Navy Waterfront Infrastructure Support-Level Analysis:

Comparison Between East and West Coasts

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Executive summary

This study resulted from recent Navy discussions concerning current infrastructure inventory of and operations relating to waterfront facilities—particularly piers, wharves, pier space, and pier loading—and how support-level requirements may differ between east and west coast installations. The concern centers on whether differences really exist and if so, how they affect shore readiness and shore investments in terms of capacity utilization based on current workload.

Objective

In light of these concerns, the Director, Shore Readiness Division (OPNAV N46) asked CNA to determine whether waterfront infrastructure support-level differences exist between east and west coast port installations in terms of infrastructure size to ship loading. If any differences exist, CNA was asked to determine what the potential infrastructure cost reductions might be if the support levels were balanced over time.

Approach

Our analysis focuses on 11 east and west coast homeports. For each installation, we extract data on waterfront operations infrastructure from the FY 2009 internet Naval Facilities Assets Data Store (iNFADS). We use the iNFADS data to characterize waterfront infrastructure at each installation, both in the aggregate and by individual category code number.

To compare workload across installations, we constructed a measure based on the amount of ship traffic the installation supported during FY 2008 and FY 2009. We used the actual results of the past 2 years to gain the most recent ship loading information and to cover the timeframe of at least one fleet response plan (FRP) cycle. Our measure, average daily linear ship feet (ADLSF), shows the total linear feet of ships in port at an installation on an average day during the 2-year period. We construct ADLSF using data on ship movements from WEBSKED, an online database that documents the daily location of Navy surface ships as well as Military Sealift Command (MSC) ships.

We combine our workload measure with the waterfront infrastructure data to generate measures of installation efficiency. These include the following:

- The ratio of average ship loading workload to total waterfront infrastructure, which we call α
- The ratio of average ship loading workload to total available berthing, which we call γ
- The ratio of average ship loading workload to total infrastructure separately for each of the 39 waterfront operations facility category codes.

Using our efficiency results, we can identify possible shore requirement reductions by facility category code. To do this, we first compute the average ratio of workload to infrastructure among installations. Next, we identify those installations with ratios below the mean and calculate the amount of infrastructure reduction that would be necessary to bring the installation to the mean level of efficiency. Finally, we use models from the Department of Defense (DoD) Facility Program Requirements Suite (FPRS) to estimate the total potential sustainment (ST) and restoration and modernization (RM) annual funding requirement reductions if the infrastructure adjustments were implemented. We calculated the potential base operating services (BOS) annual funding requirement reductions by using actual mini-BOS costs by installation for FY 2008 divided by the total square footage (SF) to generate a cost-per-SF ratio to estimate future reductions.

Results

Our Navy ship loading analysis shows that the 11 east and west coast ports supported over 47 million linear ship feet over the 2-year period. Three major homeports support over two-thirds of the total Navy ship loading workload: Norfolk, VA; San Diego, CA; and Pearl Harbor, HI. Mayport, FL, was the next busiest with 11 percent of the total loading.

Our installation efficiency analysis, which compares the ADLSF to the total normalized waterfront operations infrastructure plant replacement value (PRV), indicated that the east coast ports are usually more efficient than the west coast ports, with exception of Kings Bay, GA:

- The average value of α is 19.44 among east coast installations and 8.75 among west coast installations (including Pearl Harbor).
- New London, CT, is the most efficient location because $1 million of normalized waterfront PRV supports almost 1.9 times the workload of Norfolk, VA, and over 2.5 times more than San Diego, CA.
- Norfolk, VA, and San Diego, CA, have roughly the same amount of normalized waterfront PRV, but Norfolk supports almost 1.4 times more workload.
- The least efficient installations are NAVBASE Coronado, CA, and NAVSUBASE Kings Bay, GA, with a combined 4 percent of the ship loading workload but over 16 percent of the total normalized waterfront infrastructure PRV.

If the Navy were to balance the efficiency ratios by reducing infrastructure to the mean efficiency level at five installations, a significant amount of annual shore infrastructure support requirements would be removed. Those locations with estimated potential requirement reductions are as follows:

- NAVSTA Pearl Harbor HI - $14 million
- NAVBASE Coronado, CA - $11 million
- NAVSTA San Diego, CA - $8 million
- NAVBASE Kitsap Bremerton, WA - $6 million
- NAVSTA Everett, WA - $5 million.

Reducing waterfront infrastructure at these five installations to bring each up to the average level of efficiency (by facility type) would result in a total reduction of $44 million.

Recommendations

We recommend that the Navy not invest in new waterfront infrastructure at the six locations with low efficiencies (NAVPHIBASE Little Creek, VA; NAVBASE Kitsap Bremerton, WA; NAVSTA Everett, WA; NAVBASE Point Loma, CA; NAVBASE Coronado San Diego, CA; and NAVSUBASE Kings Bay, GA) unless significant footprint offsets are included in the scope of work. We also suggest that the Navy consider the following:

- If the Navy needs to reduce annual infrastructure operational costs, those facilities located at the least efficient port locations should be examined first based on their current condition and configuration ratings.
- Use the installation efficiency findings to give preference to potential military construction (MILCON) projects involving new ship berthing (i.e., additional capacity) that are located at the installations that have the highest ratios of workload to current berthing space. Likewise, avoid constructing new berthing at installations with low workload-to-berthing ratios.
- Review future Navy ship berthing construction plans to ensure that NAVSUBASE New London, CT, and NAVSTA Mayport, FL, are adequately provided for as they are the locations which could currently best benefit from additional berthing capacity.
- Begin to identify specific facility demolition projects in the shore function tasks of harbor master operations and small craft berthing to increase efficiency and reduce annual Navy funding requirements.

As the methodology used in this paper of shore capability area (SCA) efficiency analysis provides useful insights into shore infrastructure investment and management, we would recommend that the Navy investigate the other SCAs using a similar methodology.

Introduction

Recent Navy discussions concerning current infrastructure inventory and operations relating to waterfront facilities—in particular, piers, wharves, pier space, and pier loading—have uncovered potential inconsistencies in facility requirements between east and west coast installations.

Background

This concern centers on how these inconsistencies may affect shore readiness and shore investments in terms of underutilized piers, different berthing standards, and different pier configurations.

In light of these concerns, the Director, Shore Readiness Division (N46) asked CNA to identify any waterfront infrastructure support-level differences that exist between east and west coast installations, and to determine what the potential infrastructure annual funding requirement reductions might be if the support levels were balanced over time.

Given our tasking, this study seeks to answer two main research questions:

1. Are there differences in waterfront infrastructure support between east and west coast installations?
2. If the answer to the first question is yes, what are the potential annual requirement reductions—in sustainment (ST), restoration and modernization (RM), and base operating services (BOS)—from balancing infrastructure support levels?

In the course of answering these two primary questions, our analysis characterizes the amount of waterfront infrastructure among installations, identifies the workload supported by each installation in FY

2008 and FY 2009, and examines how workload is distributed across installations.

This analysis focuses on the primary port facilities in the United States on both coasts. It does not include gulf coast installations or overseas port locations. In addition, Navy installations whose primary mission is not port operations, such as shipyards, ordnance, and fueling logistics centers, are not included in the analysis.

This leaves us with 11 primary port operation installations on both coasts. The six west coast installations are

- Naval Base (NAVBASE) San Diego, CA
- NAVBASE Coronado San Diego, CA
- NAVBASE Point Loma, CA
- Naval Station (NAVSTA) Pearl Harbor, HI
- NAVBASE Kitsap Bremerton, WA
- NAVSTA Everett, WA

The five east coast installation included in this analysis are

- NAVSTA Norfolk, VA
- Naval Amphibious Base (NAVPHIBASE) Little Creek, VA
- NAVSTA Mayport, FL
- Naval Submarine Base (NAVSUBASE) Kings Bay, GA
- NAVSUBASE New London, CT.

Approach

We first analyze the waterfront infrastructure at each of these locations, as identified in the internet Naval Facilities Assets Data Store (iNFADS) shore inventory at the end of FY 2009. We next determine the average port loading for each of the locations in support of Navy ships and Military Sealift Command (MSC) vessels over a 2-year period covering FY 2008 and FY 2009.

We use our data on waterfront infrastructure along with a measure of installation workload to calculate the ratio of workload to total waterfront infrastructure. To aggregate across different types of waterfront facilities at a location, we add up the plant replacement values (PRVs) of all facilities in the waterfront operations shore capability area (SCA) at the installation. Further, we normalize all PRV values to reflect market prices in Norfolk, VA—this way, differences in PRV reflect differences in the amount of waterfront infrastructure (in dollars). We refer to the ratio of workload to normalized PRV as an installation-level measure of waterfront efficiency. We also estimate a regression model of the relationship between workload and waterfront infrastructure. We use our regression results to look at how the Navy could improve efficiency at installations that appear to have more waterfront infrastructure than the amount our model implies is needed.

At a finer level of detail, we replicate our efficiency analysis separately for different types of facilities, replacing normalized PRV in the denominator of our efficiency ratio with the total measure of the facility. For each facility category code number (CCN), we compute the average efficiency level among all installations. For below-average installations, we calculate the infrastructure reductions that would bring the installation to the average level of efficiency. Finally, we use Office of the Secretary of Defense (OSD) budgeting models for FY 2009 and actual BOS costs from FY 2008 to calculate the reductions to annual funding requirements that would be associated with the infrastructure reductions we identified.

The paper is organized as follows. In the next section, we characterize waterfront operations infrastructure in FY 2009, both by installation and aggregated over all east and west coast homeports. The following section describes our measure of FY 2009 workload and compares workload across the 11 homeports. Then, we describe our measures of installation efficiency and present the results of our efficiency analysis. Building on the efficiency results, the following section discusses potential requirement reductions. The last two sections present our conclusions and recommendations.

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Waterfront infrastructure

The first step in our analysis is to determine the waterfront operations infrastructure in place at each homeport. The Navy has segmented its shore infrastructure into 12 SCAs:

- Waterfront operations
- Airfield operations
- Command, control, communications, computers, combat systems, intelligence, surveillance, and reconnaissance (C5ISR) operations
- Expeditionary operations
- Intermediate/depot-level maintenance support
- Ordnance/weapons operations support
- Training support
- Supply storage support
- Sailor and family support
- Utilities support
- Base support
- Research, Development, Testing, and Evaluation (RDT&E) support.

These SCAs are divided into shore function tasks (SFTs) and facility CCNs. This study focuses on waterfront operations—that is, those facilities that provide capability ashore to support the Navy's current and future surface, submarine, and nuclear carrier force requirements. These facilities are typically general-purpose berthing piers, port control offices, degaussing/deperming facilities, small water-craft support facilities, fueling stations, harbor defense structures, seawalls, and bulkheads.

The waterfront operations SCA includes facilities that fall within 50 different CCNs under seven SFTs. Table 1 provides a brief summary of SFTs and the number of CCNs under each.

Table 1. Navy waterfront operations facility category codes

SFT	CCN	CCN description
Harbor master operations	13710	Oceanographic building
	13720	Lighthouse
	13730	LORAN building
	13732	DECCA building
	13733	Navigation aid test center
	13740	Port control office
	13810	Beacon ship
	13820	Navigation aid target
	13825	Antenna navigation
	14355	Transit shed
	15610	Waterfront transit shed
	15620	Container operations building
	15964	Waterfront operations building
	15970	Dredge control pumping facility
	16410	Breakwater
	16420	Groins or jetties
	16430	Levees
Piers	15120	General purpose berthing pier
	15140	Fueling pier
	15160	Supply pier
	15190	Access trestle to piers and wharves
	16310	Mooring dolphin
	16320	Mooring platform
	16330	Stake pile moorings
Wharves	15220	General purpose berthing wharf
	15240	Fueling wharf
	15260	Supply wharf
	15420	Deep water bulkhead quaywall with relieving platform
	15430	Seawalls
Small craft berthing	12220	Small craft fueling station

Table 1. Navy waterfront operations facility category codes

SFT	CCN	CCN description
	12440	Small craft ready fuel storage
	15410	Shallow water bulkhead and quaywall without relieving platform
	15510	Fleet landing
	15511	Fleet landing building
	15520	Small craft berthing
	15521	Small craft boathouse
	15950	Ferry slip
Waterfront security	16120	Fixed net anchorage
	16130	Winch house
	16210	Gun emplacements
	16910	Harbor entrance control facility
Magnetic silencing	15171	Degaussing pier
	15180	Deperming pier
	15271	Degaussing wharf
	15280	Deperming wharf
	15920	Degaussing building
	15921	Degaussing range
	15930	Deperming building
	15935	Sound survey facility
Dredging	16510	Dredging spoil area

Not all installations have every type of facility, so we only consider the 39 different category codes that show up at the installations under study. Figure 1 provides a summary matrix of the CCNs, locations, and number of facilities that we examined. These installations have a total of 698 facilities within their waterfront SCAs.

Figure 1. FY 2009 Navy waterfront installation facility CCN summary

FACILITY CATEGORY CODES	WEST COAST INSTALLATIONS						EAST COAST INSTALLATIONS					TOTAL
	NAVBASE Coronado San Diego CA	NAVSTA San Diego CA	NAVBASE Point Loma CA	NAVSTA Pearl Harbor HI	NAVBASE Kitsap Bremerton WA	NAVSTA Everett WA	NAVSTA Norfolk VA	NAVSUBASE New London CT	NAVPHIBASE Little Creek VA	NAVSUBASE Kings Bay GA	NAVSTA Mayport FL	
12220	1				1		1	1	1	1		**6**
12440					1							**1**
13710	1			1			2					**4**
13720					1						1	**2**
13810	1			2	1		1					**5**
13820	1				4					5	3	**13**
13825											1	**1**
14355				1								**1**
15120	6	14	4	9	10	5	14	8	15	2		**87**
15140	1		1	1	1		1		1		2	**8**
15160		1		1								**2**
15180			2		1		1			1		**5**
15190					1					2		**3**
15220				23	1		1	1		5	7	**38**
15240							1					**1**
15260				4			1		6			**11**
15410	3		4	1	1		6	1	17		1	**34**
15420	2	2	1	6	4		10		112		2	**139**
15430	2		6	8	8	1	4		13			**42**
15510				8	1					4		**13**
15511				2								**2**
15520	22	2	4	21	14	3	9	1	44	4	2	**126**
15521				3	3	2	5		3		2	**18**
15610				3	1	1	3			2		**10**
15920			1	2			1	1			1	**6**
15921			5				2	1				**8**
15930	1		5	1	3					1		**11**
15950	1			2								**3**
15964	7	3	1	5	4	1	9	3	1	5	3	**42**
16120										4		**4**
16210					2							**2**
16310			2	2	3		8		2	2		**19**
16320	2		1	2	6		1					**12**
16330			1									**1**
16410						1	4		1			**6**
16420									6			**6**
16430						1					1	**2**
16510										2	1	**3**
16910				1								**1**
Total	**51**	**22**	**38**	**109**	**72**	**15**	**85**	**17**	**222**	**40**	**27**	**698**

Each CCN has its own unit of measure, such as square yards, feet of berthing, or gallons. Figure 2 provides the same summary matrix, but with total quantities in the primary unit of measure (UOM).

Figure 2. FY 2009 Navy waterfront installation CCN assets summary[a]

FACILITY CATEGORY CODES	UOM	WEST COAST INSTALLATIONS						EAST COAST INSTALLATIONS					TOTAL
		NAVBASE Coronado San Diego CA	NAVSTA San Diego CA	NAVBASE Point Loma CA	NAVSTA Pearl Harbor HI	NAVBASE Kitsap Bremerton WA	NAVSTA Everett WA	NAVSTA Norfolk VA	NAVSUBASE New London CT	NAVPHIBASE Little Creek VA	NAVSUBASE Kings Bay GA	NAVSTA Mayport FL	
12220	**GM**	500				150		20	48	70	15		**803**
12440	**GA**					160,000							**160,000**
13710	**SF**	31,537			23,078			38,864					**93,479**
13720	**SF**					100						402	**502**
13810	**EA**	1			2	1		1					**5**
13820	**EA**	5				4					19	3	**31**
13825	**EA**											1	**1**
14355	**SF**				35,584								**35,584**
15120	**SY**	29,284	170,404	33,402	25,884	47,782	66,367	254,289	18,000	23,228	18,980		**687,620**
15140	**SY**	412		7,847	8,016	7,667		5,000		121		4,990	**34,053**
15160	**SY**		50,000		5,100								**55,100**
15180	**SY**			5,352		11,316		9,199			3,776		**29,643**
15190	**SY**					267					8,990		**9,257**
15220	**SY**				73,345	13,678		657	983		29,700	50,876	**169,239**
15240	**SY**							5,333					**5,333**
15260	**SY**				10,704			1,273		4,099			**16,076**
15410	**LF**	9,386		565	1,296	1,250		35,651	13,190	6,117		399	**67,854**
15420	**SY**	107,830	105,800	284	12,645	9,810		15,130		38,601		5,528	**295,628**
15430	**LF**	1,061		4,698	3,386	12,516	10,870	14,410		10,443			**57,384**
15510	**FB**				1,288	400					155		**1,843**
15511	**SF**				913								**913**
15520	**FB**	12,396	1,270	1,786	6,686	3,278	1,190	5,832	725	15,335	3,171	1,263	**52,932**
15521	**SF**				16,001	17,644	6,882	45,931		42,042		3,600	**132,100**
15610	**SF**				150,045	10,000	78,964	405,332			278,784		**923,125**
15920	**SF**			3,945	3,090			4,680	1,840			900	**14,455**
15921	**EA**			5				2	1				**8**
15930	**SF**	1,008		11,173	1,200	6,332					8,236		**27,949**
15950	**EA**	1			2								**3**
15964	**SF**	61,819	3,743	4,108	47,256	23,684	6,183	80,784	18,731	12,682	29,942	18,337	**307,269**
16120	**EA**										4		**4**
16210	**EA**					2							**2**
16310	**EA**			21	3	30		9		2	2		**67**
16320	**EA**	2		1	4	22		1					**30**
16330	**EA**			8									**8**
16410	**LF**						3,608	2,300		200			**6,108**
16420	**LF**									3,025			**3,025**
16430	**LF**						888					5,500	**6,388**
16510	**CY**										35,475,000	12,400,000	**47,875,000**
16910	**EA**				1								**1**
	Total	**14**	**5**	**14**	**23**	**22**	**8**	**21**	**8**	**13**	**14**	**13**	**155**

a. Units of measure (UOMs) are abbreviated as follows: CY = cubic yards, EA = each, FB = feet of berthing, GA = gallons, GM = gallons per minute, LF = linear feet, SF = square feet, and SY = square yards.

Figure 3 provides a summary matrix of the total PRV broken out by CCN and location.

Figure 3. FY 2009 Navy waterfront installation CCN PRV summary

FACILITY CATEGORY CODES	WEST COAST INSTALLATIONS						EAST COAST INSTALLATIONS					TOTAL
	NAVBASE Coronado San Diego CA	NAVSTA San Diego CA	NAVBASE Point Loma CA	NAVSTA Pearl Harbor HI	NAVBASE Kitsap Bremerton WA	NAVSTA Everett WA	NAVSTA Norfolk VA	NAVSUBASE New London CT	NAVPHIBASE Little Creek VA	NAVSUBASE Kings Bay GA	NAVSTA Mayport FL	
AREA COST FACTOR	1.11	1.11	1.11	2.16	1.26	1.13	0.97	1.18	0.97	0.92	0.89	
12220	$19,573				$6,665		$14,515	$1,982	$2,395	$487		$45,617
12440					$1,359,837							$1,359,837
13710	$13,032,079			$17,615,886			$12,215,741					$42,863,706
13720					$44,318						$125,842	$170,160
13810	$23,051			$83,586	$22,339		$18,680					$147,656
13820	$106,880				$121,324					$332,964	$51,417	$612,585
13825											$17,139	$17,139
14355				$10,224,591								$10,224,591
15120	$111,799,330	$646,915,016	$129,322,010	$199,289,581	$221,659,038	$256,246,503	$843,589,303	$72,643,871	$77,634,535	$59,721,197		$2,618,820,384
15140	$1,564,101		$29,790,041	$62,472,512	$29,987,296		$16,535,191		$401,422		$15,189,204	$155,939,767
15160		$189,818,025		$39,746,733								$229,564,758
15180			$20,318,122		$46,061,265		$30,518,053			$11,881,309		$108,778,749
15190					$455,144					$11,189,589		$11,644,733
15220				$571,612,572	$57,542,388		$2,179,624	$3,967,163		$92,717,247	$154,862,916	$882,881,910
15240							$17,628,543					$17,628,543
15260				$83,421,378			$4,179,690		$13,598,599			$101,199,667
15410	$7,321,671		$440,754	$2,037,725	$860,917		$24,381,713	$50,889,843	$4,169,788		$249,568	$90,351,979
15420	$409,361,553	$401,654,942	$1,078,166	$98,548,516	$43,186,904		$50,195,015		$125,936,252		$16,826,838	$1,146,788,186
15430	$852,445		$3,664,891	$5,193,485	$11,103,138	$8,632,432	$9,823,380		$7,119,052			$46,388,823
15510				$8,477,799	$1,139,134					$410,756		$10,027,689
15511				$81,034								$81,034
15520	$39,984,662	$4,096,524	$5,981,893	$44,081,595	$11,888,203	$3,906,126	$16,520,528	$2,486,044	$43,225,922	$8,481,007	$3,266,496	$183,919,000
15521				$2,630,522	$702,584	$309,355	$1,880,561		$1,622,251		$127,455	$7,272,728
15610				$42,712,706	$1,590,349	$14,086,205	$53,850,253			$32,372,608		$144,612,121
15920			$1,030,023	$1,617,440			$1,079,615	$510,713			$188,412	$4,426,203
15921			$351,095				$122,726	$74,648				$548,469
15930	$263,185		$2,919,927	$612,570	$1,876,672					$1,782,302		$7,454,656
15950	$70,219			$288,304								$358,523
15964	$16,012,894	$977,282	$1,072,582	$25,108,076	$7,019,443	$1,643,443	$17,422,554	$5,109,458	$2,893,587	$6,402,926	$3,838,799	$87,501,044
16120										$2,309,555		$2,309,555
16210					$48,446							$48,446
16310			$312,286	$87,222	$401,375		$116,687		$23,846	$24,382		$965,798
16320	$29,742		$14,871	$120,658	$390,437		$12,995					$568,703
16330			$118,966									$118,966
16410						$2,865,300	$1,567,923		$136,341			$4,569,564
16420									$2,062,159			$2,062,159
16430						$1,736,528					$8,946,182	$10,682,710
16510										$0	$0	$0
16910				$1,433,999								$1,433,999
Total	$600,441,385	$1,243,461,789	$196,415,627	$1,217,498,490	$437,467,216	$289,425,892	$1,103,853,290	$135,683,722	$278,826,149	$227,626,329	$203,690,268	$5,934,390,157

In addition to the summary matrices in figures 1, 2, and 3, appendix A contains separate profiles for each installation. Each installation profile presents detailed information on the waterfront infrastructure at the installation, including infrastructure type, amount, and value. The remainder of this section focuses on an aggregated, installation-level measure of waterfront infrastructure.

Because the units of measure vary across category codes, arriving at an installation-level measure of overall infrastructure support requires converting all of the individual infrastructure measures into a common unit of measure.

We aggregate infrastructure data at an installation by putting everything in FY 2009 dollars using PRV. As defined in [1], PRV represents the cost to design and construct a new facility (meeting current standards) to replace an existing facility at the same location. The location adjustment is an important component of the PRV calculation; it is intended to account for differences in market prices in different geographic areas. In order to compare PRV in different locations, we normalize all PRV figures so that all dollar amounts are based on prices in Norfolk in FY 2009.[1] Normalizing PRV to Norfolk dollars ensures that our PRV comparisons reflect differences in the amount of waterfront infrastructure across installations, not a combination of differences in both infrastructure and market prices.

Since PRV puts all infrastructure into dollar terms, using data on PRV allows us to aggregate across category codes. This gives us a way to compute a single number that measures the total amount of waterfront operations infrastructure at an installation.

1. The location adjustment is implemented by multiplying PRV by a location-specific area cost factor (ACF). To normalize everything to Norfolk area prices, we divide the PRV numbers in iNFADS by the appropriate ACF and multiply by the ACF for Norfolk. ACFs are based on the local costs of a market basket of labor, materials, and equipment typically used in military construction (MILCON) projects.

Table 2 shows the total waterfront infrastructure PRV, both raw and normalized to Norfolk dollars, at each of the installations in our analysis.[2]

Table 2. Waterfront operations PRV by installation

Installation	PRV	Normalized PRV	Percent of normalized total
San Diego (combined)	$2,040,318,801	$1,782,981,295	37%
NAVSTA Norfolk, VA	$1,103,853,290	$1,103,853,290	23%
NAVBASE San Diego, CA	$1,243,461,789	$1,086,628,771	22%
NAVSTA Pearl Harbor, HI	$1,217,498,490	$546,747,007	11%
NAVBASE Coronado San Diego, CA	$600,441,385	$524,710,039	11%
NAVBASE Kitsap Bremerton, WA	$437,467,216	$336,780,317	7%
NAVPHIBASE Little Creek, VA	$278,826,149	$278,826,149	6%
NAVSTA Everett, WA	$289,425,892	$248,445,235	5%
NAVSUBASE Kings Bay, GA	$227,626,329	$239,997,325	5%
NAVSTA Mayport, FL	$203,690,268	$221,999,506	5%
NAVBASE Point Loma, CA	$196,415,627	$171,642,485	4%
NAVSUBASE New London, CT	$135,683,722	$111,536,619	2%
Total	**$5,934,390,157**	**$4,871,166,743**	

In total, the Navy has roughly $5.9 billion worth of waterfront infrastructure at these 11 homeports. Normalized to Norfolk prices, total waterfront infrastructure is valued at $4.9 billion.

The four installations with the most waterfront infrastructure are NAVBASE San Diego, CA; NAVSTA Norfolk, VA; NAVSTA Pearl Harbor, HI; and NAVBASE Coronado San Diego, CA. Combined, they account for nearly 70 percent of total normalized PRV among east and west coast homeports. Normalized waterfront operations PRV at

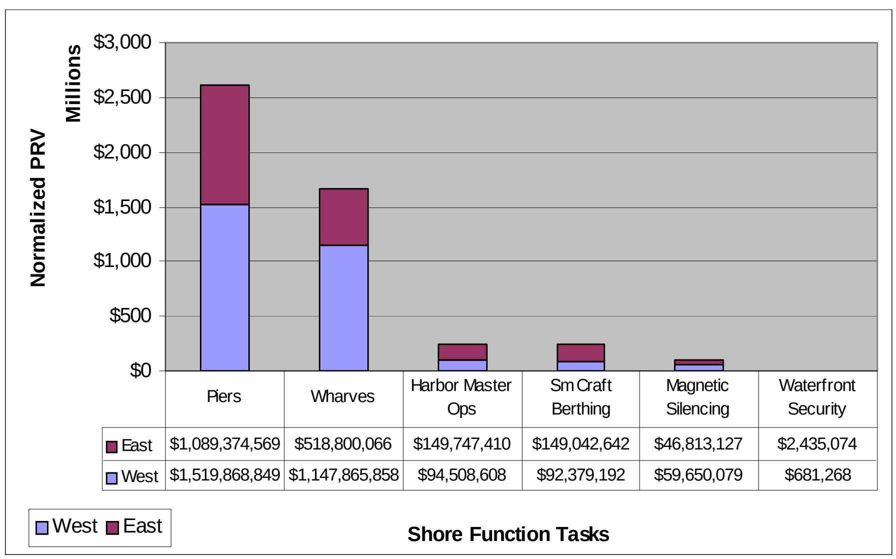
2. We used FY 2009 end-of-year iNFADS data to compute the entries in this table. In addition to the 11 homeports, the table includes a row that combines the three installations in the San Diego area: NAVBASE San Diego, CA; NAVBASE Coronado San Diego, CA; and NAVBASE Point Loma, CA.

each of the other installations is much less, ranging from $112 million at NAVSUBASE New London, CT, to about $337 million at NAVBASE Kitsap Bremerton, WA.

Further, table 2 shows that, if the three installations in the San Diego area were grouped together, they would account for about $1.8 billion (37 percent) of total normalized waterfront PRV.[3]

In addition to understanding how the Navy's waterfront infrastructure is distributed among installations, it is also useful to know how that infrastructure is broken down by type. Figure 4 shows the six SFTs in terms of total normalized PRV aggregated across all 11 homeports. This bar graph also shows the contribution totals by east and west coast installations.

Figure 4. Infrastructure breakdown by total normalized PRV

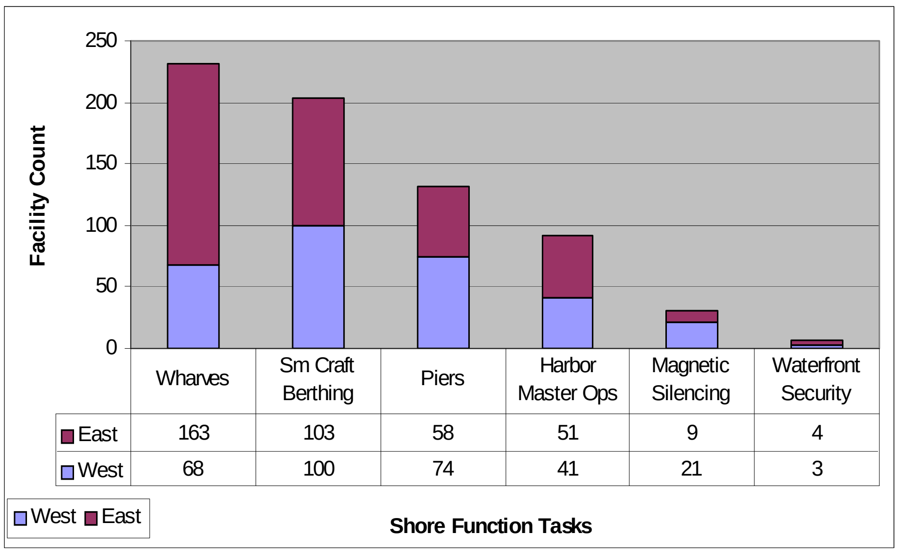


	Piers	Wharves	Harbor Master Ops	Sm Craft Berthing	Magnetic Silencing	Waterfront Security
East	$1,089,374,569	$518,800,066	$149,747,410	$149,042,642	$46,813,127	$2,435,074
West	$1,519,868,849	$1,147,865,858	$94,508,608	$92,379,192	$59,650,079	$681,268

3. We include this group of installations in order to facilitate comparisons with NAVSTA Norfolk, VA. NAVSTA Norfolk, VA handles all ship classes, whereas each San Diego installation generally supports specific classes: carriers at NAVBASE Coronado San Diego, CA; submarines at NAVBASE Point Loma, CA; and other surface ships at NAVBASE San Diego, CA.

Most of the waterfront infrastructure at U.S. homeports consists of berthing space for ships at either piers or wharves. Harbor master operations and small craft berthing make up the majority of the remaining facilities. Figure 5 shows a similar breakdown but with numbers of facilities within each shore function task.

Figure 5. Infrastructure breakdown by number of facilities



Even though piers make up the bulk of the value of waterfront facilities, the majority of facilities are wharves and small craft berthing support. Note that the west coast has a significantly greater number of magnetic silencing facilities than the east coast.

Summary

Overall, the Navy has about $5.9 billion in waterfront infrastructure assets at 11 U.S. homeports on the east and west coasts (including Hawaii). Normalizing waterfront PRV to Norfolk dollars, total waterfront infrastructure is valued at roughly $4.9 billion. Most of this infrastructure is located at the four largest homeports—NAVBASE San Diego, CA; NAVSTA Norfolk, VA; NAVSTA Pearl Harbor, HI; and

NAVBASE Coronado San Diego, CA. Of all the waterfront infrastructure at the 11 homeports, the largest proportion (in terms of PRV) is berthing for ships.

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Global shore infrastructure plans

As part of our analysis, we consulted the Global Shore Infrastructure Plan (GSIP) for each Navy enterprise. However, not all GSIPs were equally relevant to our work because our focus is on waterfront operations on the east and west coasts of the United States. Our intent in reviewing the GSIPs was to identify any infrastructure capability gaps specifically addressed in the GSIPs that were pertinent to our study. Ultimately, this would allow us to compare the results of our work with the findings listed in the GSIPs. This section summarizes what we found in each GSIP.

Surface Warfare Enterprise (SWE)

Of the 11 homeports in our analysis, sevenwere included in the SWE GSIP:

- NAVSTA Norfolk, VA
- NAVPHIBASE Little Creek, VA
- NAVSTA Mayport, FL
- NAVSTA Everett, WA
- NAVBASE San Diego, CA
- NAVBASE Point Loma, CA
- NAVSTA Pearl Harbor, HI.

The SWE GSIP [2] presented a capability gap analysis for each installation. Each gap analysis focused on four areas: waterfront operations, ordnance/weapons operations, maintenance, and training.

Because our focus is on waterfront operations, we were only concerned with GSIP findings that had something to do with waterfront operations. Table 3 summarizes the findings of the SWE GSIP—by installation—that were relevant to our study.

