

# **Navy Shore Infrastructure Investment Support: Modeling of Investment to Output Performance and Readiness**

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A handwritten signature in black ink that reads "Alan J. Marcus". The signature is written in a cursive style with a horizontal line underneath the name.

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## Summary

Historically, the Navy has taken significant risk in shore infrastructure investment by diverting funds in order to increase afloat readiness and strengthen future platforms and weapons systems capabilities. This risk manifests itself over time through increased utilities outages, roof leaks, pavement potholes, and structural failures. In recent years, investment in the shore infrastructure has been further reduced [1] in order to finance the Global War on Terrorism, homeland defense, theater security cooperation, humanitarian assistance, and peace-keeping operations.

As a result, the Navy suspects that the condition, capability, and current and future readiness of the shore infrastructure may have degraded. However, there is no consistent method for assessing the functional supporting levels of the shore infrastructure to determine the quantity of risk-burden being built up and amount of investment required to adjust this risk to acceptable levels.

CNA was tasked by the Director, Ashore Readiness Division (OPNAV N46) to develop a methodology for assessing infrastructure quality and readiness and to design a Shore Facility Investment Model (SFIM) to pull data from multiple sources [in Microsoft (MS) Excel and Access format] and combine them into an overall quality index rating. This rating system would be used as a decision support tool for Navy facility investment funds.

The development goals for the model were:

- To create a reliable system for acquiring and managing accurate, comprehensive, current, and integrated data on the condition, configuration, capacity, and operational status of all Navy facilities.
- To be output-based for quality assessment and able to balance infrastructure investments within the shore fund portfolio.

- To create a process that links force structure to infrastructure sites.
- To be a stand-alone assessment tool to aid in programming investment through analysis of future quality impact to inventory and shore readiness.
- To include a macro 20-year, long-range forecasting tool.

First, we analyzed the Navy infrastructure to determine the nature and quantity of the current inventory. The FY 2007 baseline inventory consists of 115,307 facilities with a plant replacement value (PRV) of \$173,462 million. We segmented facilities in two ways in order to give Navy leadership a better overall idea of the inventory.

We used the traditional geographic and organizational view which maps each facility to one of 1,212 unique sites at 95 installations, within 14 regions or special interest areas. We also created a functional view that maps each facility to 1,117 facility category codes, organized under 80 shore function tasks, within 12 shore capability areas. This structure allowed us to index metrics together for Navy-wide functional assessments.

We also used five levels of mission dependency index or strategic support index to categorize the risk importance of individual facilities, and we segmented the facilities by the 19 different maintenance funding sources.

Next, we identified the quality and shore readiness assessment measures to quantify the current and future support capability of the shore infrastructure. We selected four performance measures to index together to form a composite readiness index that was defined as the P<sub>(IFOM)</sub> rating (Performance (Installation Figure of Merit)). These measures are:

- P<sub>(CAPACITY)</sub> — Measures percentage of existing facilities that meet basic facility requirement (BFR) authorizations within a facility category code at a site.

- $P_{(CONDITION)}$  — Measure of an asset’s physical condition in terms of its overall replacement value and is the same as the commonly used facility condition index (FCI).
- $P_{(CONFIGURATION)}$  — Measure of an asset’s capability to support the current occupant or mission with respect to functionality. It is calculated based on the proportion of adequate, substandard, and inadequate coded space.
- $P_{(CAPABILITY\ PERFORMANCE\ LEVEL\ (CPL))}$  — Measure of the annual operating performance level achieved during the previous fiscal year as reported by installation commanders through a Navy quarterly reporting system. (Formerly known as base operating services (BOS)<sup>1</sup> support).

All these P-ratings are on a scale from 0 to 100 where 100 is the best score. They were indexed together using the following formula with weights developed by the Navy Shore Readiness Board of Directors.

$$P_{(IFOM)} = 0.36P_{(CAPACITY)} + 0.22P_{(CONDITION)} + 0.17P_{(CONFIGURATION)} + 0.25P_{(CPL)}$$

Three other measures were developed as well to assist in understanding the nature of the inventory.

- $P_{(SURPLUS\ CAPACITY)}$  — Measures percentage of existing facilities that exceed the BFR authorization within a facility category code at a site. This is an unbounded rating that can range from 0 to a very large number depending on the amount of surplus.
- $P_{(SERVICE\ LIFE\ USED)}$  — Provides the percentage of initial service life consumed based on standard service life and current age. This is also an unbounded rating that can range from 0 to a large number depending on the actual age of the facility.
- $P_{(CURRENT\ AGE)}$  — Measures the actual age of a facility in years from commissioning year to baseline year.

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1. BOS was renamed CPL during development of the SFIM. However, it was a name change only as the definition remained the same.

All P-ratings, except for  $P_{(CPL)}$ , are weighted by PRV to index together at higher levels both organizationally and functionally. After analyzing Navy infrastructure and identifying the assessment measures, we built an FY 2007 baseline reference assessment to provide a current readiness report as well as a beginning reference point for measuring future investment impact results.

We designed the basic automated model concept layout to include five separate modules using three different databases populated with data from six official Navy data sources. The modules are:

- Current Baseline Infrastructure Inventory
- Current Force Loading
- Capital Investment Impact Assessment
- Long-Range Investment Level Impact Forecasting Tool
- CPL Installations Input Tool

Because this is a programming model, all data are downloaded at the end of the previous FY with certified data and locked to maintain budgetary consistency. The SFIM stacks the special and military construction projects by demand ranking signal order (range is 0 to 1). Each candidate project calculates its output impact by assigning value points based on the current working estimate (CWE) and PRV. These value point contributions are then combined with the baseline starting point, sustainment funding level condition degradation, age based configuration degradation, and PRV inflation to forecast future results.

The finished model is a complex, integrated, stand-alone programming tool that allows the Navy to assess shore support capability risk and balance performance/pricing amounts to select the best mix of special project, demolition, and military construction projects. This model allows the Navy to shift away from a bottom-up, integrated-field-priority, wish-list driven level-of-effort programming — to a more deliberate, top-down, shore-investment-strategy driven, risk-assessed, performance-output method.

# Introduction

This paper describes the development process that CNA used to create a new methodology for the Navy to assess shore infrastructure readiness for support tasking, and it documents the design concepts for a shore facilities investment model. This model was developed as a programming tool for OPNAV N46 staff to adjust investment project profiles and funding levels to achieve desired performance output levels at the end of the current FYDP.

The methodology involved creating measures of merit to quantify the current and future performance levels and a functional segmentation of the infrastructure to provide a greater understanding of shore support capabilities and shortfalls. The new technique required a method for indexing the measures of merit together in a consistent manner to provide the Navy with an ongoing readiness assessment number. It also required the creation of a baseline year infrastructure inventory assessment to use as the starting point for analyzing future year impact of current shore investment funding profiles. We developed a process to quantify the projected impact of proposed military construction and special projects upon the measures of merit.

The intent of this work is to allow the Navy to shift away from the former field-generated priority wish-list driven level-of-effort programming process that was not linked to outputs. The new programming methodology is a more deliberate top-down CNO directed shore investment strategy that is driven by the risk-assessed performance outputs of shore capability areas.

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## Background

As mentioned in the summary, the Navy has historically taken significant risk in shore infrastructure investment by diverting funds in order to increase afloat readiness and future platforms and weapons systems capabilities. This practice was hard to argue against due to the Navy's inability to determine what the long-term impact would be upon the shore readiness capabilities. However, even with no suitable infrastructure quality measurement methodology, Navy leadership noted that the quality of the shore infrastructure was declining [2].

In May 2007, the CNO directed DCNO, Fleet Readiness and Logistics to develop and implement a Navy Shore Investment Strategy to arrest and reverse the decline of the shore infrastructure. In response, the Shore Investment Strategy Task Force was commissioned on 11 June 2007 (appendix A) and it developed a Shore Investment Strategic Guidance for CNO review and approval (appendix B).

This four-dimensional strategy required continuous visibility into the condition and capability of the shore infrastructure; sizing and alignment of shore investments to directly support Navy requirements; improve the quality of service for the sailors, civilians, and families; and enhance joint capabilities and community integration. The POM-10 shore investment guiding principles (appendix C), which were released by the Vice Chief of Naval Operations (VCNO) on 21 September 2007, reiterated the need for assessing the performance levels of the shore infrastructure.

“The desired effect is to develop a clear understanding of the Navy's shore infrastructure in terms of capacity, condition, and configuration. The current advocacy based, bottom-up, IPL<sup>2</sup> driven investment process will be replaced with a top-down, data driven, capabilities based process that aligns investment with (1) Warfighter Enterprise Outputs, (2) Improved Quality of Service and (3) Joint Capability Requirements.”

The critical challenge facing the Navy shore establishment is to develop and implement a reliable system for acquiring and managing accurate, current data on the condition, configuration, capacity, and operational status of all Navy facilities. This information, then, had to be presented in a format that was useful to Navy decision-makers. Moreover, the infrastructure impact of current and past facilities investment decisions within the FYDP needed to be identified and displayed. This allowed the Navy to better assess the shore support capability risks being assumed by the different investment courses of action. The Navy needs a new price performance type of model that can accurately assess the shore facilities performance output (and subsequent mission risk) generated by different shore investment levels.

## **The infrastructure investment problem**

The shore management issue of quantifying performance outputs of facilities in terms of the investment required to maintain it is not a new problem for the Navy or the other military Services. It has been an ongoing issue for many years. The Navy had defaulted to a reactive methodology that generated investment funding requirements through annual inspection summaries (AIS). These summaries were based on the physical inspection of each facility. This information was then used as the basis for supporting proposed project investments. The inspection results were translated to dollars and categorized as essential backlog or deferrable backlog. Projects were prioritized by local commanders and major claimants and then would be consolidated into IPLs that would be used to create the shore investment profiles based on the available funding levels.

This process was very labor intensive and expensive to maintain. Moreover, the backlog metric became discredited because it kept growing no matter what investment level was funded. Incremental

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2. An Integrated Priority Listing (IPL) is a programming process technique where field user preferences for investment are merged into one group integrated priority list, usually through some version of a group analytical hierarchy voting process.

changes to funding levels showed no correlation to the output metric of backlog because the linkages were too distant and unspecific. With increasing pressure on the Navy to support other requirements in the annual budget development processes, the Navy stopped conducting AIS inspections in 2005. The need for a better way to assess investment return for shore facilities has become more urgent and pressing.

## **Project tasking**

In light of the issues described above, CNA was asked by the Director, Ashore Readiness Division (OPNAV N46) to develop a methodology for assessing shore infrastructure quality and readiness. Our task was to develop a Shore Facility Investment Model (SFIM) that would pull data from multiple existing Navy sources and combine them into a stand-alone price/performance model. It would take the current pool of military construction and special projects and assess their impact upon future quality index ratings based on the different proposed project investment courses of action (COA). This modeled rating system will be used as a decision support tool for Navy facility investment funds.

## **Development issues**

In order to develop this new methodology for modeling shore infrastructure investment, there are numerous challenges that must be considered and accommodated within the new process. We discuss the most significant issues in the following paragraphs.

### **Size of infrastructure**

The greatest challenge is the size of the Navy's shore facilities inventory, which includes over 100,000 unique buildings and structures in over 1,000 different locations throughout the world. Plant replacement value on these facilities ranges in size from over \$500 million down to nearly \$0. The sheer size and variability of the inventory makes investment impact assessment difficult to observe. To confront this challenge, we segmented the inventory into smaller functional areas and adjusted the model reporting to reflect both numbers of

individual facilities changing quality status levels and the overall shore capability area (SCA) measure of merit change. These model adjustments were introduced in order to make the investment impacts visible for review and assessment.

## **Multiple maintenance responsibility funding streams**

Public law requires the Navy to use different funding appropriations to support investment in shore facilities. For example, the OPNAV N46 office is mostly concerned with those facilities maintained with Operation and Maintenance, Navy (O&M,N); Operation and Maintenance, Navy Reserve (O&M,NR); Navy Working Capital Fund (NWCF); and Research, Development, Test and Evaluation, Navy (RDT&E) funds. However, there are 15 other sources of funding for maintaining facilities. In the model, we built in the capability to query the inventory and segment out the facilities maintained by fund sources that were not of interest.

## **No common measures of merit for quality**

The Navy did not have common measures of merit to assess shore facilities quality when we started this work. Backlog in current year dollars, which was the legacy method, was deemed inadequate for use in the future. OSD instituted a quality measurement metric called the Q-Rating<sup>3</sup> that provided a score from 0 to 100 and reflected the lowest of the condition or configuration ratings for a facility. However, this was limited to just these two measures and did not address the other measures of quality for the infrastructure.

The Navy provided us with the following basic questions in order to identify more measures:

- Do we have enough or too much of a given type of facility?
- Is it configured correctly to support the Navy's current mission?

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3. The infrastructure quality rating or Q-Rating is defined as  $(1 - ((\text{the amount necessary to ensure that a constructed asset is restored to a condition substantially equivalent to the originally intended and designed capacity, efficiency, or capability}) / \text{PRV})) \times 100$ .

- What kind of condition or shape is it in?
- Is there enough annual funds to operate it correctly?

Although these questions relate to only one facility, they are the same questions that need to be answered for the entire inventory as well.

### **Facility planning assets have virtually disappeared**

Field personnel specializing in facility planning have virtually disappeared from the Navy due to retirements without replacement and reassignments to programs with more funding support. This challenge forced us to rely on existing data stores and repositories and use whatever information was available whether or not it was current. While new data collection efforts might have been more applicable, they are unavailable from the field (at least in the near term).

### **No acceptable way to display shore readiness results**

The CNO and senior Navy leadership are provided periodic fleet readiness reports that summarize the overall fleet readiness status of the Navy. The N46 staff would like to present to Navy leadership an equivalent readiness report for the shore. However, since there is no current method to link project investment levels and facility quality to shore output measures, it is not possible to generate a status report. The backlog report and even Q-rating roll-ups are too static and macro to be of much use in operational reporting. This guided us to develop new measures of merit that address all aspects of shore readiness tied to output measures. These measures reflect changes in output performance as facilities are added to inventory, restored, modernized, demolished, or taken out of service.

### **No method to link shore support services to fleet capability and response**

Because the Navy previously linked shore investment to major claimants and installations, there is no way to link shore support capability to fleet capability and response. Only to the extent that the amount requested was compared to the programmed amount for each major claimant and location, could some indirect measure of supporting

levels be identified for the fleet elements associated with that major claimant. To offer better insight into this challenge, we segmented the inventory into shore capability tasks and shore capability areas (SCAs) in addition to the organizational alignments. By aligning investments to both locations and functions in a matrix format, a better supporting picture was developed.

### **No methodology to measure shore investment impact on output quality**

Since there are no accepted measures of merit for shore performance output, there is no practical way to link investment to quantity or quality of shore support provided. All the measures are of an input-metric nature tied to level-of-effort programming techniques. In order to generate more direct price-performance links between investment levels and output results, it is necessary to quantify the contribution of individual investment projects to shore output performance levels.

## **Shore facilities task force**

The Shore Facilities Task Force, which was chartered by the DCNO, Fleet Readiness and Logistics in May 2007, was tasked to develop and implement a Navy Shore Investment Strategy to arrest and reverse the decline of the shore infrastructure. The Shore Investment Strategy Task Force was commissioned on 11 June 2007 and began developing practical and deliberate shore investment strategic guidance capable of achieving the desired results by adjusting, where possible, the program-of-record investments within POM-10 and PR-11, and fully implementing for POM-12. The prime goal was to implement a systematic and consistent approach to assessing the material condition of the Navy's shore establishment.

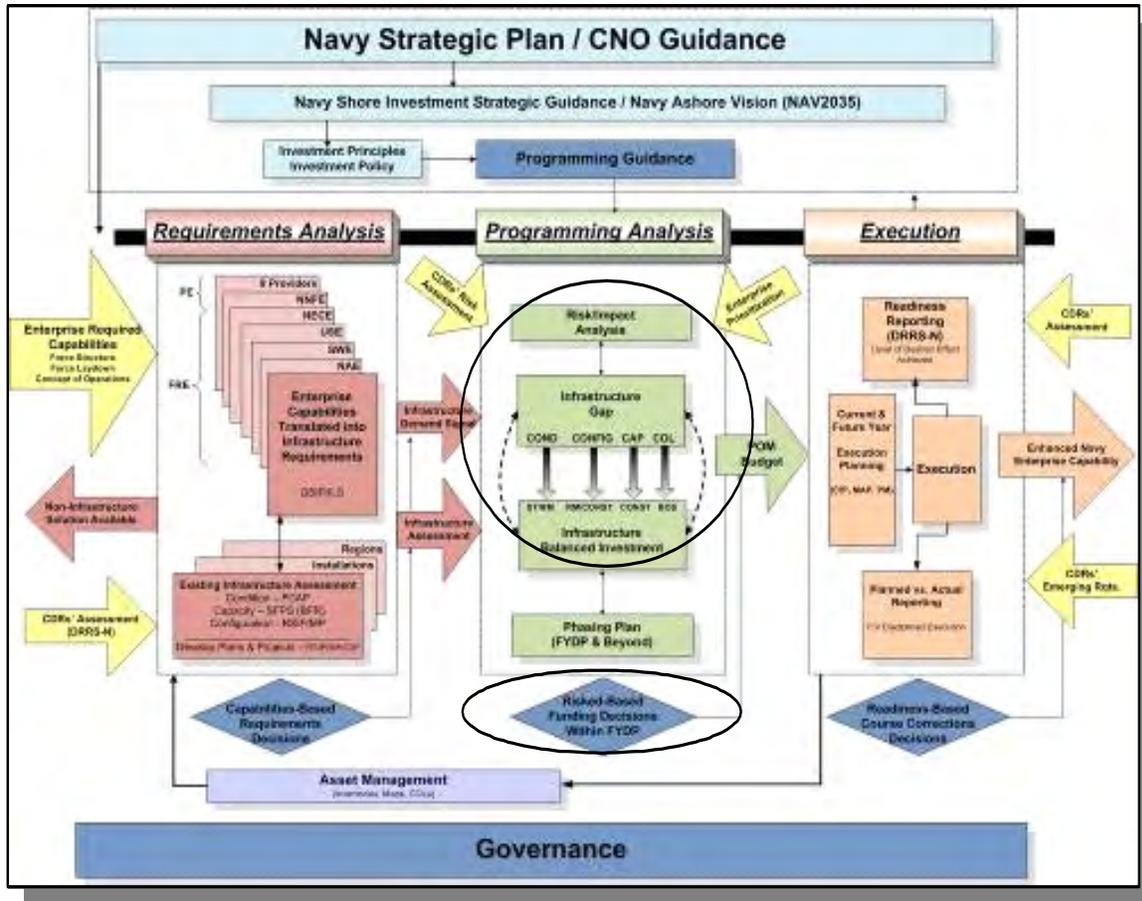
### **Shore investment process**

To accomplish this, the task force analyzed five distinct areas within the overall shore management process. The first area blended the Navy Strategic Plan and CNO shore guidance with investment principles to form the overall programming guidance for investment. The

second area reviewed the different aspects of the requirement analysis, which captured current and future fleet demand signals for shore support. These demand signals and future capability requirements are combined with current infrastructure assessment to provide programming guidance that address capability gaps and excesses. The third area included the programming analysis portion, which takes the requirements guidance and combines it with the strategic programming guidance to produce an investment program that best meets the Navy's mission requirements over the FYDP. The fourth involved the execution process, which drives completion of the investment plan and provides feedback on the degree of success obtained. The final governance area looked at the overall control process and methods for evaluating success or failure of the entire investment process. Figure 1 provides a system process flow chart that displays the connectivity and relationships between each of the process areas. The

shore facilities investment modeling portion of this study falls within the third area of programming analysis.

