters, Wikimedia Commons*

# Japanese Earthquake and Tsunami

Magnitude 9.0



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Sources: AP, Reuters

# Fukushima 1 Nuclear Power Plant



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Sources: Digital Globe, TEPCO, GE

# September 11, 2001



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*Sources: Gobetz, Jagendorf*

# Resilience



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Sources: Getty, AP

# Imagination

*“Imagination is more important than knowledge. For knowledge is limited, whereas imagination embraces the entire world, stimulating progress...”*

- Albert Einstein, 1929



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