Table 3. SWE GSIP findings

Installation	Capability gaps identified in GSIP
NAVSTA Norfolk, VA	Functionality rated fair; condition rated poor; capacity rated fair
	Waterfront operation is affected by Explosive Safety Quantity Distance arcs and an increase in the number of homeported and transient ships and associated maintenance and logistics support
	Peak loading projected for FY 2019
	Loading affected by the presence of units from multiple enterprises and other agencies
	81 percent of FY 2021 capacity requirement possessed
NAVPHIBASE Little Creek, VA	Peak loading projected for FY 2021
	Will be significantly affected by arrival of LCS
	Could be affected by the shore power requirements of LSD 41 mid-life upgrades
NAVSTA Mayport, FL	6 of 16 primary berths have exceeded or will exceed their service life by 2011
	None of the steel sheet pile bulkheads making up the berthing wharves have cathodic protection. Section loss in the sheet pile has reached 50 to 100 percent in places
	Peak loading projected for FY 2025
	Loading will initially decrease due to FFG decommissionings
	Potential for a CVN to be homeported in Mayport
NAVSTA Everett, WA	Peak loading projected for FY 2011
	Near-term peak loading due to FFG class
	Without replacement, capacity requirements will decrease
NAVBASE San Diego, CA	Functionality rated fair; condition rated poor
	Peak loading projected for FY 2021
NAVBASE Point Loma, CA	Functionality rated fair; condition rated poor
NAVSTA Pearl Harbor, HI	Peak loading projected for FY 2023, due to arrival of LCS

Undersea Enterprise (USE)

Of the 11 homeports, six were included in the Submarine Forces (SUBFOR) GSIP:

- NAVSUBASE New London, CT

- NAVSTA Norfolk, VA
- NAVSUBASE Kings Bay, GA
- NAVBASE Kitsap (NBK) Bremerton, WA (in GSIP as NBK Bremerton and NBK Bangor)
- NAVBASE Point Loma, CA
- NAVSTA Pearl Harbor, HI.

The SUBFOR GSIP [3] presented a capability gap analysis for each of these installations. Each analysis focused on the following five areas: waterfront berthing, maintenance support, training, ordnance handling, and surge capability. As with the SWE GSIP, we focus on findings that are relevant for waterfront operations. Table 4 summarizes the findings of the SUBFOR GSIP—by installation—that were relevant to our study.

Table 4. SUBFOR GSIP findings

Installation	Capability gaps identified in GSIP
NAVSUBASE New London, CT	Shortfall of seven mission capable waterfront berths for SSNs (after P-463)
	Surplus of inadequate assets
	Ordnance handling operations conflict with shore infrastructure functions and pier and submarine maintenance
NAVSTA Norfolk, VA	The existing Pier 3 does not satisfy the criteria to provide adequate infrastructure for a minimum of 50 percent of homeport submarines. Pier 3 is too narrow to support submarine operations, has ongoing utility deficiencies, and cannot properly support submarine maintenance operations
	Explosives safety arcs from ordnance handling constrain maintenance operations and redevelopment of the waterfront
NAVSUBASE Kings Bay, GA	Upgrades to Site VI layberth are needed for SSGN homeport berthing
	There are no adequate assets to accommodate the new Transit Protection System (TPS) mission
NAVBASE Kitsap Bremerton, WA	There are no adequate assets for the new TPS mission (NBK Bangor)
NAVBASE Point Loma, CA	None
NAVSTA Pearl Harbor, HI	Many waterfront berthing assets require recapitalization. Block obsolescence is a concern due to the age of the facilities
	A majority of maintenance shops and dry docks require modernization

Navy Expeditionary Combat Enterprise (NECE)

The NECE GSIP [4] covered three installations that were part of our analysis. Table 5 lists the installations and the corresponding GSIP waterfront operations capability gaps that we identified.

Table 5. NECE GSIP findings

Installation	Capability gaps identified in GSIP
NAVSUBASE New London, CT	Renovate administration and storage spaces and laydown area used by Boat Det 813 and construct a boat ramp
NAVPHIBASE Little Creek, VA	Rated red for waterfront capacity for five units—Riverine Squadrons (RIVRONs) 1 and 2 and Explosive Ordnance Disposal Mobile Units (EOD-MUs) 2, 6, and 12
NAVSTA Everett, WA	Rated yellow for waterfront functionality, proximity, and quality for Maritime Expeditionary Security Squadron (MSRON) 9

Naval Aviation Enterprise (NAE)

The NAE GSIP [5] covered five installations that were part of our analysis. The NAE GSIP included overall ratings of each of nine Commander, Navy Installations Command (CNIC) regions—the Southwest region was the only region rated green in waterfront operations. The Mid-Atlantic, Southeast, and Northwest regions were all rated yellow, and the Hawaii region was rated red. Table 6 lists waterfront operations capability gaps identified at specific installations.

Table 6. NAE GSIP findings

Installation	Capability gaps identified in GSIP
NAVSTA Norfolk, VA	Rated yellow for waterfront operations (listed as berthing, turning basins, and navigability)
NAVSTA Mayport, FL	Rated yellow for waterfront operations (listed as berthing, turning basins, and navigability)
NAVBASE Kitsap Bremerton, WA	Rated yellow for waterfront operations (listed as berthing, turning basins, and navigability)

Table 6. NAE GSIP findings

Installation	Capability gaps identified in GSIP
NAVSTA Everett, WA	Rated yellow for waterfront operations (listed as berthing, turning basins, and navigability)
NAVSTA Pearl Harbor, HI	Rated red for waterfront operations (listed as berthing, turning basins, and navigability)

As can be seen from the foregoing findings, the GSIPs focused primarily on condition and configuration material shortfalls with the supporting shore infrastructure. Capacity shortfalls for current and future port loading were identified at NAVSUBASE New London, CT; NAVSTA Mayport, FL; and possibly NAVPHIBASE Little Creek, VA. We kept these potential future capacity requirements in mind as we continued with our analysis of port loading.

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Installation workload

In order to compare waterfront operations infrastructure support among east and west coast installations, we need a measure of the workload that each installation is supporting. Since the primary purpose of waterfront operations infrastructure is to support ships when they are in port, our workload measure is based on the amount of ship traffic at an installation. Our measure accounts for variation in the number and types of ships supported, as well as how often ships are actually in port.

Defining installation workload

Broadly speaking, the workload that is being supported by waterfront operations infrastructure at a Navy installation is the ships that are in port. Therefore, an installation-level workload measure should be related to how many ships an installation supports. As an example, for long-term planning purposes, the Navy computes a measure of expected installation workload that is equal to the linear feet of berthing required for ships that are expected to be in port over a given period of time.[4]

Our measure of workload should account for several factors:

- The number of ships in port
- The classes of ships in port
- How often ships are in port.

As a measure of installation workload that accounts for these three factors, we calculate what we call Average Daily Linear Ship Feet

4. Reference [2], for example, shows required berthing feet at several installations, computed for the fiscal year of expected peak loading at the installation.

(ADLSF), which is equal to the amount of berthing space required for the ships that an installation supported on an average day during FY 2008 and FY 2009. We use data covering 2 years so that our workload measure is long enough to capture an entire fleet response plan (FRP) cycle for ships, but short enough that we only capture relatively recent ship movements. In a later section, we discuss how recent workload compares to historical workload patterns.

We compute ADLSF for an installation using the following steps:

1. For each ship that was in port at the installation for at least 1 day over FY 2008 and FY 2009, add up the total number of days that the ship was in port.
2. For each ship, determine both the length of the ship (in feet) and the ship spacing requirement, and add the two together.[5]
3. For each ship, multiply the result of step 2 by the number of days the ship was in port.
4. Add up the results of step 3 for all ships.
5. Divide the result of step 4 by the total number of days in FY 2008 and FY 2009 (i.e., 731).[6]

Installations that support more ships, support larger ships, or have ships in port more often will have higher ADLSF values than other installations.

To see how this works in practice, consider the following example. Suppose we have only two installations and two ships. Assume that ship 1 requires 400 total feet of berthing space (i.e., including the ship spacing requirement), and ship 2 requires 800 feet. Rather than compute ADLSF for each of our two installations over an entire year,

5. Reference [6] indicates that, for ships other than aircraft carriers, an additional 50 feet of berthing space is required on either end of the ship. For carriers, the requirement is 100 feet. Thus, the ship spacing requirement for carriers is 200 feet; for other ships it is 100 feet.

6. There are 731 days rather than 730 because 2008 was a leap year.

we calculate it for only 2 days, assuming that our two ships were in port at each of the two installations as given in table 7.

Table 7. Notional ship schedule

Installation	In port, day 1	In port, day 2
Installation 1	Ship 1, Ship 2	Ship 1
Installation 2	No ships	Ship 2

So, on the first day, both ships were in port at installation 1, and no ships were in port at installation 2. On the second day, ship 1 was still in port at installation 1, but ship 2 moved to installation 2. Using this notional data, we can compute ADLSF for both installations:

$$\begin{aligned} ADLSF_1 &= [(2 \cdot 400) + (1 \cdot 800)]/2 \\ &= 1600/2 \\ &= 800 \end{aligned}$$

$$\begin{aligned} ADLSF_2 &= [(0 \cdot 400) + (1 \cdot 800)]/2 \\ &= 800/2 \\ &= 400 \end{aligned}$$

Our ADLSF measure shows that, on an average day, installation 1 supports twice the workload as installation 2.

Using ADLSF as our measure of installation workload facilitates comparisons across installations. Continuing with our simple example, if we find that both installation 1 and installation 2 have the same amount of waterfront operations infrastructure, we might conclude that installation 1 is making more efficient use of its resources. Another advantage to the ADLSF measure is that it is based on actual workload.

Data sources

To construct ADLSF for each of the installations under consideration, we used WEBSKED, an online database that identifies the location and activities of Navy ships. These data allowed us to identify which ships were in port at each installation from FY 2008 to FY 2009, and for how many days.[7] To determine the length of each ship, we used information from both the Navy Fact File (available online) and the Naval Vessel Registry (NVR) (also online). Ship spacing requirements were taken from [6]. Together, the data from these sources gave us the information we needed to generate ADLSF values for each of the 11 homeports.

WEBSKED was the best available data source that met our requirements. WEBSKED gave us the information we needed to construct our workload measure, but we note that WEBSKED is meant as a scheduling tool, not necessarily a record of the actual time ships ultimately spend on different activities (such as being in port). If a ship is diverted from its schedule on short notice, WEBSKED may not always be updated to reflect the change. It is difficult to know how these deviations may affect our workload measure, since we have no way to know how common the deviations are, or whether they might tend to bias our measure up or down. We suspect that deviations from the data reported in WEBSKED are likely to have a minimal effect on our results—the deviations may be relatively infrequent, minor when they occur, and deviations that bias our workload measure upward (for example, a ship might have planned to spend time in port, but ultimately didn't) may be offset by deviations that bias our measure downward (for example, a ship makes an unscheduled port visit).

Another limitation to using WEBSKED is that it does not include any information on non-Navy, non-MSC ships. These include any foreign ships, U.S. Coast Guard ships, visiting ships, or other vessels. At the

7. Though they do not appear nearly as often as surface combatants, we also included ships operated by the Military Sealift Command (MSC) in our analysis because they, too, represent Navy waterfront operations workload. Details describing how we determined which ships were in port each day during FY 2008 and FY 2009 are given in appendix B.

larger homeports, these types of ships may represent a significant additional workload that will not be captured by our measure. However, to the extent that our analysis focuses on how the Navy's waterfront infrastructure funding requirements are affected by support-level differences, it is not obvious whether we should include these other vessels in our workload calculations. The Navy has no explicit requirement to support these other sources of ship traffic, and our focus is on Navy requirements.

A final issue with using WEBSKED data is that WEBSKED does not include records for SSBN port visits. Due to the sensitive nature of SSBN ship schedules, incorporating SSBNs into our analysis would have precluded issuing our report as an unclassified document. By omitting SSBNs, our workload measure will understate the true workload at the two installations that support these submarines—NAVSUBASE Kings Bay, GA, and NAVBASE Kitsap Bremerton, WA (which encompasses the submarine base at Bangor, WA). Because SSBNs are in port infrequently, we suspect that the impact of omitting SSBNs on our workload measure is probably low.

We believe that the WEBSKED data are adequate for our purposes (bearing in mind the effects that the limitations described above may have on our workload results). The only other data source on the time ships spend in port is the Port Operations Management System (POMS), a database generated from the records of port operations personnel at Navy installations, and maintained by CNIC. A potential benefit of POMS is that it contains information on all ships in port, including visiting ships, foreign ships, U.S. Coast Guard ships, etc., and might have allowed us to include these other vessels in our measure of waterfront workload. However, we were told by POMS experts that the data were likely only reliable for a single year, FY 2009. Because we wanted to use data from a longer time horizon, WEBSKED was our only option.

Workload results

Table 8 shows our workload measure for each homeport.

Table 8. Port loading by installation

Installation	Total linear ship feet	ADLSF	Percentage
NAVSTA Norfolk, VA	15,498,391	21,202	33%
San Diego, CA (combined)	12,858,356	17,590	27%
NAVBASE San Diego, CA	10,837,242	14,825	23%
NAVSTA Pearl Harbor, HI	6,162,978	8,431	13%
NAVSTA Mayport, FL	5,018,922	6,866	11%
NAVSUBASE New London, CT	2,968,912	4,061	6%
NAVBASE Kitsap Bremerton, WA	1,831,421	2,505	4%
NAVPHIBASE Little Creek, VA	1,549,483	2,120	3%
NAVBASE Coronado San Diego, CA	1,286,108	1,759	3%
NAVSTA Everett, WA	1,228,228	1,680	3%
NAVBASE Point Loma, CA	735,006	1,005	2%
NAVSUBASE Kings Bay, GA	561,309	768	1%
Total	**47,678,000**	**65,223**	

Note: Figures may not sum to totals due to rounding.

During FY 2008 and FY 2009, east and west coast U.S. homeports supported over 47 million linear ship feet. The majority of the FY 2009 workload fell to the three major homeports—NAVSTA Norfolk, VA; NAVBASE San Diego, CA; and NAVSTA Pearl Harbor, HI. Together, these three installations supported over two-thirds of the total workload. NAVSTA Norfolk, VA, alone supported almost one-third of the entire workload. Combined, the three San Diego area installations supported nearly the same workload as NAVSTA Norfolk, VA.

Aside from the three major homeports, most of the remaining workload occurred at east coast homeports. The next busiest homeport was NAVSTA Mayport, FL, with a workload of over 11 percent of the total. The workload at NAVSTA Mayport, FL was over 2.5 times the workload of NAVBASE Kitsap Bremerton, WA, the busiest west coast homeport (excluding NAVBASE San Diego, CA, and NAVSTA Pearl

Harbor, HI). NAVSUBASE Kings Bay, GA, had the lowest workload of all homeports, with only around 1 percent of the total. However, the workload at NAVSUBASE Kings Bay, GA, is understated due to the lack of data on SSBNs.

Workload variation

Our workload measure gives us a single number that we can use to compare workload across installations. However, our measure reflects only the average daily workload over FY 2008–FY 2009. Obviously, the number of ships in port in a single day varies over the course of a year—there are likely to be days when workload is very high, as well as days when workload is very low. By using the average daily workload, we intend for our measure to capture the typical amount of daily ship traffic at each homeport. But to get a more complete picture of how waterfront workload varies across installations, we also examined the ship traffic data to see how daily workload fluctuated at each individual homeport.

Table 9 below summarizes the daily workload distribution over FY 2008–FY 2009 at each homeport.

Table 9. FY 2008-FY 2009 workload (daily linear ship feet) variation by installation

Installation	Min	Max	Mean	Std dev	Median	25th percentile	75th percentile	Z(Max)
NAVSTA Norfolk, VA	8,515	32,739	21,202	4,770	21,062	18,119	24,336	2.42
San Diego (combined)	8,343	30,041	17,590	4,414	16,988	14,512	19,866	2.82
NAVBASE San Diego, CA	5,369	25,014	14,825	4,030	14,634	12,104	17,220	2.53
NAVSTA Pearl Harbor, HI	3,724	16,345	8,431	1,880	8,409	7,126	9,534	4.21
NAVSTA Mayport, FL	2,427	11,093	6,866	1,574	6,909	5,697	8,001	2.69
NAVSUBASE New London, CT	1,857	6,065	4,061	951	4,174	3,254	4,651	2.11
NAVBASE Kitsap Bremerton, WA	460	5,336	2,505	924	2,494	1,745	3,037	3.06
NAVPHIBASE Little Creek, VA	0	4,541	2,120	759	2,127	1,519	2,547	3.19
NAVBASE Coronado San Diego, CA	0	5,091	1,759	1,174	1,618	1,292	2,584	2.84
NAVSTA Everett, WA	0	3,602	1,680	1,021	1,416	854	2,447	1.88

Table 9. FY 2008-FY 2009 workload (daily linear ship feet) variation by installation

Installation	Min	Max	Mean	Std dev	Median	25th percentile	75th percentile	Z(Max)
NAVBASE Point Loma, CA	0	2,300	1,005	591	920	460	1,380	2.19
NAVSUBASE Kings Bay, GA	0	2,057	768	409	660	660	1,120	3.16

In general, the entries in table 9 are standard descriptive statistics. One exception is the last column, which presents Z(Max), the Z-score for the maximum daily workload observed during the 2 year period. The Z-score expresses a single data point as the number of standard deviations it is from the mean of a population. We include Z(Max) as a way to assess the peak loading we observe at each installation. As a point of reference, if the daily workload data at a given installation followed a normal distribution, roughly 95 percent of the workload observations for that installation would be within two standard deviations of the mean. Thus, we might expect Z(Max) to be a little greater than 2. Higher values of Z(Max) mean that the peak loading at an installation is large relative to normal fluctuations in workload. Extreme values of Z(Max) mean that the maximum observed workload is very high compared to normal variation in daily workload.

The data in table 9 highlight some important features of the workload data:

- There were five installations that had at least 1 day during FY 2008–FY 2009 with no ships in port.
- Peak loading can be much higher than the average daily workload. The maximum observed daily workload at NAVSTA Pearl Harbor, HI, was roughly double the average daily workload there.
- The variability in daily workload was highest at NAVSTA Norfolk, VA, and NAVBASE San Diego, CA. The standard deviation of daily workload at each of these installations was over 4,000 linear ship feet.

We can also view the daily workload data graphically, as in figure 6 below.

Figure 6. FY 2008-FY 2009 daily workload variation by installation

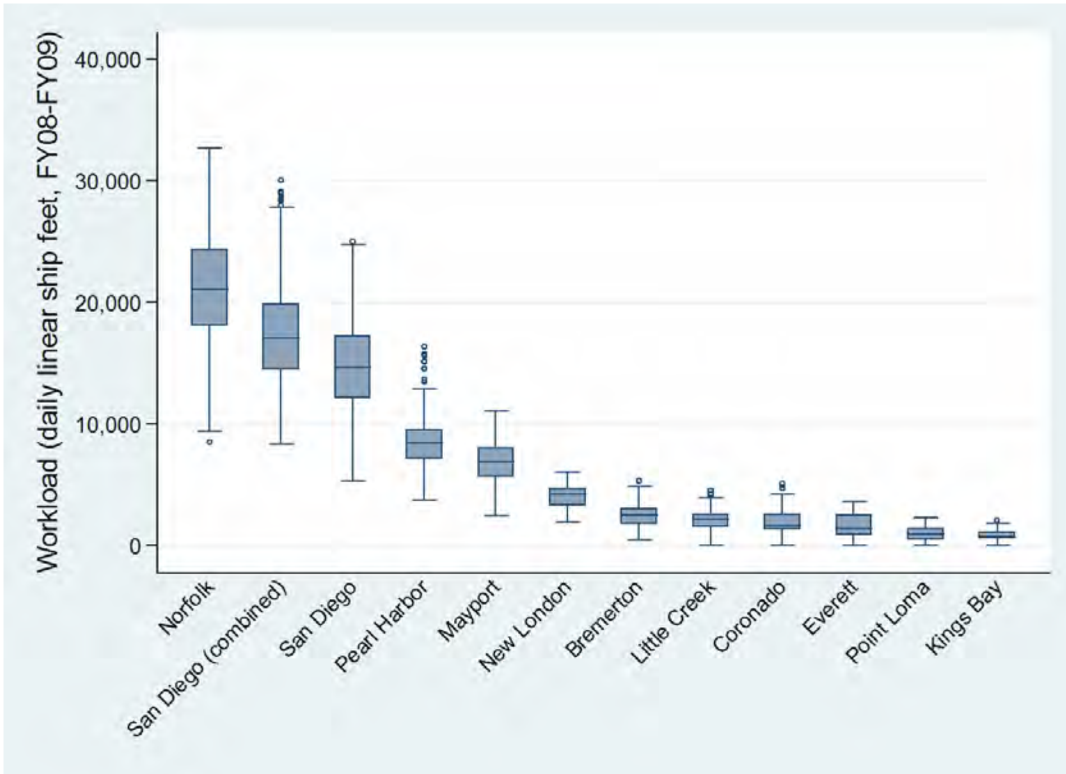


Figure 6 shows, for each installation, the amount of variation in daily workload over FY 2008–FY 2009. Each box shows the interquartile range—the range from the 25th percentile of the data to the 75th percentile. The horizontal line inside each box represents the median workload for the installation. The vertical lines extending above and below each box show the upper and lower adjacent values. The lower adjacent value is equal to the 25th percentile minus 1.5 times the interquartile range; the upper adjacent value is equal to the 75th percentile plus 1.5 times the interquartile range. The adjacent values help identify extreme values in each distribution—data points outside the range bracketed by the adjacent values are outliers. In figure 6, daily workload observations that fall outside the adjacent values are indicated with hollow circles. Basically, the adjacent values provide a sense of the expected range of the data; observations outside the expected range show greater-than-expected surges (or lulls) in workload.

Figure 6 highlights many of the features of the data that we noted from table 9. In particular, the figure highlights the fact that at NAVSTA Pearl Harbor, HI, large surges in workload occur more than at other installations. Notice that the interquartile ranges for NAVSTA Pearl Harbor, HI, and NAVSTA Mayport, FL, overlap slightly, and the range between upper and lower adjacent values for the two installations are very similar. However, there were no days at NAVSTA Mayport, FL, when workload was greater than the upper adjacent value. At NAVSTA Pearl Harbor, HI, there were several. Figure 6 also shows that installations fall into roughly three groups:

1. Major homeports (NAVSTA Norfolk, VA, and NAVBASE San Diego, CA)
2. Intermediate homeports (NAVSTA Pearl Harbor, HI, and NAVSTA Mayport, FL)
3. Small homeports (all others).

Within each group, the typical workload and the amount of variation in workload are relatively similar across installations.

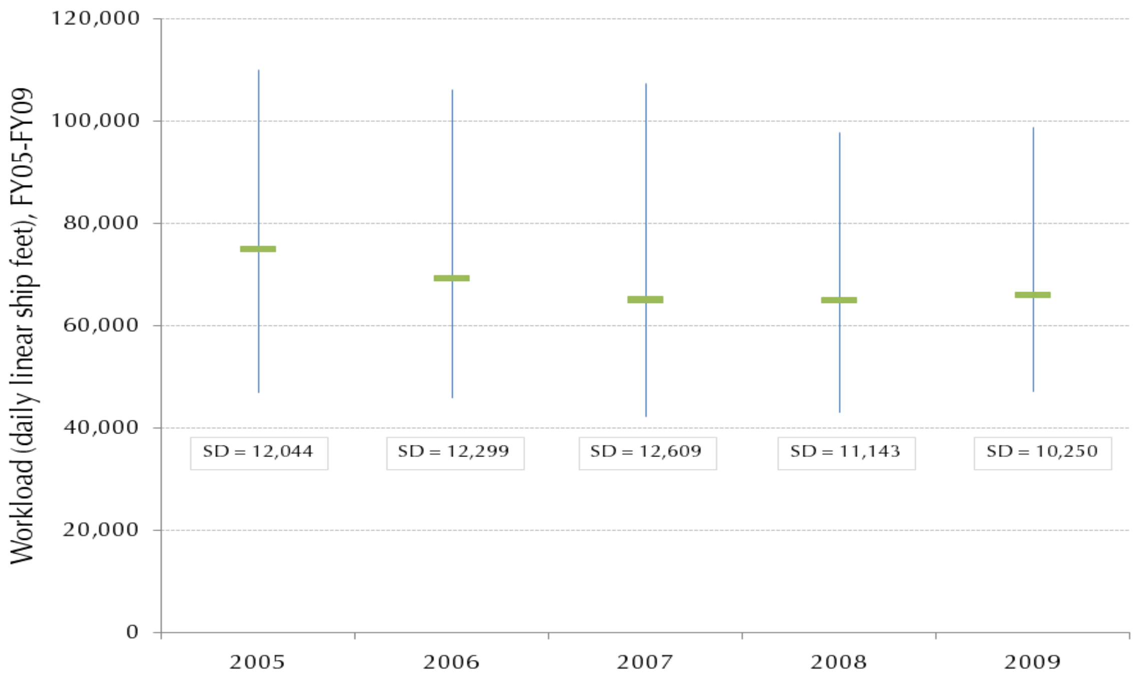
NAVSTA Norfolk, VA, is the only installation where we observe a greater-than-expected lull in workload.

Historical aggregate workload variation

Because our analysis focuses on waterfront operations infrastructure in FY 2009, our workload measure uses data on ship traffic from only the two most recent fiscal years. As we explained before, this window is long enough to include an entire FRP cycle, but short enough to be current. However, at the request of N46, we also explore how the workload data we observe for FY 2008–FY 2009 compare to historical patterns of port loading among east and west coast homeports.

To assess the aggregate, longer-term variation in workload, we gathered WEBSKED data on daily workload for all 11 homeports covering the period from FY 2005 to FY 2009. The installation profiles in appendix A include figures showing workload trends separately for each installation over this 5-year period. Figure 7 below summarizes the variation in the FY 2005–FY 2009 workload data aggregated across all 11 homeports.

Figure 7. Aggregate workload variation, FY 2005-FY 2009



In figure 7, the vertical lines show the range of daily workload for each fiscal year. The green marks indicate the average daily workload over the entire year—our ADLSF measure calculated for the entire group of 11 homeports. The box underneath each line shows the standard deviation of workload for that year. We note the following characteristics of aggregate workload over the 5-year period:

- Average daily workload declined from FY 2005 to FY 2007, then rose slightly from FY 2007 to FY 2009.
- Maximum daily workload for FY 2005 through FY 2007 was higher than for FY 2008 and FY 2009. From FY 2005 to FY 2007, the maximum daily workload was consistently over 100,000

linear ship feet. The annual maximums for FY 2008 and FY 2009 were both less than 100,000 linear ship feet.

- The amount of variation in daily workload increased from FY 2005 to FY 2007, but dropped sharply in FY 2008 and again in FY 2009.

Based on our aggregate-level historical comparison, it appears that total workload in FY 2008 and FY 2009 differed from workload patterns from FY 2005 to FY 2007. Since this analysis focuses on assessing the workload supported by current waterfront infrastructure, we focus on the most recent workload data (from FY 2008 and FY 2009), though we note that any comparisons of workload to waterfront capacity in our analysis would obviously change were overall workload to return to pre-FY 2008 levels.

Historical workload variation by coast

In addition to looking at trends in aggregate workload over FY 2005--FY 2009, we also compared total workload during the same period separately for east and west coasts. Figure 8 below shows how ADLSF varied by coast from FY 2005 to FY 2009.

Figure 8. Aggregate workload by coast, FY 2005-FY 2009

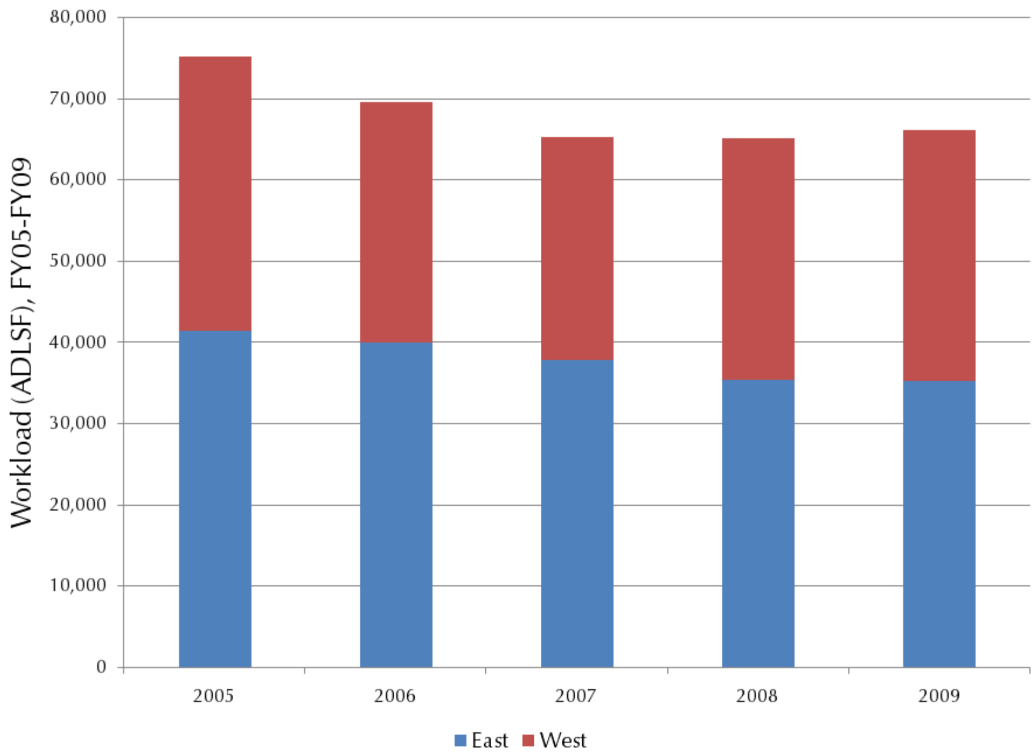


Figure 8 shows that overall, workload declined from FY 2005 to FY 2007, stayed more or less constant from FY 2007 to FY 2008, and slightly increased from FY 2008 to FY 2009. Workload on the east coast decreased each fiscal year; workload on the west coast decreased from FY 2005 to FY 2007, but rose in both FY 2008 and FY 2009.

Summary

In order to compare installations in terms of the workload that their waterfront infrastructure is supporting, we construct a measure of the total linear ship feet in port on an average day over FY 2008 and FY 2009. Our ADLSF measure accounts for the number of ships in port, the class of ships in port, and the frequency with which ships are in port. Our workload measure shows that the 11 east and west coast U.S. homeports supported over 47 million linear ship feet over this 2-year period. Over two-thirds of the workload was at the three major homeports—NAVSTA Norfolk, VA; NAVBASE San Diego, CA; and NAVSTA Pearl Harbor, HI. NAVSTA Mayport, FL, also supported a significant fraction of the overall workload. Aside from the three busiest ports, east coast installations in general supported more workload than west coast installations.

We also examined both daily workload volatility at each installation and how FY 2008–FY 2009 workload compares to workload patterns over the past five fiscal years. We found that NAVSTA Pearl Harbor, HI, experiences large surges in workload, equal to roughly double the typical daily workload there. Compared to historical patterns, total workload during FY 2008–FY 2009 was lower, with more workload shifting from the east coast to the west coast.

Installation efficiency

Based on anecdotal observations, it is a widely held belief that Navy installations on the east coast make do with less waterfront operations infrastructure than installations on the west coast. We were told, for example, that ships in port on the east coast must often nest,[8] whereas nesting is rare on the west coast. In this section, we look at whether the data support the idea that east coast installations are doing more with less.

Defining installation efficiency

In order to compare installations in terms of waterfront operations infrastructure and workload, we construct a measure of installation efficiency, which we call α:

$$\alpha = \frac{\text{ADLSF}}{\text{Total PRV (\$M)}}$$

Our measure α represents the workload that is supported by $1 million of waterfront operations infrastructure. So, for example, if $\alpha = 10$ at one installation and $\alpha = 15$ at another, it means that the second installation is supporting 50 percent more workload with each million dollars of waterfront infrastructure than the first installation. Given the interpretation of α, higher numbers imply that an installation is doing more with less.

8. Nesting is a practice of tying up ships outboard of other ships rather than directly to a pier or wharf. The net effect is to allow the same amount of berthing feet to support more than one ship. Nesting, while a practical workaround to limited berthing space, is usually not desirable due to ship maneuvering safety concerns and multiple movement of ships if inboard ships need to depart before outboard ships. It is normally done only with smaller ships and submarines.

Efficiency results

Table 10 shows the results of our efficiency calculations for east and west coast U.S. homeports. Our measure of efficiency is listed in the last column of the table, and installations are ordered from highest efficiency rating to lowest.

