



Coastal Intelligence for Improving Positioning, Expanding Commerce and Coastal Marine Transportation

Dr. Neil D. Weston

National Oceanic & Atmospheric Administration

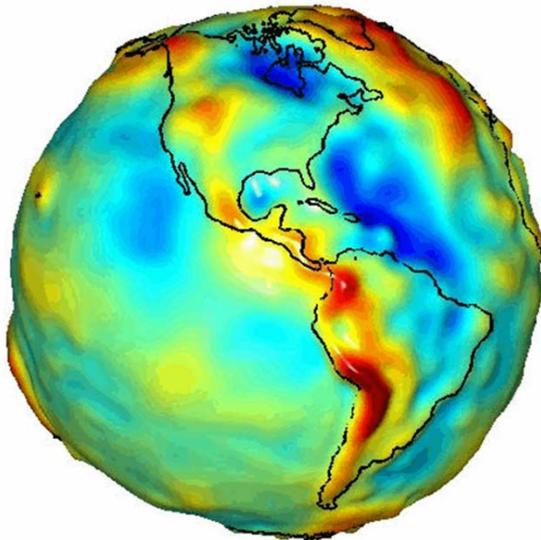
Outline

- Geodetic Review
- Geospatial Infrastructure for Commerce
- Coastal Intelligence
- Marine Transportation

Geodetic Review

Why is geodesy important?

The Earth is an irregular surface and quite difficult to model. Accurate positions and other geospatial data are required for a wide variety of applications.



- Surveying / Engineering
- Positioning / Navigation
- Gravity / Geoid Modeling
- GIS / LIS
- Sea Level Change / Tides / Currents
- Modeling
- Remote Sensing
- Science / Monitoring