Figure 1. Navy shore investment strategy implementation process flow



### SFIM role in investment process

The task force defined the parameters that a SFIM would have to accomplish as part of the programming analysis portion of the investment process. The model had to be able to:

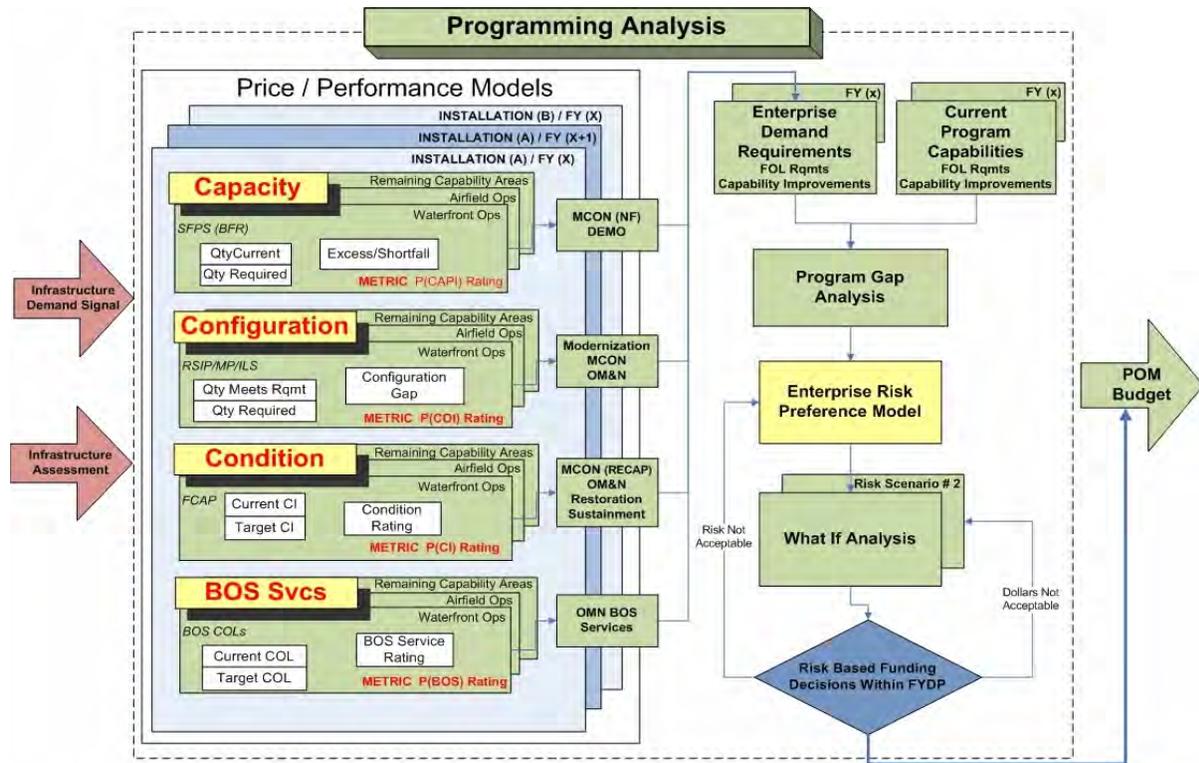
- Calculate Performance (P) ratings for capacity, configuration, condition, CPL, excess capacity, average age, and initial service life used (SLU)
- Utilize input data from existing Navy data stores, such as internet Navy facilities assets data store (iNFADS), total force manpower management system (TFFMS), and CPL costing
- Access information via filtered matrix displays that show gaps and shortfalls as well as colorized indications of severity (i.e. red, yellow, and green stoplight charts)
- Provide a ready, deep, drill-down functionality by region, installation, site, and shore capability area
- Provide a degree of “what if” analysis capability
- Quantify the impact of project investment over the FYDP

## **Initial concept**

After reviewing current fleet readiness concepts and reporting techniques, which included the operational availability concept as well as the readiness pillars measures of merit, the task force developed an initial design concept for the SFIM. It takes in the infrastructure demand signal and inventory assessment developed by the requirements analysis portion of the investment process as inputs. The model provides as an output a POM budget which is then programmed for execution. The core of the model is four price-performance models in the areas of capacity, configuration, condition, and CPL support driven by performance metrics in each area. Figure 2

provides the task force initial SFIM design concept, which was used as the basis for model development.

Figure 2. Task force initial SFIM design concept



The remainder of the model addresses risk assessment and alternative investment scenarios to link requirements with funding.

### Facilities investment model (FIM)

The task force also looked at an earlier attempt at designing a shore investment model to meet these same shore programming needs. The FIM was submitted and partially accredited for use by OPNAV N81 in December 2003. The model used PRV, AIS results, and the OSD Facilities Sustainment Model (FSM) as its key drivers. The overall metrics used for shore infrastructure output was the OSD Q-Rating

and the restoration and modernization backlog amount in dollars. The model did not look at capacity shortfalls or annual operating service support. It focused only on restoration and modernization and used project integrated priority lists to drive investment rather than future performance output. It also only compared the incremental impact of the investment course of action (COA) against the current inventory. The model quickly fell into disuse because of the Navy's decision to not continue AIS inspections in 2005 and because of the inability to balance sustainment funding and CPL with project investment accounts. The model also did not address capacity issues. We decided to start clean with SFIM and only used the Verification, Validation & Accreditation (V, V&A) partial accreditation comments as lessons-learned insights for the SFIM development.

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# Development approach

We first defined the Navy's goals for the investment model. Later, we laid out the individual process steps or milestones required to achieve these desired results.

## Development goals

As outlined in the summary, the specific development goals for this project are to:

- Develop and implement a tool for acquiring and managing accurate, comprehensive, current, and integrated data on the current condition, configuration, capacity, and operation status of all Navy facilities and present that data in a format that was useful to decision-makers.
- Be output-based for quality assessment and able to balance infrastructure investment within the shore fund portfolio to increase the quality and readiness capability in shore output support.
- Create a process that links force structure to infrastructure sites in order to assess relative importance of shore readiness at specific locations.
- Create a stand-alone assessment tool that can be used by the Navy to program infrastructure investment profiles through analysis of future quality impact to inventory and shore readiness.
- Build a macro, 20-year, long-range forecasting tool to assess long-term future potential results based upon investment funding stream levels.

## **Process steps**

We identified eight distinct steps in the development process that had to be approached in a sequential manner given that the results of the previous step were used to help develop the following step.

### **Quantify Navy infrastructure inventory organization and segmentation structure**

This first step involved reviewing the current Navy shore facilities real property inventory to determine the data elements captured and how it is organized. We also had to determine how to break down the inventory so that problem areas could be highlighted. This process is very similar to the commercial corporate strategic planning process where business markets are segmented into smaller market segments in order to facilitate business analysis.

### **Identify quality and shore readiness assessment measures**

Once we had determined how the inventory would be quantified and organized for analysis, our next step was to identify and define the performance measures we would use to assess the quality of the facilities. Our performance measures of merit needed to be

- generated from existing available information,
- reproducible,
- consistent,
- and appropriate for assessing the quality of output indicators.

### **Build FY 2007 baseline reference assessment**

The first complete year of historical data are from FY 2007. We defined this as our baseline year and use it as a starting point for comparison purposes. We applied the previously identified inventory organizational structure and metrics to produce a complete baseline of beginning values. This baseline was then used in later analysis to help quantify the impact of shore infrastructure investment decisions.

## **Design basic model concept layout**

With the baseline information in hand, we began to design the functional modules and processes of the model. The entire model had to be completely diagramed due to the anticipated interchange of data between the various modules. In addition to building the functional system flowchart, we designed the preliminary data tables that would be required by the MS Access database.

## **Build force structure unit link to locations**

We spent a great deal of time investigating the best methods of assessing risks that result from shore investment levels. We determined that developing a location or command prioritization process would not be practical or easy to accomplish. Therefore we will use a force structure module to build force loading profiles for each installation. These profiles provide the Navy with a summary of units and authorized manpower billets supported at each installation. With this information, quality levels of infrastructure support capability can be assessed for risk in terms of the units and mission areas affected.

## **Build future impact forecasting capability based on investment**

We next created the model's core module, which has the ability to measure the contribution of the various proposed investment projects to the overall quality of the infrastructure at the end of the current FYDP. This future forecasting capability had not been achieved before, and it required a new approach.

## **Create a long-range trend analysis investment stream forecasting tool**

The future impact module generated projected quality results at the end of the FYDP based on the levels selected for the shore investment accounts, and the number and type of projects selected for execution. However, a longer period of time for assessment was needed in order to match the current shore infrastructure strategy time period of 20 years. This long-range performance forecast was needed in order to produce a more macro and less precise picture of the long-

term quality results based on just projected investment funding levels rather than detailed project lists.

### **Integrate different modules into one stand-alone system**

Finally, we integrated these different modules into one automated model, which can be used as a single stand-alone programming tool by the Navy shore infrastructure planning staff.

## **Navy infrastructure segmentation**

Our first challenge was to divide the Navy's facilities inventory into smaller pieces so capability gaps and performance shortfalls could be better understood and observed. We set up the segments so that both geographic and functional organization could be viewed. The 115,307 individual facilities were mapped to 1,212 unique Navy site locations. These sites were, in turn, mapped to 95 Navy installations, which were linked to 12 Navy regions and two special interest areas. We also mapped these 115,307 facilities to 1,117 facility category codes, which were placed under one of 80 different shore function tasks. These shore function tasks were then linked to one of 12 shore capability areas. This split between locations and functions allows us to segment the inventory in a much better manner.

## Navy regions and special areas

The Commander, Navy Installations Command (CNIC) has 12 regional subordinate commands<sup>4</sup> within its organizational structure. They are listed in table 1 along with their areas of responsibility.

Table 1. Navy CNIC regional commands

Navy region	Location	Area of responsibility
Navy Region Northwest	Bangor, WA	Six-state area of Washington, Oregon, Idaho, Alaska, Wyoming, and Montana.
Navy Region Midwest	Great Lakes, IL	Sixteen-state area of North and South Dakota, Nebraska, Kansas, Oklahoma, Minnesota, Iowa, Missouri, Arkansas, Wisconsin, Illinois, Michigan, Indiana, Ohio, Kentucky, and Tennessee.
Navy Region Mid-Atlantic	Norfolk, VA	Fourteen-state area of Maine, Vermont, New Hampshire, New York, Massachusetts, Connecticut, Rhode Island, Pennsylvania, New Jersey, Delaware, West Virginia, Maryland, Virginia, and North Carolina.
Navy Region Southeast	Jacksonville, FL	Seven-state area of South Carolina, Alabama, Florida, Georgia, Mississippi, Louisiana, and Texas, along with the Caribbean area.
Navy Region Southwest	San Diego, CA	Six-state area of California, Nevada, Utah, Colorado, New Mexico, and Arizona.
Navy Region Naval District Washington	Washington, DC	District of Columbia and portions of northern Virginia and Maryland.
Navy Region Hawaii	Pearl Harbor, HI	State of Hawaii.
Navy Region Marianas	Apra Harbor, Guam	Marianas Islands area.
Navy Region Korea	Chinhae, Korea	Korean area.
Navy Region Japan	Yokosuka, Japan	Far East area.
Navy Region Europe	Naples, Italy	European and African areas.
Navy Region Southwest Asia	Manama, Bahrain	Middle Eastern area.

4. Navy Regional Contracting Command Singapore is sometimes referred to as an additional regional command making a total of 13. However, for purposes of this inventory analysis, it was included under Commander Navy Region (CNR) Japan as an installation.

The remaining Navy installations, we classified into two special interest areas of “Navy Medicine” and “Other”. Navy medicine includes those installations managed by the Navy Bureau of Medicine & Surgery located in Washington, DC. There are seven hospitals and three overseas research installations. The other category includes the government-owned, contractor-operated (GOCO) manufacturing facilities that are operated by the Naval Sea Systems Command (NAVSEA), and Naval Air Systems Command (NAVAIR). It also includes the Base Realignment and Closure (BRAC) pending closure sites that are now managed by a special program office within the Navy secretariat.

## Installations

The Navy currently lists 92 unique and different installations throughout the world. Table 2 provides a summary list of these sites and their locations. We consolidated all NAVAIR and NAVSEA GOCO sites into two installations. We also treated all BRAC sites as one installation, which gave us a total of 95 unique installations.

Table 2. Navy shore installations

ID	UIC <sup>a</sup>	Name	City	State	Country
1	N00128	NAVSTA GREAT LAKES	GREAT LAKES	IL	US
2	N00129	NAVSUBASE NEW LONDON	GROTON	CT	US
3	N00158	NAS JRB WILLOW GROVE	WILLOW GROVE	PA	US
4	N00196	NAS ATLANTA	MARIETTA	GA	US
5	N00204	NAS PENSACOLA	PENSACOLA	FL	US
6	N00205	NSA NEW ORLEANS	NEW ORLEANS	LA	US
7	N00206	NAS JRB NEW ORLEANS	BELLE CHASSE	LA	US
8	N00207	NAS JACKSONVILLE	JACKSONVILLE	FL	US
9	N00213	NAS KEY WEST	KEY WEST	FL	US
10	N00216	NAS CORPUS CHRISTI	CORPUS CHRISTI	TX	US
11	N00245	NAVSTA SAN DIEGO	SAN DIEGO	CA	US
12	N00246	NAS NORTH ISLAND	SAN DIEGO	CA	US
13	N00620	NAS WHIDBEY ISLAND	WHIDBEY ISLAND	WA	US
14	N00639	NAVSUPACT MIDSOUTH MEMPHIS	MILLINGTON	TN	US
15	N0428A	NAS PATUXENT RIVER	PATUXENT RIVER	MD	US
16	N0534A	PMRF BARKING SANDS	KEKAHA	HI	US
17	N31188	NGSA SUGAR GROVE	SUGAR GROVE	WV	US

Table 2. Navy shore installations

ID	UIC <sup>a</sup>	Name	City	State	Country
18	N32013	NAVMAG INDIAN ISLAND	PORT TOWNSEND	WA	US
19	N32411	NAVSTA NEWPORT	NEWPORT	RI	US
20	N32414	NAVSUPPACT MECHANICSBURG	MECHANICSBURG	PA	US
21	N32443	NSS NORFOLK NAVAL SHIPYARD	PORTSMOUTH	VA	US
22	N32446	NSY PORTSMOUTH	KITTERY	ME	US
23	N32778	CFA CHINHAE KOREA	CHINHAE	N/A	KS
24	N32960	NAVSUPPACT LA MADDALENA	LA MADDALENA	N/A	IT
25	N40003	NAVACTS PUERTO RICO	ROOSEVELT ROADS	N/A	RQ
26	N42237	SUBASE KINGS BAY	KINGS BAY	GA	US
27	N47609	NAWS CHINA LAKE	CHINA LAKE	CA	US
28	N48558	NAVAIRENGSTA LAKEHURST	LAKEHURST	NJ	US
29	N49422	JMF ST. MAWGANS	ST. MAWGANS	N/A	UK
30	N57095	NAVSUPPACT NORFOLK	NORFOLK	VA	US
31	N60042	NAF EL CENTRO	EL CENTRO	CA	US
32	N60087	NAS BRUNSWICK	BRUNSWICK	ME	US
33	N60191	NAS OCEANA	VIRGINIA BEACH	VA	US
34	N60201	NAVSTA MAYPORT	JACKSONVILLE	FL	US
35	N60241	NAS KINGSVILLE	KINGSVILLE	TX	US
36	N60495	NAS FALLON	FALLON	NV	US
37	N60508	NAS WHITING FIELD	MILTON	FL	US
38	N60514	NAVSTA GUANTANAMO BAY	GUANTANAMO BAY	N/A	CU
39	N61006	NSA ATHENS	ATHENS	GA	US
40	N61007	NSA ORLANDO	ORLANDO	FL	US
41	N61008	NSA PANAMA CITY	PANAMA CITY	FL	US
42	N61014	NAVSUPPDET MONTEREY	MONTEREY	CA	US
43	N61018	NSA CRANE	CRANE	IN	US
44	N61028	CFA YOKOSUKA	YOKOSUKA	N/A	JA
45	N61029	CFA OKINAWA	OKINAWA ISLAND	N/A	JA
46	N61030	CFA SASEBO	SASEBO	N/A	JA
47	N61031	NAF ATSUGI	ATSUGI	N/A	JA
48	N61032	NAF MISAWA	MISAWA AFB	N/A	JA
49	N61065	NAVWPNSTA SEAL BEACH	SEAL BEACH	CA	US
50	N61078	NAVSUPPFAC DIEGO GARCIA	DIEGO GARCIA	N/A	IO
51	N61150	NSA NORTH POTOMAC	WASHINGTON	DC	US
52	N61151	NSA SOUTH POTOMAC	DAHLGREN	VA	US
53	N61152	NAVSUPPACT ANNAPOLIS	ANNAPOLIS	MD	US
54	N61414	NAVPHIBASE LITTLE CREEK	NORFOLK	VA	US
55	N61755	NAVBASE GUAM	AGANA	N/A	GQ
56	N62585	NAVACTS UNITED KINGDOM	LONDON	N/A	UK

Table 2. Navy shore installations

ID	UIC <sup>a</sup>	Name	City	State	Country
57	N62588	NSA NAPLES	NAPLES	N/A	IT
58	N62604	NCBC GULFPORT	GULFPORT	MS	US
59	N62688	NAVSTA NORFOLK	NORFOLK	VA	US
60	N62813	NAVSTA PEARL HARBOR	PEARL HARBOR	HI	US
61	N62863	NAVSTA ROTA	ROTA	N/A	SP
62	N62995	NAS SIGONELLA	SIGONELLA SICILY	N/A	IT
63	N63005	NAVSUPPACT BAHRAIN	BAHRAIN ISLAND	N/A	BA
64	N63042	NAS LEMOORE	LEMOORE	CA	US
65	N63043	NAS MERIDIAN	MERIDIAN	MS	US
66	N63406	SUBASE SAN DIEGO	SAN DIEGO	CA	US
67	N66691	NAVSUPPACT SOUDA BAY	SOUDA BAY	N/A	GR
68	N61077	NRCC SINGAPORE	SINGAPORE	N/A	SN
68	N68317	NAVSUPPUNIT SARATOGA SPRINGS	SARATOGA SPRINGS	NY	US
70	N68436	NAVBASE KITSAP	BREMERTON	WA	US
71	N68469	NSA WASHINGTON	WASHINGTON	DC	US
72	N68890	NAVSTA PASCAGOULA	PASCAGOULA	MS	US
73	N68891	NAVSTA INGLESIDE	INGLESIDE	TX	US
74	N68967	NAVSTA EVERETT	EVERETT	WA	US
75	N69212	NAVWPNSUPPFAC YORKTOWN	YORKTOWN	VA	US
76	N69213	NAVWPNSTA EARLE	COLTS NECK	NJ	US
77	N69214	NAVWPNSTA CHARLESTON	GOOSE CREEK	SC	US
78	N69232	NAVBASE VENTURA COUNTY	POINT MUGU	CA	US
79	N83447	NAS JRB FT WORTH	FORT WORTH	TX	US
80	N00168	NATNAVMEDCEN BETHESDA	BETHESDA	MD	US
81	N00183	NAVMEDCEN PORTSMOUTH	PORTSMOUTH	VA	US
82	N00259	NAVMEDCENT SAN DIEGO	SAN DIEGO	CA	US
83	N44852	NAVMEDRSCHCEN LIMA	LIMA	N/A	PE
84	N61337	NAVHOSP BEUFORT	BEAUFORT	SC	US
85	N61751	NAVMEDRSCHUNIT 3	CAIRO	N/A	EG
86	N62814	NAVMEDRSCHCENT JAKARTA	JAKARTA, JAVA	N/A	ID
87	N68084	NAVHOSP CHARLESTON	CHARLESTON	SC	US
88	N68095	NAVHOSP BREMERTON	BREMERTON	WA	UW
89	N68096	NAVHOSP GUAM	AGANA	N/A	GQ
90	N3379A	CAMP LEMONIER	DJIBOUTI	N/A	DJ
91	N57032	NAF MILDENHALL	MILDENHALL	N/A	UK
92	N63427	NAVCOMSTA H.E. HOLT	EXMOUTH	N/A	AS
93	N00012	NAVY BASE CLOSURE SITES	VARIOUS LOCATIONS	N/A	US
94	N00019	NAVAIR GOCO OPERATIONS	VARIOUS LOCATIONS	N/A	US
95	N00024	NAVSEA GOCO OPERATIONS	VARIOUS LOCATIONS	N/A	US

a. UIC stands for unit identification code and is the unique identifying number for a Navy command or organization.