Table 10. Efficiency by installation

Installation	Workload (ADLSF)	Workload (percent)	Normalized waterfront PRV ($M)	PRV (percent)	α
NAVSUBASE New London, CT	4,061	6%	$112	2%	36.41
NAVSTA Mayport, FL	6,866	11%	$222	5%	30.93
NAVSTA Norfolk, VA	21,202	33%	$1,104	23%	19.21
NAVSTA Pearl Harbor, HI	8,431	13%	$547	11%	15.42
NAVBASE San Diego, CA	14,825	23%	$1,087	22%	13.64
San Diego, CA (combined)	17,590	27%	$1,783	37%	9.87
NAVPHIBASE Little Creek, VA	2,120	3%	$279	6%	7.60
NAVBASE Kitsap Bremerton, WA	2,505	4%	$337	7%	7.44
NAVSTA Everett, WA	1,680	3%	$248	5%	6.76
NAVBASE Point Loma, CA	1,005	2%	$172	4%	5.86
NAVBASE Coronado San Diego, CA	1,759	3%	$525	11%	3.35
NAVSUBASE Kings Bay, GA	768	1%	$240	5%	3.20
Total	**65,223**		**$4,871**		

The following results in table 10 are worth noting:

- In general, installations on the east coast are more efficient than installations on the west coast.
- NAVSUBASE New London, CT, and NAVSTA Mayport, FL, are the most efficient installations by a wide margin. At NAVSUBASE New London, CT, $1 million of normalized waterfront PRV supports nearly 90 percent more workload than NAVSTA Norfolk, VA, and over 2.5 times more workload than NAVBASE San Diego, CA. The same $1 million in normalized waterfront PRV at NAVSTA Mayport, FL, supports over 50 percent more

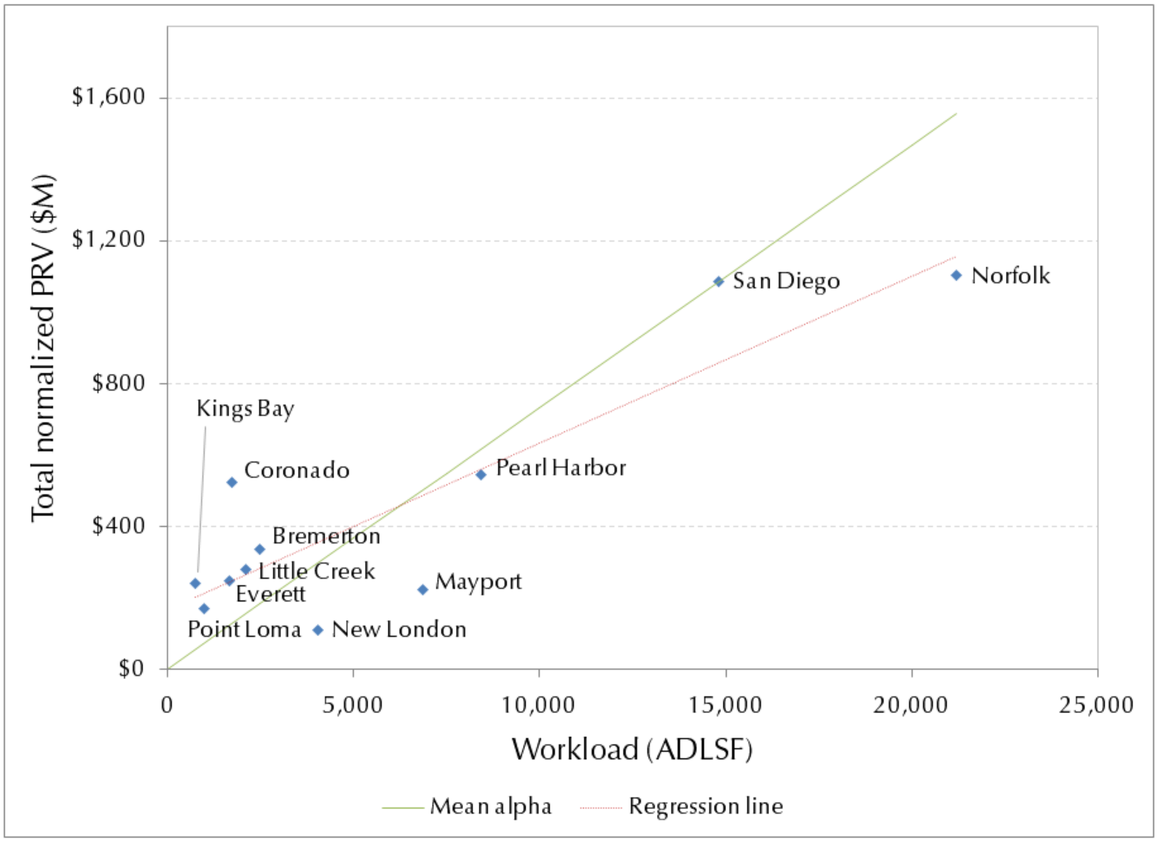
workload than at NAVSTA Norfolk, VA, and over double the workload as at NAVBASE San Diego, CA.

- If the three San Diego area installations are combined, they account for 27 percent of overall workload and 37 percent of normalized waterfront PRV. At this set of installations, $1 million of waterfront PRV supports about one-half the workload as $1 million of PRV at NAVSTA Norfolk, VA.
- NAVSUBASE Kings Bay, GA, supports the smallest workload and is last in terms of efficiency. NAVSUBASE Kings Bay, GA, accounts for 1 percent of total workload and 5 percent of normalized waterfront PRV. Again, we note that our results do not account for SSBNs at NAVSUBASE Kings Bay, GA.

In general, east coast installations are more efficient than those on the west coast. Though not listed in table 10, the mean value of α across the 11 installations is 13.62. For east coast installations, the mean value of α is 19.47; for west coast installations (including NAVSTA Pearl Harbor, HI), the mean value of α is 8.75. This difference implies that, on average, $1 million of normalized waterfront PRV supports 2.2 times as much workload on the east coast as on the west coast.

Figure 9 plots the data on workload and waterfront infrastructure for each of the homeports.

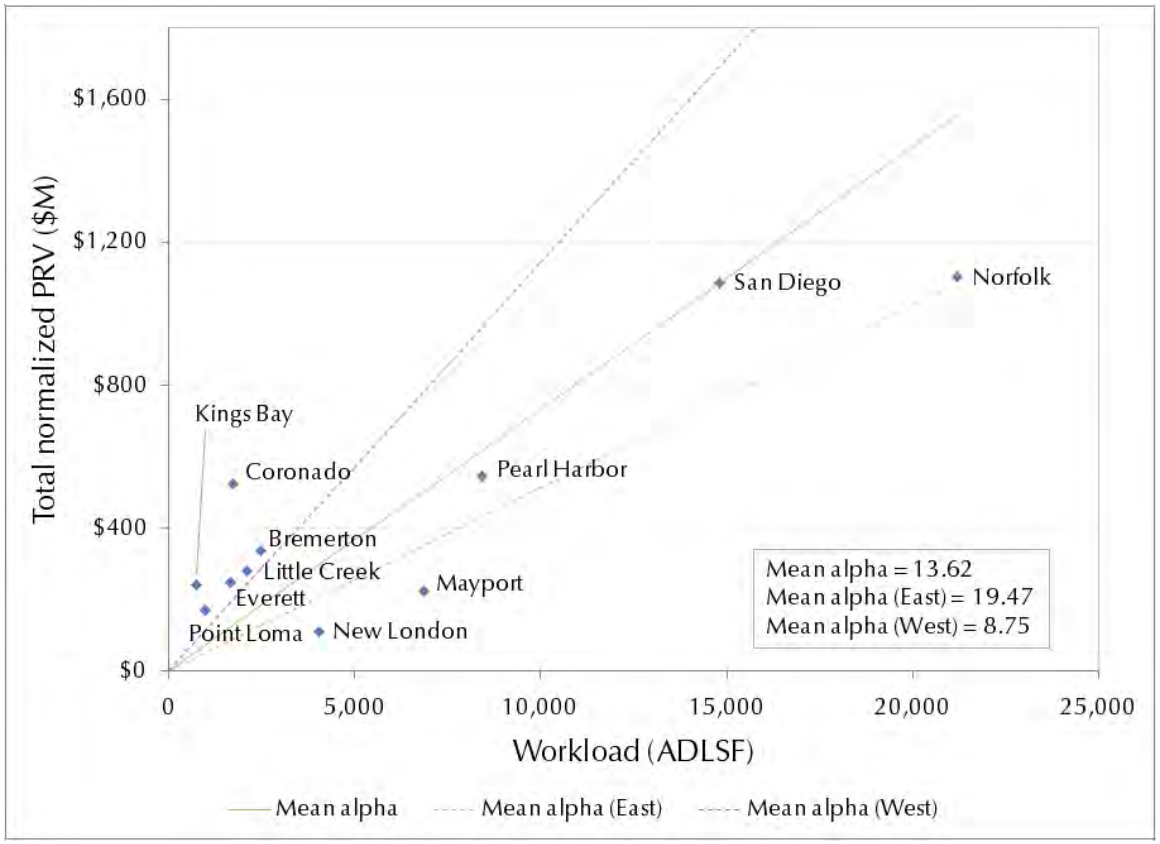
Figure 9. Installation efficiency



The green line in figure 9 shows combinations of workload and waterfront PRV where α = 13.62 (i.e., the average value of α over all installations). Because workload is on the horizontal axis, data points above the green line correspond to installations with efficiency ratings that are lower than average. Only two east coast installations—NAVSUBASE Kings Bay, GA, and NAVPHIBASE Little Creek, VA—lie above the green line. The only two west coast installations below the green line are NAVSTA Pearl Harbor, HI, and NAVBASE San Diego, CA. And NAVBASE San Diego, CA, is only slightly below the line. In other words, nearly all of the east coast homeports have above-average efficiency ratings, and nearly all of the west coast homeports have below-average ratings.

Figure 10 highlights the differences in workload support between east and west coasts.

Figure 10. Installation efficiency by coast



In figure 10, the green line shows the combinations of workload and normalized PRV that are consistent with the average efficiency rating over all 11 homeports. The orange dashed line represents combinations of the two variables that are consistent with the average efficiency rating among the five east coast installations. The purple dashed line shows combinations consistent with the average efficiency rating among the six west coast installations. The main takeaway from figure 10 is that, for a given workload, an average east coast installation has much less waterfront infrastructure support than an average west coast installation.

Returning to figure 9, the red line was fit to the data by estimating the following regression equation using ordinary least squares (OLS):

$$PRV_N(\$M) = \beta_0 + \beta_1 \text{Workload} + \varepsilon$$

This equation describes normalized waterfront PRV as a function of workload and an error term. PRV is given a subscript *N* to denote that we use normalized PRV data.

Estimating this simple model using data from the 11 homeports gives

$$PRV_N(\$M) = 165.8 + 0.05 \cdot \text{Workload}$$

with an R-squared value of 0.78.[9] One way to interpret the estimated regression equation is that it tells the amount of waterfront operations infrastructure (measured in terms of normalized PRV) required to achieve a sensible level of efficiency for a given workload.

We can use the regression equation to give us a sense ofthe adjustments that would be required to increase efficiency at certain installations. Looking at figure 9, the two installations that are farthest from the regression line are NAVBASE Coronado San Diego, CA, and NAVBASE San Diego, CA.

9. The adjusted R-squared, which adjusts the R-squared value to account for the number of parameters that are estimated, is 0.76. Both coefficient estimates are statistically significant at the 5-percent level.

Based on our aggregate analysis, there are two mechanisms for increasing efficiency at these installations:

1. Reducing waterfront operations infrastructure
2. Increasing workload.

Figure 11 shows how these adjustments could bring both NAVBASE Coronado San Diego, CA, and NAVBASE San Diego, CA, to a sensible level of efficiency. The red line in the figure reproduces the regression line from figure 9.

Figure 11. Notional efficiency gains

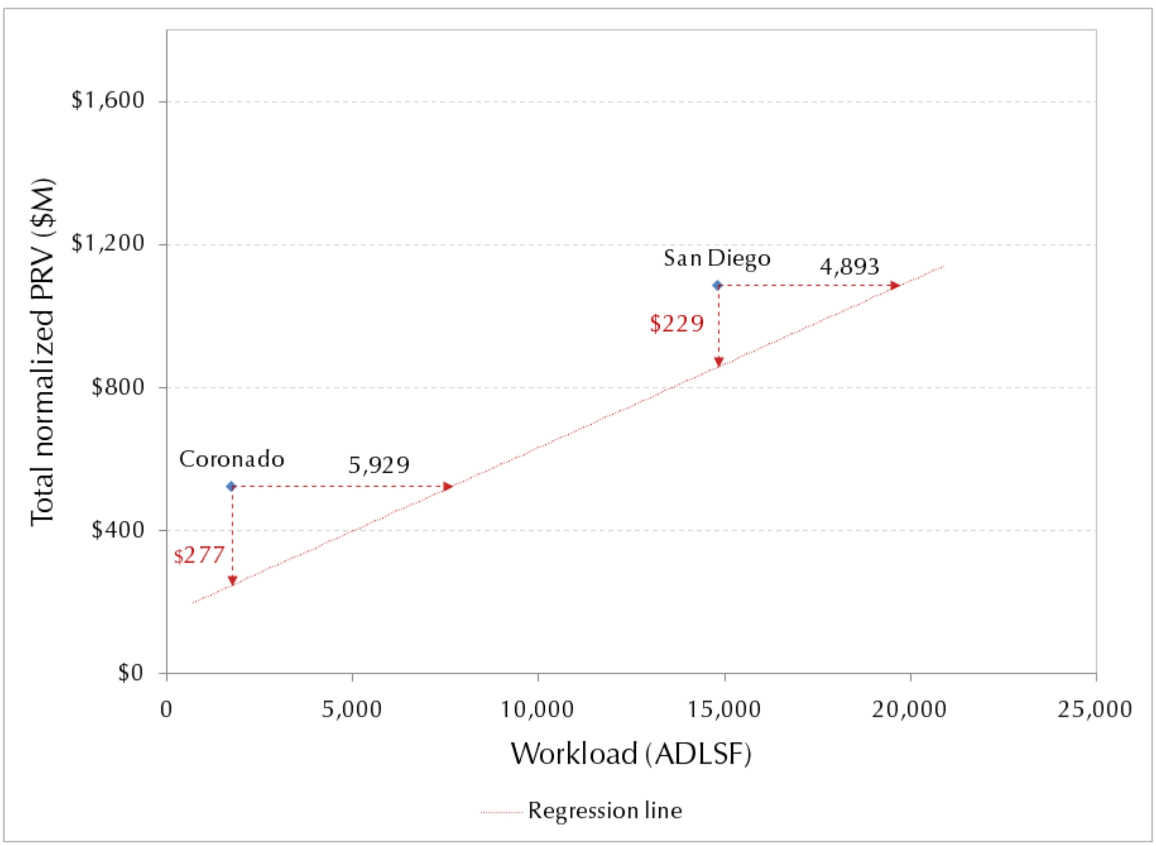


Figure 11 shows that, if the Navy sought to increase efficiency at NAVBASE Coronado San Diego, CA, by reducing waterfront infrastructure alone, it would need to eliminate $277 million of normalized PRV. Alternatively, the Navy could increase workload at NAVBASE Coronado San Diego, CA, by nearly 6,000 linear ship feet per day. Obviously, the Navy could also use some combination of both reduced waterfront PRV and additional workload to increase efficiency.

The implications for NAVBASE San Diego, CA, are similar. The Navy could eliminate $229 million of normalized PRV, increase workload by close to 5,000 linear ship feet per day, or implement some combination of reduced waterfront infrastructure and increased workload.

This aggregate-level analysis ignores several factors that would need to be considered before taking any actions to increase waterfront efficiency at either of these locations. For one, the aggregate normalized PRV reductions do not account for the breakdown of waterfront infrastructure at each installation. Our analysis in a later section addresses this concern by estimating potential requirement reductions at the level of individual category codes. Second, changing installation workloads would likely involve changing where some of the Navy's ships are homeported—decisions that would have strategic implications for the Navy. Such strategic implications are outside of the scope of this study.

Because our focus is to evaluate where the Navy should look for potential efficiency gains rather than the dollar value of such gains, we do not interpret the results in this section to imply that the Navy should eliminate over $200 million of waterfront PRV at NAVBASE Coronado San Diego, CA, and NAVBASE San Diego, CA. Rather, we take these results as a broad indication that, should the Navy decide to pursue potential waterfront operations efficiency gains, the Navy may want to focus its initial efforts on NAVBASE Coronado San Diego, CA, and NAVBASE San Diego, CA.

Berthing utilization

As another measure of installation efficiency, we compute a measure of berthing utilization, which we call γ. We generate our measure of berthing utilization at an installation using the following formula:

$$\gamma = \frac{\text{ADLSF}}{\text{Total Berthing}}$$

The only difference between γ and our efficiency measure α is the denominator. In this case, the denominator is equal to the sum of all linear feet of waterfront operations berthing available at an installation.[10] Our measure γ is intuitively appealing. It shows the proportion of total available berthing that was being used on an average day over FY 2008 and FY 2009. As with our efficiency measure α, one of the advantages to our berthing utilization measure is that it is based on actual workload.[11] Note that our computations do not consider the condition of the available berthing infrastructure. For example, if an installation has a pier that is not used because it is in poor shape, our calculations still include the pier as a potential berth.

One of the observations we heard from Navy personnel is that east coast ships nest, whereas west coast ships generally do not. Our simple utilization measure γ will capture nesting in the sense that nesting will

10. To compute total linear feet of berthing at an installation, we use data from iNFADS for FY 2009. Our measure of total feet of berthing (FB) includes only those facilities within the waterfront operations SCA.

11. One caveat to bear in mind is that γ does not account for all ship traffic during FY 2008 and FY 2009. Specifically, our workload measure does not account for non-Navy ship traffic (e.g., foreign ships, U.S. Coast Guard ships, and other visiting ships) or for port harbor craft (e.g., tugs, crane barges, berthing craft, and other yard vessels). At installations that accommodate significant numbers of these other types of ships, γ will understate the total utilization ratio.

lead to higher values of γ, all else equal. Table 11 gives our berthing utilization results.

Table 11. Berthing utilization by installation

Installation	ADLSF	Total berthing	γ
NAVSTA Mayport, FL	6,866	7,883	0.87
NAVSUBASE New London, CT	4,061	7,539	0.54
NAVSTA Norfolk, VA	21,202	47,663	0.44
NAVBASE San Diego, CA	14,825	36,552	0.41
San Diego, CA (combined)	17,589	64,902	0.27
NAVSTA Everett, WA	1,680	6,408	0.26
NAVSTA Pearl Harbor, HI	8,431	33,990	0.25
NAVBASE Kitsap Bremerton, WA	2,505	15,850	0.16
NAVBASE Coronado San Diego, CA	1,759	16,385	0.11
NAVBASE Point Loma, CA	1,005	11,965	0.08
NAVSUBASE Kings Bay, GA	768	9,954	0.08
NAVPHIBASE Little Creek, VA	2,120	33,019	0.06
Total	**65,223**	**227,208**	

Note: Total berthing utilization figures include all berthing provided by assets with the following category code numbers: 15120, 15140, 15160, 15220, 15240, 15260, 15510, and 15520.

Table 11 shows several interesting results:

- The three most utilized ports (NAVSTA Mayport, FL; NAVSUBASE New London, CT; and NAVSTA Norfolk, VA) and the two least utilized ports (NAVPHIBASE Little Creek, VA, and NAVSUBASE Kings Bay, GA) are on the east coast.
- On an average day during FY 2008 and FY 2009, the workload at NAVSTA Mayport, FL, accounted for over 87 percent of NAVSTA Mayport, FL's available berthing. The value of γ at NAVSTA Mayport, FL (0.87) is much higher than the homeport with the second highest utilization ratio, NAVSUBASE New London, CT ($\gamma = 0.54$).
- NAVBASE San Diego, CA, and NAVSTA Pearl Harbor, HI, have roughly the same amount of available berthing, but the utilization ratio at NAVBASE San Diego, CA (0.41) is over 1.5 times that at NAVSTA Pearl Harbor, HI (0.25).

- Combined, the three San Diego area installations feature over 17,000 more linear feet of berthing than NAVSTA Norfolk, VA, but a utilization ratio (0.27) over one-third lower than the ratio at NAVSTA Norfolk, VA (0.44).
- NAVPHIBASE Little Creek, VA, has the smallest γ (0.06).
- NAVSTA Everett, WA, has the least available berthing, but a utilization ratio (0.26) about the same as NAVSTA Pearl Harbor, HI (0.25).
- Among the three largest homeports—NAVSTA Norfolk, VA; NAVBASE San Diego, CA; and NAVSTA Pearl Harbor, HI—NAVSTA Norfolk, VA, and NAVBASE San Diego, CA, feature similar utilization ratios that are each almost double the ratio at NAVSTA Pearl Harbor, HI.

There is no clear pattern by coast. The east coast features the two installations with the highest utilization ratios, but the two installations with the lowest ratios are also on the east coast.

Other efficiency considerations

Our efficiency analysis is intended to provide an installation-level comparison of typical workload to existing waterfront infrastructure support. However, there are multiple factors related to port loading and waterfront infrastructure that our analysis does not capture. These include, but may not be limited to

1. ship-specific (or ship-class-specific) berthing requirements, such as required water depth and appropriate connectivity
2. the value of waterfront infrastructure capacity to support surges in port loading
3. the condition of waterfront infrastructure assets
4. how workload patterns may change in the future.

Although addressing these additional complications is outside the scope of our analysis, the factors listed do not directly impact our results. Rather, these factors may be important to bear in mind should the Navy begin serious discussions involving adjustments to waterfront infrastructure support levels.

Our tasking in this study was limited to comparing current waterfront infrastructure support levels on the east and west coasts, identifying whether differences exist, and exploring the potential requirement reductions associated with balancing support levels over time. Thus, for example, the results of our analysis do not directly apply to a future scenario involving different workload patterns on the east and west coasts.

Summary

To compare east and west coast homeports, we construct a measure of installation efficiency, α, which is equal to workload divided by total normalized waterfront operations infrastructure PRV. Larger values of α imply that an installation is doing more with less. Our analysis finds that

- NAVSUBASE New London, CT, and NAVSTA Mayport, FL, are the most efficient installations by a wide margin. At NAVSUBASE New London, CT, $1 million of normalized waterfront PRV supports nearly 90 percent more workload than at NAVSTA Norfolk, VA, and over 2.5 times more workload than at NAVBASE San Diego, CA. The same $1 million in normalized waterfront PRV at NAVSTA Mayport, FL, supports over 50 percent more workload than at NAVSTA Norfolk, VA, and over double the workload at NAVBASE San Diego, CA.

- If the three San Diego area installations are combined, they account for 27 percent of overall workload and 37 percent of normalized waterfront PRV. At this set of installations, $1 million of normalized waterfront PRV less than one-half of the workload at NAVSTA Norfolk, VA.

- NAVSUBASE Kings Bay, GA, supports the smallest workload and is last in terms of efficiency. NAVSUBASE Kings Bay, GA, accounts for 1 percent of total workload and 5 percent of normalized waterfront PRV. Again, we note that our results do not account for SSBNs at NAVSUBASE Kings Bay, GA.

- In general, installations on the east coast are more efficient than installations on the west coast. The average value of α is 19.47 among east coast installations and 8.75 among west coast installations (including NAVSTA Pearl Harbor, HI). This means that $1 million of normalized waterfront operations infrastructure supports 2.2 times as much workload on the east coast as on the west coast.

We also construct a measure of berthing utilization, γ, equal to workload divided by total available berthing space. This utilization ratio shows the proportion of total berthing space that was used on an average day over FY 2008 and FY 2009 by Navy and MSC ships. If ships nest frequently at a given installation, this will be reflected in a higher value of γ. Our analysis of berthing utilization finds the following:

- The three most utilized ports (NAVSTA Mayport, FL; NAVSUBASE New London, CT; and NAVSTA Norfolk, VA) and the two least utilized ports (NAVPHIBASE Little Creek, VA, and NAVSUBASE Kings Bay, GA) are on the east coast.
- NAVSTA Mayport, FL, has the highest utilization ratio (0.87), which is significantly higher than at any other installation.
- NAVBASE San Diego, CA, and NAVSTA Pearl Harbor, HI, have roughly the same amount of available berthing, but the utilization ratio at NAVBASE San Diego, CA (0.41) is over 1.5 times that at NAVSTA Pearl Harbor, HI (0.25).
- NAVSTA Norfolk, VA, and NAVBASE San Diego, CA, have similar utilization ratios. However, if all three San Diego area installations are grouped together, the set has 36 percent more berthing space than NAVSTA Norfolk, VA, but a utilization ratio (0.27) less than two-thirds the ratio at NAVSTA Norfolk, VA (0.44).

We note that there are multiple factors that we do not consider in our analysis, but that would be important for the Navy to bear in mind when interpreting our efficiency results. Examples include ship-specific berthing requirements, the value of extra waterfront capacity to support workload surges, and expected changes to future workload patterns.

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Potential requirement reductions

In order to see where the Navy may be able to reduce its shore infrastructure support requirements, we build on the methodology we used to compare aggregate installation efficiency in a previous section of this report. First, we compute the average level of efficiency separately by category code. Next, we identify those installations with below-average efficiency for each category code. Combining the average level of efficiency with data on installation assets, we compute the amount of infrastructure reduction that would bring each below-average installation to the average efficiency level. Finally, we use Department of Defense (DoD) cost models to determine the requirement reductions—in restoration and modernization (RM), sustainment (ST), and actual facilities-related base operating service (BOS) costing per square foot of installation real property inventory—associated with the infrastructure reductions we calculated.

Our aim is not to recommend specific reductions to infrastructure assets at any of the homeports in our analysis. Rather, we intend the results of our analysis to highlight the types of infrastructure assets where potential efficiency gains exist, and to identify the installations that show potential for efficiency improvements. Using our results, the Navy will be in a better position to begin a conversation among Navy stakeholders about adjustments to shore infrastructure.

Efficiency by category code

To identify the types and locations of waterfront operations infrastructure support the Navy may be able to reduce, we first compute efficiency separately by individual category code. Our method is similar to the one we used to compare installations at an aggregate level using PRV data. For this section of our analysis, we consider only the 23 category codes for which Navy infrastructure assets are spread out among at least three different installations.

We illustrate our methodology using category code number 15120 (a general-purpose berthing pier) as an example.

Ten of the 11 homeports—all but NAVSTA Mayport, FL—had some general-purpose pier space. For each installation, we first calculate the ratio of workload (ADLSF) to the total measure of category code 15120, which we call λ:

$$\lambda = \frac{\text{ADLSF}}{\text{Total CCN Measure}}$$

Next, we calculate the average λ across the ten homeports; we classify an installation as being efficient if its λ is greater than the average λ. An above-average λ indicates that an installation is supporting more workload per unit of pier space than an average installation. Conversely, a below-average λ means that an installation is supporting less workload per unit of pier space.

Table 12 shows the λ values for general-purpose berthing space.

Table 12. Efficiency by installation, general-purpose berthing pier

Installation	ADLSF	Unit of measure	Total CCN measure	λ
NAVSTA Pearl Harbor, HI	8,431	SY	25,884	0.326
NAVSUBASE New London, CT	4,061	SY	18,000	0.226
NAVPHIBASE Little Creek, VA	2,120	SY	23,228	0.091
NAVBASE San Diego, CA	14,825	SY	170,404	0.087
NAVSTA Norfolk, VA	21,202	SY	254,289	0.083
NAVBASE Coronado San Diego, CA	1,759	SY	29,284	0.060
NAVBASE Kitsap Bremerton, WA	2,505	SY	47,782	0.052
NAVBASE Point Loma, CA	1,005	SY	34,402	0.030
NAVSTA Everett, WA	1,680	SY	66,367	0.025
Average	**5,832**		**68,762**	**0.102**

Note: Due to the omission of SSBN ship traffic data, we omit NAVSUBASE King Bay, GA, from the table. However, the contribution of NAVSUBASE Kings Bay, GA, is included in our analysis.

For general-purpose berthing piers, the average value of λ is 0.102. NAVSTA Pearl Harbor, HI, and NAVSUBASE New London, CT, are the only installations that have above-average efficiency ratings for this category code number. This suggests that potential efficiency gains exist at each of the other eight homeports for this category code.

We use the same methodology to identify potential efficiency gains for other category codes.

Potential infrastructure reductions by category code

Given the results of our efficiency calculations, we want to determine how much infrastructure (by category code) the Navy would need to get rid of to increase efficiency at below-average installations. We can compute the necessary reduction that would bring the installation to the average level of efficiency using the following formula:

$$\delta = \left[\frac{ADLSF}{\bar{\lambda}}\right] - \text{Total CCN Measure}$$

where $\bar{\lambda}$ is the average value of λ. The term in brackets is equal to the amount of pier space that is consistent with the average level of efficiency, given the installation's workload. Because making a below-average installation more efficient means reducing infrastructure, δ will always be negative.

Continuing with the example of general-purpose berthing piers, table 13 shows the infrastructure reductions our procedure identifies for each of the eight below-average installations.

Table 13. Potential reductions by installation and coast, general-purpose berthing piers

Installation	ADLSF	$\bar{\lambda}$	Total CCN measure	Unit of measure	δ	δ (percent)
NAVSTA Everett, WA	1,680	0.102	66,367	SY	(49,896)	-75%
NAVBASE Point Loma, CA	1,005	0.102	33,402	SY	(23,549)	-70%

Table 13. Potential reductions by installation and coast, general-purpose berthing piers

Installation	ADLSF	$\bar{\lambda}$	Total CCN measure	Unit of measure	δ	δ (percent)
NAVSUBASE Kings Bay, GA	768	0.102	18,980	SY	(11,451)	-60%
NAVSTA Kitsap Bremerton, WA	2,505	0.102	47,782	SY	(23,223)	-49%
NAVBASE Coronado,. CA	1,759	0.102	29,284	SY	(12,039)	-41%
NAVSTA Norfolk, VA	21,202	0.102	254,289	SY	(46,446)	-18%
NAVBASE San Diego, CA	14,825	0.102	170,404	SY	(25,061)	-15%
NAVPHIBASE Little Creek, VA	2,120	0.102	23,228	SY	(2,826)	-12%
Total			**643,736**		**(194,491)**	**-30%**
Total (East)			**296,497**		**(60,723)**	**-20%**
Total (West)			**347,239**		**(133,768)**	**-38%**

The last column of table 13 shows the potential infrastructure reduction as a percentage of the existing infrastructure assets at each installation. For this single category code, our analysis shows the following:

- Among the eight below-average installations, the Navy would need to eliminate 30 percent of its general-purpose pier space to increase efficiency.
- The biggest potential reduction, both in absolute and percentage terms, is at NAVSTA Everett, WA. To increase efficiency to the average efficiency level, the Navy would need to reduce pier space at NAVSTA Everett, WA, by nearly 50,000 square yards, which would eliminate three-quarters of its general-purpose berthing pier space.
- By coast, increasing efficiency for general-purpose berthing piers would mean reducing total pier space by 20 percent at three east coast homeports and by 38 percent at five west coast homeports.

We use the same procedure to compute potential reductions separately by category code. Table 14 shows our results for each of the 23 category codes we considered.

Table 14. Potential UOM infrastructure reductions by CCN

CCN	UOM	NB Coronado	NB San Diego	NB Point Loma	NS Pearl Harbor	NB Bremerton	NS Everett	NS Norfolk	SB New London	NPHIB Little Creek	SB Kings Bay	NS Mayport
12220	GM	492				138			28	60	11	
13710	SF	26,077										
13810	EA	1			1	1						
13820	EA	3				1					18	
15120	SY	12,030	25,014	23,541		23,212	49,889	46,380		2,824	11,450	
15140	SY			7,601	5,952	7,054						3,310
15180	SY			3,973		7,881					2,723	
15220	SY				71,973	13,270			322		29,575	49,759
15260	SY				9,295					3,751		
15410	LF	8,899		287		557		29,786	12,066	5,541		
15420	SY	105,906	89,588		3,425	7,070				36,326		
15430	LF			3,596		9,770	9,029			15430		
15510	FB										25	
15520	FB	11,769		1,428	15520	2,385	591			14,593	2,897	
15521	SF				812	13,130	3,855	7,737		38,294		
15610	SF				39,999		57,033	128,611			268,761	
15920	SF			3,655	660				669			
15921	EA			5								
15930	SF	67		10,635		4,992					7,825	
15964	SF	58,501		2,212	31,357	18,959	3,015	40,805	11,072	8,758	28,494	5,396
16310	EA			20		28					1	
16320	EA	2		1	2	22						
16410	LF						3,357					

While reductions were identified for all installations and category codes, the amounts for each varied significantly; this indicates that some areas and locations will be more valuable to explore for potential requirement reductions than others.

Potential requirement reductions by category code

The potential infrastructure reductions listed in the last section represent potential reductions to Navy funding requirements. By reducing waterfront infrastructure, the Navy would realize lower annual requirements in its installations BOS, ST, and RM accounts.

Programming requirements for each of these three accounts are computed separately by category code. For each category code, the amount of infrastructure is multiplied by a unit cost and other adjustment factors. We use the δ's computed in the previous section to compute potential requirement reductions separately for each category code. Tables 15 through 17 show the results for each funding category. We aggregate the 23 individual category codes into shore function tasks (SFTs) to make it easier to see what types of infrastructure reductions are implied by our analysis. Note that we did not identify any potential reductions of requirements within the waterfront security SFT, so it is not included in the summaries.

Sustainment (ST)

Using the following equation, we calculated the maximum annual ST requirement reductions, by CCN, associated with reducing infrastructure assets by the δ quantities we identified:

$$\text{ST Savings}_{ij} = \delta_{ij} \cdot (F_{ij}^{\text{Unit Cost}}) \cdot (F_{ij}^{\text{Area Cost}}) \cdot (F_{ij}^{\text{Inflation}})$$

Because we are using FY 2009 unit costing data and looking at FY 2009 potential requirement reductions, the inflation factor is equal to 1 in all cases. Table 15 provides a summary of the potential maximum annual ST reduction amounts by installation and SFT.

Table 15. Potential maximum annual ST reduction amounts

Installation	Piers ($K)	Wharves ($K)	Harbor master operations ($K)	Small craft berthing ($K)	Magnetic silencing ($K)
NAVSTA Pearl Harbor, HI	385	5,478	461	521	5
NAVBASE Coronado San Diego, CA	422	3,716	360	1,023	0
NAVBASE San Diego, CA	878	3,143	0	0	0
NAVBASE Kitsap Bremerton, WA	1,183	946	89	238	331
NAVSUBASE Kings Bay, GA	311	803	708	173	99
NAVSTA Norfolk, VA	1,344	0	455	354	0
NAVPHIBASE Little Creek, VA	82	1,255	30	1,042	0
NAVSTA Everett, WA	1,766	127	188	53	0

Table 15. Potential maximum annual ST reduction amounts

Installation	Piers ($K)	Wharves ($K)	Harbor master operations ($K)	Small craft berthing ($K)	Magnetic silencing ($K)
NAVSTA Mayport, FL	88	1,321	17	0	0
NAVBASE Point Loma, CA	1,093	50	9	113	205
NAVSUBASE New London, CT	0	12	49	177	3
Totals	**7,552**	**16,851**	**2,366**	**3,693**	**644**

The total ST potential is $31.1 million across all five SFTs. More than 78 percent of the potential lies with the capital facilities of piers and wharves. The top four installations are NAVSTA Pearl Harbor, HI; NAVBASE Coronado San Diego, CA; NAVBASE San Diego, CA; and NAVSTA Kitsap Bremerton, WA. Over half the potential ST requirement reductions are located at those installations.