Surveying and Engineering



Source: Zurich-American Insurance Group

Coordination

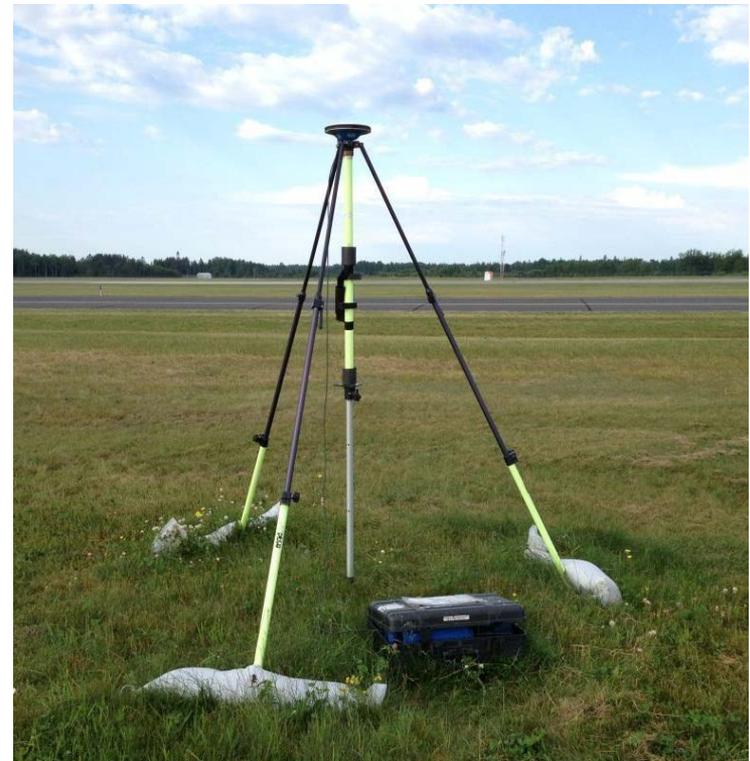


Data / Records



Infrastructure

Accuracy



Observations

Positioning and Navigation



Traffic Optimization



Shipping and Commerce



Precision Aviation

Integrating Systems



Sea Level / Tides / Currents

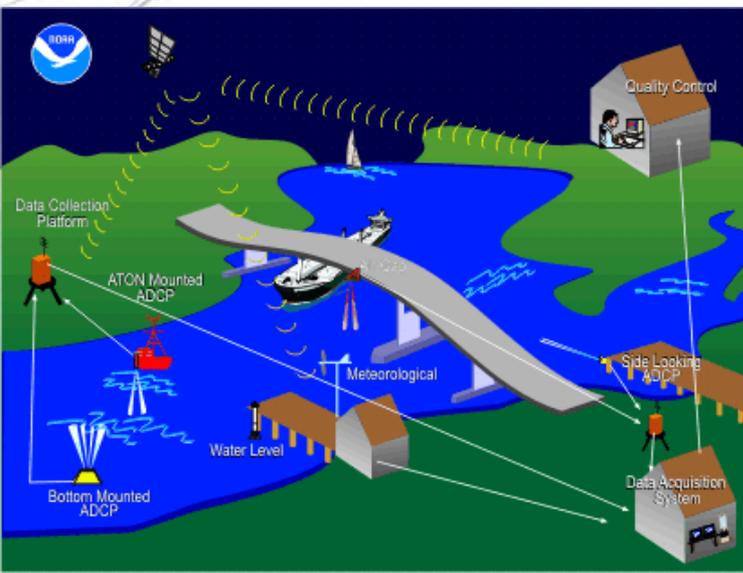
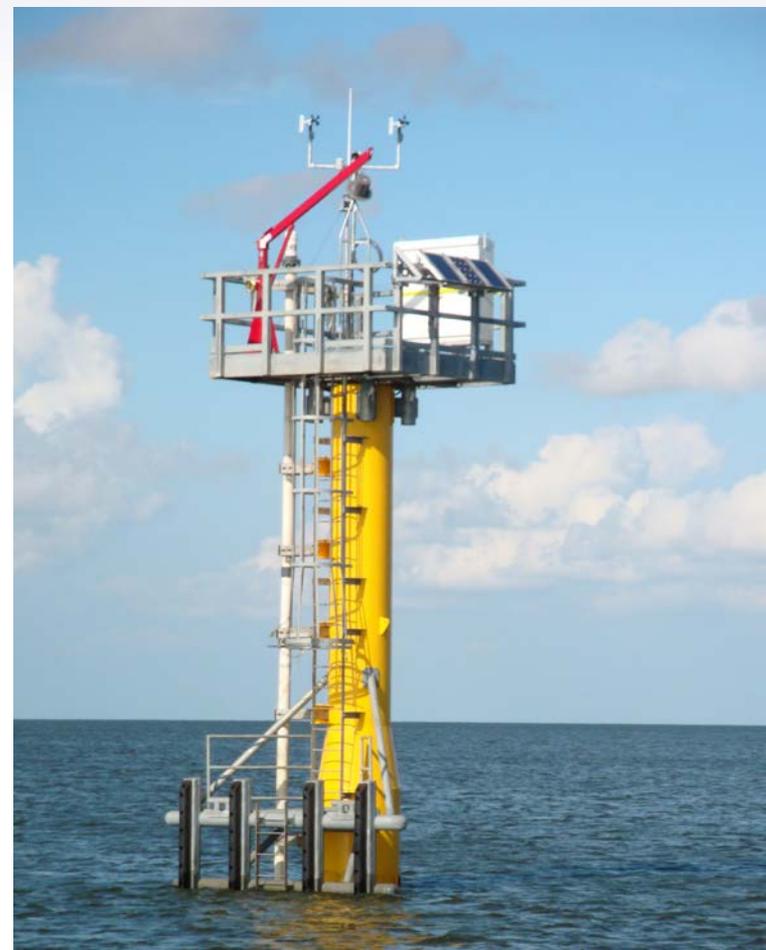
Real Time Systems

- External Components
- Independent Events
- High Speed Execution
- Fast Response
- Low Overhead
- Some Events Related