## Shore capability areas (SCAs)

We segmented the inventory functionally at the highest level by SCA. We identified 12 different areas, which are defined as:

- **Waterfront operations:** Provide capability ashore to support the Navy's current and future surface, submarine, and Carrier Vessel Nuclear (CVN) force requirements. Facilities include: general purpose berthing pier, port control office, degaussing/deperming facilities, small craft, fuelling stations, harbor defense, and seawalls/bulkheads.
- **Airfield operations:** Provide capability to support safe and effective current and future operations. Efficiently provide for the ready for tasking of aircraft. Facilities include: control towers, airfields, air passenger/air cargo terminals, aircraft ready fuel storage, air navigation/traffic aid facilities, and hangars.
- **Command, control, communications, computers, intelligence, surveillance, and reconnaissance (C4ISR) operations:** The shore facilities infrastructure provides continuity of C4ISR operations to meet war fighter and enabler requirements for information operations, space, and net-centric missions. Facilities include: satellite communications buildings, radio and radar equipment plant, space surveillance facility, and telephone lines.
- **Expeditionary operations:** Provides shore facilities that support expeditionary units ready for tasking with an emphasis on mobile, expeditionary units; joint maritime operations; and brown and green waters. Facilities include: amphibious operations buildings, Navy explosive ordnance disposal units, amphibian vehicle maintenance shops, landing craft, and SEAL team facilities.
- **Intermediate/depot level maintenance support:** Provides full range of shore based ship, sub, aircraft, network, and expeditionary maintenance capability. Facilities include: airframes

shops, aviation armament shops, dry docks, missile launch repair facilities, fitting out piers, repair piers, fitting out wharves and repair wharves (government owned and contracted), and aircraft/ship/missile/other equipment maintenance/repair shops.

- **Ordnance/weapons operations support:** Includes ammunition segregation facilities, ready magazines, fuse assembly plants, weapons shops, air and underwater weapons shops, container holding yards, waterfront/air ordnance loading/offloading, ordnance/munitions storage, and munitions repair/maintenance shops.
- **Training support:** Provides capability for institutional education and training of Navy personnel in the latest state-of-the-art skills. Provides on-line knowledge opportunities. Facilities include: drill halls, Naval Academy prep school, applied instruction buildings, mock-up jump tower, grenade launcher range, tracked vehicle drivers course, and other training facilities and ranges.
- **Supply storage support:** Provides adequate supply capability and capacity at locations that directly support training, readiness, and operational requirements. Facilities include: lubricant storage, servmart, fuel storage, petroleum, oil, and lubricants (POL) pipelines, filling stations, and warehouses.
- **Sailor and family support:** Provides capability for provision of support programs and services that benefit the sailor and his/her family. Facilities include: bachelor enlisted quarters, bachelor officers quarters-transient, child development centers, dependent schools, family housing, dining facilities, fitness centers, religious ministry facilities, morale, welfare, and recreation (MWR) facilities, exchange facilities, and post offices.
- **Medical:** Provides capability for provision of health services to America's active and retired military, and their immediate families. Facilities include: medical clinics and dental clinics. We also categorize veterinary clinics and animal treatment facilities under medical.

- **Base support:** Includes administrative offices, cemeteries, fire stations, museums, gate/sentry houses, and other force protection facilities, public works shops, roads, electrical power plants, chilled water plants, compressed air plants, gas mains, sewage and combined sewage industrial waste treatment plants, heating plants, pumping stations-potable water, other utility systems, storm sewers, brigs, aircraft rescue/firefighting facilities, and refuse collection/recycling facilities.
- **RDT&E support:** These facilities include: aircraft and flight equipment laboratory, propulsion fuel laboratory, missile systems integration laboratory, ships and marine laboratory, underwater systems range facilities, and other RDT&E labs and facilities.

This functional segmentation allowed the metrics to be separated by shore functions for all the indicator charts.

## **Mission dependency index (MDI) or strategic support index (SSI)**

We also segmented the inventory by using risk assessment techniques based on Navy operational risk management methodology. The MDI is an operational risk metric for assessing the criticality of Navy facilities [3]. It segments the inventory into mission relevant areas of:

- Critical importance (85-100)
- Significant importance (70-84)
- Moderate importance (55-69)
- Relevant importance (40-54)
- Low importance (0-39)

The dependencies are listed in descending order of risk. The local installation commander and staff assess a facility by determining the degree of interruptability of a function or service within the facility and the ability to relocate or replace the function or service within the facility. The calculation focuses on both mission intra-dependency and inter-dependency or the effects within the mission and the effects

on other missions. The MDI is calculated using an equation with three coefficients. The  $MD_{\text{Within}}$  and  $MD_{\text{Between}}$  scores are a product of the matrices used in the intra- and inter-dependency lines of question and range from 1.00 to 6.00. The third input is the number (n) of other subcomponents recognizing the subject subcomponent as a mission critical service provider. The below formula is used to calculate the MDI.

$$MDI = 26.54(aMD_{\text{Within}} + 0.125bMD_{\text{Between Average}} + 0.1cLn(n)) - 25.54 \quad (1)$$

Where:

The MDI final score is normalized from 1 to 100

$MD_{\text{Within}}$  = Mission Dependency Within an organizational subcomponents (Intra-dependency)

$MD_{\text{Between}}$  = Average Mission Dependency Between organizational subcomponents (Inter-dependency)

$Ln( )$  = natural log function

n = number of other organizational subcomponents depending on interviewed subcomponents services

Note that the natural log function is used because the difference between 1 and 2 is much more relevant than the difference between 11 and 12, for example. Equation coefficients are weighted as follows: a = 85 percent, b = 10 percent, c = 5 percent. This means that MDI scores are substantially more dependent on the subcomponent's knowledge of their facilities (intra-dependency). Additionally,  $MD_{\text{Within}}$  and  $MD_{\text{Between}}$  raw matrix scores have been weighted towards interruptability questions by a factor of 60/40. This is done because questions related to interruptability are believed by the Navy to be more objective than questions related to relocateability and replaceability.

We also developed the concept of a SSI, which is used in the same manner as a MDI when no commander's mission assessment is avail-

able because the facility doesn't exist yet such as in the case of new footprint construction. It is also an operational risk metric, but focuses on the relative importance of shore infrastructure new footprint capacity in terms of Navy objectives. The Shore Readiness Board of Directors (SRBOD)<sup>5</sup> used pair-wise ranking techniques to weigh the 12 shore capability areas in terms of criticality of support to Navy. We indexed these scores together with the mission criticality assessment program (MCAP) scores [4] which are based on the Seapower 21 operational construct relevance applied to the 80 shore function areas. This produced a composite index that ranges from 0 to 100 and that is grouped exactly the same as MDI with the same mission relevant areas. Because SSI is dependent upon the facility category code, a score can be generated for every facility, however we only use SSI to segment the capacity and excess capacity inventory views.

## Maintenance funding source

The final element used to segment the inventory was the maintenance funding source. It identifies the type of funds provided to the responsible installation for maintenance and repair of a particular facility. Table 3 provides a complete listing of the different funding sources for maintaining the inventory.

Table 3. Navy facility maintenance funding sources

Data code	Funding source name	Short title
A	Operation and Maintenance, Navy	O&M,N
B	Operation and Maintenance, Navy Reserve	O&M,NR
C	Research, Development, Test and Evaluation, Navy	RDT&E
E	Military Construction	MC
F	Other Department of Defense	OTHDoD
H	Defense Health	DH

5. The SRBOD was chartered on 8 November, 2007 by the DCNO, Fleet Readiness and Logistics to provide the governance of the shore investment strategy and to align actions across all dimensions of the shore planning, programming, budgeting, and execution process. It has since been renamed as the Shore Mission Integration Group (SMIG).

Table 3. Navy facility maintenance funding sources

Data code	Funding source name	Short title
K	Navy Working Capital Fund	NWCF
M	Miscellaneous	MISC
O	Other	OTH
P	Public Private Venture	PPVEN
Z	Outsourcing	OUTSRC
1	Family Housing, Navy	FH,N
2	Contractor-Operated Industrial Reserve Plant	COIRP
3	Contractor-Operated Research & Development Facilities	CORSTF
4	U.S. Marine Corps	USMC
6	Non-Appropriated Funds	NAF
7	Outgrantee/Lessor (Ingrant)	OG/L
8	(Pre 1995) Base Realignment & Closure	BRAC
9	Caretaker (CSO Installations)	CT

With these segmentation elements in place, we divided the inventory into smaller pieces making it easier to observe impacts as well as existing gaps and excesses.

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## Shore quality assessment measures of merit

The next step was to identify the quality and shore readiness assessment measures to use for quantifying the current and future support capability of the shore infrastructure. As previously mentioned in the summary, we selected four performance measures to index together to form a composite readiness index which was defined as the  $P_{(IFOM)}$  rating ( $\text{Performance}_{(\text{Installation Figure of Merit})}$ ).

- $P_{(\text{CONDITION})}$  — Measure of an asset's physical condition in terms of its overall replacement value. It is equal to the commonly used FCI [5].
- $P_{(\text{CONFIGURATION})}$  — Measure of an asset's capability to support the current occupant or mission with respect to functionality. It is calculated based on the proportion of adequate, substandard, and inadequate coded space.
- $P_{(\text{CAPACITY})}$  — Measures percentage of existing facilities that meet BFR authorizations within a facility category code at a site.
- $P_{(\text{CPL})}$  — Measure of the annual operating performance level achieved during the previous fiscal year as reported by installation commanders through a Navy quarterly reporting system.

These P-ratings are indexed together using the following formula with weights developed by the Navy SRBOD.

$$P_{(IFOM)} = 0.22P_{(\text{CONDITION})} + 0.17P_{(\text{CONFIGURATION})} + 0.36P_{(\text{CAPACITY})} + 0.25P_{(\text{CPL})} \quad (2)$$

Three other measures were developed as well to assist in understanding the nature of the inventory.

- $P_{(\text{SURPLUS CAPACITY})}$  — Measures percentage of existing facilities that exceed the BFR authorization within a facility category

code at a site. This is an unbounded rating that can range from 0 to a very large number depending on the amount of surplus.

- **P<sub>(SERVICE LIFE USED)</sub>** — Provides the percentage of initial service life consumed based on standard service life and current age. This is also an unbounded rating that can range from 0 to a large number depending on the actual age of the facility.
- **P<sub>(CURRENT AGE)</sub>** — Measures the actual age of a facility in years from commissioning year to baseline year.

We will discuss each of these metrics in more detail.

## Condition

The condition metric tells us what shape a facility in. This is the most common measure used to discuss facilities performance. However, in most cases the condition index (CI) includes both condition and configuration effects. For our analysis, we separated condition from configuration because condition degradation is a result of inadequate sustainment funding whereas configuration degradation is a function of time where a facility degrades each year due to obsolescence issues regardless of the level of sustainment funding. This measure is a direct input from the iNFADS database and reflects the current ratio of the sum of deficiency values divided by the plant replacement value for that facility. The measure is calculated as shown in the below formula:

$$P_{(\text{CONDITION})} = (\Sigma \text{ Facility deficiency values} / \text{Total facility PRV}) \times 100 \quad (3)$$

Where a facility deficiency value is the dollar amount required to bring one component of a facility back up to a full and useful condition. This measure is not the same as the more commonly used backlog measure, which is the sum of the existing deferred restoration and modernization project costs divided by the total PRV. The deferred cost method does not give us the total requirement since it only includes the current projects in backlog, which is the reason we selected the total deficiency value method.

## Configuration

As we mentioned above, we utilized a separate measure for configuration performance, which allows for a better understanding of the infrastructure performance state. The configuration measure quantifies an asset's capability to support the current occupant or mission with respect to functionality, and it is calculated based on the proportion of adequate,<sup>6</sup> substandard,<sup>7</sup> and inadequate<sup>8</sup> coded space. The area measures for a facility are extracted for adequate and substandard space along with the total area measure for that facility. The index is calculated by using the below formula:

$$P_{(\text{CONFIGURATION})} = \frac{[(\text{Adequate space} + 0.77(\text{Substandard space})) / \text{Total space}] \times 100}{(4)}$$

The Naval Facilities Engineering Command (NAVFAC) has traditionally weighted the contribution of substandard space by 0.85 for slightly substandard and 0.70 for significantly substandard. Since we currently have only one measure, we average the two to weight the combined substandard space quantity. NAVFAC plans to implement a new facility deficiency inspection program this summer, which will identify the two levels of substandard space.

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6. Adequate space is defined as being capable of supporting the designated function without a need for capital restoration and modernization improvements.
  7. Substandard space is defined as having deficiencies that prohibit or severely restrict, or will prohibit or severely restrict within the next five years due to expected deterioration, the use of a facility for its designated function.
  8. Inadequate space is defined as having deficiencies due to physical deterioration, functional inadequacy, or hazardous location that prohibit or severely restrict, or will prohibit or severely restrict within the next five years, the use of a facility for its designated function. Inadequate is further defined as having deficiencies that cannot be economically corrected (compared with replacement) to meet the requirements of the designated function.

## Capacity

The capacity metric deals with the most important question that users ask: “Do we have enough facility space to support our mission?” Shore capacity requirements are developed by the Navy through use of BFRs [6], which are the shore-based facilities, by category code, necessary to perform the peacetime missions of Navy shore activities. Based upon planning criteria, a BFR justification is a calculation of an installation’s, a command’s, or a region’s facilities allowances. The calculation can be modified to accommodate site-specific or unit-specific loading requirements, such as mission, personnel, functions, and equipment. BFRs cover entire functional categories of use, such as administrative offices, general warehouses, or public works shops, for both the host and tenant commands. For each category code, if the sum of all assets is greater than the BFR, there is a surplus of space; if it is less, there is a deficiency. BFRs are developed using peacetime mission and loading, and they do not include contingency requirements. BFRs are the product of a regional analysis of the following factors:

1. Projected mission, functions, and tasks;
2. Base loading; and
3. Criteria.

The shore capacity metric is the percentage of existing facilities that meet BFR authorizations within a facility category code at a site. The formula is:

$$P_{(\text{CAPACITY})} = \text{Minimum}[(\text{Total assets}_{(\text{Facility category code})} / \text{BFR}_{(\text{Facility category code})}), 1] \times 100 \quad (5)$$

Since any capacity that exceeds the BFR is defined as surplus, the metric is capped at 100, which indicates that the category code at that site has all the space that is authorized. The amount over 100 is captured by the surplus capacity measure, which is discussed below. Inadequate space is included in the total assets amount since it is still being used in almost all cases.

## CPL

The CPL measures the annual operating performance level achieved during the previous fiscal year as reported by installation commanders through a Navy quarterly reporting system. This performance measure provides us with an understanding of how well the facilities are being operated. This is the most sensitive measure because it can rapidly change depending upon the funding applied during the previous year.

This CPL assessment is structured on the CNIC installations core business model. The model groups the different base operating services into special interest areas, whose performance scores are rolled up into shore capability areas for each installation and CNIC region, and they are summarized for the entire Navy.

The quarterly performance data call (QPDC) tool, which is sponsored by CNIC/N5, was selected to serve as the data source for performance information. The QPDC surveys activities to determine performance levels of various designated programs. The programs tracked by the QPDC generally can be mapped to the special interest areas of the installation core business model. The performance scores produced by the QPDC are driven by standards for common output levels of service (COLS) and are reported directly from the field. The QPDC scores range from 0 to 10 and are normalized to 0 to 100 for use in SFIM.

## Installation figure of merit (IFOM)

Although each of these performance metrics provides some insight into the readiness levels of the shore inventory, it is necessary to index them together in order to get a single indicator of performance level that can be compared across the Navy. We indexed them together using the following formula with weights developed by the Navy SRBOD.

$$P_{(\text{IFOM})} = 0.22P_{(\text{CONDITION})} + 0.17P_{(\text{CONFIGURATION})} + 0.36P_{(\text{CAPACITY})} + 0.25P_{(\text{CPL})} \quad (6)$$

Since the weights add up to 1.0 and the ranges are all 0 to 100, the weighted measures can be added directly together without normalization. The installation level is the most detailed level at which this can be done because, concretely, it is the lowest level at which the CPL measure is reported. However, above the installation level, this overall performance measure can be consolidated by capability performance areas into regions, and for the entire Navy. It provides a constant yardstick to measure ongoing changes and investment impacts.

## Surplus capacity

We developed other measures to augment the basic four performance indicators that make up the IFOM. Each of these additional three measures have different scales that are not in the IFOM 0 to 100 scoring format. The first additional metric addresses the amount of surplus capacity within the shore inventory. This indicator measures percentage of existing facilities space that exceeds the BFR authorization within a facility category code at a site. This is an unbounded rating that can range from 0 to a very large number depending on the amount of surplus. The measure is calculated in the same manner as the capacity performance measure, but is not capped at 100. Instead, if the raw capacity score exceeds 100, 100 is subtracted from it in order to give a percentage of surplus capacity, otherwise the value is 0. The formula for this calculation is:

$$P_{(\text{SURPLUS CAPACITY})} = \text{Maximum}[(\text{Total assets}_{(\text{Facility category code})} / \text{BFR}_{(\text{Facility category code})}) - 1.0, 0] \times 100 \quad (7)$$

When calculated at the facility category code level at a site, the capacity rating will always be 100 if there is any surplus at all. However, when the ratings scores are consolidated at higher levels, such as an installation, the capacity score can be less than 100 while at the same time reflecting a surplus capacity. This results from weighting the individual ratings by PRV as part of the consolidation to higher levels and the inability to offset shortfalls with excess due to physical separation.

## Service life used

The second additional measure is a life-cycle indicator, which reflects how much of a facilities' initial service life has been consumed to date. This measure is the ratio of the current age in years over the OSD standard service life for that facility category code type of asset.<sup>9</sup> The formula used is:

$$P_{(\text{SERVICE LIFE USED})} = (\text{Current age} / \text{OSD Standard Service Life}) \times 100 \quad (8)$$

This measure is unbounded and can range to very high values for some types of facilities. It can be calculated at the facility level similar to condition and configuration, and consolidated to higher levels through weighting by PRV.

## Current age

The final additional measure is also a life-cycle indicator, which reflects the current age of a facility. It is calculated by subtracting the year in which a facility was commissioned from the current baseline year. The formula for this is:

$$P_{(\text{CURRENT AGE})} = \text{Current baseline year} - \text{Commission year} \quad (9)$$

This metric is measured in years and provides an understanding of the length of service for a particular facility. This is also calculated at the individual facility level and consolidated to higher levels via PRV weight.