Restoration and modernization (RM)

Using the following equation, we calculated the maximum annual RM requirement reductions, by CCN, associated with reducing infrastructure assets by the δ quantities we identified:

$$\text{RM Savings}_{ij} = \delta_{ij} \cdot (F_{ij}^{\text{PRV}}) \cdot (F_{ij}^{\text{Obsolescence}}) \cdot (F_{ij}^{\text{Inflation}})$$

The RM obsolescence factor was developed by OSD and is the ratio of 0.60 divided by the service life for that CCN. This factor annualizes the RM requirement into equal annual amounts. The inflation factor is equal to 1 for these calculations as well. Table 16 provides a summary of the potential maximum annual RM reduction amounts by installation and SFT.

Table 16. Potential maximum annual RM reduction amounts

Installation	Piers ($K)	Wharves ($K)	Harbor master operations ($K)	Small craft berthing ($K)	Magnetic silencing ($K)
NAVSTA Pearl Harbor, HI	432	6,137	284	308	3
NAVBASE Coronado San Diego, CA	448	3,944	249	600	0
NAVBASE San Diego, CA	931	3,336	0	0	0
NAVBASE Kitsap Bremerton, WA	1,291	975	58	133	348
NAVSUBASE Kings Bay, GA	354	913	413	104	101
NAVSTA Norfolk, VA	1,509	0	314	274	0
NAVPHIBASE Little Creek, VA	92	1,378	20	617	0
NAVSTA Everett, WA	1,891	95	135	28	0
NAVSTA Mayport, FL	99	1,486	11	0	0
NAVBASE Point Loma, CA	1,164	37	6	64	190
NAVSUBASE New London, CT	0	13	31	133	2
Totals	**8,212**	**18,313**	**1,521**	**2,260**	**645**

The total RM potential is $31.0 million across all five SFTs. Almost 86 percent of the potential reductions lie with the capital facilities of piers and wharves. The top four installations are again NAVSTA Pearl Harbor, HI; NAVBASE Coronado San Diego, CA; NAVBASE San Diego, CA; and NAVSTA Kitsap Bremerton, WA. Almost 63 percent of the RM potential requirement reductions are located at those installations.

Base operating services (BOS)

Using the following equation, we calculated the maximum annual BOS requirement reductions, by CCN, associated with reducing infrastructure assets by the δ quantities we identified:

$$\text{BOS Reduction} = \delta_{ij} \cdot (F_{ij}^{\text{SF Cost}}) \cdot (F_{ij}^{\text{Inflation}})$$

We calculated the square-foot (SF) cost factor by summing the total FY 2008 expenditures in four BOS fund accounts[12] and dividing by the total SF at that location. The inflation factor for these calculations is 1.0231 [7] since the cost factor is in FY 2008 dollars. Table 17 provides a summary of the potential maximum annual BOS requirement reduction amounts by installation and SFT.

Table 17. Potential maximum annual BOS reduction amounts

Installation	Piers ($K)	Wharves ($K)	Harbor master operations ($K)	Small craft berthing ($K)	Magnetic silencing ($K)
NAVSTA Pearl Harbor, HI	0	0	227	3	2
NAVBASE Coronado San Diego, CA	0	0	267	0	0
NAVBASE San Diego, CA	0	0	0	0	0
NAVBASE Kitsap Bremerton, WA	0	0	97	67	26
NAVSUBASE Kings Bay, GA	0	0	1,526	0	40
NAVSTA Norfolk, VA	0	0	671	31	0
NAVPHIBASE Little Creek, VA	0	0	30	133	0
NAVSTA Everett, WA	0	0	227	15	0
NAVSTA Mayport, FL	0	0	5	0	0
NAVBASE Point Loma, CA	0	0	6	0	39
NAVSUBASE New London, CT	0	0	58	0	3
Totals	**0**	**0**	**3,114**	**249**	**110**

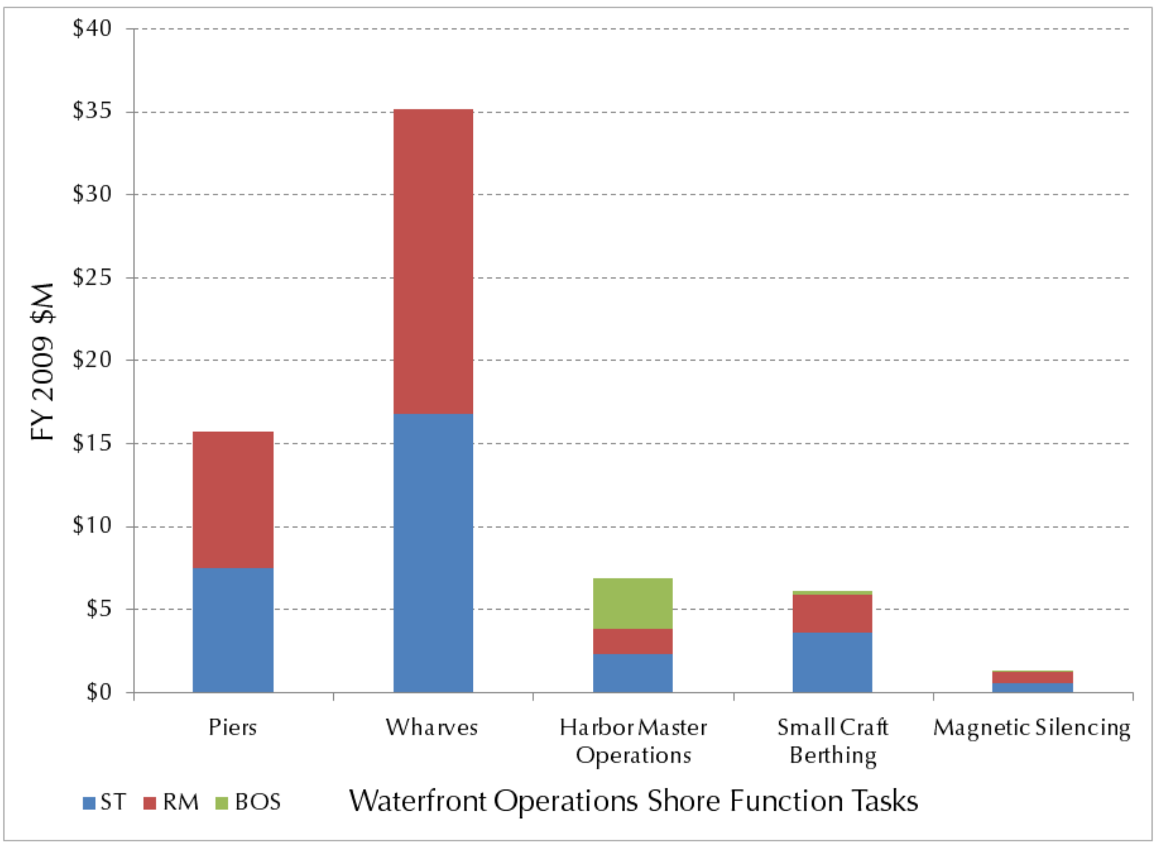
The total BOS requirement reduction potential is $3.5 million across all five SFTs. Piers and wharves are measured in square yards, so the Installation SF cost factor cannot be applied to them. This results in zero potential reductions in those areas. Almost 90 percent of the identified potential reductions lie within harbor master operations.

12. Those four accounts were utilities (UT), facilities services (FX), facilities planning (FP), and transportation (TR).

Total possible reductions

Figures 12 and 13 summarize the total potential annual savings by both SFT and location. Figure 12 shows the potential cost savings for each of the five SFTs in the waterfront operations SCA.

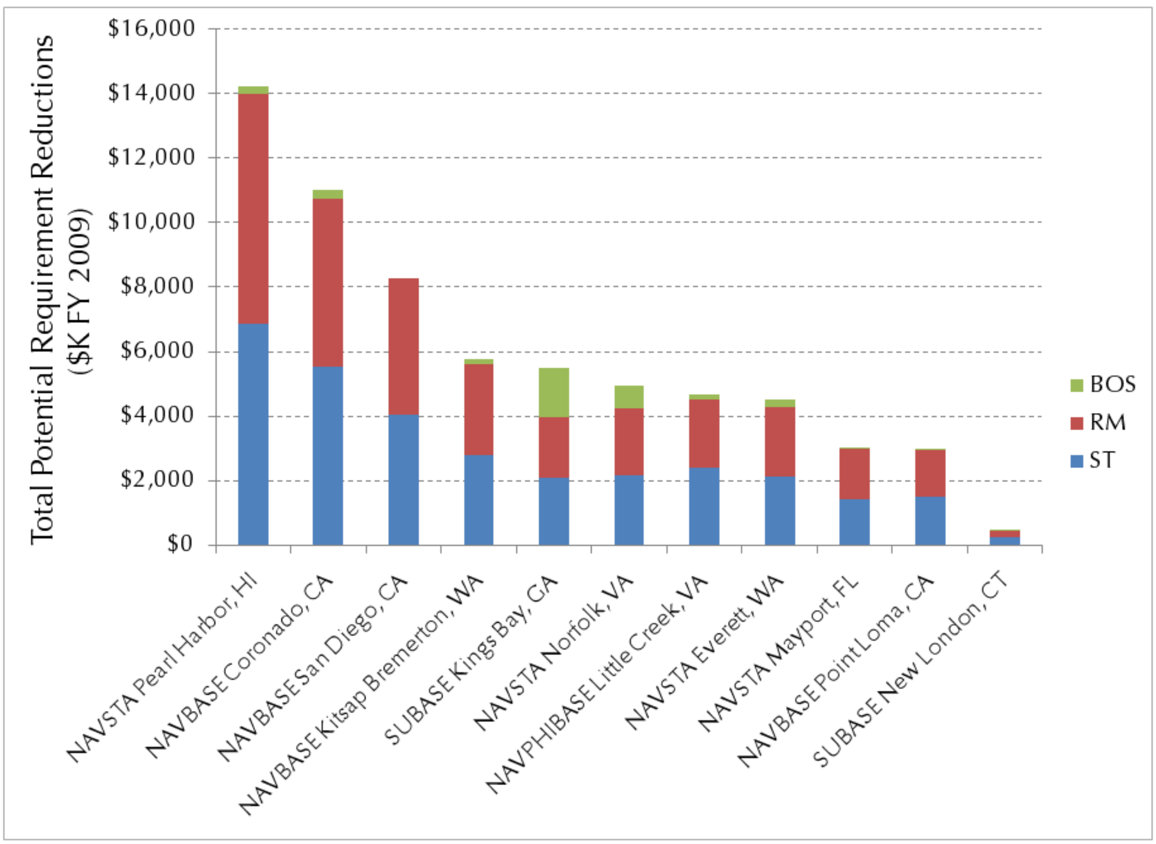
Figure 12. Annual requirement reductions by SFT



The total potential annual reductions across all SFTs and locations is $65.5 million. The largest potential requirement reductions are associated with the capital facility investments of wharves and piers. The Navy could reduce its ST and RM requirements by a total of roughly $50 million if it reduced infrastructure in just these two waterfront SFTs. We note that nearly all the potential reductions are to the ST and RM requirements. The only SFT where potential BOS requirement reductions exist is within harbor master operations. The reduction of magnetic silencing infrastructure would only lead to small reductions in the overall Navy requirement.

Figure 13 summarizes the total potential annual requirement reductions by location.

Figure 13. Total potential annual reductions by location



Although all locations could improve their support efficiency in selected waterfront CCN areas, the bulk of the requirement reduction potential (almost 72 percent) lies on the west coast. The greatest potential lies with three installations: NAVSTA Pearl Harbor, HI (22 percent); NAVBASE Coronado San Diego, CA (17 percent); and NAVBASE San Diego, CA (13 percent).

How feasible are the potential reductions?

Even though we have identified the maximum potential annual requirement reductions that might be achieved by eliminating waterfront infrastructure at selected Navy ports to balance the port loading efficiency, it doesn't mean that these savings are achieveable. Though our analysis finds that the Navy could reduce its funding requirements by over $65 million annually by reducing waterfront infrastructure, it is important to consider whether these infrastructure reductions make sense for the Navy. We based our estimates on requirement factors that have not been fully funded in the past. Even if the money was programmed and provided to the installations for support of these facilities, it doesn't mean that it was actually spent on those facilities.

In addition, most of the potential reductions (about $51 million) were in a few, very large capital structures that make up the piers and wharves assets. In these cases, it may not make sense from a strategic or practical view point to target these facilities or portions of facilities for demolition. But, the Navy could mothball selected facilities to achieve some annual reductions without demolition. However, setting aside the potential reductions to piers and wharves, it is more likely that the smaller and less capital nature of facilities within the harbor master operations and small craft berthing SFTs would make better candidates for possible downsizing.

Summary

When the workload measures are applied at the CCN level, we find potential requirement reductions at all the installations. Almost all potential efficiency gains, however, are located at west coast installations, with the greatest potential gains at NAVSTA Pearl Harbor, HI, and NAVBASE Coronado San Diego, CA. Our results also indicate that the vast majority of the potential reductions are within the piers and wharves SFT areas, which is made up of relatively few large and difficult-to-segment capital facilities. Reduction through demolition or mothballing of these facilities may not be feasible for strategic or practical reasons; however, because facilities within the harbor master operations and small craft berthing areas are smaller, more numerous, and less investment capital intensive, they may be better reduction candidates. These two SFTs offer potential maximum requirement reductions of over $13 million.

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Conclusions

The goal of our analysis was to investigate whether significant differences in waterfront infrastructure support exist between east and west coast installations. Our next task was to estimate the potential cost requirement reductions associated with balancing support levels over time.

As the first step in our analysis, we examined how the Navy's waterfront operations infrastructure is distributed among the 11 east and west coast homeports. We used plant replacement value (PRV) to aggregate different types of infrastructure assets at an installation level, and we normalized PRV to FY 2009 Norfolk dollars to account for variation in area cost factors across installations. We found that

- The Navy has waterfront infrastructure assets totaling $5.9 billion—$4.9 billion when normalized
- The three installations with the most waterfront operations infrastructure by normalized PRV—NAVSTA Norfolk, VA ($1.1 billion); NAVBASE San Diego, CA ($1.1 billion); and NAVSTA Pearl Harbor, HI ($547 million)—account for over half of the total
- Over three-quarters of total waterfront infrastructure (as measured by normalized PRV) is berthing space for ships.

The next step in our analysis was to construct a measure of waterfront operations workload at the installation level. Because the purpose of waterfront infrastructure is to support ships in port, we wanted our measure to reflect the amount of ship traffic at each homeport. We developed a measure called average daily linear ship feet (ADLSF), which is equal to the total linear feet of all Navy and Military Sealift Command (MSC) ships in port at the installation on an average day. We computed our workload measure using data on ship movements from FY 2008 and FY 2009. An advantage of our workload measure is that it is based on data on actual ship traffic. Our workload measure is larger for installations that have ships in port more often, have more ships in port, or have larger ships in port. We used ADLSF to compare workload across homeports. We found the following:

- The 11 east and west coast homeports handled over 47.6 million linear feet of ships over FY 2008 and FY 2009.
- NAVSTA Norfolk, VA, handled the most workload, with an ADLSF measure of 21,202 (33 percent of the total). NAVBASE San Diego, CA, and NAVSTA Pearl Harbor, HI, were the next busiest homeports. NAVBASE San Diego, CA's ADLSF of 14,825 represented 23 percent of total workload; NAVSTA Pearl Harbor, HI, accounted for 13 percent of the total with an ADLSF of 8,431
- NAVSUBASE Kings Bay, GA, supported the lowest workload with an ADLSF of 768 (1 percent of total workload). However, recall that our data excludes port visits by SSBNs.
- In general, east coast homeports supported more workload than west coast homeports during FY 2008 and FY 2009.

Combining the data on waterfront infrastructure and workload, we constructed an installation-level measure of efficiency, α. We defined α as equal to workload divided by normalized waterfront PRV. This efficiency measure allowed us to compare workload support per dollar of waterfront infrastructure across installations. We found the following:

- In general, east coast installations are more efficient than west coast installations. The average value of α is 19.447 among east coast installations and 8.75 among west coast installations (including NAVSTA Pearl Harbor, HI). This means that $1 million of normalized waterfront operations infrastructure supports 2.2 times as much workload on the east coast as on the west coast.
- NAVSUBASE New London, CT, and NAVSTA Mayport, FL, are the most efficient installations by a wide margin. At NAVSUBASE New London, CT, $1 million of normalized waterfront

PRV supports nearly 90 percent more workload than at NAVSTA Norfolk, VA, and over 2.5 times more workload than at NAVBASE San Diego, CA. The same $1 million in normalized waterfront PRV at NAVSTA Mayport, FL, supports over 50 percent more workload than at NAVSTA Norfolk, VA, and over double the workload at NAVBASE San Diego, CA.

- If the three San Diego area installations are combined, they account for 27 percent of overall workload and 37 percent of normalized waterfront PRV. In fact, $1 million of waterfront PRV at this set of installations supports about one-half of the workload that $1 million of PRV supports at NAVSTA Norfolk, VA.
- NAVSUBASE Kings Bay, GA, supports the smallest workload and is last in terms of efficiency. NAVSUBASE Kings Bay, GA, accounts for 1 percent of total workload and 5 percent of normalized waterfront PRV. Again, we note that our results do not account for SSBN ship traffic.

As another measure of installation efficiency, we examined berthing utilization at each homeport. Our measure of berthing utilization, γ, is equal to workload divided by the total linear feet of berthing available at the installation. We found the following:

- The three most utilized ports (NAVSTA Mayport, FL; NAVSUBASE New London, CT; and NAVSTA Norfolk, VA) and the two least utilized ports (NAVPHIBASE Little Creek, VA, and NAVSUBASE Kings Bay, GA) are on the east coast.
- On an average day during FY 2008 and FY 2009, the workload at NAVSTA Mayport, FL, accounted for nearly 90 percent of NAVSTA Mayport, FL's available berthing. The value of γ at NAVSTA Mayport, FL (0.87) is much higher than the homeport with the second highest utilization ratio, NAVSUBASE New London, CT ($\gamma = 0.54$).
- NAVBASE San Diego, CA, and NAVSTA Pearl Harbor, HI, have roughly the same amount of available berthing, but the utilization ratio at NAVBASE San Diego, CA (0.41) is over twice the ratio at NAVSTA Pearl Harbor, HI (0.25).

- Combined, the three San Diego area installations feature over 17,000 more linear feet of berthing than NAVSTA Norfolk, VA, but a utilization ratio (0.27) over one-third lower than the ratio at NAVSTA Norfolk, VA (0.44).

- NAVSTA Everett, WA, has the least available berthing, but a utilization ratio (0.26) higher than the ratio at NAVSTA Pearl Harbor, HI (0.25).

- Among the three largest homeports—NAVSTA Norfolk, VA; NAVBASE San Diego, CA; and NAVSTA Pearl Harbor, HI—NAVSTA Norfolk, VA, and NAVBASE San Diego, CA, feature similar utilization ratios that are each over double the ratio at NAVSTA Pearl Harbor, HI.

If the Navy were to increase efficiency at select installations by reducing waterfront infrastructure, it could potentially reduce its annual funding requirements in the ST, RM, and BOS accounts. To estimate these potential reductions, we calculated our efficiency measure, α, separately for each of the category code numbers in the waterfront operations SCA. For installations that are below average, we computed the infrastructure reduction that would raise the installation's efficiency level to the average. We then calculated the implied requirement reductions in the ST, RM, and BOS accounts. We found the following:

- Overall, the Navy could reduce its annual requirements by over \$65 million (in FY 2009).

- Nearly all of the potential reductions are in the ST and RM accounts.

- Of the total potential reductions, \$51 million (78 percent) is in the SFTs of piers and wharves.

- Excluding piers and wharves, the only SFTs that show significant potential for reduced requirements are harbor master operations and small craft berthing. These two SFTs represent potential reductions of \$6.9 million and \$6.2 million (in FY 2009).

Because piers and wharves are large capital investments for the Navy, and because of the strategic implications, reducing pier and wharf infrastructure either through demolition or mothballing is unlikely to be a realistic way ahead for the Navy. Instead, our results suggest that, if the Navy wants to reduce its annual requirements by reducing waterfront infrastructure, it should focus first on the SFTs of harbor master operations and small craft berthing.

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Recommendations

Broadly, we recommend that the Navy not invest in new waterfront infrastructure at the six locations with low efficiencies (NAVPHIBASE Little Creek, VA; NAVBASE Kitsap Bremerton, WA; NAVSTA Everett, WA; NAVBASE Point Loma, CA; NAVBASE Coronado San Diego, CA; and NAVSUBASE Kings Bay, GA) unless significant footprint offsets are included in the scope of work.

Based on our analysis of the waterfront operations infrastructure at U.S. homeports, we make the following additional recommendations:

- If the Navy needs to reduce annual infrastructure operational costs, those facilities located at the least efficient port locations should be examined first based on their current condition and configuration ratings.
- Use the installation efficiency findings to give preference to potential MILCON projects involving new ship berthing (i.e., additional capacity) that are located at the installations that have the highest ratios of workload to current berthing space. Likewise, avoid constructing new berthing at installations with low workload-to-berthing ratios.
- Review future Navy ship berthing construction plans to ensure that NAVSUBASE New London, CT, and NAVSTA Mayport, FL, are adequately provided for because they are the locations that could currently benefit most from additional berthing capacity.
- Begin to identify specific facility demolition projects in the SFTs of harbor master operations and small craft berthing in order to increase efficiency and reduce annual Navy funding requirements.

We also recommend that the Navy consider applying a similar evaluation process to the other shore capability areas (SCAs) and expand the scope to all installations worldwide.

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Appendix A: Installation profiles

This appendix provides detailed profiles of each of the east and west coast homeports included in our analysis. Each profile consists of three figures and four tables. The first figure is a recent satellite photo showing the installation. The second figure provides a profile generated with FY 2008 end-of-year data that show the number and type of assigned commands, workforce billets authorized, and waterfront inventory information. The third figure shows workload data from FY 2005–FY 2009.

The first table summarizes the results of our analysis for the installation, including our measures of normalized waterfront operations PRV, workload, overall efficiency, and berthing utilization. The second table provides a detailed summary of the current waterfront infrastructure assets at that installation. The third table lists all of the ships and number of days in port that we used in our workload calculations. Finally, the fourth table describes the potential annual requirement reductions by CCN that may be possible at that installation.

Naval Station Norfolk, VA

NAVSTA Norfolk, VA, is located north of downtown Norfolk, VA, and is the largest Navy port facility on the east coast.

Installation profile

Figure 14 is a satellite view of the installation.

Figure 14. NAVSTA Norfolk, VA, satellite view

Figure 15 provides an FY 2008 installation profile summary.

Figure 15. NAVSTA Norfolk, VA, installation profile

FY 2008 Installation Profile

UIC: N62688
Title: NAVSTA Norfolk VA
Total Units: 317
Total BA: 56,342

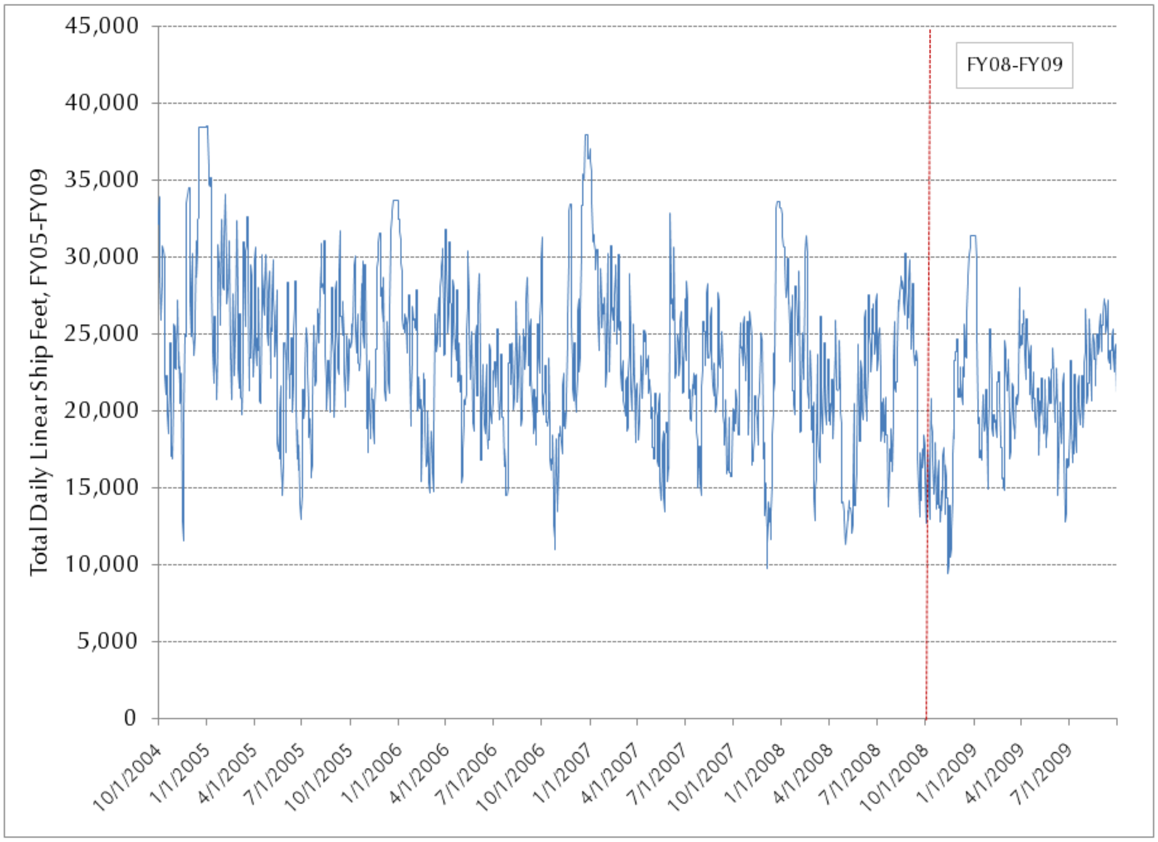
Assigned Commands			
Unit type	Warfighter	Shore support	Total Units
ADMIN	0	7	7
COMD	30	88	118
COMM	0	1	1
EXPD	1	4	5
HELO	5	2	7
LOG	8	22	30
MED	0	10	10
PLANE	6	4	10
RDTE	0	2	2
RES	0	5	5
SHIP	57	0	57
SHORE	0	25	25
SUB	16	0	16
TRAIN	4	20	24
Totals	127	190	317

Workforce Billets Authorized			
Labor class	Warfighter	Shore support	Total BA
AD ENL	37,224	6,147	43,371
AD OFF	3,183	1,519	4,702
CIVIL SER	4	4,651	4,655
CNTR	101	911	1,012
FN DIR	0	3	3
FN INDIR	0	0	0
FTS	235	241	476
SELRES	689	1,434	2,123
Totals	41,436	14,906	56,342

SCA - Waterfront Operations			
PRV ($)	# FAC	AVE AGE	AVE % SLU
451,987,360	88	41	88
P(COND)	P(CONF)	P(CAP)	P(BOS)
88	68	90	82
ST REQ ($K)		RM REQ ($K)	
10,257		6,956	

Figure 16 shows the variation in daily workload between FY 2005 and FY 2009. The red dashed vertical line separates the data for FY 2008–FY 2009—which we used to construct our workload measure—from the data for other years.

Figure 16. NAVSTA Norfolk, VA, daily workload, FY 2005-FY 2009



Installation efficiency findings

Table 18 provides a summary of the metric values and ranks this installaion against the other installations reviewed in this report.

Table 18. NAVSTA Norfolk, VA, analysis summary

Metric	Value	Rank
Total waterfront operations PRV	$1,103,853,290	3 of 11
Area cost factor	1.00	8 of 11
Normalized waterfront PRV	$1,103,853,290	1 of 11
ADLSF	21,200	1 of 11
α	19.21	3 of 11
Total available berthing	47,663	1 of 11
γ	0.44	3 of 11

Table 18. NAVSTA Norfolk, VA, analysis summary

Metric	Value	Rank
Total potential requirement reductions		
Sustainment	$2,154K	6 of 11
Restoration and modernization	$2,097K	7 of 11
Base operating services	$701K	2 of 11

Installation waterfront facilities

Table 19 provides a detailed summary of waterfront facilities by CCN at NAVSTA Norfolk, VA.

Table 19. NAVSTA Norfolk, VA, detailed waterfront facilities summary

CCN	Description	UOM	Number facility records	Assets total	PRV
15120	General purpose berthing pier	SY	14	254,289	$843,589,303
15610	Waterfront transit shed	SF	3	405,332	$53,850,253
15420	Deep water bulkhead quaywall with relieving platform	SY	10	15,130	$50,195,015
15180	Deperming pier	SY	1	9,199	$30,518,053
15410	Fueling wharf	LF	6	35,651	$24,381,713
15240	Fueling wharf	SY	1	5,333	$17,628,543
15964	Waterfront operations building	SF	9	80,784	$17,422,554
15140	Fueling pier	SY	1	5,000	$16,535,191
15520	Small craft berthing	FB	9	5,832	$16,520,528
13710	Oceanographic building	SF	2	38,864	$12,215,741
15430	Seawalls	LF	4	14,410	$9,823,380
15260	Supply wharf	SY	1	1,273	$4,179,690
15220	General purpose berthing wharf	SY	1	657	$2,179,624
15521	Small craft boathouse	SF	5	45,931	$1,880,561
16410	Breakwater	LF	4	2,300	$1,567,923
15920	Degaussing building	SF	1	4,680	$1,079,615
15921	Degaussing range	EA	2	2	$122,726
16310	Mooring dolphin	EA	8	9	$116,687
13810	Beacon ship	EA	1	1	$18,680
12220	Small craft fueling station	GM	1	20	$14,515

Table 19. NAVSTA Norfolk, VA, detailed waterfront facilities summary

CCN	Description	UOM	Number facility records	Assets total	PRV
16320	Mooring platform	EA	1	1	$12,995
	Total		**85**		**$1,103,853,290**

Installation ship traffic

Table 20 lists all ships that were identified as being in port at Norfolk for at least 1 day during FY 2008 and FY 2009. Ships that are home-ported at Norfolk appear in bold.

Table 20. NAVSTA Norfolk, VA, ship traffic

Class	Hull number	Name	Days in port
CG	**60**	**Normandy**	**617**
LHD	**1**	**Wasp**	**500**
FFG	**55**	**Elrod**	**478**
LHA	**4**	**Nassau**	**471**
DDG	**84**	**Bulkeley**	**461**
DDG	**71**	**Ross**	**443**
FFG	**47**	**Nicholas**	**431**
CG	**56**	**San Jacinto**	**427**
DDG	**51**	**Arleigh Burke**	**423**
CG	**72**	**Vella Gulf**	**411**
LPD	**17**	**San Antonio**	**400**
DDG	**74**	**McFaul**	**397**
CG	**61**	**Monterey**	**392**
DDG	**52**	**Barry**	**391**
CG	**55**	**Leyte Gulf**	**390**
DDG	**75**	**Donald Cook**	**390**
DDG	**78**	**Porter**	**388**
DDG	**98**	**Forrest Sherman**	**386**
DDG	**87**	**Mason**	**385**
LPD	13	Nashville	385
CG	**68**	**Anzio**	**382**
DDG	**55**	**Stout**	**381**

Table 20. NAVSTA Norfolk, VA, ship traffic

Class	Hull number	Name	Days in port
DDG	**94**	**Nitze**	**374**
FFG	**59**	**Kauffman**	**370**
FFG	**53**	**Hawes**	**368**
DDG	**57**	**Mitscher**	**365**
LHD	**3**	**Kearsarge**	**364**
LPD	**15**	**Ponce**	**358**
DDG	**61**	**Ramage**	**358**
DDG	**95**	**James E. Williams**	**357**
SSN	**753**	**Albany**	**355**
DDG	**67**	**Cole**	**353**
DDG	**66**	**Gonzalez**	**351**
LSD	44	Gunston Hall	331
SSN	**750**	**Newport News**	**328**
LHD	**7**	**Iwo Jima**	**309**
TAO	198	Big Horn	302
DDG	**72**	**Mahan**	**300**
CVN	**71**	**Theodore Roosevelt**	**297**
DDG	**79**	**Oscar Austin**	**295**
DDG	**58**	**Laboon**	**287**
CVN	**69**	**Dwight D. Eisenhower**	**275**
DDG	**81**	**Winston S. Churchill**	**275**
SSN	699	Jacksonville	266
SSN	**765**	**Montpelier**	**245**
DDG	**96**	**Bainbridge**	**245**
TAO	196	Kanawha	239
FFG	**52**	**Carr**	**237**
SSN	**714**	**Norfolk**	**236**
TAO	201	Patuxent	234
SSN	**756**	**Scranton**	**233**
LHD	**5**	**Bataan**	**231**
TAO	189	John Lenthall	228
TAKE	1	Lewis and Clark	206
TAKE	2	Sacagawea	205
CVN	**75**	**Harry S. Truman**	**204**
TAFS	10	Saturn	203
SSN	**764**	**Boise**	**200**
TAO	195	Leroy Grumann	194
AOE	8	Arctic	194

Table 20. NAVSTA Norfolk, VA, ship traffic

Class	Hull number	Name	Days in port
SSN	**723**	**Oklahoma City**	**187**
CV	67	John F. Kennedy	182
AOE	6	Supply	177
LCS	**1**	**Freedom**	**174**
LSD	48	Ashland	164
TAO	203	Laramie	156
TAKE	5	Robert E. Peary	155
CVN	**77**	**George H.W. Bush**	**151**
CVN	73	George Washington	133
LSD	51	Oak Hill	123
CVN	**65**	**Enterprise**	**115**
TAGOS	20	Able	70
DDG	**103**	**Truxtun**	**70**
PC	12	Thunderbolt	70
PC	7	Squall	61
TATF	172	Apache	52
LSD	50	Carter Hall	45
SSN	770	Tucson	42
SSN	777	North Carolina	39
ARS	53	Grapple	29
SSN	769	Toledo	27
TAH	20	Comfort	26
SSN	710	Augusta	25
LSD	43	Fort McHenry	24
AE	34	Mount Baker	21
DDG	99	Farragut	17
CVN	70	Carl Vinson	15
CG	64	Gettysburg	14
FFG	28	Boone	13
FFG	58	Samuel B. Roberts	12
SSN	761	Springfield	12
CG	69	Vicksburg	12
DDG	104	Sterett	11
FFG	49	Robert G. Bradley	10
FFG	39	Doyle	9
DDG	102	Sampson	8
TAFS	9	Spica	7
DDG	106	Stockdale	6

Table 20. NAVSTA Norfolk, VA, ship traffic

Class	Hull number	Name	Days in port
FFG	29	Stephen W. Groves	5
CG	58	Philippine Sea	4
RV	NA	Dolores Chouest	3
DDG	80	Roosevelt	2
DDG	68	The Sullivans	2
ARS	51	Grasp	1
PC	3	Hurricane	1
SSN	778	New Hampshire	1

Potential requirement reductions

Table 21 provides a breakdown summary of the potential annual funding requirement reductions by CCN.

