



How Naval Facilities in Hampton Roads Are Coping With Rising Relative Sea Levels

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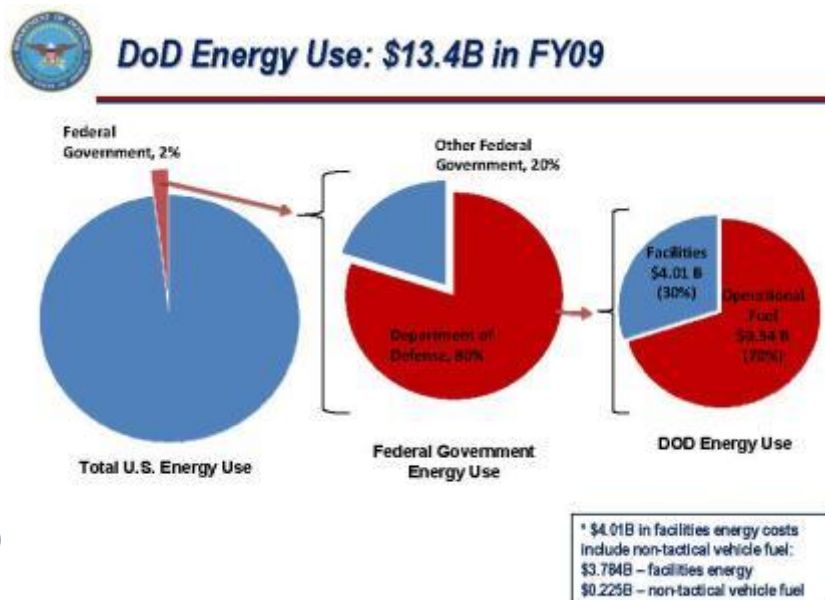
Federal Recognition of Climate Change



- Recognizes Climate Change and Environmental Impacts (SLR)
- Federal Government/DoD Large Footprint (307,295 buildings)
- Lead by Example
- Executive Orders, Federal Laws
- Policy and Implementation

2 Components

- Sustainability (*Reduction*)
 - Reduce Impact/Contributions
 - Energy Efficiencies (Reduce Costs)
 - Renewable Energy
- Adaptation/Strategy (*Response*)



FY09 \$13.4B

- Federal Gov't 2%
- DoD 80%
- Facilities 30%



Federal/DoD Climate Change Drivers, Policy, and Directives



E.O. 13690: Establishing Federal Flood Risk Management Standard

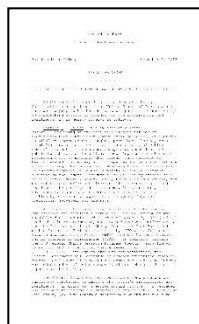
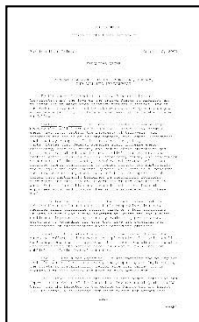
- updates E.O. 11988: Floodplain Management
- defines flood hazard areas based on: climate-informed approach, 100-yr flood plus 2-3 feet, or 500-yr flood elevation

Federal

DoD

Navy

Tri-service



E.O. 13514:
"Federal Agencies will reduce, monitor, track, & report GHG emissions"

E.O. 13653:
"[facilitate] efforts to improve climate preparedness and resilience; help safeguard our economy, infrastructure, environment, and natural resources;"

2014 Quadrennial Defense Review (QDR):
"Climate change poses a significant challenge ..."
"[DoD] will complete a comprehensive assessment of all installations to assess potential impacts of climate change on missions and operational resiliency, ... adapt as required"

Strategic Sustainability Performance Plan (2010):
"DoD will develop a plan to conduct initial vulnerability and risk assessments at each of its installations and facilities ..."