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9. This measure is not reset when major restoration and modernization is performed on a facility. The reset service life is termed extended service life. We did not use this measure because the source data was not available from the Navy. However, the Navy plans on capturing this information in iNFADS sometime in the future.

## Threshold indicators

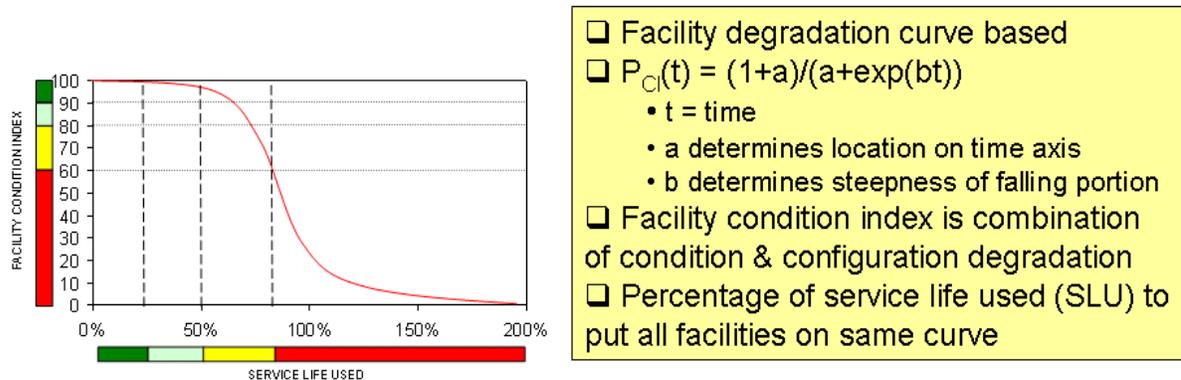
All P-ratings, with the exception of CPL, are weighted by PRV to index together at higher levels both organizationally and functionally. CPL is weighted by a simple average since it is a reported rating rather than an infrastructure calculated measure. To allow for management dashboard types of displays, we used colors to represent different performance attainment levels. We selected four ranges within the 0 to 100 scale to visually indicate with colors the relative level of quality. Green represents excellent quality with scores between 90 and 100; light green reflects good quality with scores between 80 and 89; yellow represents fair quality with scores between 61 and 79; and red represents poor quality with scores between 0 and 60.<sup>10</sup> These colors allow Navy leadership to quickly scan display charts for red and yellow high risk areas for consideration and evaluation. These ranges match what OSD has used in the past for Q-Rating displays. Figure 3 shows how

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10. Note that the  $P_{(\text{SURPLUS CAPACITY})}$  and  $P_{(\text{SERVICE LIFE USED})}$  ratings use the same colors but with different ranges since they are unbounded: Green (0-25 percent), Light Green (25-50 percent), Yellow (50-80 percent), and Red (Over 80 percent).  $P_{(\text{CURRENT AGE})}$  rating has no color thresholds.

we equated the scales to a typical facility condition and configuration life-cycle degradation curve [7].

Figure 3. Shore infrastructure threshold indicators



- New facility (Excellent)** – Above 90  $P_{CI}$  and first 25% of service life: Sustainment focus to avoid premature degradation, no modernization or recapitalization.
- Prime use facility (Good)** – 80 to 89  $P_{CI}$  and 25 to 50% of service life: Maintain sustainment focus but some investment in modernization or repair depending on mission criticality (MDI).
- Mature facility (Fair)** – 61 to 79  $P_{CI}$  and 50 to 80% of service life: Shift to restoration and modernization as in steep part of deterioration curve.
- Aged facility (Poor)** – Below 60  $P_{CI}$  and over 80% of service life: Maintain minimum service with restoration and repair investment. Consider as recapitalization candidate depending on mission criticality and enduring need.

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## **FY 2007 baseline assessment**

To conduct the baseline fiscal year assessment, in November 2007, we downloaded the final certified FY 2007 facility inventory from iNFADS into our MS Access database.

### **Total inventory**

Our analysis of the baseline inventory showed that there were 115,307 facilities of which 64,748 were buildings, 32,722 were structures, 17,162 were utilities, and 675 were temporary construction. The combined PRV was \$173,462 million. We excluded Marine Corps facilities because our study looks only at Navy inventory. Figure 4 shows the

inventory facility count composition by SCA. Figure 5 shows the same inventory but by value instead of number.

Figure 4. Navy Real Property Inventory (RPI) facility count by SCA

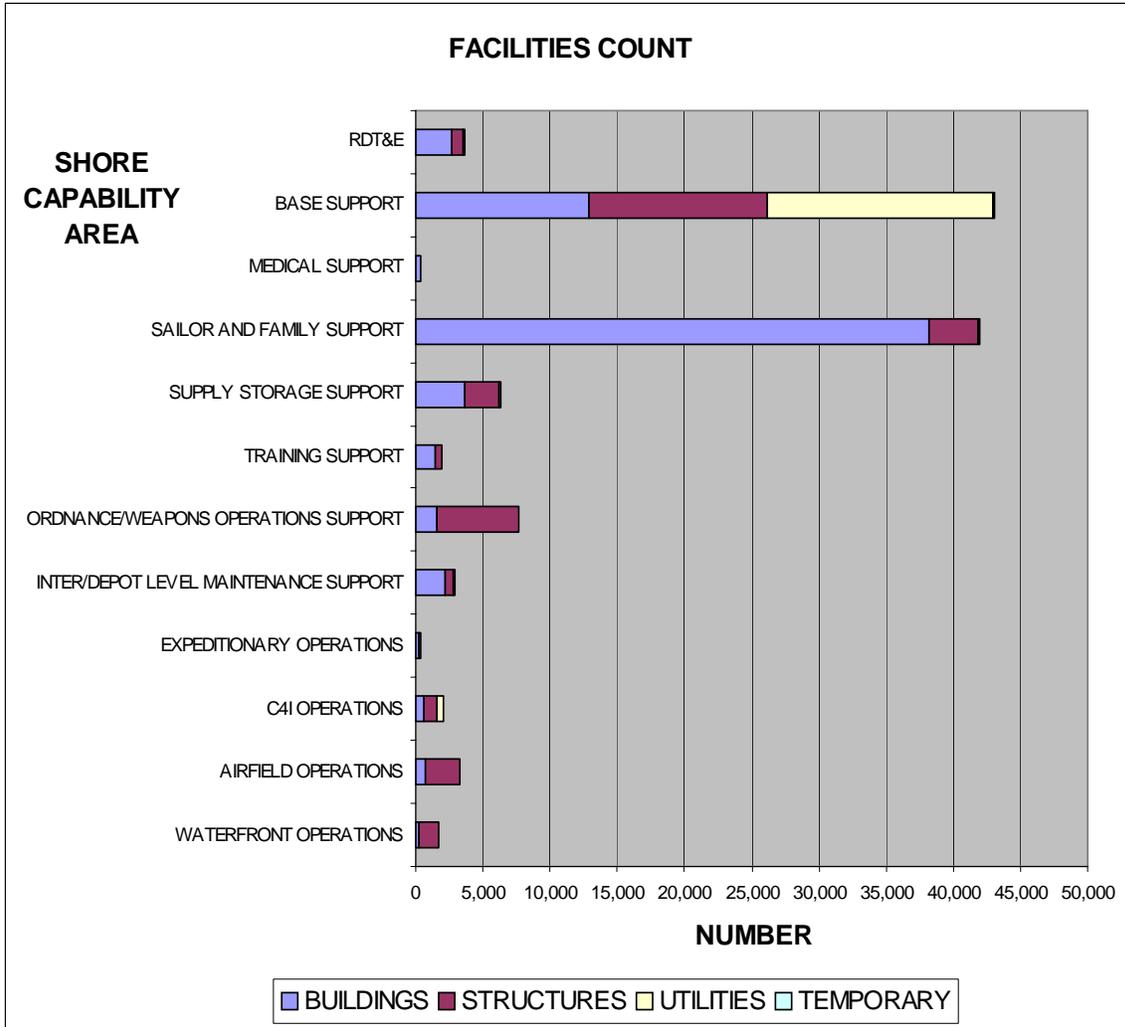
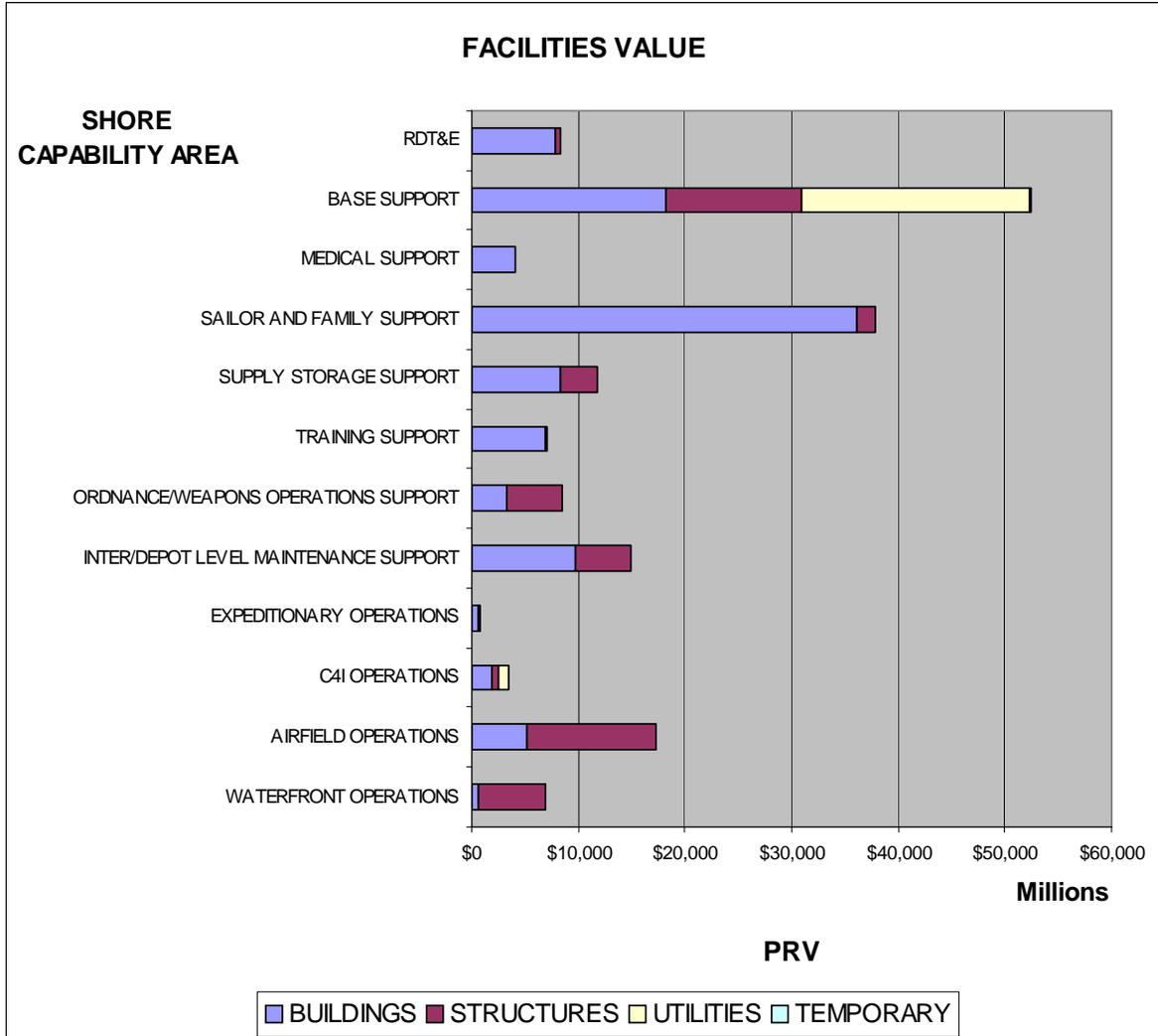


Figure 5. Navy RPI PRV by SCA



## PRV and facility count by segments

We generated summary tables to report the number of facilities and total PRV for each of the elements within the inventory segments. PRV is one of the key real property inventory data elements and title 31 U.S. Code 1105 requires that it be generated. PRV is the cost to replace an existing facility with a generic facility that can perform the

same function(s). The notional replacement facility is generally understood to be the same size and to occupy the same site as the existing facility. The notional replacement facility is also assumed to be constructed to current standards of materials and design. This estimate is calculated at the site level and is based on the standard OSD algorithm:

$$\text{PRV} = (\text{Facility quantity}) \times (\text{Construction cost factor}) \times (\text{Area cost factor}) \times (\text{Historical records adjustment}) \times (\text{Planning and design factor}) \times (\text{Supervision inspection and overhead factor}) \times (\text{Contingency factor}) \quad (10)$$

We used these tables to validate our later database queries by defining what portion of the inventory was included within the query. Since the inventory is so large, it is difficult at times to know what portion is being extracted.

## Regions

Table 4 provides the breakdown by Navy regions and special areas.

Table 4. FY 2007 baseline inventory PRV and facility count by Navy region

UIC	Region name	PRV (\$K)	Share of total	Number of facilities
N3049B	CNR EUROPE	\$4,569,504	3%	3,227
N61449	CNR HAWAII	\$12,458,128	7%	9,566
N61076	CNR JAPAN	\$14,012,320	8%	8,275
N61075	CNR KOREA	\$236,245	0%	393
N61128	CNR MARIANAS	\$8,427,770	5%	3,318
N61463	CNR MID-ATLANTIC	\$26,191,647	15%	15,992
N61040	CNR MIDWEST	\$9,225,044	5%	6,028
N00171	CNR NDW	\$9,832,620	6%	8,238
N68742	CNR NORTHWEST	\$10,178,263	6%	6,439
N09697	CNR SOUTHEAST	\$26,009,985	15%	24,965
N00242	CNR SOUTHWEST	\$26,900,493	16%	20,631
N61108	CNR SW ASIA	\$1,738,547	1%	483
N00018	NAVY MEDICINE	\$3,094,104	2%	621
N00000	OTHER	\$20,593,406	12%	7,131
<b>TOTAL</b>		<b>\$173,468,076</b>		<b>115,307</b>

We note that the 12 regions are not equal in size and three of the largest regions, Commander Navy Region (CNR) Southwest, CNR Southeast, and CNR Mid-Atlantic hold 46 percent of the inventory assets. The other special interest area is also large with 12 percent of the inventory, but contains base closure properties that have not yet been disposed or GOCO manufacturing facilities, which are supported by acquisition funding. Neither of these areas have facilities assets that will be held by the Navy over the long term.

## Installations

Table 5 contains a breakdown by the 95 recognized Navy installations.

Table 5. FY 2007 baseline inventory PRV and facility count by Navy installations

UIC	Installation name	PRV (\$K)	Share of total	Number of facilities
N00128	NAVSTA GREAT LAKES	4,573,270	2.6%	2,323
N00129	NAVSUBASE NEW LONDON	2,006,867	1.2%	1,816
N00158	NAS JRB WILLOW GROVE	524,647	0.3%	347
N00196	NAS ATLANTA	190,323	0.1%	234
N00204	NAS PENSACOLA	2,812,783	1.6%	1,988
N00205	NSA NEW ORLEANS	490,733	0.3%	183
N00206	NAS JRB NEW ORLEANS	732,485	0.4%	561
N00207	NAS JACKSONVILLE	2,385,773	1.4%	1,818
N00213	NAS KEY WEST	1,668,058	1.0%	2,146
N00216	NAS CORPUS CHRISTI	1,789,807	1.0%	692
N00245	NAVSTA SAN DIEGO	3,669,202	2.1%	3,427
N00246	NAS NORTH ISLAND	5,345,833	3.1%	2,835
N00620	NAS WHIDBEY ISLAND	2,181,372	1.3%	1,754
N00639	NAVSUPPACT MIDSOUTH MEMPHIS	825,950	0.5%	815
N0428A	NAS PATUXENT RIVER	2,872,031	1.7%	2,983
N0534A	PMRF BARKING SANDS	489,945	0.3%	656
N31188	NGSA SUGAR GROVE	161,476	0.1%	236
N32013	NAVMAG INDIAN ISLAND	270,554	0.2%	275
N32411	NAVSTA NEWPORT	2,298,348	1.3%	1,348
N32414	NAVSUPPACT MECHANICSBURG	2,498,023	1.4%	776
N32443	NSS NORFOLK NAVAL SHIPYARD	2,331,926	1.3%	661
N32446	NSY PORTSMOUTH	1,378,443	0.8%	545
N32778	CFA CHINHAE KOREA	236,244	0.1%	393

Table 5. FY 2007 baseline inventory PRV and facility count by Navy installations

UIC	Installation name	PRV (\$K)	Share of total	Number of facilities
N32960	NAVSUPPACT LA MADDALENA	126,005	0.1%	126
N40003	NAVACTS PUERTO RICO	2,097,257	1.2%	2,237
N42237	SUBASE KINGS BAY	2,569,393	1.5%	1,609
N47609	NAWS CHINA LAKE	2,584,309	1.5%	2,215
N48558	NAVAIRENGSTA LAKEHURST	1,208,928	0.7%	936
N49422	JMF ST. MAWGANS	104,032	0.1%	54
N57095	NAVSUPPACT NORFOLK	1,134,521	0.7%	1,446
N60042	NAF EL CENTRO	787,894	0.5%	699
N60087	NAS BRUNSWICK	1,009,359	0.6%	882
N60191	NAS OCEANA	2,393,347	1.4%	1,395
N60201	NAVSTA MAYPORT	1,240,082	0.7%	1,926
N60241	NAS KINGSVILLE	1,201,522	0.7%	476
N60495	NAS FALLON	1,464,437	0.8%	952
N60508	NAS WHITING FIELD	1,078,373	0.6%	975
N60514	NAVSTA GUANTANAMO BAY	2,221,066	1.3%	3,493
N61006	NSA ATHENS	72,435	0.0%	135
N61007	NSA ORLANDO	108,792	0.1%	84
N61008	NSA PANAMA CITY	366,106	0.2%	556
N61014	NAVSUPPDET MONTEREY	1,270,814	0.7%	1,014
N61018	NSA CRANE	3,825,824	2.2%	2,890
N61028	CFA YOKOSUKA	5,491,828	3.2%	2,793
N61029	CFA OKINAWA	547,927	0.3%	489
N61030	CFA SASEBO	2,174,689	1.3%	1,630
N61031	NAF ATSUGI	2,319,545	1.3%	1,501
N61032	NAF MISAWA	388,132	0.2%	186
N61065	NAVWPNSTA SEAL BEACH	2,967,571	1.7%	2,233
N61078	NAVSUPPFAC DIEGO GARCIA	2,642,831	1.5%	1,313
N61150	NSA NORTH POTOMAC	703,700	0.4%	355
N61151	NSA SOUTH POTOMAC	2,243,793	1.3%	2,754
N61152	NAVSUPPACT ANNAPOLIS	1,657,785	1.0%	1,157
N61414	NAVPHIBASE LITTLE CREEK	1,553,215	0.9%	1,586
N61755	NAVBASE GUAM	8,427,770	4.9%	3,318
N62585	NAVACTS UNITED KINGDOM <sup>a</sup>	0	0.0%	0
N62588	NSA NAPLES	1,084,186	0.6%	606
N62604	NCBC GULFPORT	1,039,544	0.6%	878
N62688	NAVSTA NORFOLK	4,655,224	2.7%	1,710
N62813	NAVSTA PEARL HARBOR	11,968,183	6.9%	8,910
N62863	NAVSTA ROTA	1,580,187	0.9%	1,285

Table 5. FY 2007 baseline inventory PRV and facility count by Navy installations

UIC	Installation name	PRV (\$K)	Share of total	Number of facilities
N62995	NAS SIGONELLA	1,340,767	0.8%	968
N63005	NAVSUPPACT BAHRAIN	606,006	0.3%	385
N63042	NAS LEMOORE	2,375,959	1.4%	1,825
N63043	NAS MERIDIAN	755,020	0.4%	1,030
N63406	SUBASE SAN DIEGO	2,297,589	1.3%	2,306
N66691	NAVSUPPACT SOUDA BAY	331,907	0.2%	185
N61077	NRCC SINGAPORE	112,672	0.1%	57
N68317	NAVSUPPUNIT SARATOGA SPRINGS	60,371	0.0%	142
N68436	NAVBASE KITSAP	6,946,477	4.0%	3,692
N68469	NSA WASHINGTON	2,355,311	1.4%	989
N68890	NAVSTA PASCAGOULA	90,193	0.1%	134
N68891	NAVSTA INGLESIDE	254,811	0.1%	251
N68967	NAVSTA EVERETT	779,860	0.4%	718
N69212	NAVWPNSUPPFAC YORKTOWN	1,627,862	0.9%	1,344
N69213	NAVWPNSTA EARLE	1,349,092	0.8%	822
N69214	NAVWPNSTA CHARLESTON	1,878,989	1.1%	2,851
N69232	NAVBASE VENTURA COUNTY	4,136,887	2.4%	3,125
N83447	NAS JRB FT WORTH	966,441	0.6%	708
N00168	NATNAVMEDCEN BETHESDA	955,453	0.6%	208
N00183	NAVMEDCEN PORTSMOUTH	639,874	0.4%	66
N00259	NAVMEDCENT SAN DIEGO	677,859	0.4%	69
N44852	NAVMEDRSCHCEN LIMA	12,406	0.0%	2
N61337	NAVHOSP BEUFORT	167,690	0.1%	113
N61751	NAVMEDRSCHUNIT 3	51,885	0.0%	51
N62814	NAVMEDRSCHCENT JAKARTA	12,982	0.0%	7
N68084	NAVHOSP CHARLESTON	115,292	0.1%	14
N68095	NAVHOSP BREMERTON	149,303	0.1%	43
N68096	NAVHOSP GUAM	311,361	0.2%	48
N3379A	CAMP LEMONIER	1,132,541	0.7%	98
N57032	NAF MILDENHALL	2,421	0.0%	3
N63427	NAVCOMSTA H.E. HOLT	334,698	0.2%	306
N00012	NAVY BASE CLOSURE SITES	18,289,969	10.5%	6,270
N00019	NAVAIR GOCO OPERATIONS	1,806,284	1.0%	577
N00024	NAVSEA GOCO OPERATIONS	497,154	0.3%	284
<b>TOTAL</b>		<b>\$173,468,076</b>		<b>115,307</b>

a. NAVACTS UNITED KINGDOM as an installation was disestablished during the fiscal year and supported units relocated to Naples Italy.