Table 21. NAVSTA Norfolk, VA, potential requirement reductions

CCN	UOM	SFT	δ	ST ($K)	RM ($K)	BOS ($K)	Total ($K)
15120	SY	Piers	46,380	1,344	1,509	0	2,854
15610	SF	Harbor master operations	128,611	314	175	509	998
15410	LF	Small craft berthing	29,786	342	270	0	612
15964	SF	Harbor master operations	40,805	141	139	162	442
15521	SF	Small craft berthing	7,737	11	4	31	46
		Totals		**2,152**	**2,097**	**702**	**4,952**

Naval Base San Diego, CA

NAVBASE San Diego, CA, is located southwest of downtown San Diego, CA, and is one of the largest port facilities on the west coast.

Installation profile

Figure 17 is a satellite view of the installation.

Figure 17. NAVBASE San Diego, CA, satellite view

Figure 18 provides an FY 2008 installation profile summary.

Figure 18. NAVBASE San Diego, CA, installation profile

FY 2008 Installation Profile

UIC:	N00245	**Total Units:**	232
Title:	NAVSTA San Diego CA	**Total BA:**	39,959

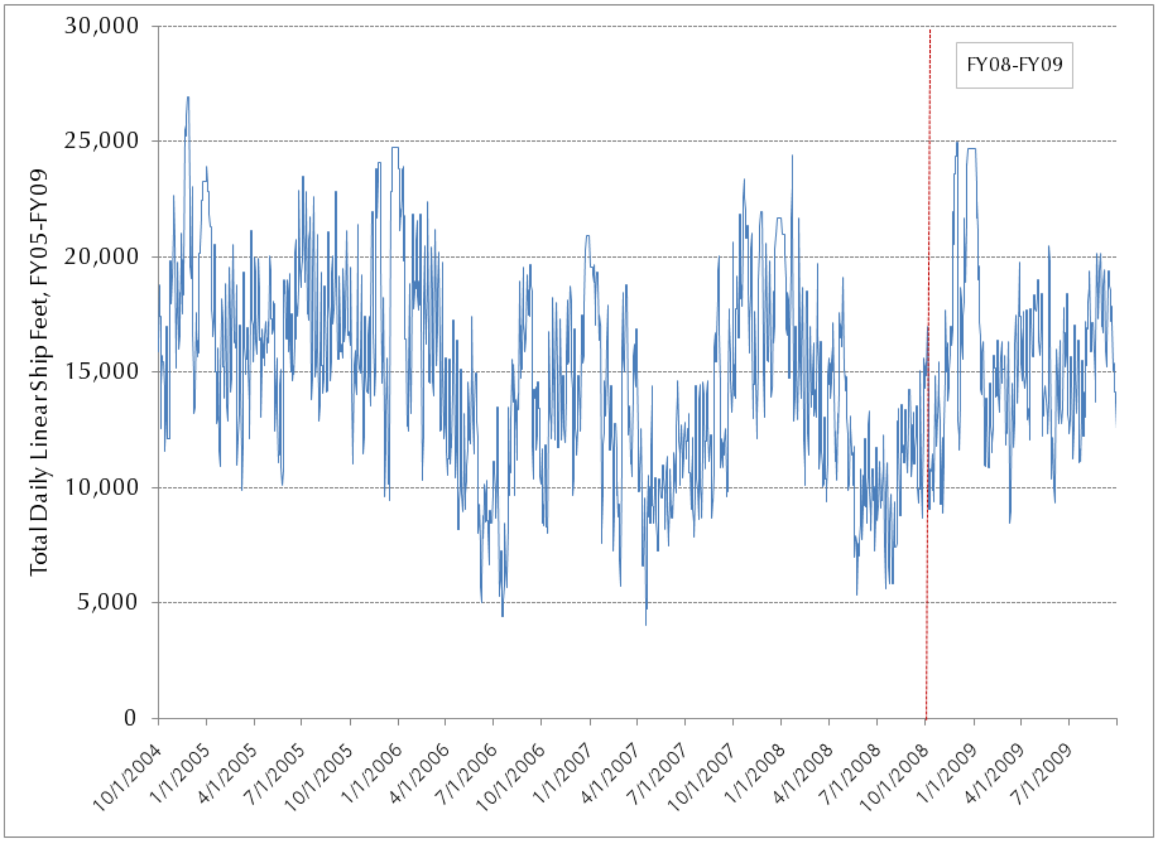
Assigned Commands			
Unit type	**Warfighter**	**Shore support**	**Total Units**
ADMIN	3	2	5
COMD	29	44	73
COMM	0	2	2
EXPD	10	5	15
HELO	1	0	1
LOG	8	17	25
MED	0	19	19
PLANE	0	0	0
RDTE	0	5	5
RES	0	6	6
SHIP	54	1	55
SHORE	0	13	13
SUB	0	0	0
TRAIN	0	13	13
Totals	**105**	**127**	**232**

Workforce Billets Authorized			
Labor class	**Warfighter**	**Shore support**	**Total BA**
AD ENL	20,658	4,232	24,890
AD OFF	1,649	1,125	2,774
CIVIL SER	21	9,961	9,982
CNTR	0	635	635
FN DIR	0	18	18
FN INDIR	0	0	0
FTS	155	250	405
SELRES	467	788	1,255
Totals	**22,950**	**17,009**	**39,959**

SCA - Waterfront Operations			
PRV ($)	**# FAC**	**AVE AGE**	**AVE % SLU**
461,201,888	22	45	89
P(COND)	**P(CONF)**	**P(CAP)**	**P(BOS)**
92	88	100	81
ST REQ ($K)		**RM REQ ($K)**	
9,877		5,672	

Figure 16 shows the variation in daily workload between FY 2005 and FY 2009. The red dashed vertical line separates the data for FY 2008–FY 2009—which we used to construct our workload measure—from the data for other years.

Figure 19. NAVBASE San Diego, CA, daily workload, FY 2005-FY 2009



Installation efficiency findings

Table 22 provides a summary of the metric values and ranks this installation against the other installations reviewed in this report.

Table 22. NAVBASE San Diego, CA, analysis summary

Metric	Value	Rank
Total waterfront operations PRV	$1,243,461,789	1 of 11
Area cost factor	1.11	5 of 11
Normalized waterfront PRV	$1,086,628,771	2 of 11
ADLSF	14,825	2 of 11
α	13.64	5 of 11
Total available berthing	36,552	2 of 11
γ	0.41	4 of 11

Table 22. NAVBASE San Diego, CA, analysis summary

Metric	Value	Rank
Total potential requirement reductions		
Sustainment	$4,021K	3 of 11
Restoration and modernization	$4,268K	3 of 11
Base operating services	$0K	11 of 11

Installation waterfront facilities

Table 23 provides a detailed summary of waterfront facilities by CCN at NAVBASE San Diego, CA.

Table 23. NAVBASE San Diego, CA, detailed waterfront facilities summary

CCN	Description	UOM	Number facility records	Assets total	PRV
15120	General purpose berthing pier	SY	14	170,404	$646,915,016
15420	Deep water bulkhead quaywall with relieving platform	SY	2	105,800	$401,654,942
15160	Supply pier	SY	1	50,000	$189,818,025
15520	Small craft berthing	FB	2	1,270	$4,096,524
15964	Waterfront operations building	SF	3	3,743	$977,282
	Total		**22**		**$1,243,461,789**

Installation ship traffic

Table 24 lists the ships that were identified as being in port at San Diego for at least 1 day during FY 2008 and FY 2009. Ships that are homeported at San Diego appear in bold.

Table 24. NAVBASE San Diego, CA, ship traffic

Class	Hull number	Name	Days in port
CG	**52**	**Bunker Hill**	**644**
CG	**59**	**Princeton**	**503**
LHA	**5**	**Peleliu**	**498**

Table 24. NAVBASE San Diego, CA, ship traffic

Class	Hull number	Name	Days in port
LHD	**6**	**Bonhomme Richard**	**496**
DDG	**102**	**Sampson**	**471**
LPD	**8**	**Dubuque**	**456**
DDG	**100**	**Kidd**	**452**
LSD	**47**	**Rushmore**	**447**
FFG	**38**	**Curts**	**444**
DDG	**88**	**Preble**	**434**
DDG	**65**	**Benfold**	**432**
LSD	**42**	**Germantown**	**416**
DDG	**97**	**Halsey**	**404**
DDG	**69**	**Milius**	**397**
DDG	**91**	**Pinckney**	**393**
FFG	**41**	**McClusky**	**389**
LSD	**52**	**Pearl Harbor**	**386**
LPD	**7**	**Cleveland**	**380**
LHA	**1**	**Tarawa**	**374**
LHD	**4**	**Boxer**	**374**
FFG	**46**	**Rentz**	**362**
LSD	**45**	**Comstock**	**360**
FFG	**48**	**Vandegrift**	**352**
CG	**53**	**Mobile Bay**	**342**
CG	**71**	**Cape St. George**	**340**
CG	**54**	**Antietam**	**333**
DDG	**76**	**Higgins**	**331**
DDG	**101**	**Gridley**	**329**
DDG	**53**	**John Paul Jones**	**326**
CG	**62**	**Chancellorsville**	**325**
LPD	**18**	**New Orleans**	**322**
FFG	**43**	**Thach**	**314**
FFG	**33**	**Jarrett**	**311**
FFG	**51**	**Gary**	**297**
DDG	**83**	**Howard**	**294**
CG	**57**	**Lake Champlain**	**262**
TAH	19	Mercy	224
DDG	**73**	**Decatur**	**222**
DDG	**104**	**Sterett**	**214**
MCM	**10**	**Warrior**	**166**
TAO	202	Yukon	160

Table 24. NAVBASE San Diego, CA, ship traffic

Class	Hull number	Name	Days in port
TATF	171	Sioux	148
DDG	**106**	**Stockdale**	**147**
MCM	**14**	**Chief**	**144**
LPD	**20**	**Green Bay**	**143**
MCM	**9**	**Pioneer**	**126**
MCM	**4**	**Champion**	**116**
MCM	**6**	**Devastator**	**97**
TATF	169	Navajo	95
TAO	187	Henry J. Kaiser	92
LPD	9	Denver	75
FFG	60	Rodney M. Davis	63
AOE	7	Rainier	61
TAKE	4	Richard E. Byrd	43
TAGOS	20	Able	33
FFG	61	Ingraham	32
TAO	200	Guadalupe	30
CG	70	Lake Erie	27
FFG	54	Ford	25
CG	65	Chosin	19
DDG	92	Momsen	16
DDG	86	Shoup	15
DDG	93	Chung-Hoon	14
DDG	59	Russell	11
AOE	10	Bridge	5
FFG	37	Crommelin	5
SSN	688	Los Angeles	4
TAKE	5	Robert E. Peary	3

Potential requirement reductions

Table 25 provides a breakdown summary of the potential annual funding requirement reductions by CCN.

Table 25. NAVBASE San Diego, CA, potential requirement reductions

CCN	UOM	SFT	δ	ST ($K)	RM ($K)	BOS ($K)	Total ($K)
15420	SY	Wharves	89,588	3,143	3,336	0	6,479
15120	SY	Piers	25,014	878	931	0	998
		Totals		**4,021**	**4,268**	**0**	**8,289**

Naval Station Pearl Harbor, HI

NAVSTA Pearl Harbor, HI, is located on Oahu in the Hawaiian Islands and is west of Honolulu.

Installation profile

Figure 20 is a satellite view of the installation.

Figure 20. NAVSTA Pearl Harbor, HI, satellite view

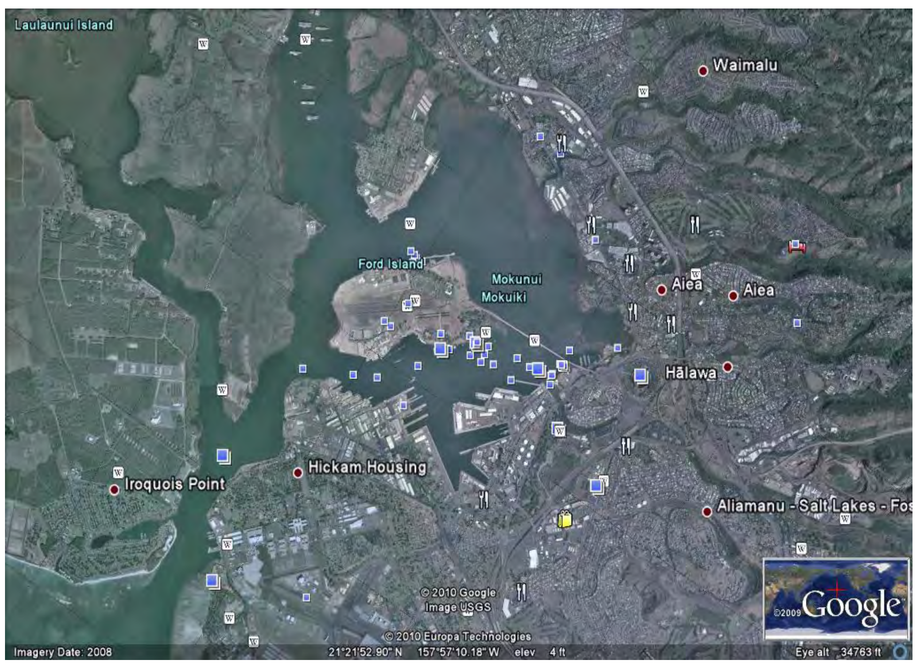


Figure 21 provides an FY 2008 installation profile summary.

Figure 21. NAVSTA Pearl Harbor, HI, installation profile

FY 2008 Installation Profile

UIC:	N62813	**Total Units:**	160
Title:	NAVSTA Pearl Harbor HI	**Total BA:**	20,409

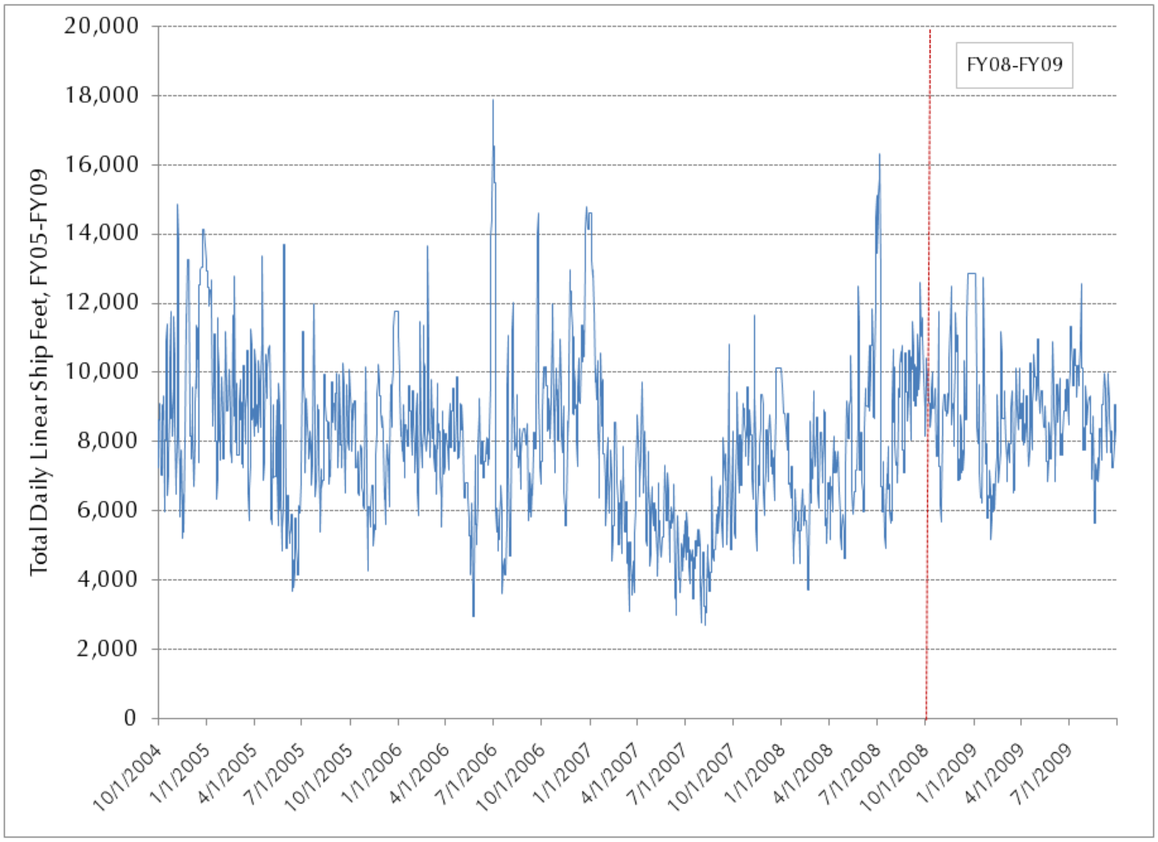
Assigned Commands			
Unit type	**Warfighter**	**Shore support**	**Total Units**
ADMIN	1	5	6
COMD	7	63	70
COMM	0	3	3
EXPD	5	4	9
HELO	0	0	0
LOG	0	16	16
MED	0	4	4
PLANE	0	0	0
RDTE	1	1	2
RES	0	1	1
SHIP	11	0	11
SHORE	1	10	11
SUB	15	0	15
TRAIN	1	11	12
Totals	**42**	**118**	**160**

Workforce Billets Authorized			
Labor class	**Warfighter**	**Shore support**	**Total BA**
AD ENL	5,103	3,248	8,351
AD OFF	548	959	1,507
CIVIL SER	11	8,046	8,057
CNTR	2	943	945
FN DIR	0	5	5
FN INDIR	0	0	0
FTS	54	36	90
SELRES	59	1,395	1,454
Totals	**5,777**	**14,632**	**20,409**

SCA - Waterfront Operations			
PRV ($)	**# FAC**	**AVE AGE**	**AVE % SLU**
536,483,808	112	60	125
P(COND)	**P(CONF)**	**P(CAP)**	**P(BOS)**
83	91	75	82
ST REQ ($K)		**RM REQ ($K)**	
11,711		7,980	

Figure 19 shows the variation in daily workload between FY 2005 and FY 2009. The red dashed vertical line separates the data for FY 2008–FY 2009—which we used to construct our workload measure—from the data for other years.

Figure 22. NAVSTA Pearl Harbor, HI, daily workload, FY 2005-FY 2009



Installation efficiency findings

Table 26 provides a summary of the metric values and ranks this installation against the other installations reviewed in this report.

Table 26. NAVSTA Pearl Harbor, HI, analysis summary

Metric	Value	Rank
Total waterfront operations PRV	$1,217,498,490	2 of 11
Area cost factor	2.16	1 of 11
Normalized waterfront PRV	$546,747,007	3 of 11
ADLSF	8,431	3 of 11
α	15.42	4 of 11
Total available berthing	33,990	3 of 11
γ	0.25	6 of 11

Table 26. NAVSTA Pearl Harbor, HI, analysis summary

Metric	Value	Rank
Total potential requirement reductions		
Sustainment	$6,850K	1 of 11
Restoration and modernization	$7,164	1 of 11
Base operating services	$232K	5 of 11

Installation waterfront facilities

Table 27 provides a detailed summary of waterfront facilities by CCN at NAVSTA Pearl Harbor, HI.

Table 27. NAVSTA Pearl Harbor, HI, detailed waterfront facilities summary

CCN	Description	UOM	Number facility records	Assets total	PRV
15220	General purpose berthing wharf	SY	23	73,345	$571,612,572
15120	General purpose berthing pier	SY	9	25,884	$199,289,581
15420	Deep water bulkhead quaywall with relieving platform	SY	6	12,645	$98,548,516
15260	Supply wharf	SY	4	10,704	$83,421,378
15140	Fueling pier	SY	1	8,016	$62,472,512
15520	Small craft berthing	FB	21	6,686	$44,081,595
15610	Waterfront transit shed	SF	3	150,045	$42,712,706
15160	Supply pier	SY	1	5,100	$39,746,733
15964	Waterfront operations building	SF	5	47,256	$25,108,076
13710	Oceanographic building	SF	1	23,078	$17,615,886
14355	Transit shed	SF	1	35,584	$10,224,591
15510	Fleet landing	FB	8	1,288	$8,477,799
15430	Seawalls	LF	8	3,386	$5,193,485
15521	Small craft boathouse	SF	3	16,001	$2,630,522
15410	Fueling wharf	LF	1	1,296	$2,037,725
15920	Degaussing building	SF	2	3,090	$1,617,440
16910	Harbor entrance control facility	EA	1	1	$1,433,999
15930	Deperming building	SF	1	1,200	$612,570
15950	Ferry slip	EA	2	2	$288,304
16320	Mooring platform	EA	2	4	$120,658
16310	Mooring dolphin	EA	2	3	$87,222

Table 27. NAVSTA Pearl Harbor, HI, detailed waterfront facilities summary

CCN	Description	UOM	Number facility records	Assets total	PRV
13810	Beacon ship	EA	2	2	$83,586
15511	Fleet landing building	SF	2	913	$81,034
	Total		**109**		**$1,217,498,490**

Installation ship traffic

Table 28 lists the ships that were identified as being in port at NAVSTA Pearl Harbor, HI, for at least 1 day during FY 2008 and FY 2009. Ships that are homeported at NAVSTA Pearl Harbor, HI, appear in bold.

Table 28. NAVSTA Pearl Harbor, HI, ship traffic

Class	Hull number	Name	Days in port
SSN	**717**	**Olympia**	**651**
SSN	**773**	**Cheyenne**	**626**
SSN	**771**	**Columbia**	**564**
CG	**70**	**Lake Erie**	**527**
CG	**73**	**Port Royal**	**507**
CG	**65**	**Chosin**	**506**
SSN	**722**	**Key West**	**455**
DDG	**77**	**O'kane**	**435**
DDG	**60**	**Paul Hamilton**	**425**
DDG	**93**	**Chung-Hoon**	**400**
SSN	**762**	**Columbus**	**398**
FFG	**57**	**Reuben James**	**387**
DDG	**70**	**Hopper**	**382**
FFG	**37**	**Crommelin**	**378**
SSN	688	Los Angeles	369
SSN	**766**	**Charlotte**	**365**
SSN	**721**	**Chicago**	**342**
DDG	**59**	**Russell**	**338**
SSN	**701**	**La Jolla**	**334**
DDG	90	Chafee	332

Table 28. NAVSTA Pearl Harbor, HI, ship traffic

Class	Hull number	Name	Days in port
SSN	**752**	**Pasadena**	**275**
SSN	708	Minneapolis-St. Paul	268
SSN	**763**	**Santa Fe**	**244**
SSN	713	Houston	199
SSN	**770**	**Tucson**	**184**
SSN	**698**	**Bremerton**	**160**
ARS	52	Salvor	157
SSN	715	Buffalo	153
SSN	**699**	**Jacksonville**	**119**
SSN	**724**	**Louisville**	**118**
TAO	200	Guadalupe	117
AE	35	Kiska	103
TATF	169	Navajo	98
TAO	202	Yukon	75
SSN	**772**	**Greeneville**	**71**
SSN	**776**	**Hawaii**	**64**
SSGN	726	Ohio	31
SSGN	727	Michigan	29
LSD	45	Comstock	25
TAGOS	20	Able	23
AOE	10	Bridge	21
SSN	21	Seawolf	18
TATF	171	Sioux	18
LPD	20	Green Bay	13
DDG	69	Milius	13
TAFS	3	Niagara Falls	12
CV	63	Kitty Hawk	10
FFG	60	Rodney M. Davis	10
FFG	33	Jarrett	9
DDG	102	Sampson	8
CG	57	Lake Champlain	8
DDG	91	Pinckney	8
SSN	22	Connecticut	8
CVN	74	John C. Stennis	7
LPD	18	New Orleans	7
SSN	754	Topeka	7
LHD	4	Boxer	6
LHD	6	Bonhomme Richard	6

Table 28. NAVSTA Pearl Harbor, HI, ship traffic

Class	Hull number	Name	Days in port
CG	54	Antietam	6
MV	NA	Cape Gibson	6
SSN	719	Providence	5
DDG	76	Higgins	5
LPD	8	Dubuque	5
FFG	46	Rentz	5
FFG	48	Vandegrift	5
LHA	5	Peleliu	5
FFG	54	Ford	4
TAH	19	Mercy	4
DDG	88	Preble	4
DDG	100	Kidd	4
DDG	92	Momsen	3
CVN	72	Abraham Lincoln	3
CG	71	Cape St. George	3
LSD	42	Germantown	3
CVN	76	Ronald Reagan	2
DDG	86	Shoup	2
CG	59	Princeton	2
CVN	68	Nimitz	2
CG	62	Chancellorsville	2
CG	53	Mobile Bay	2
FFG	61	Ingraham	2
LSD	47	Rushmore	2
SSN	758	Asheville	2
FFG	43	Thach	2
DDG	53	John Paul Jones	2
LHA	1	Tarawa	2
LPD	7	Cleveland	2
DDG	65	Benfold	2
LSD	52	Pearl Harbor	2
SSN	767	Hampton	1
DDG	83	Howard	1
SSN	759	Jefferson City	1
LPD	9	Denver	1
FFG	38	Curts	1
DDG	101	Gridley	1

Table 28. NAVSTA Pearl Harbor, HI, ship traffic

Class	Hull number	Name	Days in port
SSN	725	Helena	1
DDG	97	Halsey	1

Potential requirement reductions

Table 29 provides a breakdown summary of the potential annual funding requirement reductions by CCN.

Table 29. NAVSTA Pearl Harbor, HI, potential requirement reductions

CCN	UOM	SFT	δ	ST ($K)	RM ($K)	BOS ($K)	Total ($K)
15220	SY	Wharves	71,973	4,655	5,215	0	9,871
15260	SY	Wharves	9,295	601	674	0	1,275
15520	FB	Small craft berthing	3,681	518	307	0	825
15140	SY	Piers	5,952	385	431	0	816
15964	SF	Harbor master operations	31,357	243	162	100	505
15420	SY	Wharves	3,425	222	248	0	470
15610	SF	Harbor master operations	39,999	218	121	128	467
15920	SF	Magnetic silencing	660	5	4	2	11
15521	SF	Small craft berthing	812	3	1	2	6
16320	EA	Piers	2	0	1	0	1
13810	EA	Harbor master operations	1	0	0	0	0
		Totals		**6,850**	**7,164**	**232**	**14,246**

Naval Station Mayport, FL

NAVSTA Mayport, FL, is located east of Jacksonville, FL, and is one of the largest small combatant port facilities on the east coast.

Installation profile

Figure 23 is a satellite view of the installation.

Figure 23. NAVSTA Mayport, FL, satellite view

Figure 24 provides a FY 2008 installation profile summary.

Figure 24. NAVSTA Mayport, FL, installation profile

FY 2008 Installation Profile

UIC:	N60201	**Total Units:**	75
Title:	NAVSTA Mayport FL	**Total BA:**	9,507

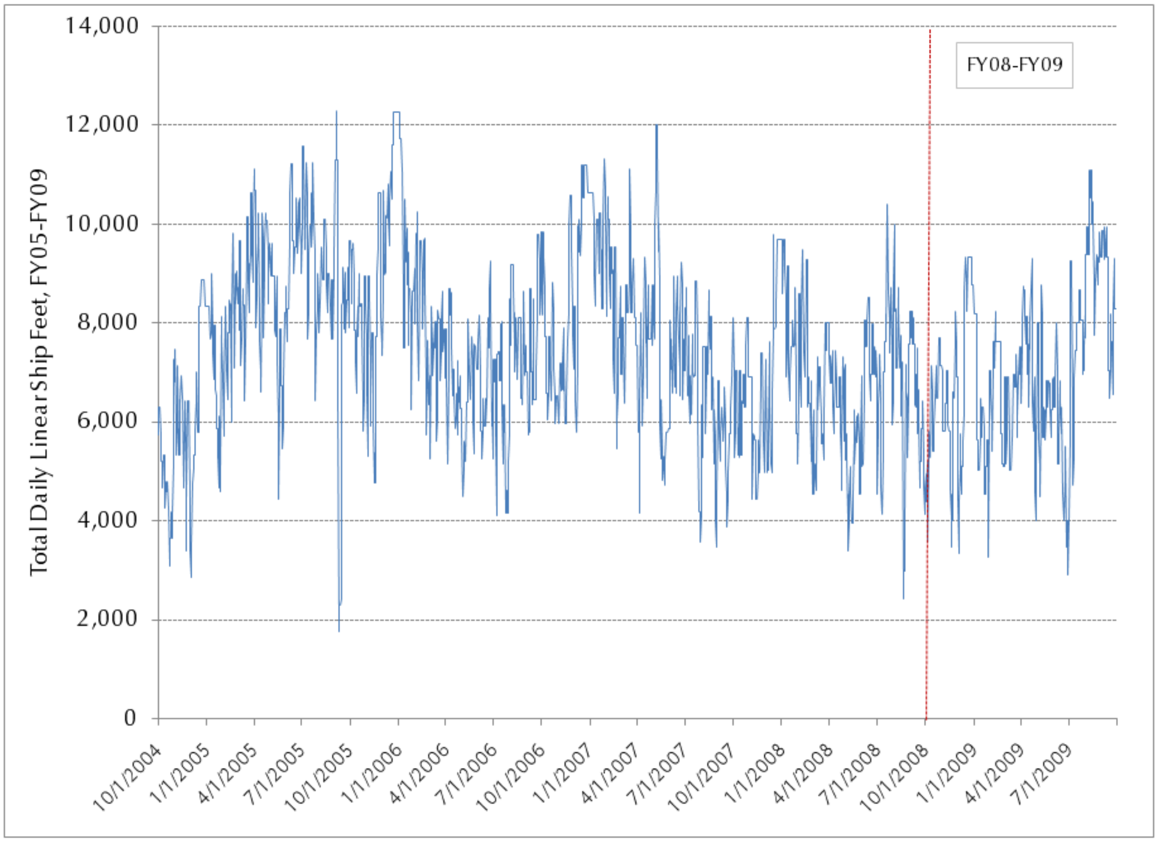
Assigned Commands			
Unit type	Warfighter	Shore support	Total Units
ADMIN	0	0	0
COMD	4	16	20
COMM	0	1	1
EXPD	0	1	1
HELO	6	6	12
LOG	0	6	6
MED	0	2	2
PLANE	0	0	0
RDTE	0	0	0
RES	0	0	0
SHIP	21	0	21
SHORE	0	5	5
SUB	0	0	0
TRAIN	0	7	7
Totals	31	44	75

Workforce Billets Authorized			
Labor class	Warfighter	Shore support	Total BA
AD ENL	5,217	1,805	7,022
AD OFF	602	256	858
CIVIL SER	0	706	706
CNTR	0	135	135
FN DIR	0	0	0
FN INDIR	0	0	0
FTS	361	27	388
SELRES	295	103	398
Totals	6,475	3,032	9,507

SCA - Waterfront Operations			
PRV ($)	# FAC	AVE AGE	AVE % SLU
79,217,696	27	40	82
P(COND)	P(CONF)	P(CAP)	P(BOS)
81	83	75	85
ST REQ ($K)		RM REQ ($K)	
1,628		1,055	

Figure 22 shows the variation in daily workload between FY 2005 and FY 2009. The red dashed vertical line separates the data for FY 2008–FY 2009—which we used to construct our workload measure—from the data for other years.

Figure 25. NAVSTA Mayport, FL, daily workload, FY 2005-FY 2009



Installation efficiency findings

Table 30 provides a summary of the metric values and ranks this installation against the other installations reviewed in this report.