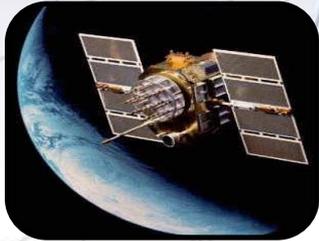
Integration



Local &
Offshore Measurements



Geospatial Applications



Satellite Orbits



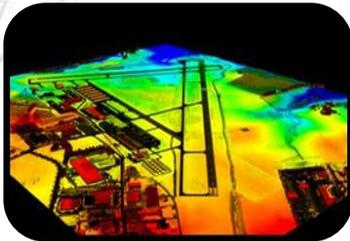
Height Modernization



Remote Sensing



Coastal



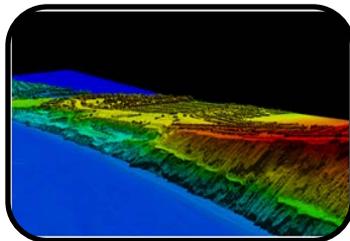
Aviation



VDatum



CORS



Coastal Mapping



Consulting



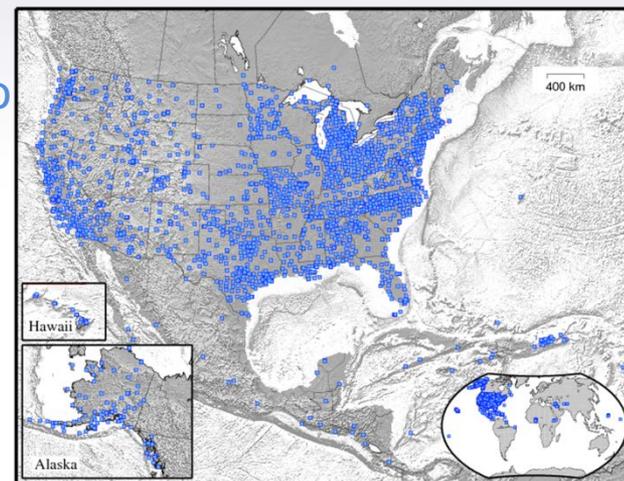
Emergency Response

Continuously Operating Reference Stations

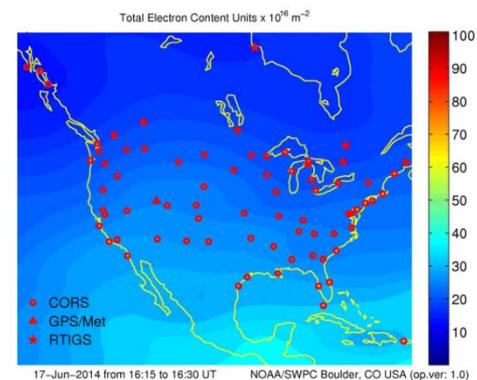
CORS enable accurate positioning and provide an interface between land and ocean observing systems

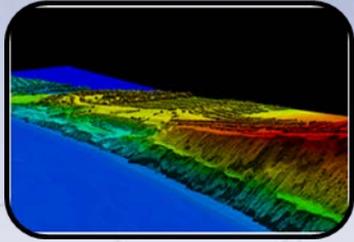
- Co-located with tide stations, CORS can contribute to local and global sea-level rise calculations by measuring land subsidence relative to water levels.
- CORS data can also be used to monitor and predict the distribution of moisture and electrons in the atmosphere; as well as produce ionospheric models of total electron content (TEC) that impact GNSS-derived positional accuracy.

2014 CORS Network



~ 1900 Stations

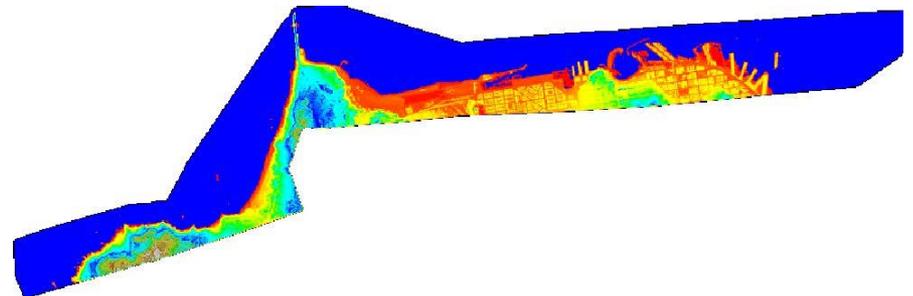




Coastal Mapping

NGS delineates the nation's national shoreline which defines the territorial limits.

- Up-to-date shoreline is an integral component of NOAA's nautical charts which support a wide range of coastal applications.
- NGS uses multiple remote sensing technologies (digital imagery, lidar, radar, etc.) from various platforms (aircraft, satellites) to survey the shoreline and other areas of interest.