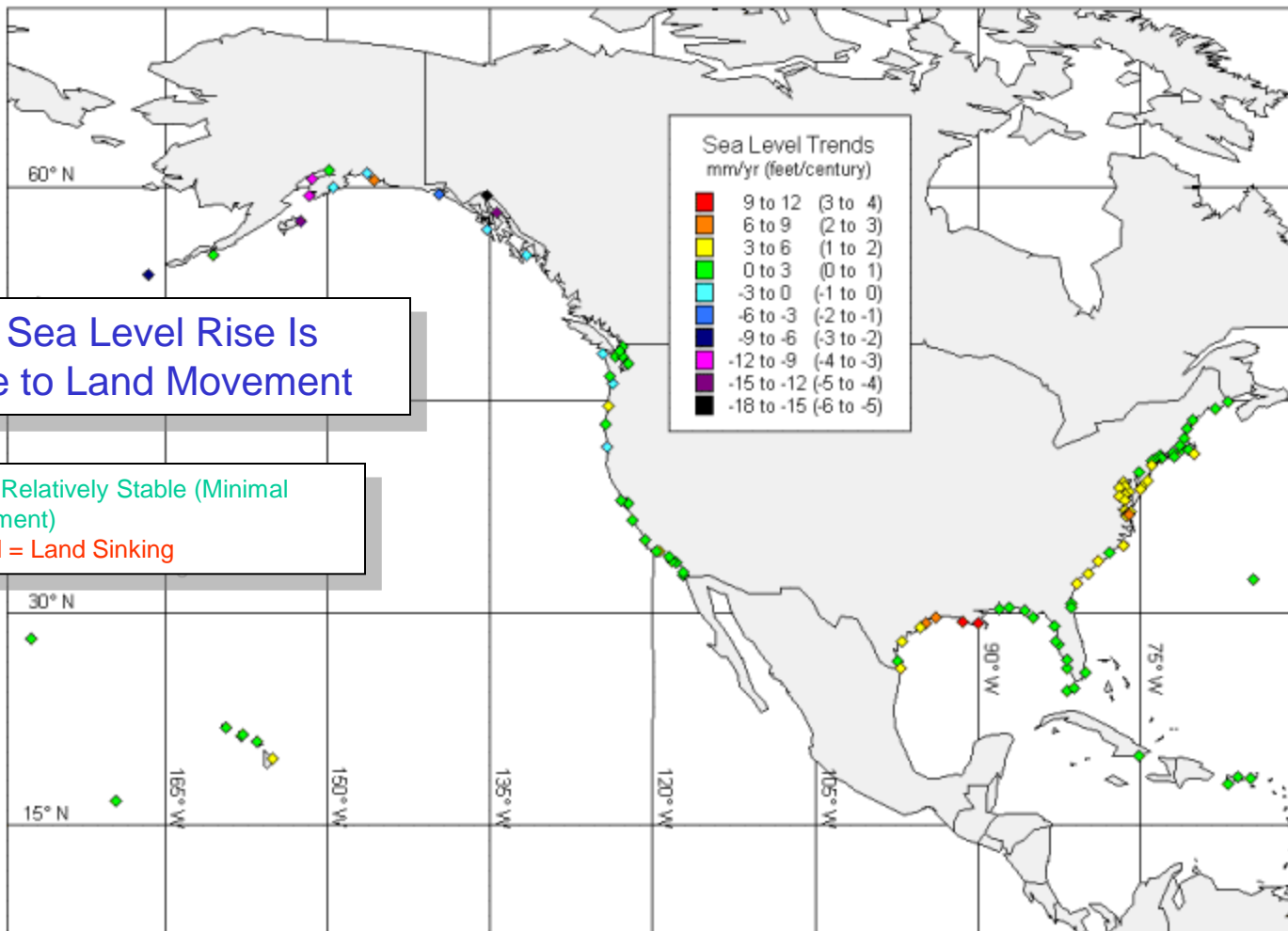
Maritime Strategy:
"Climate change is gradually opening up the waters of the Arctic"
"These opportunities offer potential for growth, they are potential sources of competition for access and natural resources"

UFC 2-100-01:
"3-5.6.2.3 ... master planners will seek to understand, monitor and adapt to [changes in external conditions that impact planning decisions] ..."