Table 30. NAVSTA Mayport, FL, analysis summary

Metric	Value	Rank
Total waterfront operations PRV	$203,690,268	9 of 11
Area cost factor	0.89	11 of 11
Normalized waterfront PRV	$221,999,506	9 of 11
ADLSF	6,863	5 of 11
α	30.91	2 of 11
Total available berthing	7,883	9 of 11
γ	0.87	1 of 11

Table 30. NAVSTA Mayport, FL, analysis summary

Metric	Value	Rank
Total potential requirement reductions		
Sustainment	$1,426K	10 of 11
Restoration and modernization	$1,596	9 of 11
Base operating services	$5K	10 of 11

Installation waterfront facilities

Table 31 provides a detailed summary of waterfront facilities by CCN at NAVSTA Mayport, FL.

Table 31. NAVSTA Mayport, FL, detailed waterfront facilities summary

CCN	Description	UOM	Number facility records	Assets total	PRV
15220	General purpose berthing wharf	SY	7	50,876	$154,862,916
15420	Deep water bulkhead quaywall with relieving platform	SY	2	5,528	$16,826,838
15140	Fueling pier	SY	2	4,990	$15,189,204
16430	Levees	LF	1	5,500	$8,946,182
15964	Waterfront operations building	SF	3	18,337	$3,838,799
15520	Small craft berthing	FB	2	1,263	$3,266,496
15410	Fueling wharf	LF	1	399	$249,568
15920	Degaussing building	SF	1	900	$188,412
15521	Small craft boathouse	SF	2	3,600	$127,455
13720	Lighthouse	SF	1	402	$125,842
13820	Navigation aid target	EA	3	3	$51,417
13825	Antenna navigation	EA	1	1	$17,139
16510	Dredging spoil area	CY	1	12,400K	$0
	Total		**27**		**$203,690,268**

Installation ship traffic

Table 32 lists the ships that were identified as being in port at Mayport for at least 1 day during FY 2008 and FY 2009. Ships that are home-ported at Mayport appear in bold.

Table 32. NAVSTA Mayport, FL, ship traffic

Class	Hull number	Name	Days in port
FFG	**36**	**Underwood**	**476**
FFG	**58**	**Samuel B. Roberts**	**457**
FFG	**49**	**Robert G. Bradley**	**457**
FFG	**50**	**Taylor**	**456**
FFG	**32**	**John L. Hall**	**456**
FFG	**28**	**Boone**	**447**
FFG	**8**	**McInerney**	**445**
CG	**66**	**Hue City**	**431**
FFG	**45**	**De Wert**	**430**
CG	**58**	**Philippine Sea**	**416**
FFG	**40**	**Halyburton**	**416**
DDG	**99**	**Farragut**	**406**
FFG	**29**	**Stephen W. Groves**	**405**
FFG	**39**	**Doyle**	**393**
DDG	**80**	**Roosevelt**	**373**
FFG	**42**	**Klakring**	**372**
DDG	**64**	**Carney**	**368**
DDG	**68**	**The Sullivans**	**366**
CG	**69**	**Vicksburg**	**341**
CG	**64**	**Gettysburg**	**310**
FFG	**56**	**Simpson**	**240**
FFG	59	Kauffman	25
DDG	103	Truxtun	21
FFG	37	Crommelin	15
FFG	52	Carr	7
RV	NA	Chouest	7
DDG	75	Donald Cook	6
SSN	691	Memphis	6
DDG	87	Mason	5
CG	55	Leyte Gulf	5

Table 32. NAVSTA Mayport, FL, ship traffic

Class	Hull number	Name	Days in port
FFG	53	Hawes	5
DDG	104	Sterett	5
SSN	757	Alexandria	5
AOE	8	Arctic	4
PC	4	Monsoon	4
DDG	66	Gonzalez	4
DDG	81	Winston S. Churchill	4
DDG	96	Bainbridge	4
FFG	55	Elrod	4
CG	68	Anzio	4
DDG	95	James E. Williams	4
DDG	98	Forrest Sherman	4
DDG	74	McFaul	4
LHD	1	Wasp	4
SSN	706	Albuquerque	4
DDG	72	Mahan	4
DDG	78	Porter	4
DDG	106	Stockdale	3
CG	56	San Jacinto	3
SSN	690	Philadelphia	3
TAO	201	Patuxent	3
DDG	102	Sampson	3
LSD	51	Oak Hill	3
SSN	774	Virginia	2
TAO	203	Laramie	2
TAKE	1	Lewis and Clark	2
PC	7	Squall	2
SSN	765	Montpelier	2
SSN	764	Boise	2
DDG	67	Cole	2
TAFS	10	Saturn	2
SSN	751	San Juan	2
TAKE	2	Sacagawea	2
ARS	51	Grasp	2
TAO	196	Kanawha	2
DDG	61	Ramage	1
CVN	65	Enterprise	1
DDG	57	Mitscher	1

Table 32. NAVSTA Mayport, FL, ship traffic

Class	Hull number	Name	Days in port
DDG	94	Nitze	1
CVN	71	Theodore Roosevelt	1
TAKE	5	Robert E. Peary	1
DDG	84	Bulkeley	1
CVN	75	Harry S. Truman	1
DDG	58	Laboon	1
CVN	69	Dwight D. Eisenhower	1

Potential requirement reductions

Table 33 provides a breakdown summary of the potential annual funding requirement reductions by CCN.

Table 33. NAVSTA Mayport, FL, potential requirement reductions

CCN	UOM	SFT	δ	ST ($K)	RM ($K)	BOS ($K)	Total ($K)
15220	SY	Wharves	49,759	1,321	1,486	0	2,807
15140	SY	Piers	3,310	88	99	0	187
15964	SF	Harbor master operations	5,396	17	11	6	34
		Totals		**1,426**	**1,596**	**6**	**3,028**

Submarine Base New London, CT

SUBASE New London, CT, is located north of Groton, CT, on the east side of the Thames river.

Installation profile

Figure 26 is a satellite view of the installation.

Figure 26. SUBASE New London, CT, satellite view

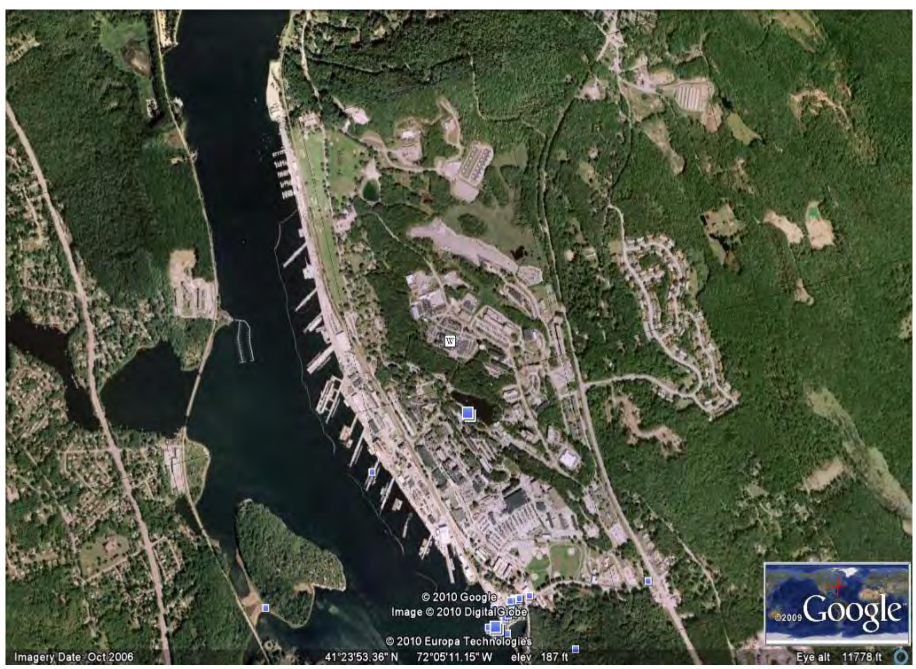


Figure 27 provides an FY 2008 installation profile summary.

Figure 27. SUBASE New London, CT, installation profile

FY 2008 Installation Profile

UIC: N00129
Title: NAVSUBASE New London CT
Total Units: 82
Total BA: 6,339

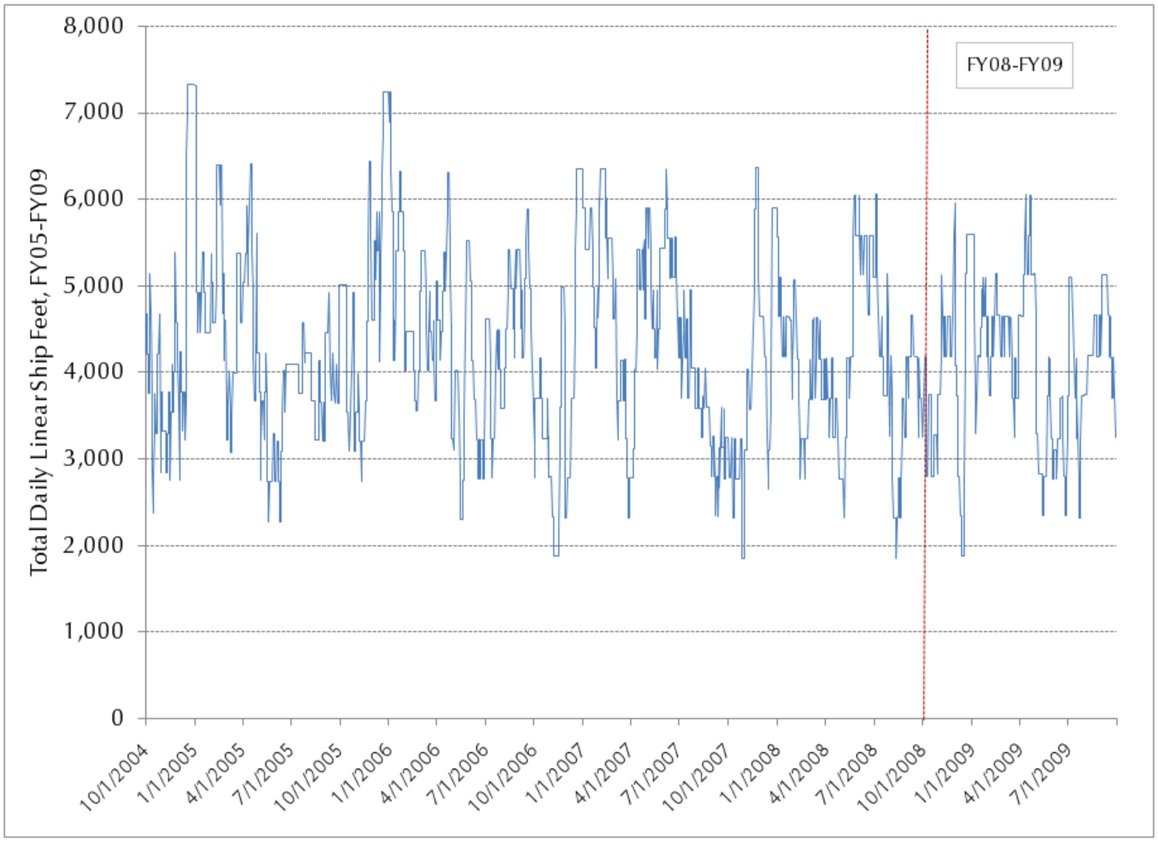
Assigned Commands			
Unit type	Warfighter	Shore support	Total Units
ADMIN	0	3	3
COMD	3	19	22
COMM	1	1	2
EXPD	0	2	2
HELO	0	0	0
LOG	0	7	7
MED	0	4	4
PLANE	0	0	0
RDTE	0	1	1
RES	0	1	1
SHIP	0	0	0
SHORE	0	12	12
SUB	20	0	20
TRAIN	0	8	8
Totals	24	58	82

Workforce Billets Authorized			
Labor class	Warfighter	Shore support	Total BA
AD ENL	2,442	1,803	4,245
AD OFF	279	292	571
CIVIL SER	0	858	858
CNTR	0	502	502
FN DIR	0	0	0
FN INDIR	0	0	0
FTS	0	19	19
SELRES	0	144	144
Totals	2,721	3,618	6,339

SCA - Waterfront Operations			
PRV ($)	# FAC	AVE AGE	AVE % SLU
37,325,808	17	39	85
P(COND)	P(CONF)	P(CAP)	P(BOS)
72	57	91	82
ST REQ ($K)		RM REQ ($K)	
865		543	

Figure 25 shows the variation in daily workload between FY 2005 and FY 2009. The red dashed vertical line separates the data for FY 2008–FY 2009—which we used to construct our workload measure—from the data for other years.

Figure 28. SUBASE New London, CT, daily workload, FY 2005-FY 2009



Installation efficiency findings

Table 34 provides a summary of the metric values and ranks this installation against the other installations reviewed in this report.

Table 34. SUBASE New London, CT, analysis summary

Metric	Value	Rank
Total waterfront operations PRV	$135,683,722	11 of 11
Area cost factor	1.18	3 of 11
Normalized waterfront PRV	$111,536,619	11 of 11
ADLSF	4,061	5 of 11
α	36.41	1 of 11
Total available berthing	7,539	10 of 11
γ	0.54	2 of 11

Table 34. SUBASE New London, CT, analysis summary

Metric	Value	Rank
Total potential requirement reductions		
Sustainment	$240K	11 of 11
Restoration and modernization	$179	11 of 11
Base operating services	$61K	8 of 11

Installation waterfront facilities

Table 35 provides a detailed summary of waterfront facilities by CCN at SUBASE New London, CT.

Table 35. SUBASE New London, CT, detailed waterfront facilities summary

CCN	Description	UOM	Number facility records	Assets total	PRV
15120	General purpose berthing pier	SY	8	18,000	$72,643,871
15410	Fueling wharf	LF	1	13,190	$50,889,843
15964	Waterfront operations building	SF	3	18,731	$5,109,458
15220	General purpose berthing wharf	SY	1	983	$3,967,163
15520	Small craft berthing	FB	1	725	$2,486,044
15920	Degaussing building	SF	1	1,840	$510,713
15921	Degaussing range	EA	1	1	$74,648
12220	Small craft fueling station	GM	1	48	$1,982
	Total		**17**		**$135,683,722**

Installation ship traffic

Table 36 lists the ships that were identified as being in port at New London for at least 1 day during FY 2008 and FY 2009. Ships that are homeported at New London appear in bold.

Table 36. SUBASE New London, CT, ship traffic

Class	Hull number	Name	Days in port
SSN	**775**	**Texas**	**577**
SSN	776	Hawaii	435
SSN	**751**	**San Juan**	**428**
SSN	**719**	**Providence**	**410**
SSN	**760**	**Annapolis**	**398**
SSN	**720**	**Pittsburgh**	**391**
SSN	**774**	**Virginia**	**389**
SSN	**777**	**North Carolina**	**379**
SSN	**768**	**Hartford**	**365**
SSN	**761**	**Springfield**	**357**
SSN	**690**	**Philadelphia**	**336**
SSN	**757**	**Alexandria**	**333**
SSN	706	Albuquerque	326
SSN	**755**	**Miami**	**303**
SSN	**778**	**New Hampshire**	**227**
SSN	**691**	**Memphis**	**202**
SSN	**700**	**Dallas**	**180**
SSN	**769**	**Toledo**	**149**
SSN	710	Augusta	104
SSN	714	Norfolk	25
SSN	764	Boise	21
SSN	724	Louisville	13
SSN	725	Helena	13
SSN	772	Greeneville	11
TATF	172	Apache	8
ARS	51	Grasp	3

Potential requirement reductions

Table 37 provides a breakdwon summary of the potential annual funding requirement reductions by CCN.

Table 37. SUBASE New London, CT, potential requirement reductions

CCN	UOM	SFT	δ	ST ($K)	RM ($K)	BOS ($K)	Total ($K)
15410	LF	Small craft berthing	12,066	176	133	0	309
15964	SF	Harbor master operations	11,072	49	31	58	138
15220	SY	Wharves	322	12	13	0	25
15920	SF	Magnetic silencing	669	3	2	3	8
12220	GM	Small craft berthing	28	0	0	0	0
		Totals		**240**	**179**	**61**	**480**

Naval Base Kitsap Bremerton, WA

NAVBASE Kitsap Bremerton, WA, consists of two main sites. The naval station is on the southeast side of Bremerton facing Puget Sound. The Naval submarine base at Bangor, WA, is located northwest of Bremerton, WA, on the Kitsap peninsula.

Installation profile

Figure 29 is a satellite view of the installation.

Figure 29. NAVBASE Kitsap Bremerton, WA, satellite view

Figure 30 provides an FY 2008 installation profile summary.

Figure 30. NAVBASE Kitsap Bremerton, WA, installation profile

FY 2008 Installation Profile

UIC: N68436
Title: NAVBASE Kitsap Bremerton WA

Total Units: 100
Total BA: 24,946

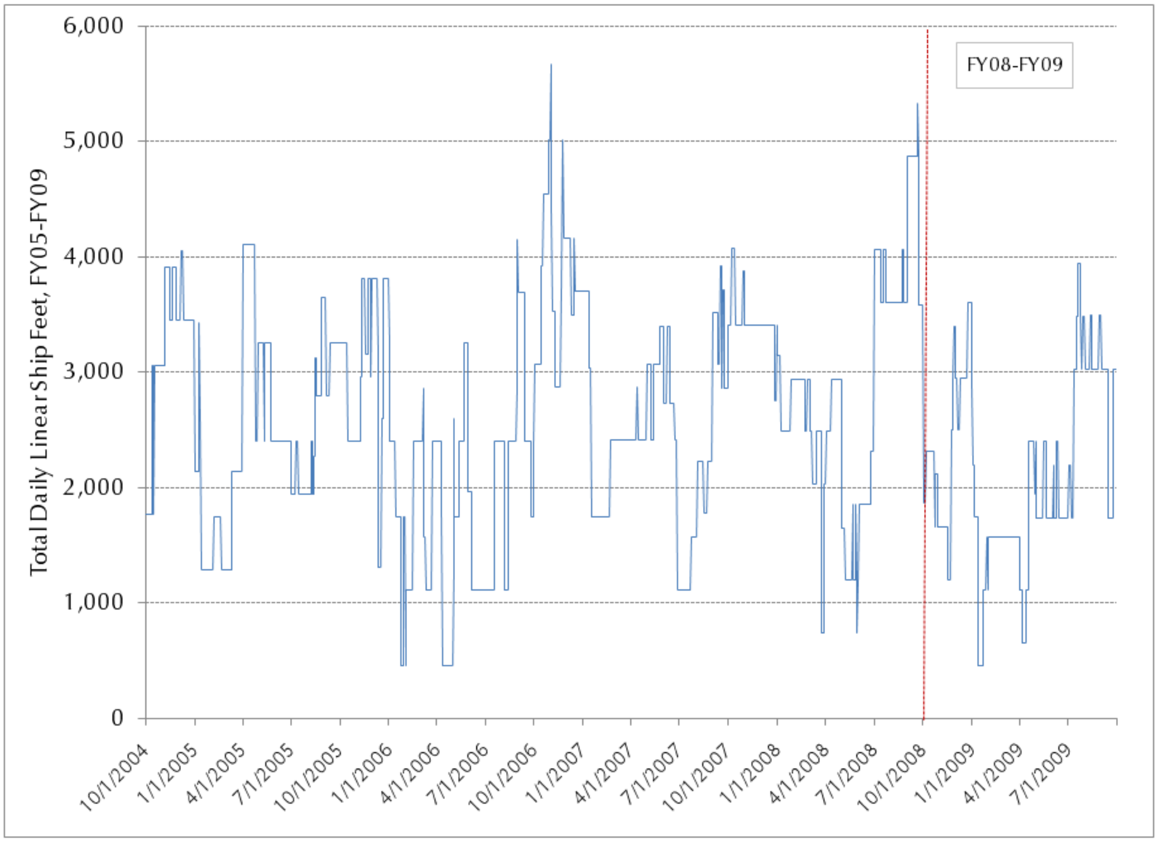
Assigned Commands			
Unit type	Warfighter	Shore support	Total Units
ADMIN	0	1	1
COMD	3	28	31
COMM	0	0	0
EXPD	1	3	4
HELO	0	0	0
LOG	3	8	11
MED	0	4	4
PLANE	0	0	0
RDTE	3	5	8
RES	0	1	1
SHIP	1	0	1
SHORE	0	9	9
SUB	22	0	22
TRAIN	1	7	8
Totals	**34**	**66**	**100**

Workforce Billets Authorized			
Labor class	Warfighter	Shore support	Total BA
AD ENL	6,156	2,042	8,198
AD OFF	518	322	840
CIVIL SER	0	14,208	14,208
CNTR	0	156	156
FN DIR	0	0	0
FN INDIR	0	0	0
FTS	0	29	29
SELRES	247	1,268	1,515
Totals	**6,921**	**18,025**	**24,946**

SCA - Waterfront Operations			
PRV ($)	# FAC	AVE AGE	AVE % SLU
187,748,912	75	36	78
P(COND)	P(CONF)	P(CAP)	P(BOS)
90	86	93	85
ST REQ ($K)		RM REQ ($K)	
4,141		2,577	

Figure 28 shows the variation in daily workload between FY 2005 and FY 2009. The red dashed vertical line separates the data for FY 2008–FY 2009—which we used to construct our workload measure—from the data for other years.

Figure 31. NAVBASE Kitsap Bremerton, WA, daily workload, FY 2005-FY 2009



Installation efficiency findings

Table 38 provides a summary of the metric values and ranks this installation against the other installations reviewed in this report.

Table 38. NAVBASE Kitsap Bremerton, WA, analysis summary

Metric	Value	Rank
Total waterfront operations PRV	437,467,216	5 of 11
Area cost factor	1.26	3 of 11
Normalized waterfront PRV	336,780,317	5 of 11
ADLSF	2,505	6 of 11
α	7.43	7 of 11
Total available berthing	15,850	6 of 11
γ	0.16	7 of 11

Table 38. NAVBASE Kitsap Bremerton, WA, analysis summary

Metric	Value	Rank
Total potential requirement reductions		
Sustainment	$2,786K	4 of 11
Restoration and modernization	$2,804	4 of 11
Base operating services	$190K	6 of 11

Installation waterfront facilities

Table 39 provides a detailed summary of waterfront facilities by CCN at NAVBASE Kitsap Bremerton, WA.

Table 39. NAVBASE Kitsap Bremerton, WA, detailed waterfront facilities summary

CCN	Description	UOM	Number facility records	Assets total	PRV
15120	General purpose berthing pier	SY	10	47,782	$221,659,038
15220	General purpose berthing wharf	SY	1	13,678	$57,542,388
15180	Deperming pier	SY	1	11,316	$46,061,265
15420	Deep water bulkhead quaywall with relieving platform	SY	4	9,810	$43,186,904
15140	Fueling pier	SY	1	7,667	$29,987,296
15520	Small craft berthing	FB	14	3,278	$11,888,203
15430	Seawalls	LF	8	12,516	$11,103,138
15964	Waterfront operations building	SF	4	23,684	$7,019,443
15930	Deperming building	SF	3	6,332	$1,876,672
15610	Waterfront transit shed	SF	1	10,000	$1,590,349
12440	Small craft ready fuel storage	GA	1	160,000	$1,359,837
15510	Fleet landing	FB	1	400	$1,139,134
15410	Fueling wharf	LF	1	1,250	$860,917
15521	Small craft boathouse	SF	3	17,644	$702,584
15190	Access trestle to piers and wharves	SY	1	267	$455,144
16310	Mooring dolphin	EA	3	30	$401,375
16320	Mooring platform	EA	6	22	$390,437
13820	Navigation aid target	EA	4	4	$121,324
16210	Gun emplacements	EA	2	2	$48,446
13720	Lighthouse	SF	1	100	$44,318
13810	Beacon ship	EA	1	1	$22,339

Table 39. NAVBASE Kitsap Bremerton, WA, detailed waterfront facilities summary

CCN	Description	UOM	Number facility records	Assets total	PRV
12220	Small craft fueling station	GM	1	150	$6,665
	Total		**72**		**$437,467,216**

Installation ship traffic

Table 40 lists the ships that were identified as being in port at Bremerton for at least 1 day during FY 2008 and FY 2009. Ships that are homeported at Bremerton appear in bold.

Table 40. NAVBASE Kitsap Bremerton, WA, ship traffic

Class	Hull number	Name	Days in port
CVN	**74**	**John C. Stennis**	**416**
SSN	**21**	**Seawolf**	**394**
AS	**39**	**Emory S. Land**	**366**
SSN	**22**	**Connecticut**	**352**
SSN	711	San Francisco	294
SSGN	**727**	**Michigan**	**239**
CVN	72	Abraham Lincoln	166
SSGN	**726**	**Ohio**	**126**
SSN	718	Honolulu	92
CV	63	Kitty Hawk	29
SSN	713	Houston	5
SSN	698	Bremerton	5
SSN	771	Columbia	4
SSN	772	Greeneville	4
SSN	715	Buffalo	4
SSN	759	Jefferson City	2
SSN	722	Key West	2

Potential requirement reductions

Table 41 provides a breakdown summary of the potential annual funding requirement reductions by CCN.

Table 41. NAVBASE Kitsap Bremerton, WA, potential requirement reductions

CCN	UOM	SFT	δ	ST ($K)	RM ($K)	BOS ($K)	Total ($K)
15120	SY	Piers	23,212	907	981	0	1,888
15220	SY	Wharves	13,270	518	561	0	1,079
15180	SY	Magnetic silencing	7,881	308	333	0	641
15420	SY	Wharves	7,070	276	299	0	575
15140	SY	Piers	7,054	276	298	0	574
15520	FB	Small craft berthing	2,385	203	116	0	319
15430	LF	Wharves	9,770	151	115	0	266
15964	SF	Harbor master operations	18,959	89	57	97	243
15521	SF	Small craft berthing	13,130	26	9	68	103
15930	SF	Magnetic silencing	4,992	24	15	25	64
15410	LF	Small craft berthing	557	8	7	0	15
16310	EA	Piers	28	0	7	0	7
16320	EA	Piers	22	1	5	0	6
12220	GM	Small craft berthing	138	0	1	0	1
13810	EA	Harbor master operations	1	0	0	0	0
13820	EA	Harbor master operations	1	0	0	0	0
		Totals		**2,787**	**2,804**	**190**	**5,781**

Naval Amphibious Base Little Creek, VA

NAVPHIBASE Little Creek, VA, is located east of NAVSTA Norfolk, VA, and is the sole expeditionary support base on the east coast.

Installation profile

Figure 32 is a satellite view of the installation.

Figure 32. NAVPHIBASE Little Creek, VA, satellite view

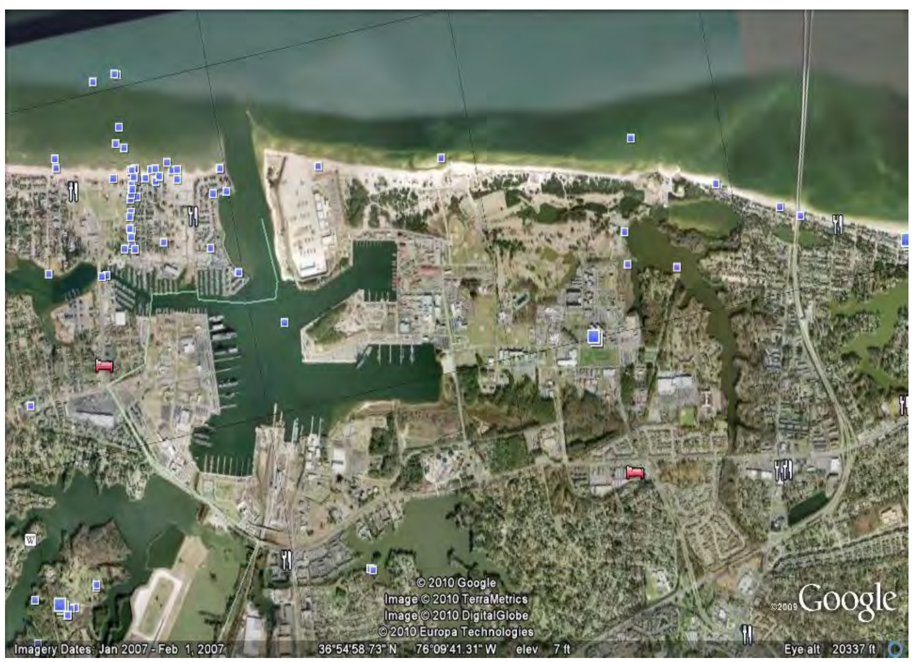


Figure 33 provides an FY 2008 installation profile summary.

Figure 33. NAVPHIBASE Little Creek, VA, installation profile

FY 2008 Installation Profile

UIC:	N61414	**Total Units:**	119
Title:	NAVPHIBASE Little Creek VA	**Total BA:**	12,214

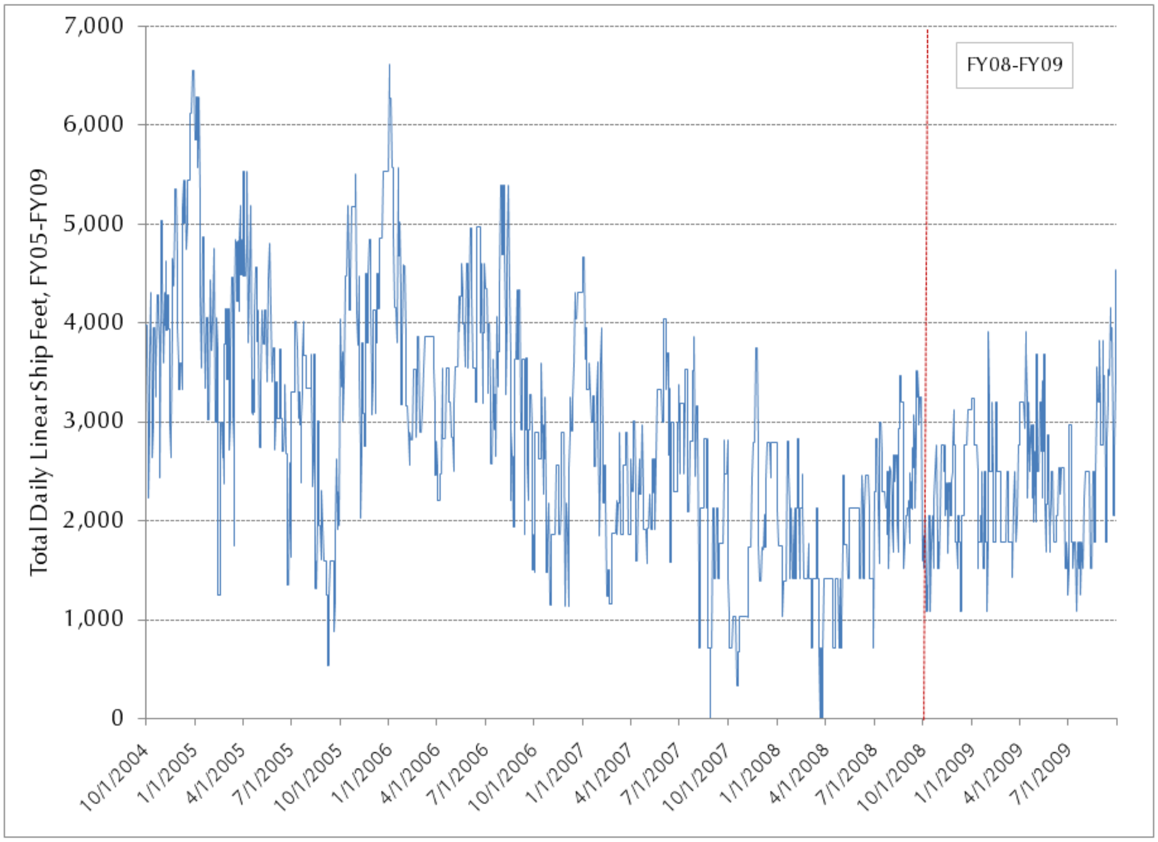
Assigned Commands			
Unit type	Warfighter	Shore support	Total Units
ADMIN	0	0	0
COMD	15	21	36
COMM	5	10	15
EXPD	25	6	31
HELO	0	0	0
LOG	1	2	3
MED	4	2	6
PLANE	0	0	0
RDTE	0	2	2
RES	0	1	1
SHIP	11	1	12
SHORE	0	8	8
SUB	0	0	0
TRAIN	1	4	5
Totals	62	57	119

Workforce Billets Authorized			
Labor class	Warfighter	Shore support	Total BA
AD ENL	5,937	1,867	7,804
AD OFF	673	584	1,257
CIVIL SER	32	993	1,025
CNTR	12	402	414
FN DIR		0	0
FN INDIR		0	0
FTS	24	88	112
SELRES	650	952	1,602
Totals	7,328	4,886	12,214

SCA - Waterfront Operations			
PRV ($)	# FAC	AVE AGE	AVE % SLU
119,805,600	193	54	126
P(COND)	P(CONF)	P(CAP)	P(BOS)
91	80	84	83
ST REQ ($K)		RM REQ ($K)	
2,760		1,910	

Figure 31 shows the variation in daily workload between FY 2005 and FY 2009. The red dashed vertical line separates the data for FY 2008–FY 2009—which we used to construct our workload measure—from the data for other years.

Figure 34. NAVPHIBASE Little Creek, VA, daily workload, FY 2005-FY 2009



Installation efficiency findings

Table 42 provides a summary of the metric values and ranks this installation against the other installations reviewed in this report.