Ecosystem and Climate Operations

The NGS ECO program is researching how to apply precise positioning models, tools and techniques for marsh restoration to support community resilience in response to climate change.

ECO has also developed guidelines for collecting elevation data and monitoring restoration projects.



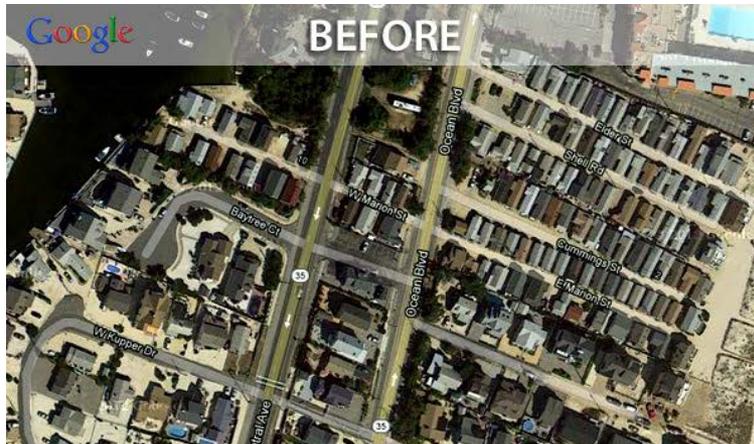
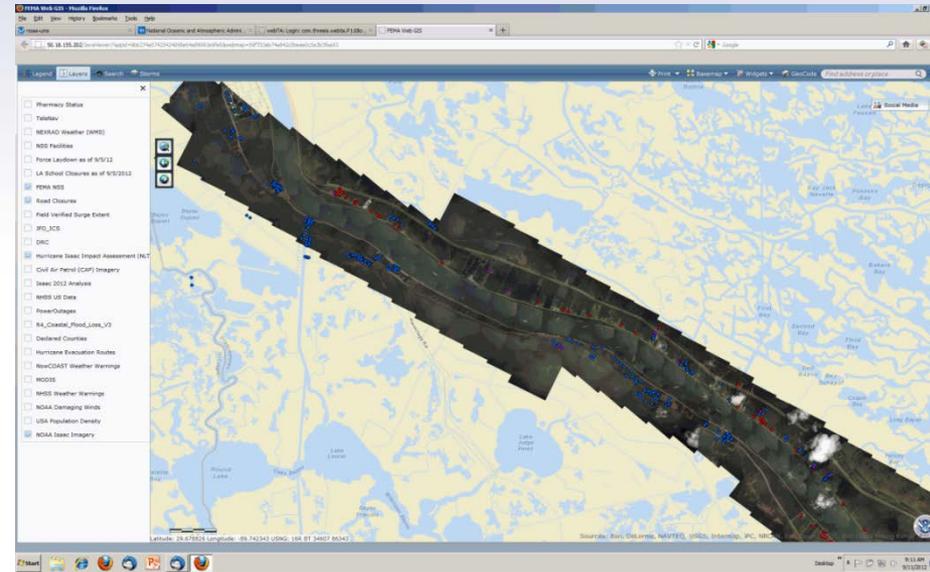
Courtesy USGS, Patuxent Wildlife Research Center





Emergency Response Imagery

To support NOAA's national security and emergency response requirements, NGS collects high resolution, geo-referenced imagery from natural disasters such as hurricanes, tornados and earthquakes.



Geospatial Infrastructure for Economic Growth



Precision Agriculture



Aviation



Satellite Operations



Transportation



Disaster Response



Personal Navigation



Shipping and Commerce



Exploration



Fishing and Boating





Coastal Intelligence

Coasts and Coastal Communities

Environmental Impacts and Challenges

- Climate change
- Sea level rise / flooding
- Catastrophic events (hurricanes / typhoons)
- Financial loss
- Economic and physical impacts
- Resources
- Population growth
- Development
- Marine transportation



Coastal Intelligence - Benefits

- Foster healthy and sustainable coastal and marine resources, habitats and ecosystems
- Strengthen the resilience of communities and regions
- Scientific data for decision making, products and services as well as actionable information
- Provides insight on present and future conditions of the coastal zone
- Enhancing economies
- Managing resources