The largest five installations make up 22 percent of the total inventory. The single largest installation is Naval Station Pearl Harbor, Hawaii. The next largest is Naval Base Guam, Marianas Islands. The remaining installations in the top five are Naval Base KITSAP Bremer-ton, Washington, Commander Fleet Activities Yokosuka, Japan, and Naval Air Station North Island, California. Even though the Norfolk regional complex and San Diego regional complex have larger concentrations of inventory they are split between several smaller installations.

### Shore capability areas

The Navy has identified 12 SCAs and table 6 shows the breakdown of the inventory into each of them.

Table 6. FY 2007 baseline inventory PRV and facility count by Navy SCA

SCA	PRV (\$K)	Share of total	Number of facilities
WATERFRONT OPERATIONS	\$6,857,792	4%	1,750
AIRFIELD OPERATIONS	\$17,224,176	10%	3,291
C4I OPERATIONS	\$3,458,338	2%	2,080
EXPEDITIONARY OPERATIONS	\$717,154	0%	312
INTER/DEPOT LEVEL MAINTENANCE SUPPORT	\$14,989,543	9%	2,876
ORDNANCE/WEAPONS OPERATIONS SUPPORT	\$8,466,804	5%	7,649
TRAINING SUPPORT	\$7,026,892	4%	1,991
SUPPLY STORAGE SUPPORT	\$11,755,297	7%	6,293
SAILOR AND FAMILY SUPPORT	\$37,933,709	22%	42,004
MEDICAL SUPPORT	\$4,158,937	2%	326
BASE SUPPORT	\$52,491,726	30%	43,112
RDT&E	\$8,387,708	5%	3,623
<b>TOTAL</b>	<b>\$173,468,076</b>		<b>115,307</b>

The inventory is not spread evenly across the 12 capability areas. The largest two capability areas are base support and sailor and family support. They contain over 52 percent of the entire infrastructure between them.

## Mission dependency index

The MDI segments the existing inventory into six levels of importance in terms of local mission sensitivity to length of interruption and time to replace. Table 7 provides the inventory breakdown.

Table 7. FY 2007 baseline inventory PRV and facility count by Navy MDI

MDI group	MDI description	PRV (\$K)	Share of total	Number of facilities
0	NO CATEGORY	\$15,292,951	9%	34,158
1	LOW	\$61,360,633	35%	46,093
2	MODERATE	\$16,941,875	10%	9,991
3	RELEVANT	\$19,587,363	11%	8,063
4	SIGNIFICANT	\$22,948,733	13%	8,414
5	CRITICAL	\$37,336,521	22%	8,588
<b>TOTAL</b>		<b>\$173,468,076</b>		<b>115,307</b>

We noted that the distribution of facilities was bowl shaped with the majority of facilities in either the critical or low categories of MDI. Over 57 percent of the inventory is in one of these two groups.

## Strategic support index

The SSI was developed to help place proposed new facilities into the same six bands as MDI. Since it is impossible to assess facilities locally that are yet to be built, the SSI provides an alternative method for assessment. SSI bands are only used for capacity and excess capacity displays. However, they are calculated for all facilities. Table 8 shows the inventory distribution.

Table 8. FY 2007 baseline inventory PRV and facility count by Navy SSI

SSI group	SSI description	PRV (\$K)	Share of total	Number of facilities
0	NO CATEGORY	\$0	0%	6
1	LOW	\$7,935,345	5%	3,437
2	MODERATE	\$67,320,244	39%	52,517

Table 8. FY 2007 baseline inventory PRV and facility count by Navy SSI

SSI group	SSI description	PRV (\$K)	Share of total	Number of facilities
3	RELEVANT	\$73,741,884	43%	54,973
4	SIGNIFICANT	\$4,819,707	3%	984
5	CRITICAL	\$19,650,896	11%	3,390
<b>TOTAL</b>		<b>\$173,468,076</b>		<b>115,307</b>

The SSI distribution is more like the standard bell shaped curve in that SSI groups 2 and 3 have over 82 percent of the total inventory.

### Maintenance funding source

The final breakdown is by facility maintenance funding sources. Table 9 provides this information.

Table 9. FY 2007 baseline inventory PRV and facility count by Navy maintenance funding source

Fund source	Source name	PRV (\$K)	Share of total	Number of facilities
O&M,N	OPERATION & MAINTENANCE, NAVY	\$83,928,073	48%	43,364
NWCF	NAVY WORKING CAPITAL FUND	\$26,872,905	15%	18,566
CT	CARETAKER (CSO INSTALLATIONS)	\$20,029,274	12%	8,715
OTHD <sub>o</sub> D	OTHER DEPARTMENT OF DEFENSE	\$10,003,513	6%	54,973
FH,N	FAMILY HOUSING, NAVY	\$6,623,493	4%	13,883
PPVVEN	PUBLIC PRIVATE VENTURE	\$5,921,354	3%	3,390
OG/L	OUTGRANTEE/LESSOR (INGRANT)	\$5,435,333	3%	4,083
DH	DEFENSE HEALTH	\$5,233,168	3%	921
O&M,NR	OPERATION & MAINTENANCE, NAVY RESERVE	\$3,595,354	2%	3,018
COIRP	CONTRACTOR-OPERATED INDUSTRIAL RESERVE PLANT	\$2,883,082	2%	1,054
RDT&E,N	RESEARCH, DEVELOPMENT, TEST AND EVALUATION, NAVY	\$2,071,030	1%	2,060
NAF	NON-APPROPRIATED FUNDS	\$403,279	0%	308
OTH	OTHER	\$188,642	0%	92
USMC	U.S. MARINE CORPS	\$135,960	0%	71
CORSTF	CONTRACTOR-OPERATED RESEARCH AND DEVELOPMENT FACILITIES	\$133,995	0%	60

Table 9. FY 2007 baseline inventory PRV and facility count by Navy maintenance funding source

Fund source	Source name	PRV (\$K)	Share of total	Number of facilities
UNKWN	UNKNOWN	\$9,280	0%	3
OUTSRC	OUTSOURCING	\$261	0%	1
MC	MILITARY CONSTRUCTION	\$70	0%	1
MISC	MISCELLANEOUS	\$10	0%	1
<b>TOTAL</b>		<b>\$173,468,076</b>		<b>115,307</b>

The four funding sources that CNIC is mostly interested in make up 66 percent of the total inventory. They are: O&M,N; O&M,NR; NWCF; and RDT&E,N.

## Navy-wide baseline assessments

We produced baseline inventory assessment matrix charts to display the different infrastructure quality metrics by organizational structure. The following figures provide the Navy-wide summary versions of these charts.

## Capacity

The below display provides the baseline capacity quality measure for shortfalls in figure 6. It is segmented by SCAs and SSI bands.

Figure 6. Navy-wide FY 2007 capacity assessment

CAPACITY ASSESSMENT			NAVY-WIDE						
Shore Capability Area	Strategic Support Index		Critical (5)	Significant (4)	Relevant (3)	Moderate (2)	Low (1)	No Category (0)	Overall SCA P-Rating
	FRV (\$M)	# FAC	19,651	4,820	73,742	67,320	7,935	0	173,468
			3,390	984	54,973	52,517	3,437	6	115,307
Waterfront Ops	6,858	1,750	99	-	93	-	-	-	93
Airfield Ops	17,224	3,291	87	-	100	94	-	-	93
C4I Ops	3,458	2,080	-	-	96	-	-	-	96
Exped Ops	717	312	-	-	-	77	-	-	77
Maint Support	14,990	2,876	95	95	93	-	-	-	95
Ordnance Support	8,467	7,649	-	-	96	91	-	-	96
Training Support	7,027	1,991	88	-	94	-	88	-	88
Supply Storage Support	11,755	6,293	-	-	-	90	80	-	89
Sail or & Family Support	37,934	42,004	-	-	91	86	93	-	87
Medical	4,159	326	95	-	-	-	95	-	95
Base Support	52,491	43,112	-	-	97	99	97	-	97
RDT&E	8,388	3,623	-	-	-	90	-	-	90
Overall	173,468	115,307	93	95	96	89	90	-	93

The results indicates that the Navy has 93 percent of the required amount of infrastructure capacity for the current mission requirements. We note that the expeditionary operations SCA reflected the greatest shortfall with only 77 percent of the authorized capacity available.

## Condition

Figure 7 provides the condition quality measure for the baseline fiscal year. It is segmented by SCA and MDI bands.

Figure 7. Navy-wide FY 2007 condition assessment

CONDITION ASSESSMENT			NAVY-WIDE						
Shore Capability Area	Mission Dependency Index		Critical (5)	Significant (4)	Relevant (3)	Moderate (2)	Low (1)	No Category (0)	Overall SCA P-Rating
	PRV (\$M)	# FAC							
			37,336	22,949	19,587	16,942	61,361	15,293	173,468
			8,588	8,414	8,063	9,991	46,093	34,158	115,307
Waterfront Ops	6,858	1,750	92	89	87	92	93	100	90
Airfield Ops	17,224	3,291	83	77	80	76	79	100	79
C4I Ops	3,458	2,080	78	77	83	84	92	100	85
Exped Ops	717	312	84	85	77	82	85	100	83
Maint Support	14,990	2,876	81	69	72	71	79	100	78
Ordnance Support	8,467	7,649	82	86	85	85	83	100	84
Training Support	7,027	1,991	68	68	68	72	75	100	71
Supply Storage Support	11,755	6,293	69	69	67	65	74	100	69
Sailor & Family Support	37,934	42,004	71	73	72	71	76	96	73
Medical	4,159	326	67	93	80	95	81	100	86
Base Support	52,491	43,112	84	79	74	71	87	95	82
RDT&E	8,388	3,623	67	68	66	70	75	100	69
Overall	173,468	115,307	79	77	73	74	82	96	78

This assessment shows us that the facility inventory, weighted by PRV, is in fair condition. However, the critical facilities are almost in the same condition as the overall inventory, which points to an area that should receive greater focus. For this performance measure we also

generated a facility threshold number analysis. Figure 8 provides this display.

Figure 8. Navy-wide FY 2007 facility condition threshold count

FACILITY CONDITION THRESHOLD COUNT			NAVY-WIDE																						
SHORE CAPABILITY AREA	FRV (\$K)	FACILITIES TOTAL	PERCENT OBTAINING EACH THRESHOLD LEVEL													NUMBER OBTAINING THRESHOLD LEVEL									
			0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	Green	Light Green
WATERFRONT OPS	6,857,792	1,750	59													1,083	99	212	167	289					
AIRFIELD OPS	17,224,176	3,291	38													1,242	469	549	202	829					
OIL OPS	3,468,388	2,080	60													1,288	79	329	85	349					
EXPEDITIONARY OPS	717,154	312	45													141	50	67	34	20					
MAINTENANCE SUPPORT	14,989,543	2,876	30													854	298	612	666	448					
ORDNANCE SUPPORT	8,466,804	7,619	44													3,387	334	414	701	2,813					
TRAINING SUPPORT	7,026,892	1,991	31													609	222	639	271	250					
SUPPLY STORAGE SUPPORT	11,755,297	6,293	31													1,989	478	1,034	891	1,921					
SAILOR AND FAMILY SUPPORT	37,983,709	4,008	77													4,389	1,107	2,773	1,579	32,194					
MEDICAL	4,158,987	326	76													43	8	8	19	283					
BASE SUPPORT	52,491,726	48,107	47													20,457	3,256	4,982	3,403	10,989					
RDT&E	8,387,708	3,623	29													1,050	287	905	1,055	320					
OVERALL	173,468,076	115,307	32													36,380	6,725	12,494	9,072	50,680					

This display shows that the greatest percentage of facilities in poor condition is found within the maintenance support (23 percent) and RDT&E (29 percent) SCAs.

## Configuration

The configuration quality measure for the baseline fiscal year is shown in figure 9. It is segmented by SCAs and MDI bands.

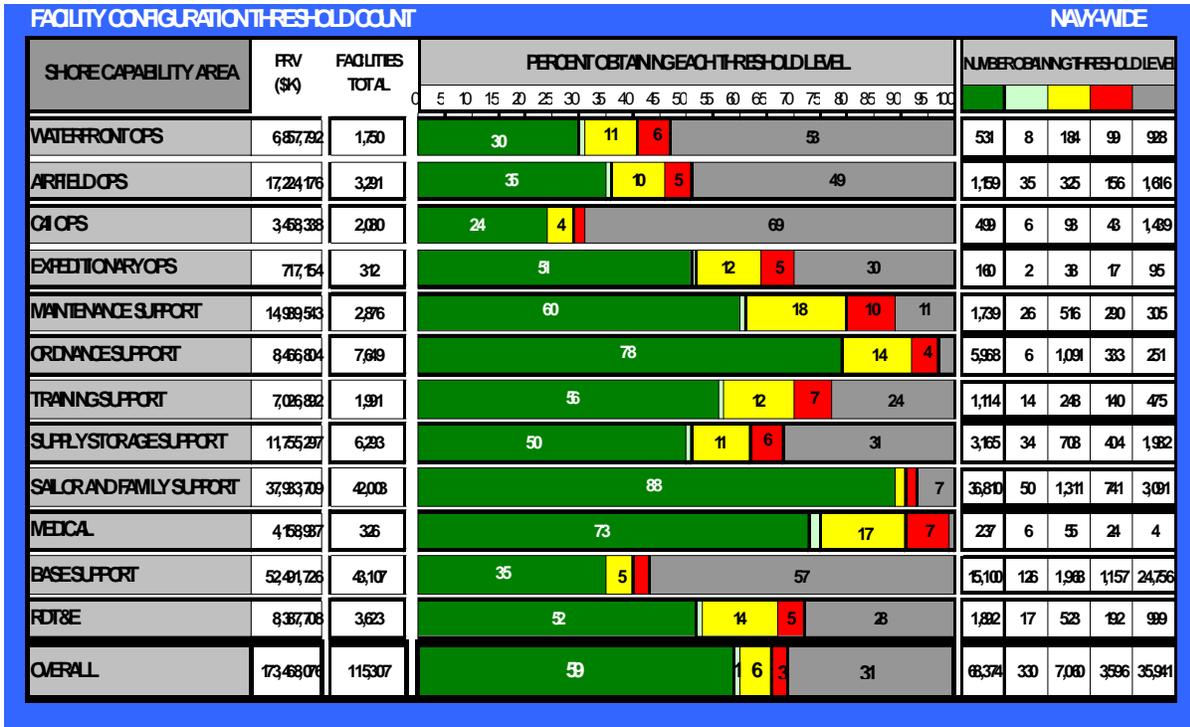
Figure 9. Navy-wide FY 2007 configuration assessment

CONFIGURATION ASSESSMENT			NAVY-WIDE						
Shore Capability Area	Mission Dependency Index		Critical (5)	Significant (4)	Relevant (3)	Moderate (2)	Low (1)	No Category (0)	Overall SCA P-Rating
	PRV (\$M)	# FAC							
			37,336	22,949	19,587	16,942	61,361	15,293	173,468
			8,588	8,414	8,063	9,991	46,093	34,158	115,307
Waterfront Ops	6,858	1,750	87	76	89	84	88	30	84
Airfield Ops	17,224	3,291	88	85	89	87	85	100	86
C4I Ops	3,458	2,080	92	82	94	95	92	97	91
Exped Ops	717	312	98	99	88	96	93	-	95
Maint Support	14,990	2,876	87	81	89	83	89	100	87
Ordnance Support	8,467	7,649	91	94	95	96	89	100	93
Training Support	7,027	1,991	90	95	91	92	92	100	92
Supply Storage Support	11,755	6,293	87	92	90	87	88	83	89
Sailor & Family Support	37,934	42,004	93	92	91	91	87	100	94
Medical	4,159	326	92	95	97	94	91	-	92
Base Support	52,491	43,112	93	91	89	90	90	99	91
RDT&E	8,388	3,623	95	93	92	89	92	-	93
Overall	173,468	115,307	91	89	90	90	89	100	91

This analysis indicates that the overall Navy-wide configuration is in excellent shape with only a couple of serious gaps within waterfront

operations. As with condition, we generated a facility threshold number analysis for configuration. Figure 10 provides this display.

Figure 10. Navy-wide FY 2007 facility configuration threshold count



The greatest percentage of facilities in poor condition is found in the medical (10 percent) and maintenance support (7 percent) SCAs.

## CPL

The capability performance levels are reported in figure 11. It is segmented by SCAs, but not by MDI or SSI since the CPL funding is not allocated by the Navy down to those levels.