Table 42. NAVPHIBASE Little Creek, VA, analysis summary

Metric	Value	Rank
Total waterfront operations PRV	278,826,149	6 of 11
Area cost factor	1.00	8 of 11
Normalized waterfront PRV	278,826,149	6 of 11
ADLSF	2,081	7 of 11
α	7.46	6 of 11
Total available berthing	33,019	4 of 11
γ	0.06	11 of 11

Table 42. NAVPHIBASE Little Creek, VA, analysis summary

Metric	Value	Rank
Total potential requirement reductions		
Sustainment	$2,410K	5 of 11
Restoration and modernization	$2,107	6 of 11
Base operating services	$163K	7 of 11

Installation waterfront facilities

Table 43 provides a detailed summary of waterfront facilities by CCN at NAVPHIBASE Little Creek, VA.

Table 43. NAVPHIBASE Little Creek, VA, detailed waterfront facilities summary

CCN	Description	UOM	Number facility records	Assets total	PRV
15420	Deep water bulkhead quaywall with relieving platform	SY	112	38,601	$125,936,252
15120	General purpose berthing pier	SY	15	23,228	$77,634,535
15520	Small craft berthing	FB	44	15,335	$43,225,922
15260	Supply wharf	SY	6	4,099	$13,598,599
15430	Seawalls	LF	13	10,443	$7,119,052
15410	Fueling wharf	LF	17	6,117	$4,169,788
15964	Waterfront operations building	SF	1	12,682	$2,893,587
16420	Groins or jetties	LF	6	3,025	$2,062,159
15521	Small craft boathouse	SF	3	42,042	$1,622,251
15140	Fueling pier	SY	1	121	$401,422
16410	Breakwater	LF	1	200	$136,341
16310	Mooring dolphin	EA	2	2	$23,846
12220	Small craft fueling station	GM	1	70	$2,395
	Total		**222**		**$278,826,149**

Installation ship traffic

Table 44 lists the ships that were identified as being in port at Little Creek for at least 1 day during FY 2008 and FY 2009. Ships that are homeported at Little Creek appear in bold.

Table 44. NAVPHIBASE Little Creek, VA, ship traffic

Class	Hull number	Name	Days in port
PC	**4**	**Monsoon**	**401**
PC	**3**	**Hurricane**	**368**
PC	**2**	**Tempest**	**364**
PC	**7**	**Squall**	**341**
PC	**12**	**Thunderbolt**	**319**
LSD	**48**	**Ashland**	**240**
LSD	**41**	**Whidbey Island**	**222**
LSD	**44**	**Gunston Hall**	**219**
LSD	**50**	**Carter Hall**	**212**
LSD	**43**	**Fort McHenry**	**195**
LSD	**51**	**Oak Hill**	**180**
TATF	172	Apache	145
ARS	51	Grasp	104
RV	NA	Dolores Chouest	84
ARS	53	Grapple	81
LCS	1	Freedom	52

Potential requirement reductions

Table 45 provides a breakdown summary of the potential annual funding requirement reductions by CCN.

Table 45. NAVPHIBASE Little Creek, VA, potential requirement reductions

CCN	UOM	SFT	δ	ST ($K)	RM ($K)	BOS ($K)	Total ($K)
15420	SY	Wharves	36,326	1,053	1,182	0	2,235
15520	FB	Small craft berthing	14,593	921	546	0	1,467
15260	SY	Wharves	3,751	109	122	0	231
15521	SF	Small craft berthing	38,294	57	21	133	211

Table 45. NAVPHIBASE Little Creek, VA, potential requirement reductions

CCN	UOM	SFT	δ	ST ($K)	RM ($K)	BOS ($K)	Total ($K)
15120	SY	Piers	2,824	82	92	0	174
15430	LF	Wharves	8,163	94	74	0	168
15410	LF	Small craft berthing	5,541	64	50	0	114
15964	SF	Harbor master operations	8,758	30	20	30	80
12220	GM	Small craft berthing	60	0	0	0	0
		Totals		**2,410**	**2,107**	**163**	**4,680**

Naval Base Coronado San Diego, CA

NAVBASE Coronado San Diego, CA, has two main sites with the city of Coronado, CA, sandwiched in between. NAS North Island, CA, hosts the larger ships for the San Diego area, and NAVPHIBASE Coronado, CA, is the sole expeditionary support base on the west coast.

Installation profile

Figure 35 is a satellite view of the installation.

Figure 35. NAVBASE Coronado San Diego, CA, satellite view

Figure 36 provides a FY 2008 installation profile summary.

Figure 36. NAVBASE Coronado San Diego, CA, installation profile

FY 2008 Installation Profile

UIC: N00246
Title: NAVBASE Coronado CA

Total Units: 148
Total BA: 18,948

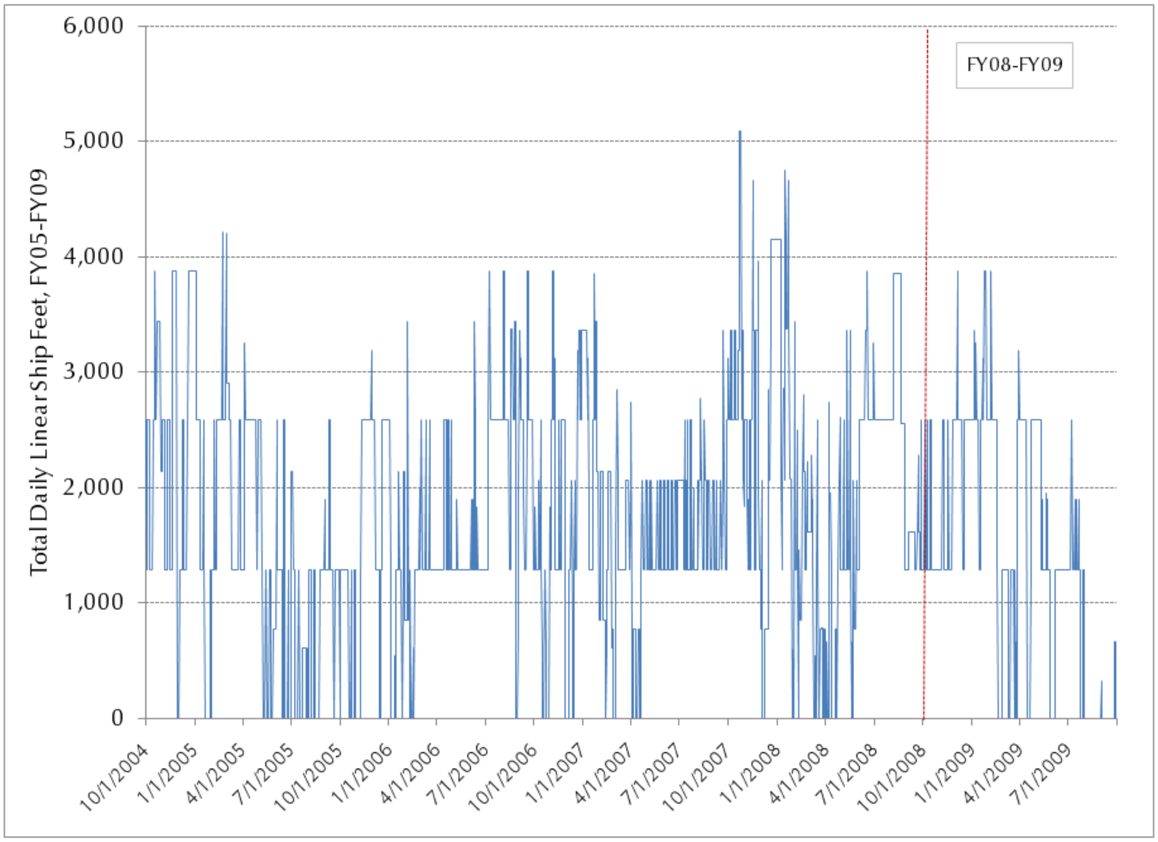
Assigned Commands			
Unit type	Warfighter	Shore support	Total Units
ADMIN	1	1	2
COMD	11	36	47
COMM	4	5	9
EXPD	25	2	27
HELO	15	8	23
LOG	1	10	11
MED	0	3	3
PLANE	1	2	3
RDTE	0	1	1
RES	0	2	2
SHIP	0	0	0
SHORE	0	5	5
SUB	0	0	0
TRAIN	2	13	15
Totals	60	88	148

Workforce Billets Authorized			
Labor class	Warfighter	Shore support	Total BA
AD ENL	4,948	4,079	9,027
AD OFF	893	864	1,757
CIVIL SER	23	4,664	4,687
CNTR	9	853	862
FN DIR	0	0	0
FN INDIR	0	0	0
FTS	244	156	400
SELRES	1,224	991	2,215
Totals	7,341	11,607	18,948

SCA - Waterfront Operations			
PRV ($)	# FAC	AVE AGE	AVE % SLU
263,780,896	50	40	85
P(COND)	P(CONF)	P(CAP)	P(BOS)
94	89	71	82
ST REQ ($K)		RM REQ ($K)	
6,417		3,969	

Figure 34 shows the variation in daily workload between FY 2005 and FY 2009. The red dashed vertical line separates the data for FY 2008–FY 2009—which we used to construct our workload measure—from the data for other years.

Figure 37. NAVBASE Coronado, San Diego, CA, daily workload, FY 2005-FY 2009



Installation efficiency findings

Table 46 provides a summary of the metric values and ranks this installation against the other installations reviewed in this report.

Table 46. NAVBASE Coronado San Diego, CA, analysis summary

Metric	Value	Rank
Total waterfront operations PRV	600,441,385	4 of 11
Area cost factor	1.11	5 of 11
Normalized waterfront PRV	524,710,039	4 of 11
ADLSF	1,759	8 of 11
α	3.35	10 of 11
Total available berthing	16,385	5 of 11
γ	0.11	8 of 11

Table 46. NAVBASE Coronado San Diego, CA, analysis summary

Metric	Value	Rank
Total potential requirement reductions		
Sustainment	$5,521K	2 of 11
Restoration and modernization	$5,241	2 of 11
Base operating services	$267K	3 of 11

Installation waterfront facilities

Table 47 provides a detailed summary of waterfront facilities by CCN at NAVBASE Coronado San Diego, CA.

Table 47. NAVBASE Coronado San Diego, CA, detailed waterfront facilities summary

CCN	Description	UOM	Number facility records	Assets total	PRV
15420	Deep water bulkhead quaywall with relieving platform	SY	2	107,830	$409,361,553
15120	General purpose berthing pier	SY	6	29,284	$111,799,330
15520	Small craft berthing	FB	22	12,396	$39,984,662
15964	Waterfront operations building	SF	7	61,819	$16,012,894
13710	Oceanographic building	SF	1	31,537	$13,032,079
15410	Fueling wharf	LF	3	9,386	$7,321,671
15140	Fueling pier	SY	1	412	$1,564,101
15430	Seawalls	LF	2	1,061	$852,445
15930	Deperming building	SF	1	1,008	$263,185
13820	Navigation aid target	EA	1	5	$106,880
15950	Ferry slip	EA	1	1	$70,219
16320	Mooring platform	EA	2	2	$29,742
13810	Beacon ship	EA	1	1	$23,051
12220	Small craft fueling station	GM	1	500	$19,573
	Total		**51**		**$600,441,385**

Installation ship traffic

Table 48 lists the ships that were identified as being in port at Coronado for at least 1 day during FY 2008 and FY 2009. Ships that are homeported at Coronado appear in bold.

Table 48. NAVBASE Coronado San Diego, CA, ship traffic

Class	Hull number	Name	Days in port
CVN	**68**	**Nimitz**	**440**
CVN	**76**	**Ronald Reagan**	**295**
CVN	73	George Washington	85
TAO	187	Henry J. Kaiser	46
TAKE	3	Alan Shepard	37
TAO	202	Yukon	30
CVN	72	Abraham Lincoln	23
CV	63	Kitty Hawk	21
CVN	74	John C. Stennis	18
TATF	169	Navajo	18
AOE	7	Rainier	14
TATF	171	Sioux	11
CG	62	Chancellorsville	8
DDG	86	Shoup	5
LPD	18	New Orleans	5
CG	54	Antietam	5
DDG	76	Higgins	4
FFG	43	Thach	3
DDG	102	Sampson	3
DDG	59	Russell	3
DDG	91	Pinckney	2
DDG	53	John Paul Jones	2
DDG	73	Decatur	2
DDG	83	Howard	2
CG	59	Princeton	2
TAKE	4	Richard E. Byrd	2
FFG	48	Vandegrift	1
FFG	38	Curts	1
CG	53	Mobile Bay	1
DDG	104	Sterett	1

Table 48. NAVBASE Coronado San Diego, CA, ship traffic

Class	Hull number	Name	Days in port
CG	71	Cape St. George	1
DDG	69	Milius	1
FFG	46	Rentz	1
DDG	65	Benfold	1
FFG	61	Ingraham	1
MCM	6	Devastator	1
FFG	33	Jarrett	1
CVN	74	John C. Stennis	1

Potential requirement reductions

Table 49 provides a breakdown summary of the potential annual funding requirement reductions by CCN.

Table 49. NAVBASE Coronado San Diego, CA, potential requirement reductions

CCN	UOM	SFT	δ	ST ($K)	RM ($K)	BOS ($K)	Total ($K)
15420	SY	Wharves	105,906	3,716	3,944	0	7,660
15520	FB	Small craft berthing	11,769	899	504	0	1,403
15120	SY	Piers	12,030	422	448	0	870
15964	SF	Harbor master operations	58,501	246	155	185	586
13710	SF	Harbor master operations	26,077	114	93	82	289
15410	LF	Small craft berthing	8,899	124	92	0	216
12220	GM	Small craft berthing	492	0	4	0	4
13820	EA	Harbor master operations	3	0	1	0	1
15930	SF	Magnetic silencing	67	0	0	0	0
13810	EA	Harbor master operations	1	0	0	0	0
16320	EA	Piers	2	0	0	0	0
		Totals		**5,521**	**5,241**	**267**	**11,029**

Naval Station Everett, WA

NAVSTA Everett, WA, is located on the west side of Everett, WA, and faces Puget Sound. It is one of the smaller port facilities on the west coast.

Installation profile

Figure 38 is a satellite view of the installation.

Figure 38. NAVSTA Everett, WA, satellite view

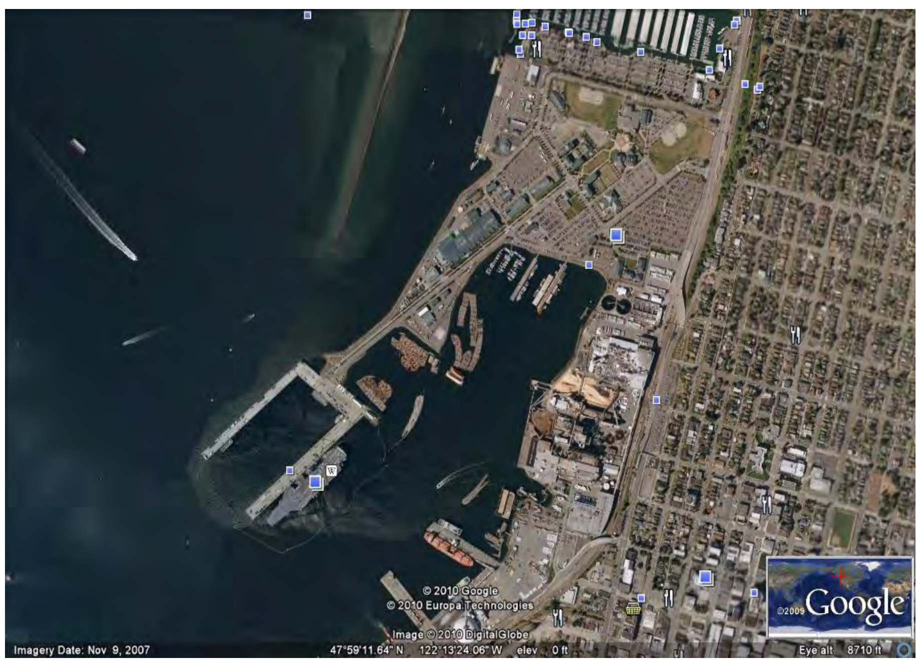


Figure 39 provides an FY 2008 installation profile summary.

Figure 39. NAVSTA Everett, WA, installation profile

FY 2008 Installation Profile

UIC:	N68967	**Total Units:**	53
Title:	NAVSTA Everett WA	**Total BA:**	5,709

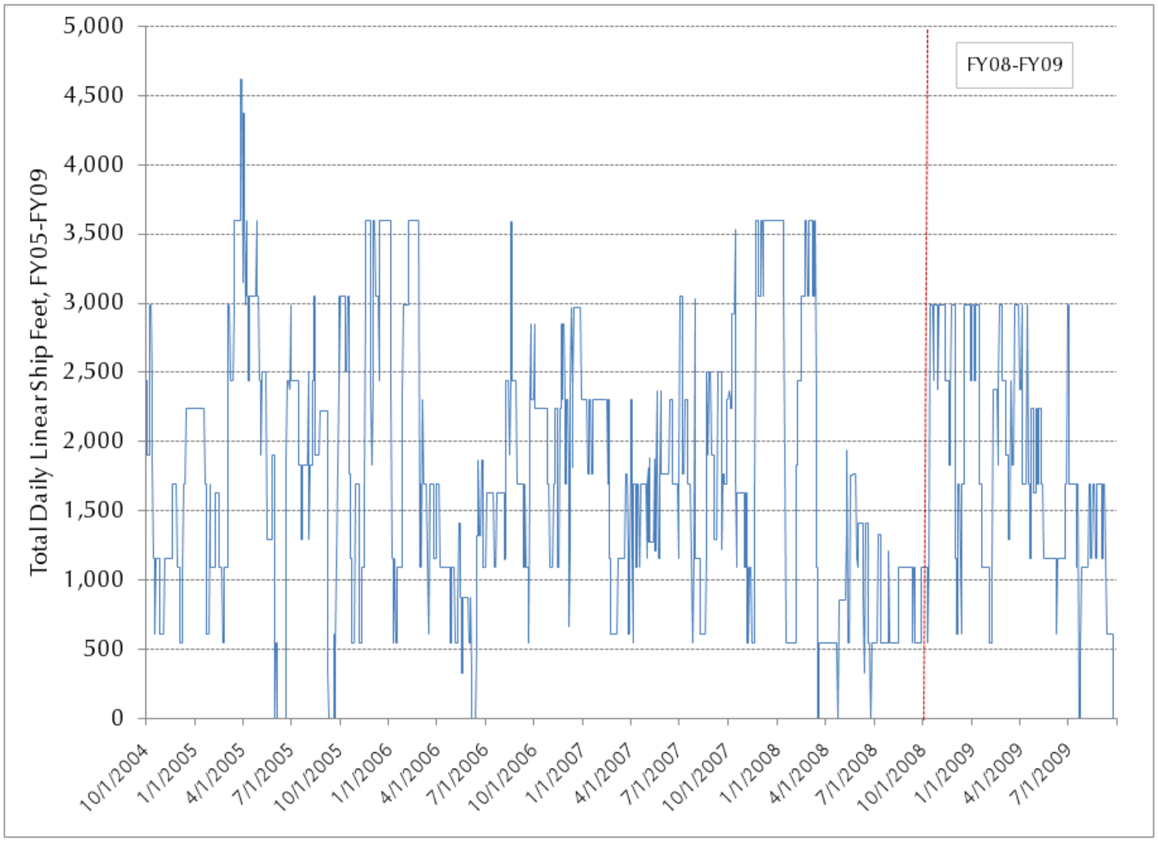
Assigned Commands			
Unit type	**Warfighter**	**Shore support**	**Total Units**
ADMIN	0	0	0
COMD	2	16	18
COMM	0	1	1
EXPD	0	6	6
HELO	0	0	0
LOG	0	3	3
MED	0	2	2
PLANE	0	0	0
RDTE	0	0	0
RES	0	11	11
SHIP	6	0	6
SHORE	0	4	4
SUB	0	0	0
TRAIN	0	2	2
Totals	**8**	**45**	**53**

Workforce Billets Authorized			
Labor class	**Warfighter**	**Shore support**	**Total BA**
AD ENL	4,019	505	4,524
AD OFF	290	57	347
CIVIL SER	0	114	114
CNTR	0	28	28
FN DIR	0	0	0
FN INDIR	0	0	0
FTS	54	166	220
SELRES	60	416	476
Totals	**4,423**	**1,286**	**5,709**

SCA - Waterfront Operations			
PRV ($)	**# FAC**	**AVE AGE**	**AVE % SLU**
120,920,304	13	20	43
P(COND)	**P(CONF)**	**P(CAP)**	**P(BOS)**
93	90	93	85
ST REQ ($K)		**RM REQ ($K)**	
2,924		1,876	

Figure 37 shows the variation in daily workload between FY 2005 and FY 2009. The red dashed vertical line separates the data for FY 2008–FY 2009—which we used to construct our workload measure—from the data for other years.

Figure 40. NAVSTA Everett, WA, daily workload, FY 2005-FY 2009



Installation efficiency findings

Table 50 provides a summary of the metric values and ranks this installation against the other installations reviewed in this report.

Table 50. NAVSTA Everett, WA, analysis summary

Metric	Value	Rank
Total waterfront operations PRV	289,425,892	7 of 11
Area cost factor	1.13	4 of 11
Normalized waterfront PRV	248,445,235	7 of 11
ADLSF	1,680	9 of 11
α	6.77	8 of 11
Total available berthing	6,408	11 of 11
γ	0.26	5 of 11

Table 50. NAVSTA Everett, WA, analysis summary

Metric	Value	Rank
Total potential requirement reductions		
Sustainment	$2,133K	7 of 11
Restoration and modernization	$2,150	5 of 11
Base operating services	$241K	4 of 11

Installation waterfront facilities

Table 51 provides a detailed summary of waterfront facilities by CCN at NAVSTA Everett, WA.

Table 51. NAVSTA Everett, WA, detailed waterfront facilities summary

CCN	Description	UOM	Number facility records	Assets total	PRV
15120	General purpose berthing pier	SY	5	66,367	$256,246,503
15610	Waterfront transit shed	SF	1	78,964	$14,086,205
15430	Seawalls	LF	1	10,870	$8,632,432
15520	Small craft berthing	FB	3	1,190	$3,906,126
16410	Breakwater	LF	1	3,608	$2,865,300
16430	Levees	LF	1	888	$1,736,528
15964	Waterfront operations building	SF	1	6,183	$1,643,443
15521	Small craft boathouse	SF	2	6,882	$309,355
	Total		**15**		**$289,425,892**

Installation ship traffic

Table 52 lists the ships that were identified as being in port at Everett for at least 1 day during FY 2008 and FY 2009. Ships that are home-ported at Everett appear in bold.

Table 52. NAVSTA Everett, WA, ship traffic

Class	Hull number	Name	Days in port
FFG	**61**	**Ingraham**	**399**
DDG	**92**	**Momsen**	**371**
FFG	**60**	**Rodney M. Davis**	**348**
FFG	**54**	**Ford**	**347**
CVN	**72**	**Abraham Lincoln**	**237**
DDG	**86**	**Shoup**	**86**
TATF	171	Sioux	19
AOE	10	Bridge	17
DDG	90	Chafee	14
TAKE	4	Richard E. Byrd	6
DDG	53	John Paul Jones	6
DDG	88	Preble	5
CVN	74	John C. Stennis	3
DDG	59	Russell	3
CG	59	Princeton	1

Potential requirement reductions

Table 53 provides a breakdown summary of the potential annual funding requirement reductions by CCN.

Table 53. NAVSTA Everett, WA, potential requirement reductions

CCN	UOM	SFT	δ	ST ($K)	RM ($K)	BOS ($K)	Total ($K)
15120	SY	Piers	49,889	1,766	1,891	0	3,657
15610	SF	Harbor master operations	57,033	170	91	215	476
15430	LF	Wharves	9,029	127	95	0	222
15520	FB	Small craft berthing	591	45	26	0	71
16410	LF	Harbor master operations	3,357	5	37	0	42
15964	SF	Harbor master operations	3,015	13	8	11	32

Table 53. NAVSTA Everett, WA, potential requirement reductions

CCN	UOM	SFT	δ	ST ($K)	RM ($K)	BOS ($K)	Total ($K)
15521	SF	Small craft berthing	3,855	7	2	15	24
		Totals		**2,133**	**2,150**	**241**	**4,524**

Naval Base Point Loma, CA

NAVBASE Point Loma, CA, is located northwest of San Diego, CA, and occupies the end of Point Loma. It is the primary attack sub homeport on the west coast.

Installation profile

Figure 41 is a satellite view of the installation.

Figure 41. NAVBASE Point Loma, CA, satellite view

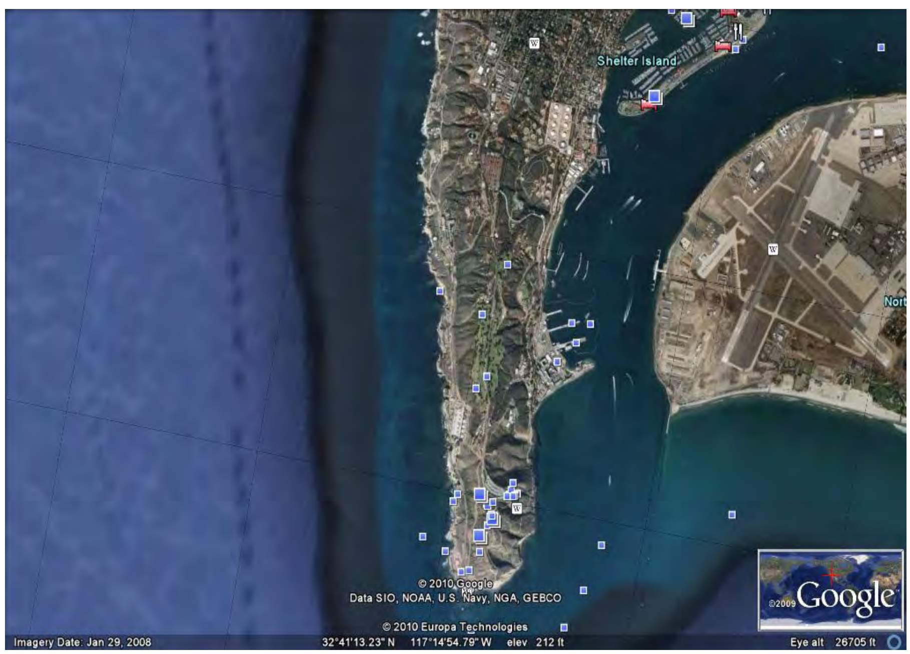


Figure 42 provides an FY 2008 installation profile summary.

Figure 42. NAVBASE Point Loma, CA, installation profile

FY 2008 Installation Profile

UIC:	N63406	**Total Units:**	33
Title:	NAVSUBASE San Diego CA	**Total BA:**	3,052

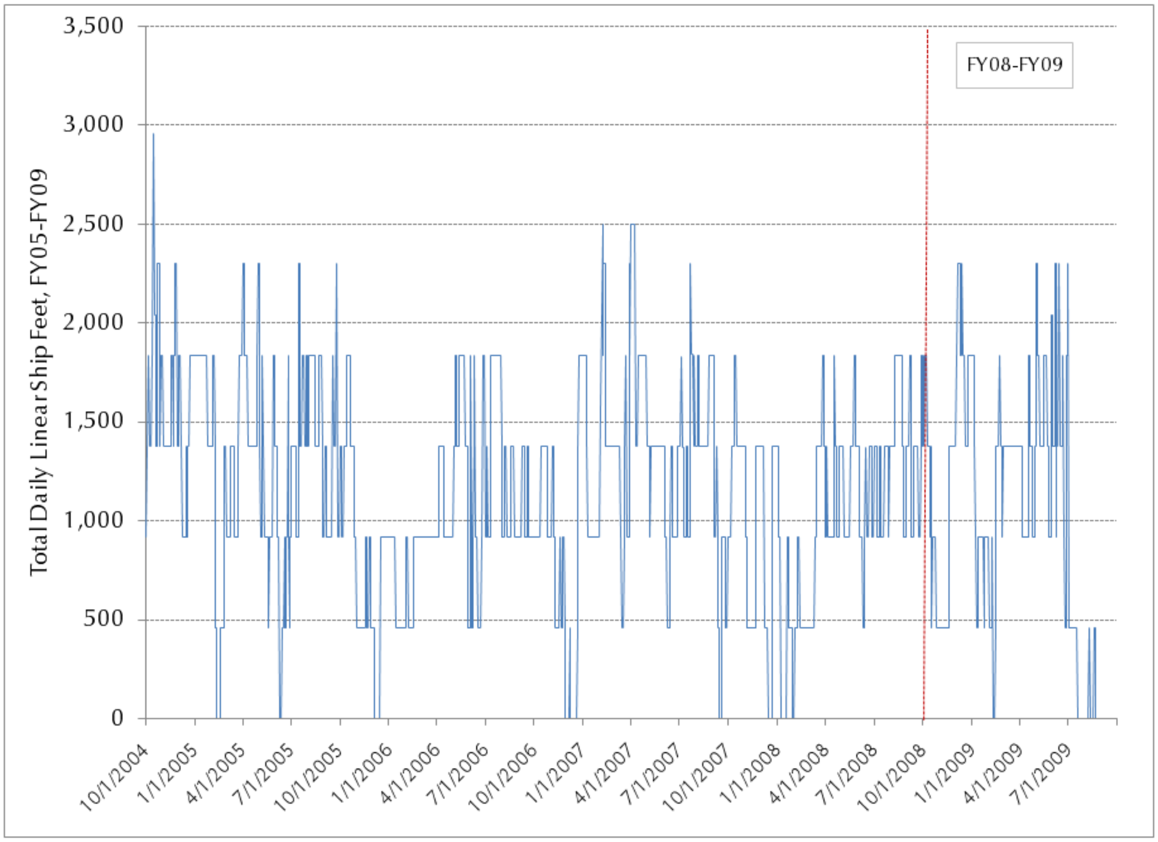
Assigned Commands			
Unit type	**Warfighter**	**Shore support**	**Total Units**
ADMIN	0	0	0
COMD	2	13	15
COMM	0	0	0
EXPD	0	1	1
HELO	0	0	0
LOG	0	5	5
MED	0	2	2
PLANE	0	0	0
RDTE	0	2	2
RES	0	0	0
SHIP	0	0	0
SHORE	0	2	2
SUB	5	0	5
TRAIN	0	1	1
Totals	**7**	**26**	**33**

Workforce Billets Authorized			
Labor class	**Warfighter**	**Shore support**	**Total BA**
AD ENL	700	1,023	1,723
AD OFF	79	206	285
CIVIL SER	0	526	526
CNTR	0	332	332
FN DIR	0	0	0
FN INDIR	0	0	0
FTS	0	78	78
SELRES	0	108	108
Totals	**779**	**2,273**	**3,052**

SCA - Waterfront Operations			
PRV ($)	**# FAC**	**AVE AGE**	**AVE % SLU**
82,333,888	35	47	99
P(COND)	**P(CONF)**	**P(CAP)**	**P(BOS)**
87	85	94	81
ST REQ ($K)		**RM REQ ($K)**	
1,775		1,083	

Figure 40 shows the variation in daily workload between FY 2005 and FY 2009. The red dashed vertical line separates the data for FY 2008–FY 2009—which we used to construct our workload measure—from the data for other years.

Figure 43. NAVBASE Point Loma, CA, daily workload, FY 2005-FY 2009



Installation efficiency findings

Table 54 provides a summary of the metric values and ranks this installation against the other installations reviewed in this report.

Table 54. NAVBASE Point Loma, CA, analysis summary

Metric	Value	Rank
Total waterfront operations PRV	196,415,627	10 of 11
Area cost factor	1.11	5 of 11
Normalized waterfront PRV	171,642,485	10 of 11
ADLSF	1,005	10 of 11
α	5.84	9 of 11
Total available berthing	11,965	7 of 11
γ	0.08	9 of 11

Table 54. NAVBASE Point Loma, CA, analysis summary

Metric	Value	Rank
Total potential requirement reductions		
Sustainment	$1,471K	9 of 11
Restoration and modernization	$1,462	10 of 11
Base operating services	$45K	8 of 11

Installation waterfront facilities

Table 55 provides a detailed summary of waterfront facilities by CCN at NAVBASE Point Loma, CA.

Table 55. NAVBASE Point Loma, CA, detailed waterfront facilities summary

CCN	Description	UOM	Number facility records	Assets total	PRV
15120	General purpose berthing pier	SY	4	33,402	$129,322,010
15140	Fueling pier	SY	1	7,847	$29,790,041
15180	Deperming pier	SY	2	5,352	$20,318,122
15520	Small craft berthing	FB	4	1,786	$5,981,893
15430	Seawalls	LF	6	4,698	$3,664,891
15930	Deperming building	SF	5	11,173	$2,919,927
15420	Deep water bulkhead quaywall with relieving platform	SY	1	284	$1,078,166
15964	Waterfront operations building	SF	1	4,108	$1,072,582
15920	Degaussing building	SF	1	3,945	$1,030,023
15410	Fueling wharf	LF	4	565	$440,754
15921	Degaussing range	EA	5	5	$351,095
16310	Mooring dolphin	EA	2	21	$312,286
16330	Stake pile moorings	EA	1	8	$118,966
16320	Mooring platform	EA	1	1	$14,871
	Total		**38**		**$196,415,627**

Installation ship traffic

Table 56 below lists all of the ships that were identified as being in port at Point Loma for at least 1 day during FY 2008 and FY 2009. Ships that are homeported at Point Loma appear in bold.

Table 56. NAVBASE Point Loma, CA, ship traffic

Class	Hull number	Name	Days in port
SSN	**759**	**Jefferson City**	**350**
SSN	**754**	**Topeka**	**321**
SSN	**758**	**Asheville**	**309**
SSN	**767**	**Hampton**	**303**
SSN	**725**	**Helena**	**264**
SSN	750	Newport News	18
SSN	717	Olympia	6
SSN	770	Tucson	6
SSN	698	Bremerton	5
SSN	771	Columbia	4
SSN	763	Santa Fe	4
SSN	701	La Jolla	3
SSN	22	Connecticut	2
SSGN	726	Ohio	2

Potential requirement reductions

Table 57 provides a breakdown summary of the potential annual funding requirement reductions by CCN.