Coastal Intelligence - Integration

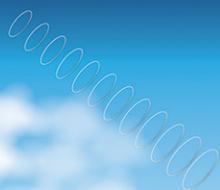
- Integrated support tools for port communities
 - Real time systems and access
 - Web-based, smart systems (iphone, tablets etc.)
- Regional data and predictions of physical systems
 - Tides, currents and waves
 - Salinity, water temperature and visibility
 - Wind speed and direction
- Early warning systems
 - Ecological hazards
 - Inundation / flooding



Coastal Intelligence - Systems



satellite communication



decision support tools



airborne LiDAR
aerial imagery
airborne gravimeter

air gap sensor



continuously operating reference station



PORTS[®] visibility sensor



water level gauge



water quality monitoring



buoys:
ocean chemistry
wave sensors
water temperature gauge
meteorological sensors
harmful algal bloom monitoring

meteorological station

high frequency radar

single beam sonar
multibeam sonar

ATON mounted acoustic doppler current profiler
bottom mounted acoustic doppler current profiler



glider or autonomous underwater vehicle



Marine Transportation

Marine Transportation - Commerce

- Society depends on maritime commerce
- ~75% of trade involves marine transportation
- Gross Domestic Product (GDP) and coastal infrastructure
- Contributes to the global economy
- Impacts to goods, services and people
- Cost effective
- Competition



Marine Transportation – Coastal Infrastructure

Decisions based on...

Aids to navigation

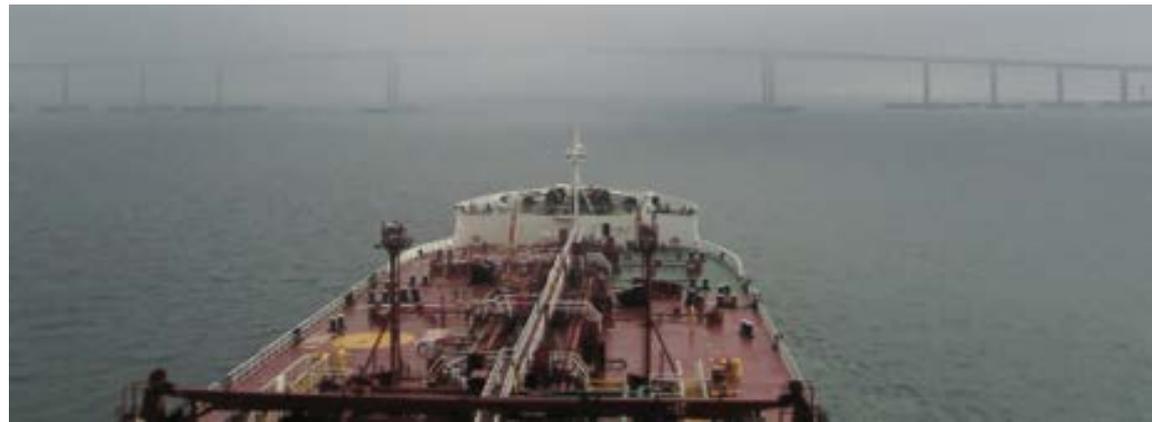
- Electronic nautical charts (ENC), radar, depth sounder
- Positioning – GPS, DGPS, Loran, EGNOS

Local knowledge and information

- Winds, visibility and sea conditions
- Currents, tides and depths
- Pilots

Ship characteristics

- Draft
- Manifest
- Size



Marine Transportation – NOAA **PORTS**®

Real-time observations to improve safety and economic efficiency of maritime commerce

- Reliable, cost-effective information on the environmental state
- Integration of oceanographic and meteorological sensors
- Designed to meet coastal community needs
 - Water sensors, currents, waves, salinity, temperature
 - Ship bridge height, winds, visibility
 - Designed for 24 hours a day, every day of the year operation
 - Simple (1 – 2 sensors) to complex (100+ sensors)



Marine Transportation – NOAA **PORTS**®

Benefits

- Improved safety
 - Reduce commercial marine transportation accidents
 - Reduce recreational boating accidents
 - Fewer groundings and collisions
 - Fewer weather-related incidents
- Increased efficiency
 - More efficient commercial marine transportation
 - Enhanced fishing productivity
- Improved storm surge forecasts
- Improved public services

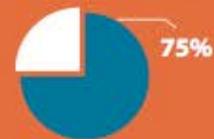
Where is PORTS®?