Figure 11. Navy-wide FY 2007 CPL assessment

CAPABILITY PERFORMANCE LEVEL ASSESSMENT			NAVY-WIDE
Shore Capability Area			Overall SCA P-Rating
	PRV (\$M)	# FAC	
			173,468
			115,307
Waterfront Ops	6,858	1,750	80
Airfield Ops	17,224	3,291	87
C4I Ops	3,458	2,080	74
Exped Ops	717	312	-
Maint Support	14,990	2,876	-
Ordnance Support	8,467	7,649	-
Training Support	7,027	1,991	-
Supply Storage Support	11,755	6,293	82
Sailor & Family Support	37,934	42,004	79
Medical	4,159	326	-
Base Support	52,491	43,112	72
RDT&E	8,388	3,623	-
Overall	173,468	115,307	75

We note that the area with the largest portion of inventory achieved the worst CPL quality rating. C4I operations also were lower than the other operational areas.

## Installation figure of merit (IFOM)

After identifying each of the four quality measures that make up the IFOM, we could show the Navy-wide values in figure 12. The inventory is segmented by SCA and performance metric.

Figure 12. Navy-wide FY 2007 IFOM performance assessment

INFRASTRUCTURE FIGURE OF MERIT (IFOM) ASSESSMENT						NAVY-WIDE	
Shore Capability Area	Performance Metric		Condition	Config	Capacity	CPL	IFOM
	PRV (\$M)	# FAC					
Waterfront Ops	6,858	1,750	90	84	93	80	88
Airfield Ops	17,224	3,291	79	86	93	87	87
C4I Ops	3,458	2,080	85	91	96	74	87
Exped Ops	717	312	83	95	77	-	83
Maint Support	14,990	2,876	78	87	95	-	88
Ordnance Support	8,467	7,649	94	93	96	-	92
Training Support	7,027	1,991	71	92	88	-	84
Supply Storage Support	11,755	6,293	69	89	89	82	83
Sailor & Family Support	37,934	42,004	73	94	87	79	83
Medical	4,159	326	86	92	95	-	82
Base Support	52,491	43,112	82	91	97	72	86
RDT&E	8,388	3,623	69	93	90	-	84
Overall	173,468	115,307	78	91	93	75	85

The overall IFOM rating for the Navy was determined to be 85, a good score. However, there are numerous examples of only fair ratings in both condition and CPLs. These SCAs should receive greater investment attention.

## Surplus capacity

While not part of the IFOM calculation, we determined what the surplus capacity is as well. Figure 13 provides this display. It is segmented by SCA and SSI.

Figure 13. Navy-wide FY 2007 surplus capacity performance assessment

SURPLUS CAPACITY ASSESSMENT		NAVY-WIDE							
Shore Capability Area	Strategic Support Index		Critical (5)	Significant (4)	Relevant (3)	Moderate (2)	Low (1)	No Category (0)	Overall SCA P-Rating
	FRV (\$M)	# FAC							
			19,651	4,820	73,742	67,320	7,935	0	173,468
			3,390	984	54,973	52,517	3,437	6	115,307
Waterfront Ops	6,858	1,750	42	-	291	-	-	-	289
Airfield Ops	17,224	3,291	7	-	4	47	-	-	41
C4I Ops	3,458	2,080	-	-	27	-	-	-	27
Exped Ops	717	312	-	-	-	2	-	-	2
Maint Support	14,990	2,876	14	254	12	-	-	-	91
Ordnance Support	8,467	7,649	-	-	32	95	-	-	37
Training Support	7,027	1,991	89	-	15	-	12	-	51
Supply Storage Support	11,755	6,293	-	-	-	198	8	-	176
Sailor & Family Support	37,934	42,004	-	-	35	283	66	-	246
Medical	4,159	326	22	-	-	-	17	-	22
Base Support	52,491	43,112	-	-	1,901	8	76	-	1,864
RDT&E	8,388	3,623	-	-	-	13	-	-	13
Overall	173,468	115,307	28	254	1,359	175	42	-	667

The most significant surplus capacity was noted in the MDI relevant area of base support, with a capacity 1,901 percent over authorized amounts.

## Service life used

We also calculated the initial SLU and show the results in figure 14. It is segmented by SCAs and MDI bands.

Figure 14. Navy-wide FY 2007 SLU performance assessment

INITIAL SERVICE LIFE USED ASSESSMENT			NAVY-WIDE						
Shore Capability Area	Mission Dependency Index		Critical (5)	Significant (4)	Relevant (3)	Moderate (2)	Low (1)	No Category (0)	Overall SCA P-Rating
	FRV (\$M)	# FAC	37,336	22,949	19,587	16,942	61,361	15,293	173,468
			8,588	8,414	8,063	9,991	46,093	34,158	115,307
Waterfront Ops	6,858	1,750	135	109	100	114	103	111	111
Airfield Ops	17,224	3,291	129	114	97	112	102	116	110
C4I Ops	3,458	2,080	101	106	96	158	107	70	106
Exped Ops	717	312	30	35	49	43	38	0	38
Maint Support	14,990	2,876	130	114	105	102	113	20	119
Ordnance Support	8,467	7,649	90	89	100	109	98	75	100
Training Support	7,027	1,991	77	82	74	74	73	20	75
Supply Storage Support	11,755	6,293	133	117	117	122	128	128	125
Sail or & Family Support	37,934	42,004	70	58	67	74	85	53	86
Medical	4,159	326	101	103	106	110	112	0	108
Base Support	52,491	43,112	129	107	110	106	111	113	115
RDT&E	8,388	3,623	81	72	85	70	79	0	79
Overall	173,468	115,307	117	95	91	99	105	59	100

Although this performance metric does not take into account restoration and modernization of existing facilities, thereby extending their service life, it does indicate that a majority of the current inventory has met or exceeded its initial service life. We were able to ana-

alyze this metric based on facility threshold count as well. Figure 15 provides this display.

Figure 15. Navy-wide FY 2007 SLU facility threshold count

FACILITY SERVICE LIFE USED THRESHOLD COUNT				NAVY-WIDE																				
SHORE CAPABILITY AREA	FRV (\$)	FACILITIES TOTAL	PERCENT OBTAINING EACH THRESHOLD LEVEL												NUMBER OBTAINING THRESHOLD LEVEL									
			0-5	5-10	10-15	15-20	20-25	25-30	30-35	35-40	40-45	45-50	50-55	55-60	60-65	65-70	70-75	75-80	80-85	85-90	90-95	95-100	0-5	5-10
WATERFRONT OPS	685,732	1,750	8	9	10	72										141	163	173	1268	5				
AIRFIELD OPS	17,241,766	3,291	9	13	18	59										238	417	601	1952	28				
CI OPS	3,483,388	2,080	13	14	25	48										274	289	520	988	9				
EXPEDITIONARY OPS	717,154	312	25		23			11	37						4	77	72	34	115	14				
MAINTENANCE SUPPORT	14,989,593	2,876	9	21		17	40						4	267	536	483	1414	106						
ORDNANCE SUPPORT	8,466,804	7,619	5	8	9	78										338	602	689	5961	29				
TRAINING SUPPORT	7,026,882	1,991	16		21		18			44						317	419	381	874	20				
SUPPLY STORAGE SUPPORT	11,755,297	6,283	13	17		14		53						3	801	1,076	889	3322	195					
SAILOR AND FAMILY SUPPORT	37,983,709	4,008	20		11		36				32				8,283	4,802	15,223	13,539	136					
MEDICAL	4,158,987	326	12	16		12		59						39	51	40	192	4						
BASE SUPPORT	52,491,726	4,107	19		18		17			44						8,300	7,771	7,415	18,956	665				
FDI&E	8,337,708	3,623	10	18		17			53						377	681	625	1905	35					
OVERALL	173,468,076	115,307	17		15		23			44						19,487	16,909	27,083	50,576	1,216				

While a large portion of facilities have exceeded their initial service life in all SCAs, ordnance support (78 percent) and waterfront operations (72 percent) have the highest percentages.

## Current age

The final display that we generated was the current age of the facilities, which is shown in figure 16. It is segmented by SCA and MDI band. The number reflects the PRV weighted age in years.

Figure 16. Navy-wide FY 2007 current facility age performance assessment

CURRENT AGE ASSESSMENT			NAVY-WIDE						
Shore Capability Area	Mission Dependency Index		Critical (5)	Significant (4)	Relevant (3)	Moderate (2)	Low (1)	No Category (0)	Overall SCA P-Rating
	PRV (\$M)	# FAC	37,336	22,949	19,587	16,942	61,361	15,293	173,468
Waterfront Ops	6,858	1,750	58	50	48	53	48	39	51
Airfield Ops	17,224	3,291	49	47	40	52	45	38	47
C4I Ops	3,458	2,080	43	42	43	54	39	26	41
Exped Ops	717	312	18	20	25	24	20	-	20
Maint Support	14,990	2,876	62	54	47	45	50	5	55
Ordnance Support	8,467	7,649	48	48	54	60	54	21	55
Training Support	7,027	1,991	39	41	38	37	36	22	37
Supply Storage Support	11,755	6,293	50	48	49	49	54	45	52
Sail or & Family Support	37,934	42,004	35	29	32	34	37	31	33
Medical	4,159	326	31	31	33	33	35	-	34
Base Support	52,491	43,112	52	0	53	53	47	41	49
RDT&E	8,388	3,623	43	40	45	38	42	-	42
Overall	173,468	115,307	50	0	42	48	45	32	45

This analysis shows that the oldest facilities are in the maintenance and ordnance supporting SCAs, which are mostly located on Navy shipyards and Naval magazines. It is important to note that the oldest facilities are also the most critical.

With the baseline year measures identified, we were able to move on to the design of the investment model.

## Basic SFIM design concept

The basic design concept for the model includes five interconnected modules. In order to accomplish the programming analysis, we first developed a baseline inventory reporting system as of the beginning of the POM cycle. Since the CPL measure is an annual measure based on actual results, we needed a separate module to capture this information, translate it into a similar IFOM metric, and feed it into the baseline reporting module. This then allowed us to produce comprehensive IFOM analyses for the baseline year.

The future impact module assesses the impact of alternative proposed investment projects and funding streams upon the baseline inventory, and it forecasts the potential performance state of the inventory at the end of the FYDP. It generates quality points for each of the four quality metrics of condition, configuration, capacity, and capability performance level for each facility impacted by a proposed project. The model uses the project funded amount allocated to each of the facilities impacted which is then divided by the PRV of the facility to estimate the quality impact for that facility. The module then aggregates these quality points to project the detailed impact by fiscal year throughout the FYDP based on the proposed COA project listing.

The Navy also requested a longer and broader view of potential performance measures for a period of 20 years beyond the FYDP. This time frame matches up the current shore strategic planning cycle. Since project lists only exist for the six year FYDP period, funding levels only could be used, which results in less precise forecasts. This long-range forecasting tool is a separate module that provides a different and longer range forecast, but with a similar analysis technique and modeling approach as the future impact module.

The final force loading module provides a basis for investment risk analysis to help answer the “so what” question relating to adjustments

in investment levels at different locations. We initially looked at prioritizing installations, but this installation ranking information doesn't currently exist and would be very difficult and time consuming to produce. Therefore, we determined that this module would advise the number and type of commands that are located at an installation along with the number of authorized manpower billets by labor type for the baseline year. These installation force loading profiles should be helpful in informing the leadership of the true mission impact of facility investment decisions upon Navy units. The force loading module is intended to be a supplemental programming tool to quickly determine the basic Navy mission importance of each installation in light of the proposed investment.

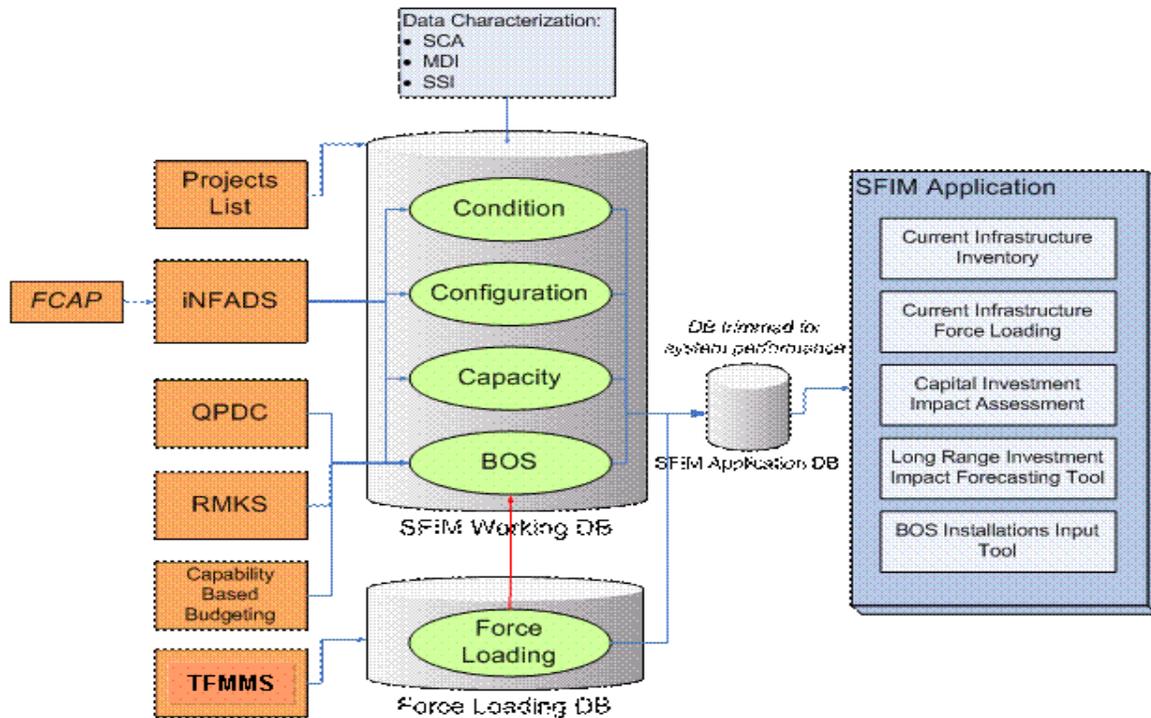
Our criteria for programming design was that the model had to be flexible and reasonably adjustable since we were producing the business rules for conducting the programming while at the same time designing the information output reports. We used Java front end processing with a MS Access based data structure for the first version of the model. Although historical data capture will eventually require more robust data storage capability, the above combination allowed for the greatest flexibility and shortest developmental period for the model. This design solution can operate behind the Navy's firewall and with existing software at no additional annual operating support costs. We used existing data that were reported by Navy certified data repositories, because the amount of information and the timeline precluded developing data calls to the field. Finally, the system is reasonably fast in producing displays and allows for multiple users with restricted user access.

## Overall layout

The overall system design layout can be seen in figure 17. We identified six major Navy data repositories from which to pull information into the SFIM application. We ended up with three distinct databases within MS Access. The first is the facilities inventory database, which contains the basic infrastructure information. The second contains the force loading information of units and billet authorizations at each installation. The final database is a SFIM applications data store

that contains all the supplemental information needed to manipulate the information and produce information displays.

Figure 17. Navy-wide FY 2007 current facility age performance assessment



The SFIM application has five interconnected modules that produce different information outputs. They are the baseline development section which has:

- A current infrastructure inventory module
- A BOS installations input tool module

The future assessment section has the following modules within it:

- A capital investment impact assessment module
- A long range investment impact forecasting tool module

The final section is the risk assessment portion, which has one module:

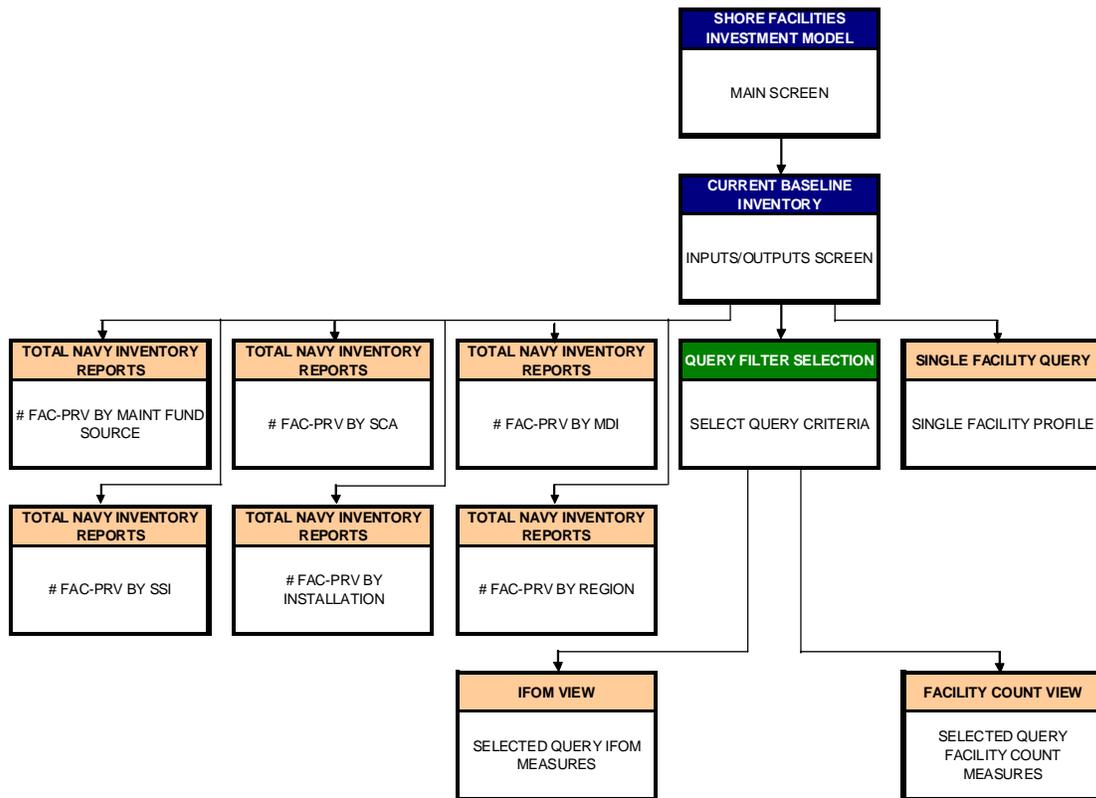
- A current infrastructure force loading module

We discuss these modules in detail below.