Table 57. NAVBASE Point Loma, CA, potential requirement reductions

CCN	UOM	SFT	δ	ST ($K)	RM ($K)	BOS ($K)	Total ($K)
15120	SY	Piers	23,541	826	877	0	1,703
15140	SY	Piers	7,601	267	283	0	550
15180	SY	Magnetic silencing	3,973	139	148	0	287
15520	FB	Small craft berthing	1,428	109	61	0	170
15930	SF	Magnetic silencing	10,635	45	28	29	102
15430	LF	Wharves	3,596	50	37	0	87

Table 57. NAVBASE Point Loma, CA, potential requirement reductions

CCN	UOM	SFT	δ	ST ($K)	RM ($K)	BOS ($K)	Total ($K)
15920	SF	Magnetic silencing	3,655	15	10	10	35
15954	SF	Harbor master operations	2,212	9	6	6	21
15921	EA	Magnetic silencing	5	6	4	0	10
15410	LF	Small craft berthing	287	4	3	0	7
16310	EA	Piers	20	1	4	0	5
16320	EA	Piers	1	0	0	0	0
		Totals		**1,471**	**1,461**	**45**	**2,977**

Submarine Base Kings Bay, GA

SUBASE Kings Bay, GA, is the sole Trident Submarine Base on the east coast and is located near St Mary's, GA, along the intercoastal waterway.

Installation profile

Figure 44 is a satellite view of the installation.

Figure 44. SUBASE Kings Bay, GA, satellite view

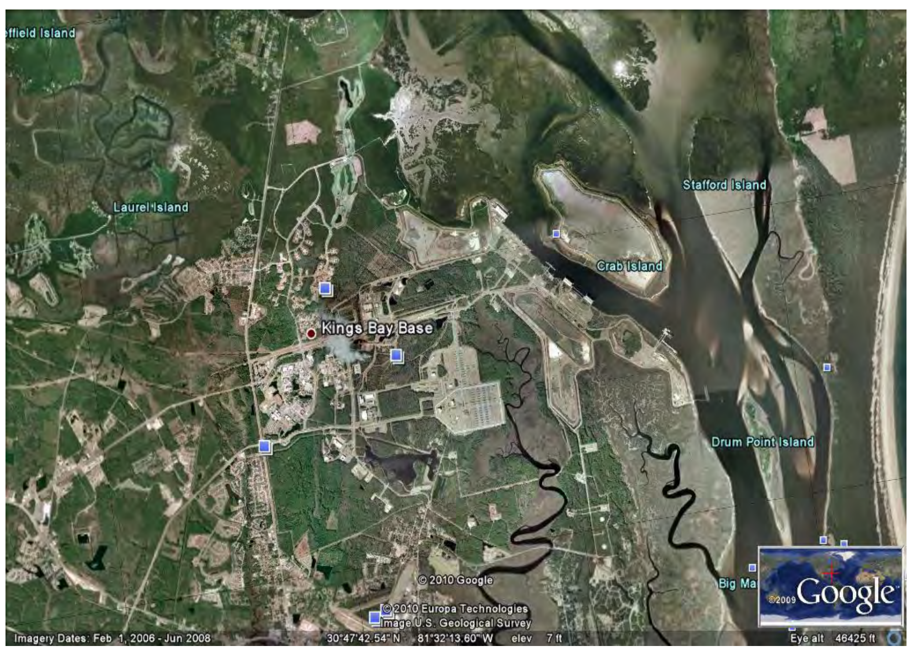


Figure 45 provides an FY 2008 installation profile summary.

Figure 45. SUBASE Kings Bay, GA, installation profile

FY 2008 Installation Profile

UIC: N42237
Title: NAVSUBASE Kings Bay GA

Total Units: 55
Total BA: 6,719

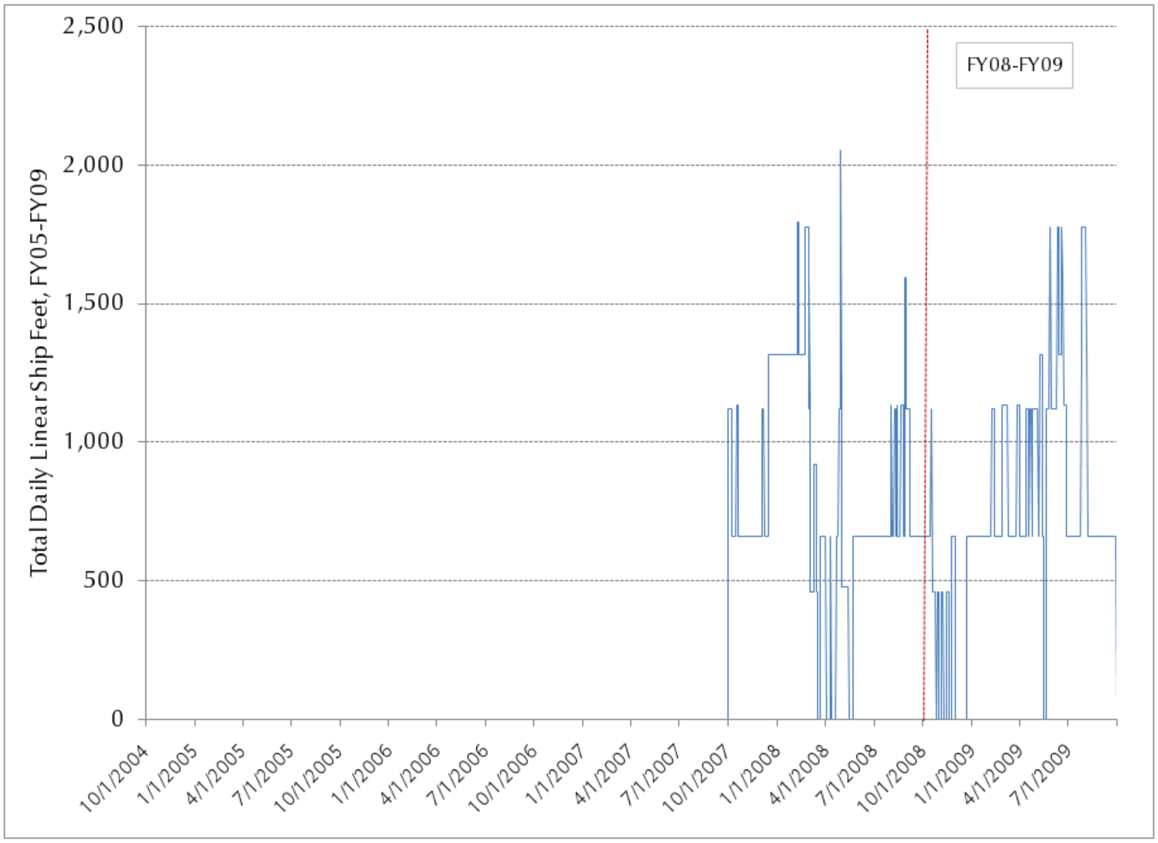
Assigned Commands			
Unit type	**Warfighter**	**Shore support**	**Total Units**
ADMIN	0	1	1
COMD	1	12	13
COMM	4	4	8
EXPD	0	3	3
HELO	0	0	0
LOG	0	3	3
MED	0	1	1
PLANE	0	0	0
RDTE	0	0	0
RES	0	4	4
SHIP	0	0	0
SHORE	0	4	4
SUB	12	0	12
TRAIN	0	6	6
Totals	17	38	55

Workforce Billets Authorized			
Labor class	**Warfighter**	**Shore support**	**Total BA**
AD ENL	2,036	2,096	4,132
AD OFF	209	199	408
CIVIL SER	1	1,750	1,751
CNTR	0	157	157
FN DIR	0	0	0
FN INDIR	0	0	0
FTS	0	75	75
SELRES	0	196	196
Totals	2,246	4,473	6,719

SCA - Waterfront Operations			
PRV ($)	**# FAC**	**AVE AGE**	**AVE % SLU**
119,610,448	39	23	49
P(COND)	**P(CONF)**	**P(CAP)**	**P(BOS)**
81	78	86	85
ST REQ ($K)		**RM REQ ($K)**	
2,743		1,953	

Figure 43 shows the variation in daily workload between FY 2005 and FY 2009. The red dashed vertical line separates the data for FY 2008–FY 2009—which we used to construct our workload measure—from the data for other years.

Figure 46. SUBASE Kings Bay, GA, daily workload, FY 2005-FY 2009



Installation efficiency findings

Table 58 provides a summary of the metric values and ranks this installation against the other installations reviewed in this report.

Table 58. SUBASE Kings Bay, GA, analysis summary

Metric	Value	Rank
Total waterfront operations PRV	227,626,3297	8 of 11
Area cost factor	0.92	10 of 11
Normalized waterfront PRV	239,997,325	8 of 11
ADLSF	768	11of 11
α	3.20	11 of 11
Total available berthing	9,954	8 of 11
γ	0.08	10 of 11

Table 58. SUBASE Kings Bay, GA, analysis summary

Metric	Value	Rank
Total potential requirement reductions		
Sustainment	$2.094K	8 of 11
Restoration and modernization	$1,884	8 of 11
Base operating services	$1,566K	1 of 11

Installation waterfront facilities

Table 59 provides a detailed summary of waterfront facilities by CCN at SUBASE Kings Bay, GA.

Table 59. SUBASE Kings Bay, GA, detailed waterfront facilities summary

CCN	Description	UOM	Number facility records	Assets total	PRV
15220	General purpose berthing wharf	SY	5	29,700	$92,717,247
15120	General purpose berthing pier	SY	2	18,980	$59,721,197
15610	Waterfront transit shed	SF	2	278,784	$32,372,608
15180	Deperming pier	SY	1	3,776	$11,881,309
15190	Access trestle to piers and wharves	SY	2	8,990	$11,189,589
15520	Small craft berthing	FB	4	3,171	$8,481,007
15964	Waterfront operations building	SF	5	29,942	$6,402,926
16120	Fixed net anchorage	EA	4	4	$2,309,555
15930	Deperming building	SF	1	8,236	$1,782,302
15510	Fleet landing	FB	4	155	$410,756
13820	Navigation aid target	EA	5	19	$332,964
16310	Mooring dolphin	EA	2	2	$24,382
12220	Small craft fueling station	GM	1	15	$487
16510	Dredging spoil area	CY	2	35,475,000	$0
	Total		**40**		**$227,626,329**

Installation ship traffic

Table 60 lists the ships that were identified as being in port at Kings Bay for at least 1 day during FY 2008 and FY 2009. Ships that are homeported at Kings Bay appear in bold.

Table 60. SUBASE Kings Bay, GA, ship traffic

Class	Hull number	Name	Days in port
SSGN	**729**	**Georgia**	**417**
SSGN	**728**	**Florida**	**294**
SSN	690	Philadelphia	33
SSN	753	Albany	26
SSN	774	Virginia	15
SSN	776	Hawaii	15
SSN	770	Tucson	13
SSN	763	Santa Fe	13
SSN	778	New Hampshire	11
SSN	777	North Carolina	10
SSN	720	Pittsburgh	10
SSN	765	Montpelier	10
SSN	714	Norfolk	9
SSN	724	Louisville	6
SSN	775	Texas	6
SSN	756	Scranton	5
SSN	706	Albuquerque	5
SSN	750	Newport News	4
SSN	710	Augusta	4
SSN	755	Miami	3

Potential requirement reductions

Table 61 provides a breakdown summary of the potential annual funding requirement reductions by CCN.

Table 61. SUBASE Kings Bay, GA, potential requirement reductions

CCN	UOM	SFT	δ	ST ($K)	RM ($K)	BOS ($K)	Total ($K)
15610	SF	Harbor master operations	268,761	615	347	1,379	2,341
15220	SY	Wharves	29,575	803	913	0	1,716
15120	SY	Piers	11,450	311	353	0	664
15964	SF	Harbor master operations	28,494	93	62	146	301
15520	FB	Small craft berthing	2,897	171	103	0	274
15180	SY	Magnetic silencing	2,723	74	84	0	158
15930	SF	Magnetic silencing	7,825	25	18	40	83
13820	EA	Harbor master operations	18	1	3	0	4
15510	FB	Small craft berthing	25	1	1	0	2
12220	GM	Small craft berthing	11	0	0	0	0
16310	EA	Piers	1	0	0	0	0
		Totals		**2,094**	**1,884**	**1,565**	**5,543**

Appendix B: Data handling procedures

To carry out our analysis, we collected data on both waterfront operations infrastructure and workload for each of the 11 U.S. homeports we considered. This appendix describes the steps we took to prepare the data for our analysis.

Infrastructure data

The internet Naval Facilities Assets Data Store (iNFADS) contains detailed information on the entire inventory of property possessed by the Navy. From the FY 2009 iNFADS data, we extracted all records for east and west coast homeports that are in the waterfront operations SCA.

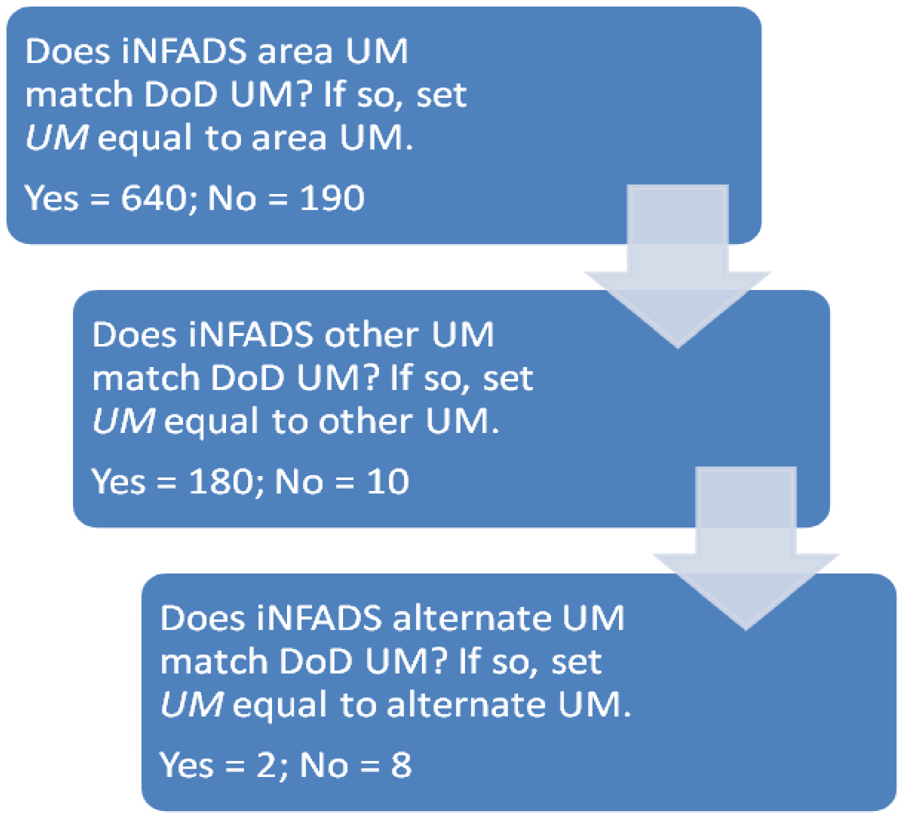
Identifying units of measure

Because part of our analysis involves using DoD pricing models to compute potential cost savings, we had to make sure that our infrastructure data for each CCN were expressed in the appropriate unit of measure (UOM). The iNFADS data include three different UOM fields for each record—area UOM, other UOM, and alternate UOM. For example, for CCN 15120, a general purpose berthing pier, area UOM is square yards (SY), and other UOM is berthing feet (FB). iNFADS also includes three different area measures that correspond to each of the different UOMs (total area, total other area, and total alternate area).

In order to use the DoD pricing models, we had to determine which UOM they used and make sure we used the same UOM for our analysis.

Figure 47 shows the steps we took to put the infrastructure data into the appropriate UOMs. Before beginning the process, we created a new variable called *UM* to represent the UOM we needed to use in the pricing models.

Figure 47. Process of identifying correct unit of measure



As indicated in figure 47, there were eight records for which there was no iNFADS UOM field that matched the appropriate DoD UOM. Table 62 shows the CCN, facility identification number, iNFADS area

UOM, and DoD UOM for each of these records, along with how we dealt with each one.

Table 62. UOM assignment for data discrepancies

CCN	Facility ID	iNFADS area UOM	DoD UOM	Disposition
12220	NFA200000463981	SF	GM	Dropped (duplicate record)
13720	NFA100001003923	CP	SF	Set UOM to SF and calculated area by multiplying length by width
15120	NFA100000759280	DW	SY	Set UOM to SY and calculated area by multiplying length by width and dividing the result by 9
15420	NFA100001163493	LF	SY	Set UOM to SY and calculated area by multiplying length by width and dividing the result by 9
15420	NFA100000746071	LF	SY	Set UOM to SY and calculated area by multiplying length by width and dividing the result by 9
15510	NFA100001253207	LF	FB	Dropped (duplicate record)
15520	NFA100000936605	SF	FB	Dropped (duplicate record)
15520	NFA100000936570	GM	FB	Dropped (duplicate record)

Of the eight records we were unable to match, half were duplicate records (meaning there was another record with the same facility ID). For each of these duplicate records, the other record with the same facility ID had at least one iNFADS UOM that matched the DoD UOM, so we dropped the duplicate record with no UOM match.

For the remaining four records, we set the variable UOM equal to the DoD UOM and calculated the appropriate area measure manually using the length and width measurements in iNFADS. As a check on our manual calculations, we also verified that the iNFADS length and width measurements were denominated in feet by looking at length, width, and total area measurements for other facilities with a UOM of either SF or SY.

Normalizing plant replacement value (PRV)

As part of our analysis, we used PRV as a way to aggregate all waterfront operations CCNs at an installation. PRV is meant to represent the cost of constructing a new facility to replace an existing one at a given location. Thus, PRV puts all infrastructure assets in dollar terms. However, the PRV calculation includes an adjustment for geographic variation in construction costs. This adjustment is accomplished by multiplying unit costs by an area cost factor (ACF). So, given identical infrastructure at two installations, if one is in a high-cost area, its facilities will have higher PRV.

Because we want to interpret differences in PRV as differences in the aggregate amount of waterfront infrastructure, we normalize all PRV values to the market prices in Norfolk in FY 2009. To do this, we use the following formula:

$$\mathrm{PRV}_i^N = \mathrm{PRV}_i\left(\frac{\mathrm{ACF}_{\mathrm{Norfolk}}}{\mathrm{ACF}_i}\right)$$

Following the guidance in [1], we use FY 2009 military construction (MILCON) ACFs for each installation, which are given in table 63.

Table 63. FY 2009 MILCON ACFs

Installation	FY 2009 ACF (MILCON)
NAVBASE Kitsap Bremerton, WA	1.26
NAVSTA Everett, WA	1.13
NAVSTA Norfolk, VA	0.97
NAVBASE San Diego, CA	1.11
NAVBASE Coronado San Diego, CA	1.11
NAVBASE Point Loma, CA	1.11
SUBASE New London, CT	1.18
NAVSTA Pearl Harbor, HI	2.16
NAVSTA Mayport, FL	0.89
SUBASE Kings Bay, GA	0.92
NAVPHIBASE Little Creek, VA	0.97

ACFs are not separately defined for the three San Diego area installations, or for NAVPHIBASE Little Creek, VA. We used the San Diego ACF for all three of the San Diego area installations and the Norfolk ACF for NAVPHIBASE Little Creek, VA.

Workload data

The WEBSKED online database provides daily information on the location and activities of all U.S. Navy and Military Sealift Command (MSC) ships. We used WEBSKED to identify which ships were in port at each of the east and west coast installations included in our analysis.

One of the fields available in WEBSKED is an identifier for whether a ship is underway or in port. Each of these broad classifications includes a number of different activities that a ship may be involved in. WEBSKED also contains other fields that give finer detail on what a ship was doing. For our purposes, we counted a ship as being in port if the broad indicator of ship status indicated that the ship was in port.

The only way that the WEBSKED database allows users to identify where a ship was in port is through a field labeled "location." However, the location field does not use the same naming conventions as other Navy databases, such as iNFADS. Initially, we searched WEBSKED for any ship recorded as being in port in the United States (omitting the gulf coast) on any day in FY 2009. This yielded a list of 51 unique locations. Many of these locations were cities where no Navy installation exists—presumably these records indicate port calls. Further, some Navy installations appear to have been listed using different names. For example, there were records featuring both "NORTH ISLAND NAS" and "NORTH ISLAND" as location values. To perform our analysis, we had to translate the locations listed in WEBSKED into the installations as identified in iNFADS (e.g., "NAVBASE Coronado San Diego, CA" rather than North Island).

Table 64 lists all 51 unique location values we identified in WEBSKED. The table also shows whether the location was included in our analysis, and, if so, the Navy installation we assumed was being referenced.

Table 64. Crosswalk of WEBSKED locations to Navy installations

WEBSKED location	Included in analysis?	Navy installation name (iNFADS)
NORFOLK VA	Yes	NAVSTA NORFOLK VA
NEWPORT NEWS VA	Yes	NAVSTA NORFOLK VA
SAN DIEGO-NAVSTA	Yes	NAVBASE SAN DIEGO or NAVBASE POINT LOMA
SAN DIEGO	Yes	NAVBASE SAN DIEGO or NAVBASE POINT LOMA
PEARL HARBOR	Yes	NAVSTA PEARL HARBOR HI
MAYPORT	Yes	NAVSTA MAYPORT FL
GROTON	Yes	NAVSUBASE NEW LONDON CT
LITTLE CREEK VA	Yes	NAVPHIBASE LITTLE CREEK VA
BREMERTON	Yes	NAVAL BASE KITSAP BREMERTON WA
BANGOR WA	Yes	NAVAL BASE KITSAP BREMERTON WA
EVERETT	Yes	NAVSTA EVERETT WA
NORTH ISLAND NAS	Yes	NAVBASE CORONADO
NORTH ISLAND	Yes	NAVBASE CORONADO
KINGS BAY	Yes	SUBASE KINGS BAY GA
NORFOLK NAVAL SHYD	No	NSS NORFOLK NAVAL SHIPYARD VA
NORFOLK NORSHIP C	No	NSS NORFOLK NAVAL SHIPYARD VA
PORTSMOUTH NH SHYD	No	NSY BOS PORTSMOUTH NH
PORTSMOUTH NSY	No	NSY BOS PORTSMOUTH NH
CHARLESTON SC	No	NAVWPNSTA CHARLESTON SC
EARLE	No	NAVWPNSTA EARLE NJ
INDIAN ISLAND WA	No	NAVMAG INDIAN ISLAND WA
SEAL BEACH NWS	No	NAVWPNSTA SEAL BEACH CA
SEAL BEACH	No	NAVWPNSTA SEAL BEACH CA
NEWPORT RI	No	NAVSTA NEWPORT
ALEXANDRIA VA	No	N/A
ANNAPOLIS	No	N/A
AUGUSTA BAY	No	N/A
AUGUSTA IT	No	N/A

Table 64. Crosswalk of WEBSKED locations to Navy installations

WEBSKED location	Included in analysis?	Navy installation name (iNFADS)
BAE SHIPYARD SAN DIEGO	No	N/A
BALTIMORE MD	No	N/A
BATH ME	No	N/A
BOSTON MA	No	N/A
BRISTOL RI	No	N/A
BRUNSWICK ME	No	N/A
BUENAVENTURA	No	N/A
CRANEY ISLAND	No	N/A
EAST BREMERTON	No	N/A
FORT LAUDERDALE	No	N/A
JACKSONVILLE	No	N/A
LONG BEACH CA	No	N/A
MANCHESTER WA	No	N/A
MAUI	No	N/A
MIAMI	No	N/A
NEW YORK CITY	No	N/A
PHILADELPHIA	No	N/A
PORTLAND OR	No	N/A
PORTSMOUTH NH	No	N/A
PORTSMOUTH VA	No	N/A
ROCKPORT MA	No	N/A
SEATTLE	No	N/A
STATEN ISLAND	No	N/A

Ship traffic in San Diego

The WEBSKED data do not separately identify the homeports of NAVBASE San Diego, CA, and NAVBASE Point Loma, CA. Rather, there are just two San Diego area location names that appear in WEBSKED: SAN DIEGO and SAN DIEGO-NAVSTA. To measure workload separately at each of the three San Diego area homeports, we need a method for assigning the ship days listed in WEBSKED at the two San Diego locations to each of the three actual Navy installations.

Among the three San Diego homeports, all carriers go to NAVBASE Coronado San Diego, CA, and all submarines go to Point Loma. As a result, we assign ship days to each of the three San Diego homeports using the following rules:

- Ship-days for aircraft carriers are assigned to NAVBASE Coronado San Diego, CA.
- Ship-days for submarines are assigned to NAVBASE Point Loma, CA.
- Ship-days for all other surface ships are assigned to NAVBASE San Diego, CA.

Appendix C: Potential impact of SSBNs

For our analysis, we did not obtain data on port visits by SSBN class submarines. Doing so would have forced us to classify our report, either in whole or in part, and we received guidance from N46 that keeping the report unclassified was a higher priority than including the SSBN data. In the body of the paper, we point out that our results omit data on SSBNs and mention how the lack of SSBN data is likely to influence our results.

Although we do not obtain actual SSBN port visit data for FY 2008–FY 2009, this appendix shows how notional data on SSBN port visits impacts our findings. Using publicly available information on planned SSBN schedules, we made reasonable assumptions that allowed us to estimate how our efficiency results might have changed had we included SSBN data.

As we note in the body of our report, SSBNs are homeported at only two installations: SUBASE Kings Bay, GA, and NAVBASE Kitsap Bremerton, WA (at Bangor, WA). There are six SSBNs homeported at Kings Bay and eight homeported at Bangor. The first assumption we make is that SUBASE Kings Bay, GA and NAVBASE Kitsap Bremerton, WA are the only two installations in our analysis that have SSBNs in port over FY 2008–FY 2009. Further, we assume that the SSBNs homeported at Kings Bay do not visit Bangor, and the other way around.

Our installation-level workload measure is based on three things: the number of days ships are in port, the length of ships, and the appropriate ship spacing requirements. The length of an Ohio-class SSBN is listed as 560 feet, and the ship spacing requirement is 100 feet. So the only unknown is the number of days each SSBN was in port at each of the two homeports.

According to the Navy's online Fact File, SSBNs are at sea for 77 days and then in port for 35 days for maintenance, on average. So, one average SSBN ship cycle lasts 112 days. Given that there are 731 days in FY 2008–FY 2009, the 2-year period covers six complete SSBN ship cycles and 59 additional days. Six complete cycles imply a total of 210 days in port. We assume that the 59 additional days are spent entirely at sea.

We compute the extra workload for both SUBASE Kings Bay, GA, and NAVBASE Kitsap Bremerton, WA, using the following formula:

$$\text{Extra Workload} = \frac{(\text{\# of SSBNs} \cdot \text{Total length per SSBN} \cdot \text{\# days in port})}{731}$$

Table 64 below summarizes the extra workload at each of the two installations, as well as how our workload measure changes when the we incorporate the extra workload associated with SSBNs.

Table 65. Potential effect of SSBNs on workload

Installation	ADLSF	ADLSF Rank	SSBN Workload	Modified ADLSF	Modified Rank
NAVBASE Kitsap Bremerton, WA	2,505	7 of 11	1,517	4,022	6 of 11
SUBASE Kings Bay, GA	768	11 of 11	1,138	1,906	8 of 11

Our estimate of the SSBN workload increases our workload measure at both installations fairly significantly. ADLSF at SUBASE Kings Bay, GA, is nearly 2.5 times larger when SSBNs are included. At Bremerton, ADLSF increases by about 61 percent.

The additional SSBN workload also impacts our efficiency measure, α. Table 65 shows how the efficiency measures for each installation change when our estimates of SSBN workload are included in the calculations.

Table 66. Potential effect of SSBNs on installation efficiency

Installation	α	α Rank	PRV_N ($M)	Modified ADLSF	Modified α	Modified α Rank
NAVBASE Kitsap Bremerton, WA	7.44	7 of 11	$337	4,022	11.94	6 of 11
SUBASE Kings Bay, GA	3.20	11 of 11	$240	1,906	7.94	7 of 11

Excluding SSBNs, both installations had low efficiency ratings, with SUBASE Kings Bay, GA, having the lowest rating among all 11 installations. The efficiency rating for NAVBASE Kitsap Bremerton, WA, was roughly similar to the rating for NAVPHIBASE Little Creek, VA (7.60). When we include our estimates of SSBN workload, the efficiency ratings of both locations improve, though both remain in the bottom half in terms of efficiency. For NAVABASE Kitsap Bremerton, WA, α increases to 11.94, meaning that $1 million of normalized PRV supports roughly 60 percent more linear feet of ship when we include our estimate of SSBN workload. The new α is close to the efficiency rating for NAVBASE San Diego, CA (13.64). For SUBASE Kings Bay, GA, α increases to 7.94, moving the installation from last to seventh in our efficiency rankings, slightly ahead of NAVPHIBASE Little Creek, VA. The difference implies that $1 million of normalized PRV supports almost 2.5 times more linear ship feet when we include an estimate of SSBN workload.

Though not based on official data on SSBN port visits, our estimates provide a sense of how the SSBN data would potentially influence the results. Incorporating the new efficiency ratings for both locations, the average α across all 11 installations increases from 13.62 to 14.46, or roughly 6.2 percent. For east coast installations, the average α increases from 19.47 to 20.42, or about 4.9 percent. Among west coast installations, the average α increases from 8.75 to 9.5, or about 8.6 percent.

Ultimately, using a reasonable approximation of the extra workload associated with SSBNs, the qualitative results of our efficiency analysis are virtually unchanged. This is because there is a submarine base on both the east coast and the west coast, and both submarine bases likely handle similar volumes of SSBN ship traffic.

Glossary

A

ACF	Area cost factor
AD ENL	Active duty enlisted
AD OFF	Active duty officer
ADLSF	Average daily linear ship feet
ADMIN	Administrative support

B

BOS	Base operating services

C

C5ISR	Command, control, communications, computers, combat systems, intelligence, surveillance, and reconnaissance
CCN	Category code number (facilities)
CIVIL SER	Civil servant
COMD	Command and control
COMM	Communications and electronic surveillance
CNIC	Commander, Navy Installations Command
CNTR	Contractor
CVN	Carrier vessel nuclear

D

DoD	Department of Defense

E

EA	Each
EODMU	Explosive ordnance disposal mobile unit
EXPD	Expeditionary operations

F

FB	Feet of berthing
FFG	Guided missile frigate
FN DIR	Foreign national direct hire
FN INDIR	Foreign national indirect hire
FP	Facilities planning
FPRS	Facility program requirements suite
FRP	Fleet response plan
FTS	Full time service (reserves)
FX	Facilities services

G

GM	Gallons per minute
GSIP	Global shore infrastructure plan

H

HELO	Helicopter operations

I

iNFADS	Internet Naval facilities assets data store

J

K

L

LCS	Littoral combat ship
LF	Linear feet
LOG	Logistics operations
LSD	Dock landing ship

M

MED	Medical support
MSC	Military Sealift Command
MSRON	Maritime expeditionary security squadron

N

NAE	Naval Aviation Enterprise
NAVBASE	Naval base
NAVPHIBASE	Naval amphibious base
NVR	Naval vessel registry
NAVSTA	Naval station
NAVSUBASE	Naval submarine base

O

OLS	Ordinary least squares
OPNAV	Office of the Chief of Naval Operations
OSD	Office of the Secretary of Defense

P

P(BOS)	Performance metric (base operating services)
P(CAP)	Performance metric (capacity)
P(COND)	Performance metric (configuration/obsolescence)
P(CONF)	Performance metric (condition)
PLANE	Fixed wing operations
PRV	Plant replacement value (facilities)

Q

R

RDTE	Research, development, testing, and evaluation
RES	Reserves support
RIVRON	Riverine squadron
RM	Restoration and modernization (facilities)

S

SCA	Shore capability area (facilities)
SELRES	Selected reservist (reserves)
SF	Square feet
SFT	Shore function task (facilities)
SHIP	Ship operations

SHORE	Shore support operations
SLU	Service life used (facilities)
ST	Sustainment (facilities)
SUB	Submarine operations
SUBFOR	Submarine forces
SWE	Surface Warfare Enterprise
SY	Square yards

T

TPS	Transit protection system
TR	Transportation
TRAIN	Training support operations

U

UT	Utilities
USE	Undersea Enterprise

V

W

WEBSKED	Web-enabled scheduling system

X

Y

Z

References

[1] Department of Defense, Unified Facilities Criteria (UFC) 3-701-09, *DoD Facilities Pricing Guide*, 15 Sep 2009

[2] Commander, Naval Surface Forces, *Global Shore Infrastructure Plan: Surface Warfare Enterprise*, Jun 2008

[3] Commander, U.S. Submarine Forces, *Global Shore Infrastructure Plan: U.S. Submarine Forces*, Oct 2007

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[5] Commander, Naval Air Forces, *Global Shore Infrastructure Plan: Naval Aviation Enterprise*, Sep 2008

[6] Department of Defense, Unified Facilities Criteria (UFC) 2-000-05N, *Facility Planning Criteria for Navy/Marine Corps Shore Installations*, 31 Jan 2005

[7] Department of Defense, *National Defense Budget Estimates for FY 2009*, Oct 2008

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List of figures

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List of tables

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