UFCs under revision to incorporate SLR



Sea Level Rise – US Coast Lines



Local Sea Level Rise Is Relative to Land Movement

Green = Land Relatively Stable (Minimal Vertical Movement)
Yellow to Red = Land Sinking

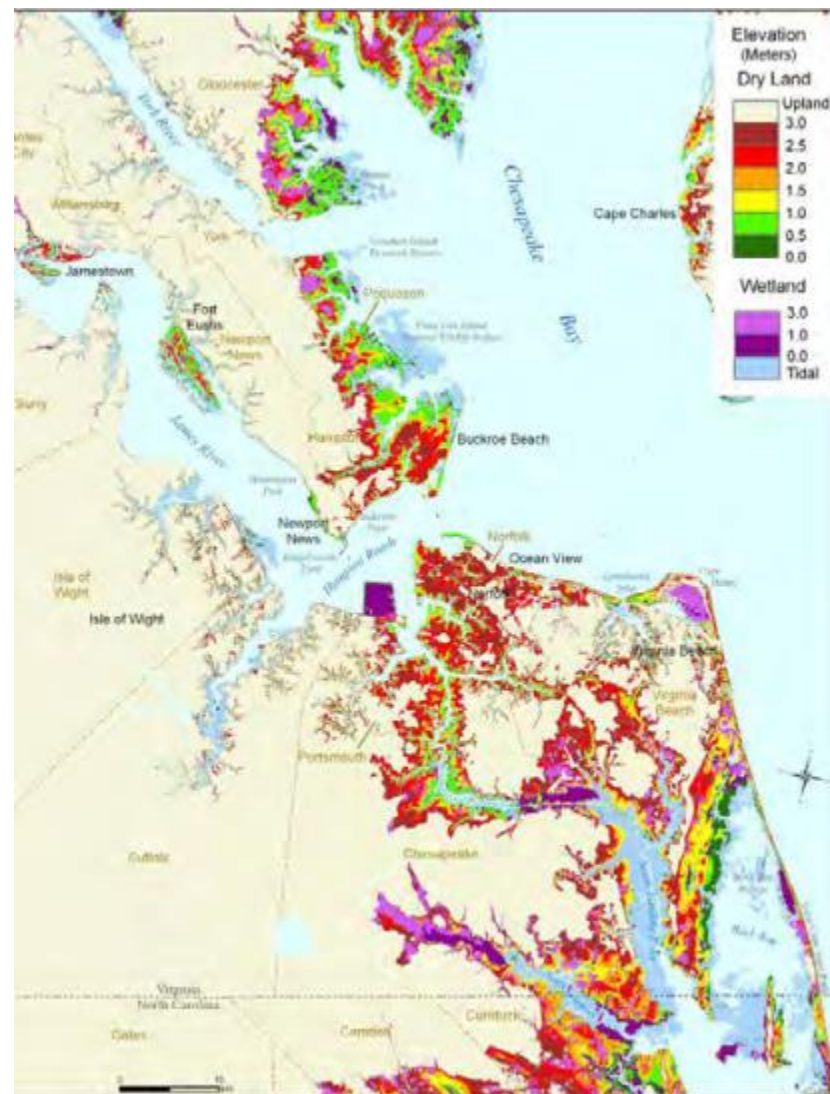
NOAA Data



Hampton Roads Region Vulnerabilities

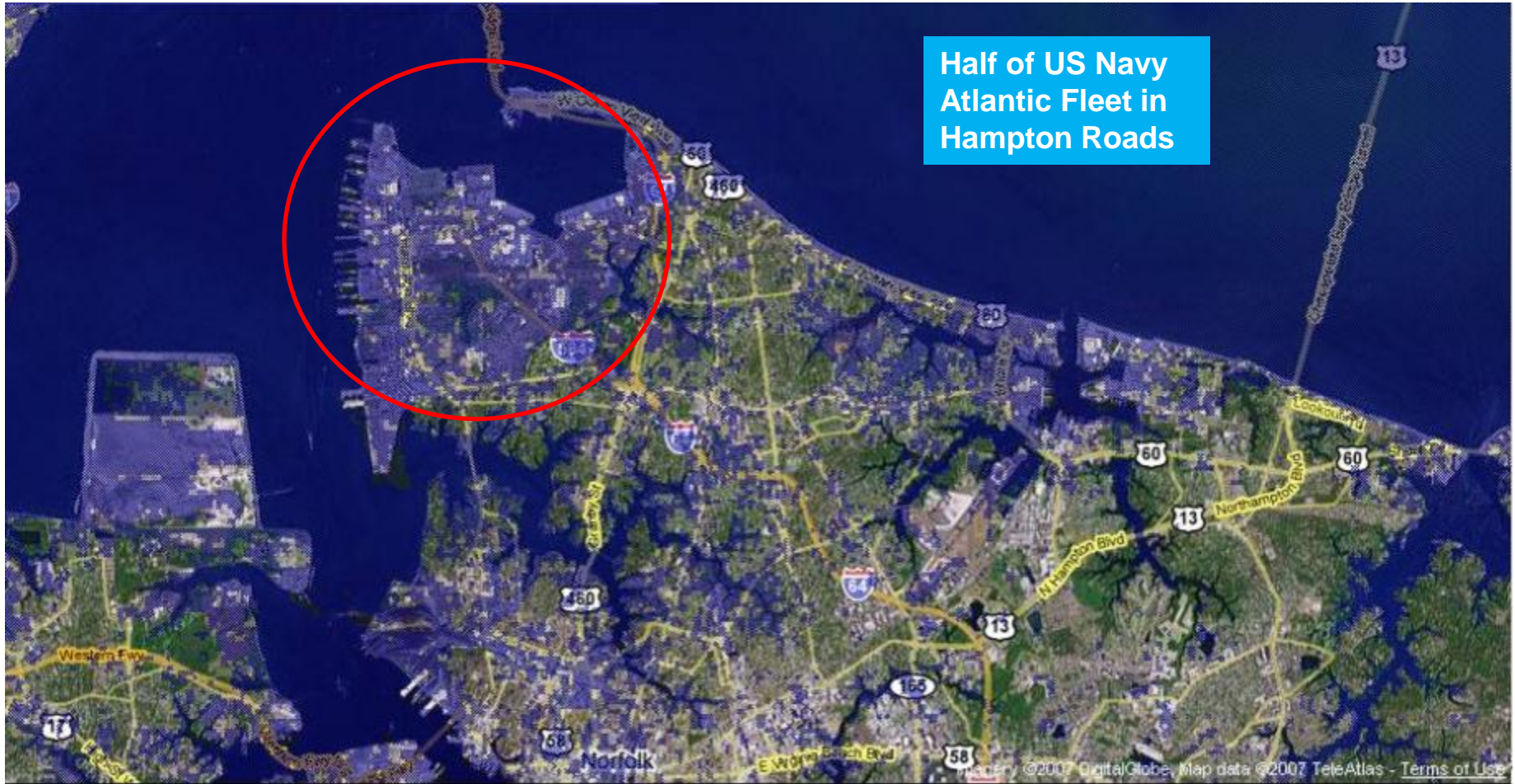


- Region vulnerable to Relative Sea Level Rise (RSLR= water level increase + land subsidence)
 - RSLR projected 5.1 mm/yr (Sewells Point)
 - SLR est. ~ 1 ft by 2065 (Regionally)
 - NS Norfolk Pier elev. = 9.0 ft MLLW
 - Average Facility Life \geq 50 years
 - Tide ~ 3.0 ft
 - CAT 1 Storm (74-95 mph, 4-5 ft surge)
 - 3' tide + 1' SLR + 5' storm surge = ~ 9 ft
 - Piers overtopped (not including wave action)
 - CAT 2 Storm (96-110 mph, 6-8 ft surge)
- Current piers, roadways, and utilities flood during Nor'easters or heavy rains
 - Pre-existing regional flooding problem
- Even if piers were raised, how do you cope with base access?
 - Navy dependent on civil infrastructure





NS Norfolk and Surrounding Area



Half of US Navy Atlantic Fleet in Hampton Roads

* Storm Surge in Norfolk (Category 4: 15 ft)



Sea Level Rise Impacts



- More frequent & severe storms
- Higher storm surge & wave action
- Base and roadway flooding
- Over-topped piers
- Utility damage and disruptions
- Shoreline erosion
- Pier & bulkhead scour
- Cost to secure utilities & facilities
- Land use and master planning
- Regional infrastructure impacts
 - Highways/roadways
 - Communications
 - Utilities
- *Disrupts Fleet ops, maintenance, & training*