PORTS® currently serves about one-third of the 175 major seaports in the U.S.

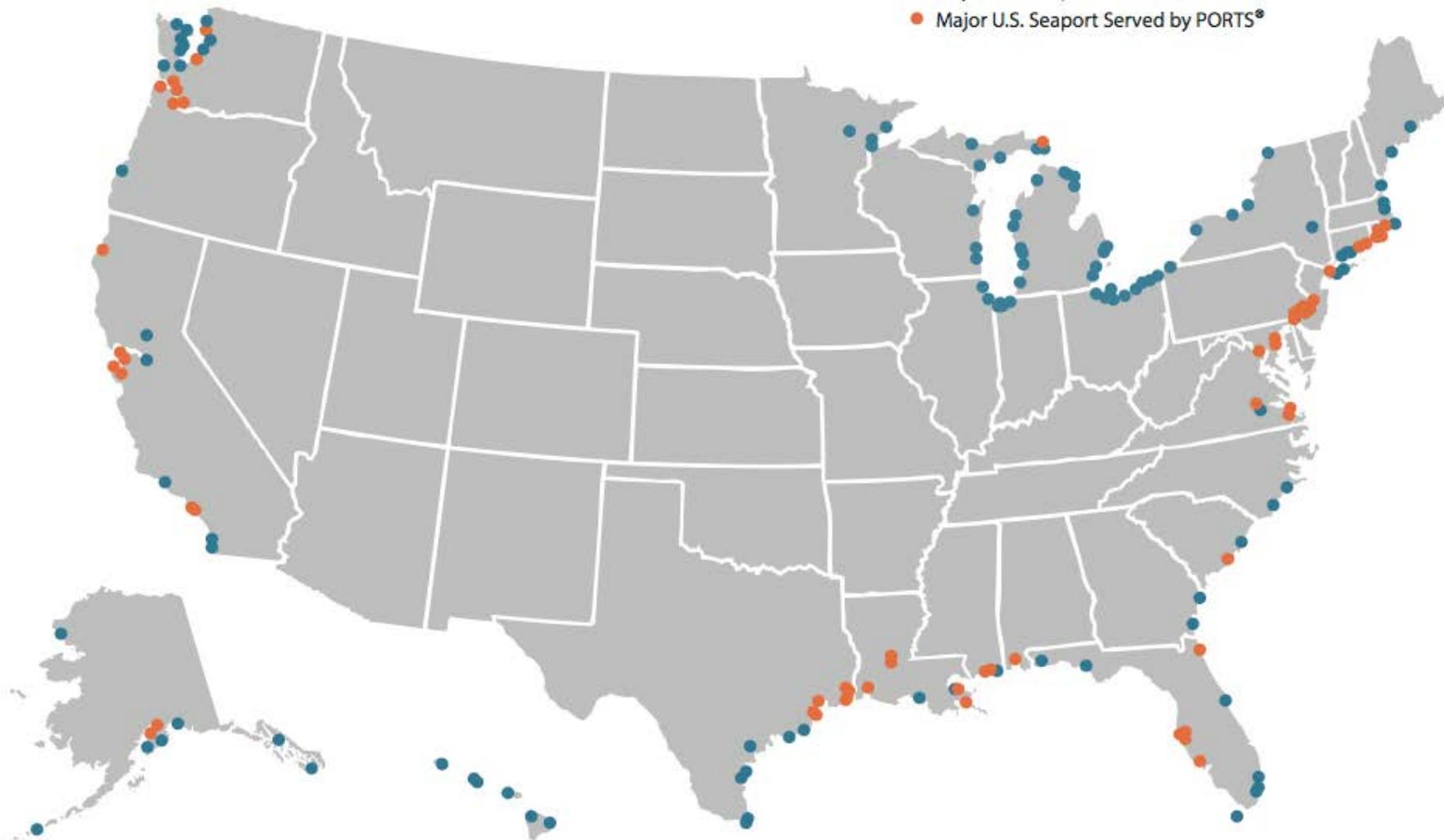
Percent of 175 major seaports currently served by PORTS®.



Percent of depth constrained total tonnage that passes through seaports currently served by PORTS®.



- Major U.S. Seaport
- Major U.S. Seaport Served by PORTS®





Gracias