## Current baseline infrastructure inventory

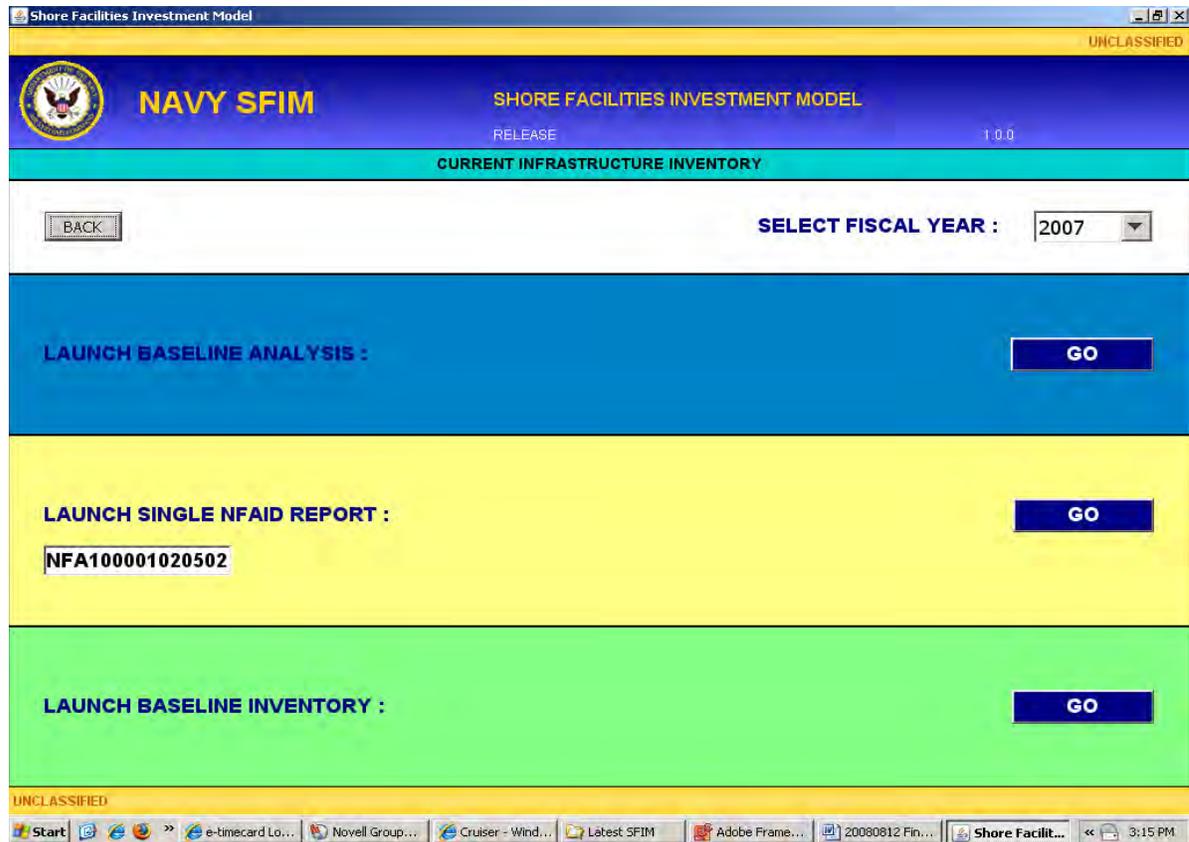
Each SFIM module is accessed via a main selection screen that directs the user to a main control screen for that specific module. Figure 18 provides a functional block diagram of the current baseline inventory module.

Figure 18. SFIM baseline inventory module functional block layout



The input/output control screen is shown in figure 19. It is divided into four basic sections.

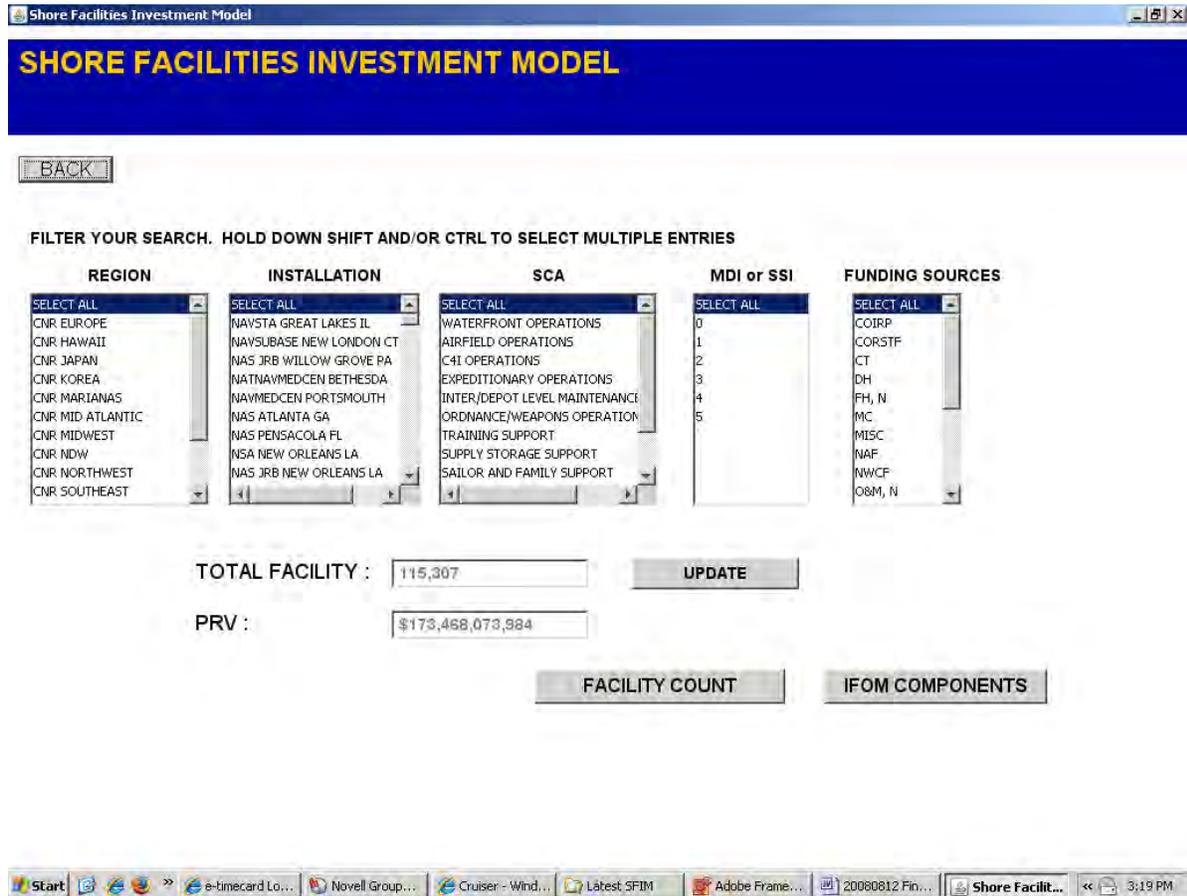
Figure 19. SFIM baseline inventory main control screen



The first section allows the user to select the baseline inventory year to be used. Our first year was FY 2007. However we had to be able to shift to additional baseline years as a new baseline is loaded into the model each year.

The next section directs the user to the current baseline year analysis section. Figure 20 provides a view of the query filter selection screen.

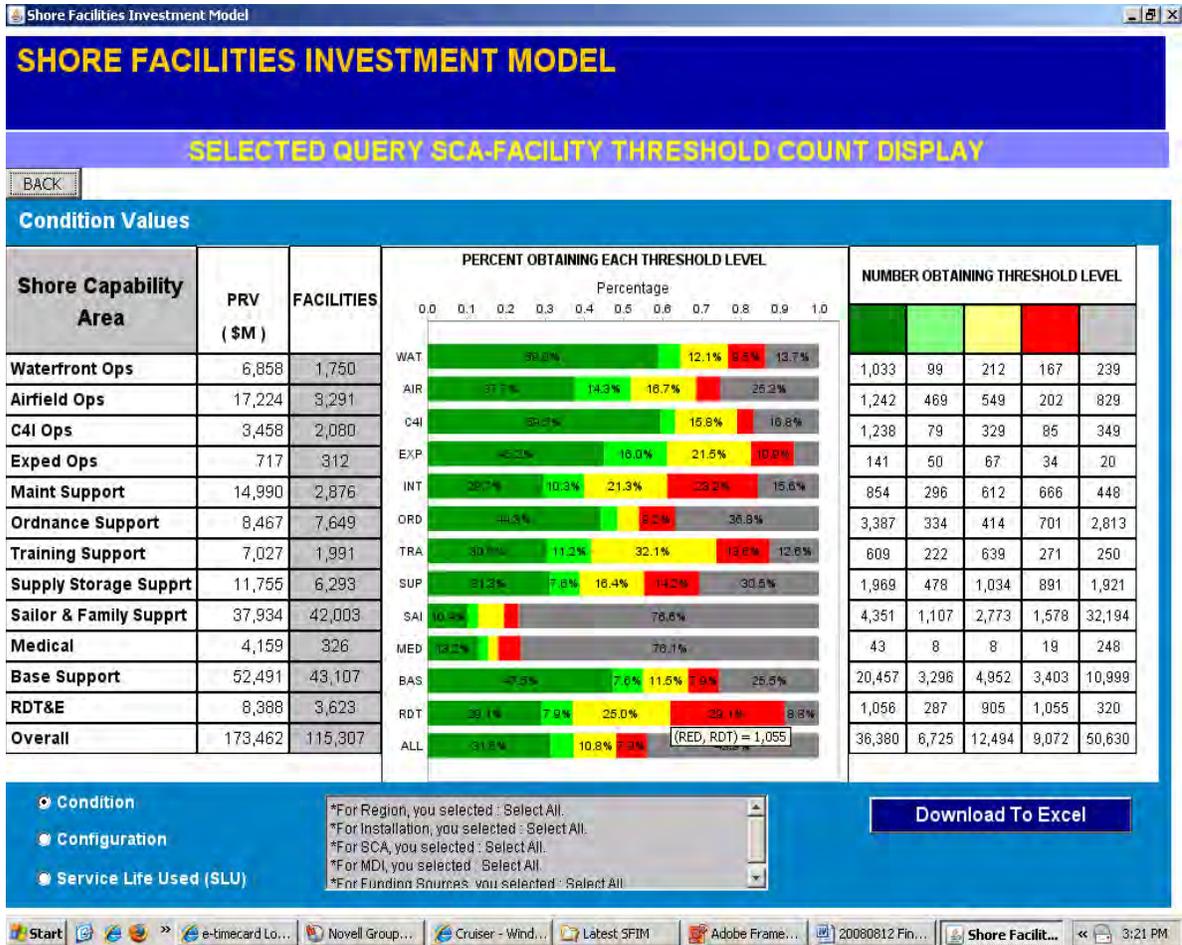
Figure 20. SFIM baseline inventory query filter selection screen



The user selects the segment of inventory that is desired by highlighting the filtered selection choices and then selecting the update button. This then renews the total facility count and PRV value for the selected query. The user has two choices for output display reports. Selecting either the facility count or IFOM components brings up

each family of reports. Figure 21 provides an example of the facility count report family.

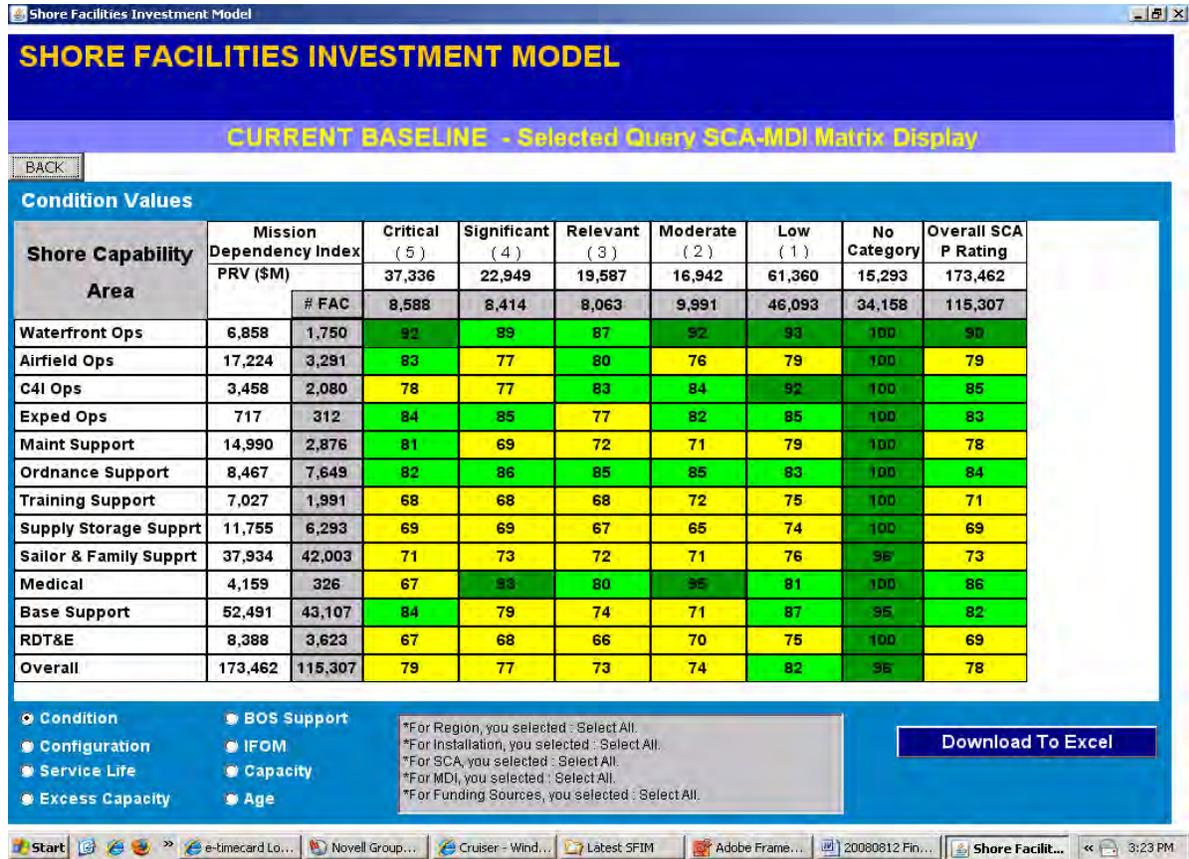
Figure 21. SFIM baseline inventory facility count report screen



This display report provides the percent and count of facilities within each of the threshold bands for condition, configuration, and SLU by SCA for the filtered portion of the inventory shown in the gray box. Clicking each of the radio buttons on the bottom left hand corner will show the same report for each of the metric areas. The download to Excel button is on all report screens and allows for the transfer of the report raw data to MS Excel spreadsheets.

The other display option is for the IFOM component report family. Figure 22 provides an example of this display.

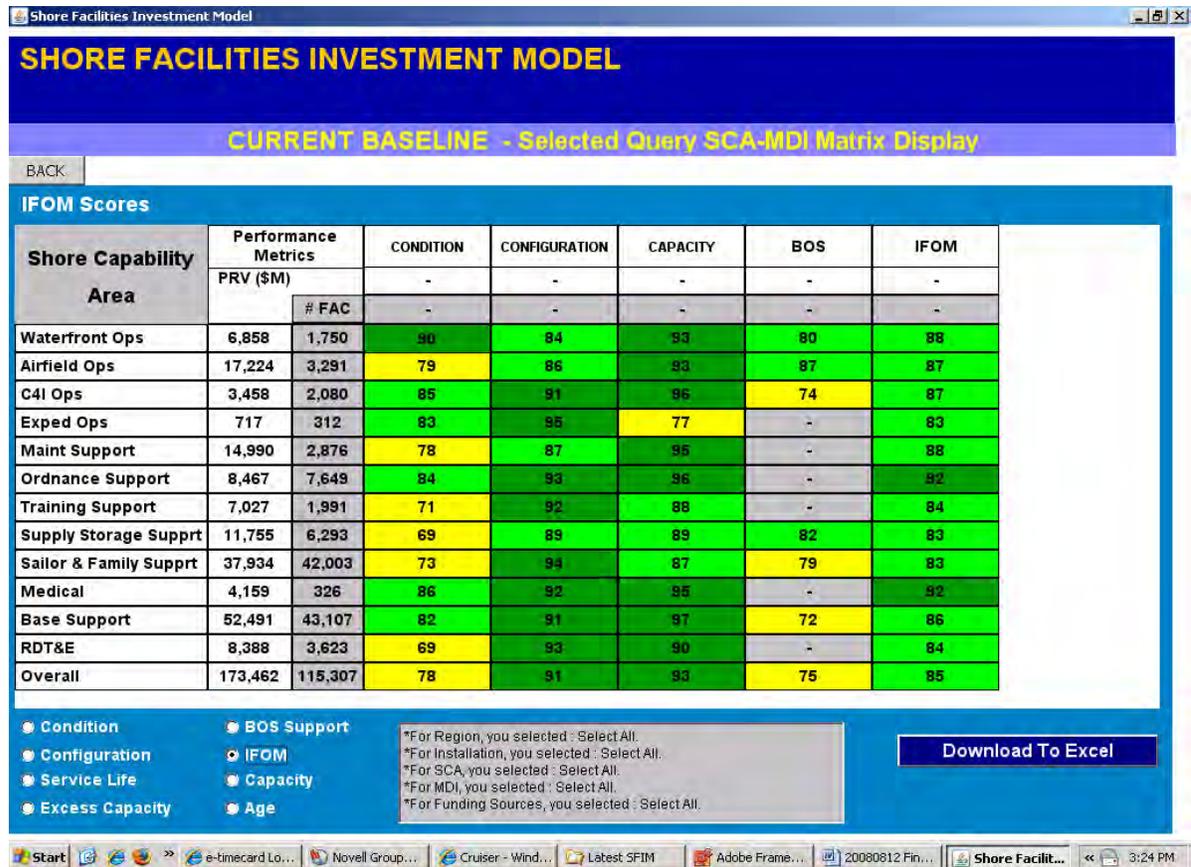
Figure 22. SFIM baseline inventory IFOM component report screen



This display provides the IFOM measure results by SCA and MDI or SSI category for the query that is listed in the gray box. The basic display structure remains the same as the user scrolls through each of the reports by clicking on the appropriate radio button. The user's choices include each of infrastructure performance metrics (condition, configuration, capacity, CPL support, excess capacity, SLU, and age). The IFOM display is different in that it does not have MDI or SSI across the top but lists the overall SCA ratings and the resultant

IFOM performance score for each SCA. Figure 23 provides an example of this report.

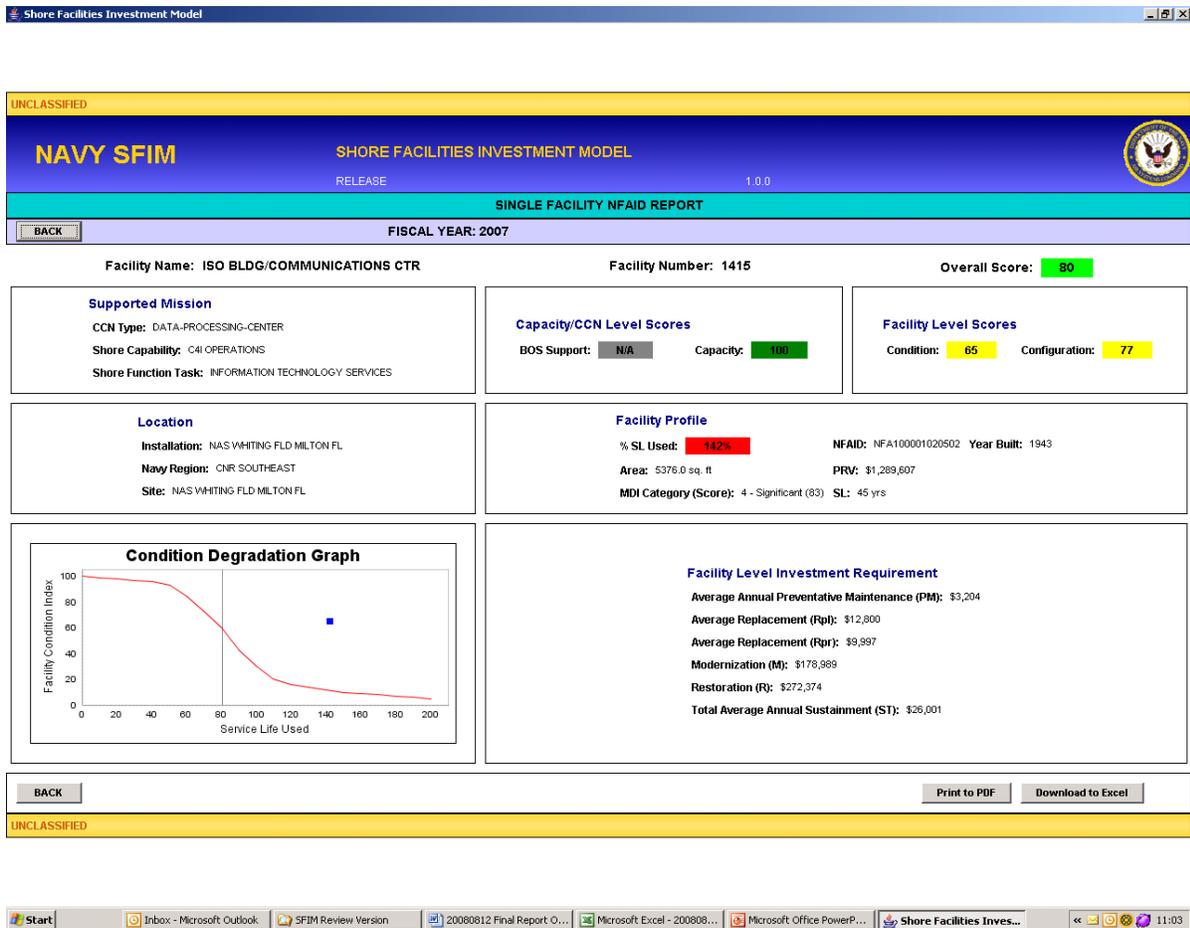
Figure 23. SFIM baseline inventory IFOM report screen



Returning to the main control screen, the next section allows the user to enter a single facility by its unique Navy facilities asset identification

(NFAID) number and view a profile for just that facility. Figure 24 provides an example of a single facility profile report.