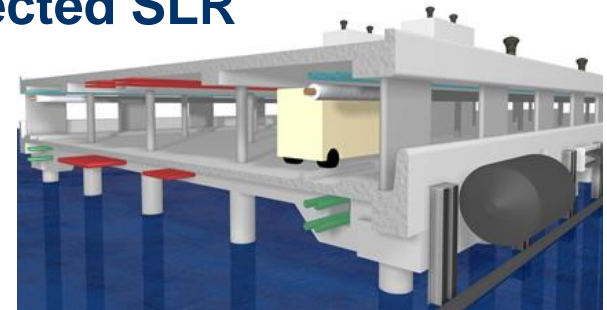




Adaptation/Mitigation Considerations



- Site facilities out of areas potentially impacted by SLR
- Evaluating facility elevation based on projected SLR
- Protect existing infrastructure
- Shoreline protection
- Challenges:
 - SLR not limited to one technical discipline, facility or base
 - Mitigation may shift problem to another location
 - Supporting infrastructure (roads, utilities, land)
 - Not limited to base
 - Platform compatibility (ships and aircraft)
 - Mitigation is costly
 - Difficult to justify to budgeteers based on scientific uncertainty
 - Can't do everything at once – adaptive management & programmatic approach





Incorporating SLR into Navy Facilities



Project Examples (SLR considered/indirect response):

- **Replace Fuel Pier D, NFT Craney Island, VA:**
 - SLR factored in new deck elevation: +3 ft; pier as high as operations permitted
- **Elevating utilities along waterfront as possible during repair**
 - Double-deck piers at NSN, utilities on lower deck to protect from waves and flooding
- **New BEQ at NSN (P-123) designed to incorporate resilient features (solar, storm-water management)**
- **Fort Story, VA & Dam Neck, VA Shoreline Projects:**
 - Beach replenishment and shoreline protection due to mitigate erosion
- **Dry-dock Flood Protection Study, NNSY & PNSY:**
 - Evaluating dry-docks and critical support infrastructure protection from flooding & surge; 500-year flood considered, wave and SLR elevations may also be considered
- **NWS Earle Installation Master Plan considering SLR impacts**
- **Incorporating higher building elevations, flood protection, and resilient features into project documents.**
 - P-726, Operations & Maintenance Facility, JEB Little Creek-Ft Story



Key Drivers to defending the Navy against SLR



• Education:

- Developing understanding of SLR, its impacts, and solutions
- Working with U.S. Army Corps of Engineers, Virginia Institute of Marine Sciences, Municipalities, Universities, and Private sector on regional response/solution
- Navy participation in workshops & discussions on infrastructure impacts of SLR & Navy's unique requirements
- Communicating impacts of SLR to CNRMA/NAVFAC design & planning communities of practice

• Planning:

- Incorporate SLR into Installation Development Plans, Region Shore Infrastructure Plans, & Global Shore Infrastructure Plan
- Incorporate SLR into Criteria & Project Requirements
- NAVFAC MIDLANT Guidance: plan for 2 feet of SLR by 2050



Government Collaboration Initiatives: Force Multiplier



• Local/State Engagement:

- Old Dominion University Adaptation workshops
- VA Climate Change and Resiliency Commission
- VA Recurrent Flooding Sub-panel, Secure Commonwealth Panel
- Hampton Roads Sea Level Rise Preparedness and Resilience Intergovernmental Planning Pilot Project
- Hampton Roads Planning District Commission

• Federal/DoD Engagement:

- DoD Climate Change Adaptation Working Group
- Navy Task Force Climate Change
- Federal Climate Partners for the Mid-Atlantic
- North Atlantic Coast Comprehensive Study
- Navy Climate Readiness Community of Practice
- NAVFAC Mid-Atlantic Sea Level Rise Working Group



Government Collaboration Initiative: JLUS



- Developing innovative Joint Land Use Study (JLUS) in Hampton Roads partnering with the Hampton Roads Planning District Commission, Norfolk, and Virginia Beach to address recurrent flooding & SLR





QUESTIONS?