Figure 24. SFIM baseline inventory single facility profile screen



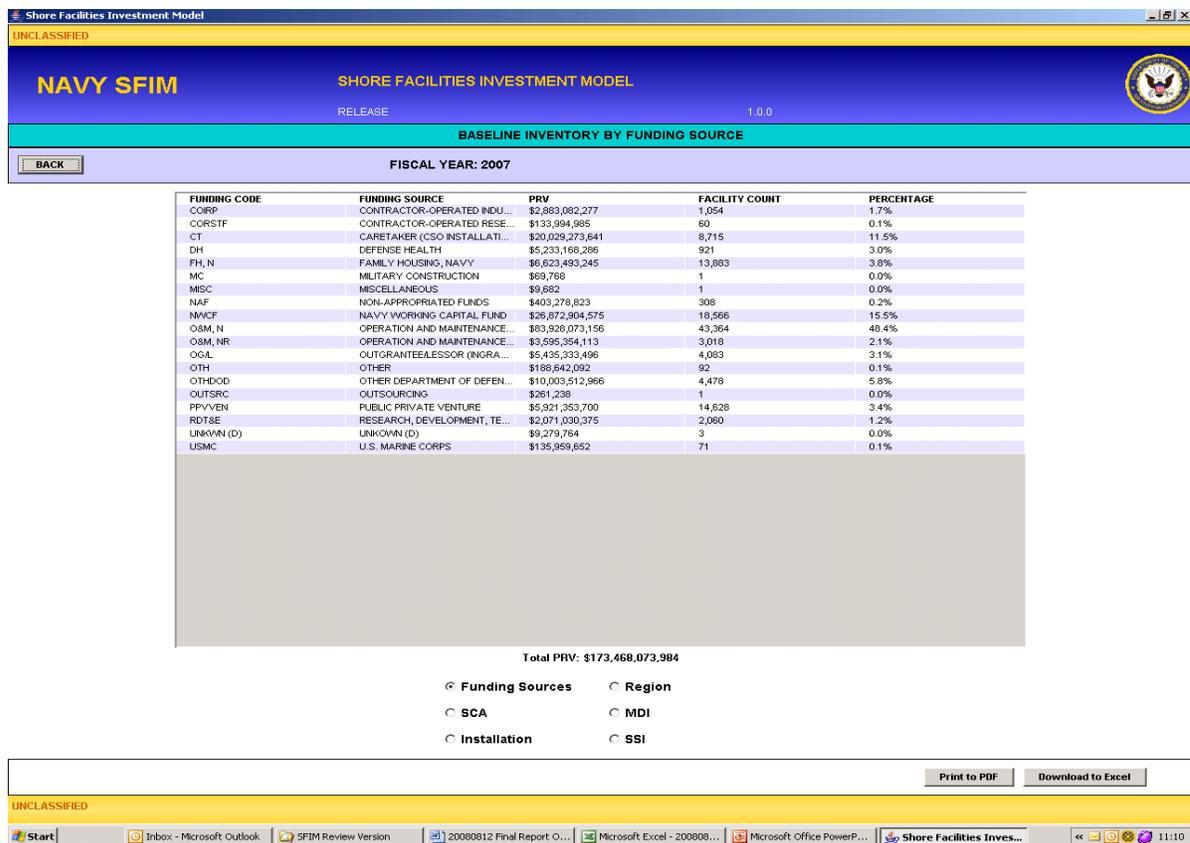
The profile provides basic information about the facility and plots the condition index and SLU on a condition degradation graph to show what its current position is relative to a standard degradation curve.

The final section of the main control screen launches a series of six standard reports that provide basic baseline information on a number of facilities and total PRV by:

- Region
- Installation
- SCA
- MDI
- SSI

These reports, which we include for general reference, are static, and they are generated at the beginning of each programming cycle. Figure 25 provides an example of this type of report.

Figure 25. SFIM baseline inventory structure standard report screen

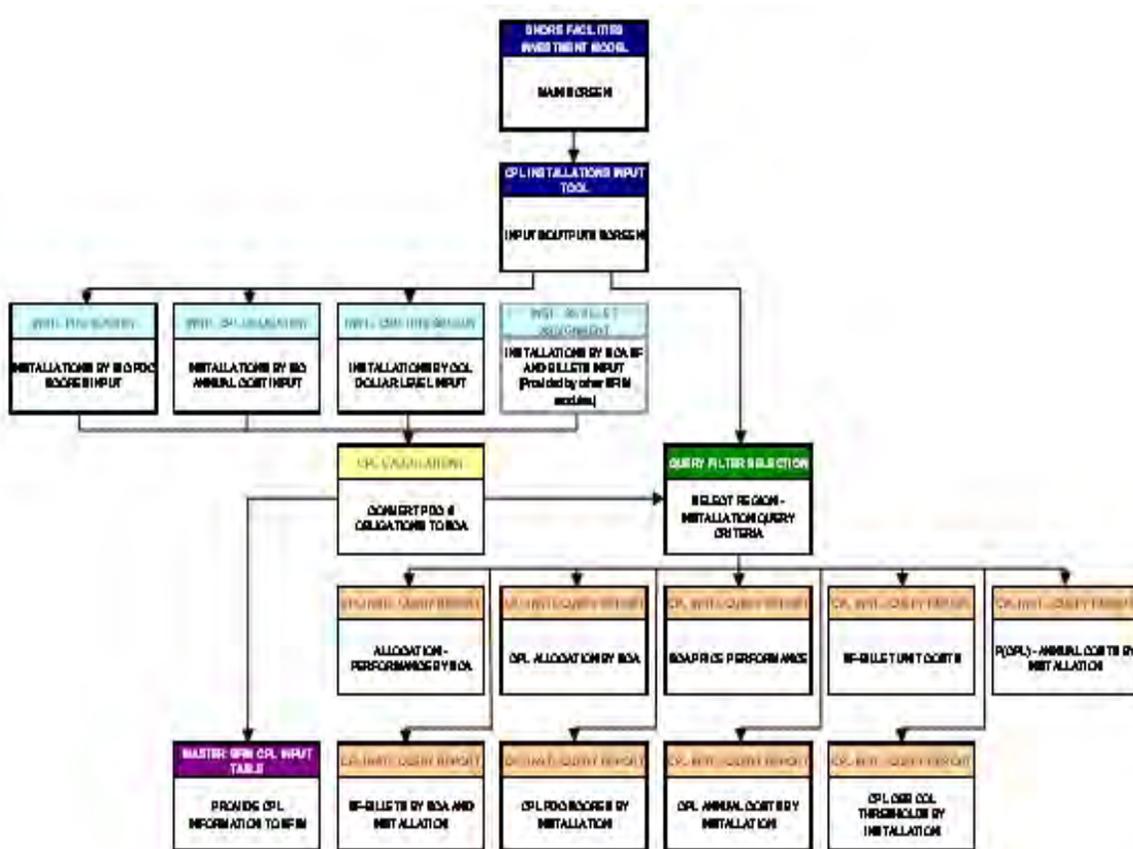


The report structure remains the same as different user choices are selected via the radio buttons on the bottom. The display changes to show the PRV and facility count for each of the selections. This module needs the actual CPL or CPL results to produce the IFOM performance rating, which must come from the CPL installations input module since the information is not included in the basic facilities data sources.

## CPL installations input tool

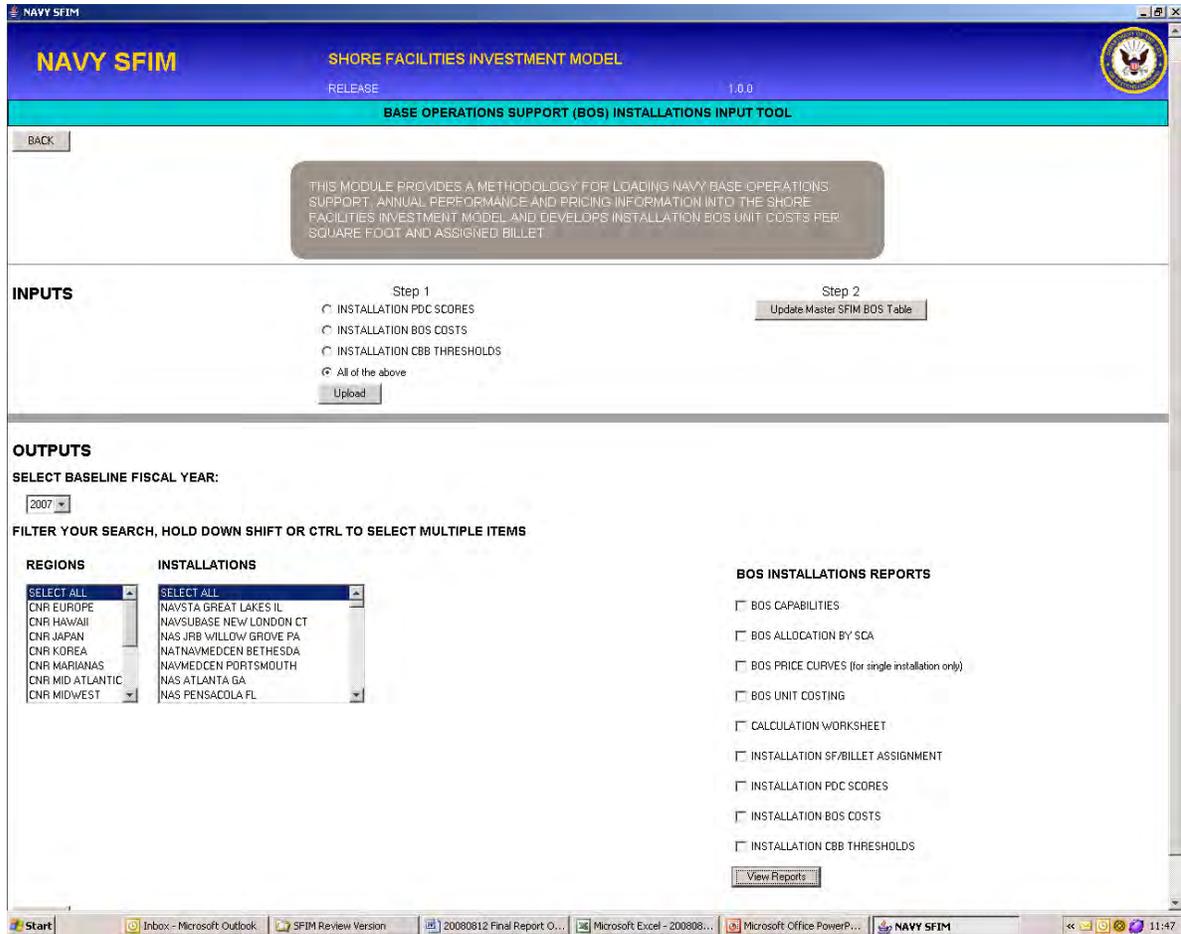
The CPL (also referred to as base operating services) installations input tool module is also accessed through the main selection screen. Figure 26 provides a functional block diagram for the module.

Figure 26. SFIM CPL installations input module functional block layout



The first functional block is the module control screen, which is shown in figure 27.

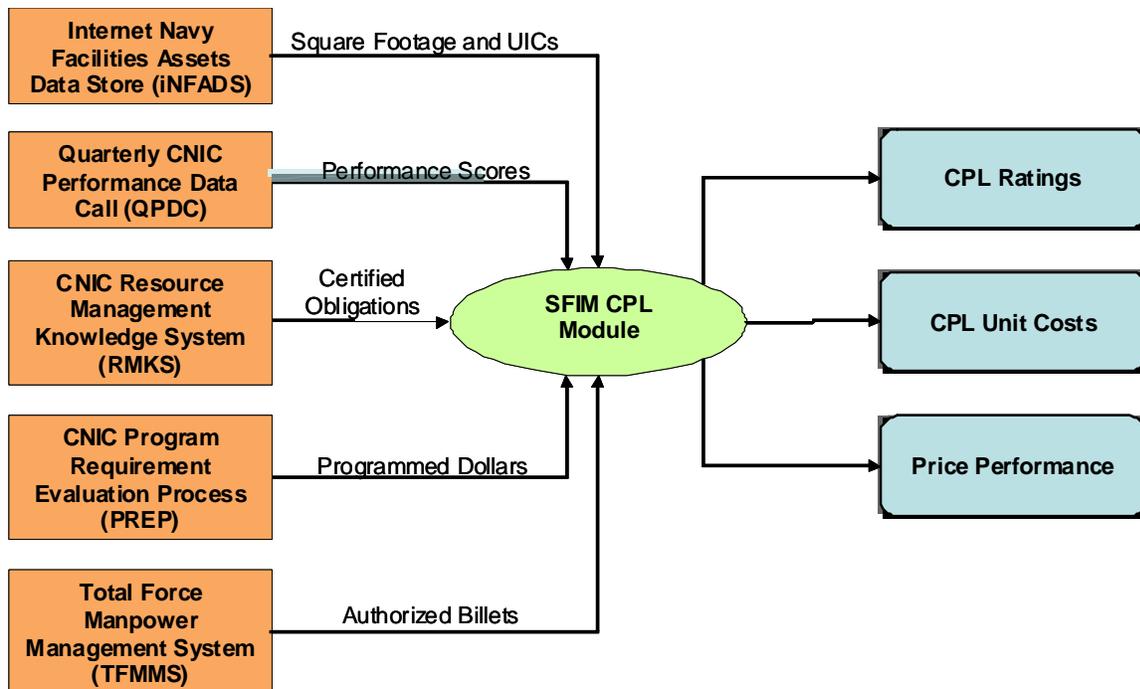
Figure 27. SFIM CPL installations main control screen



The main control screen is divided into input and output sections. The input section allows the user to select the input tables to load with new fiscal year information at the beginning of each fiscal year. Again the primary purpose of this module is to input source data to generate the actual CPL metric for the baseline year since it is not calculated anywhere else. Currently only FY 2007 certified information has been entered. After each of the three input tables are up to date,

step 2 is to update the SFIM master data files so that the current information can be accessed by the other modules. Namely, the current infrastructure inventory module is the primary recipient of this information. This is only done once at the beginning of the investment cycle and not again until the following year. Figure 28 provides a diagram of the input sources and types of outputs generated for this module.

Figure 28. SFIM CPL installations input tool system diagram

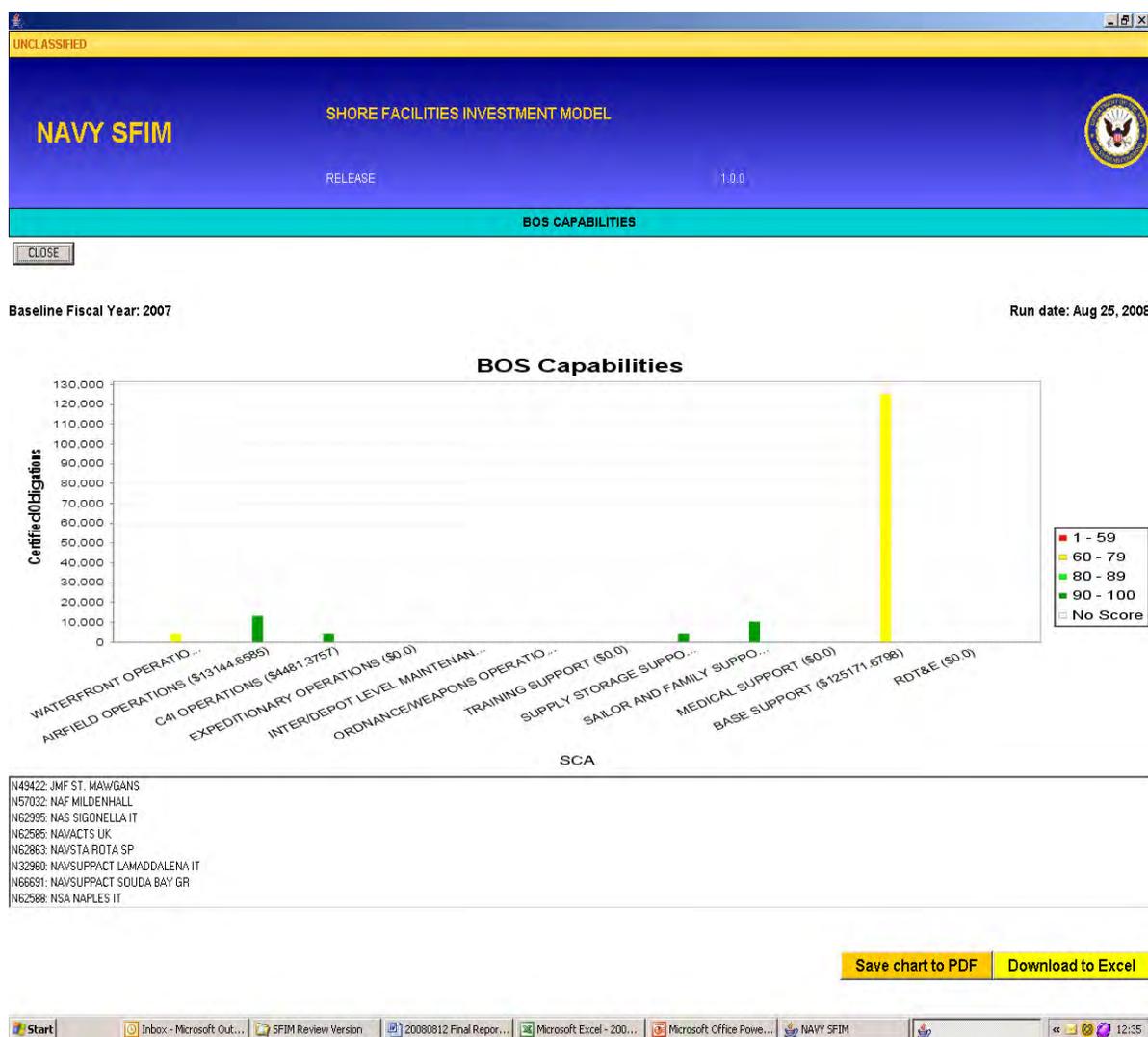


The primary function of this module is to produce the master SFIM CPL input table each year. However, we added some additional management reporting capability to assist with higher level analyses. This output section allows for selection of the baseline fiscal year (the model currently only contains FY 2007 information). It also has a query filter that allows the user to produce the reports by region or installation. There are nine query-based reports that are available as

outputs to help with the analysis of CPL data. A query report is generated by first selecting the region and/or installation and then clicking on the square selection box. The desired report can then be selected from the listing on the right side of the screen.

The first query report listed is the CPL capabilities display. Figure 29 provides a sample report display.

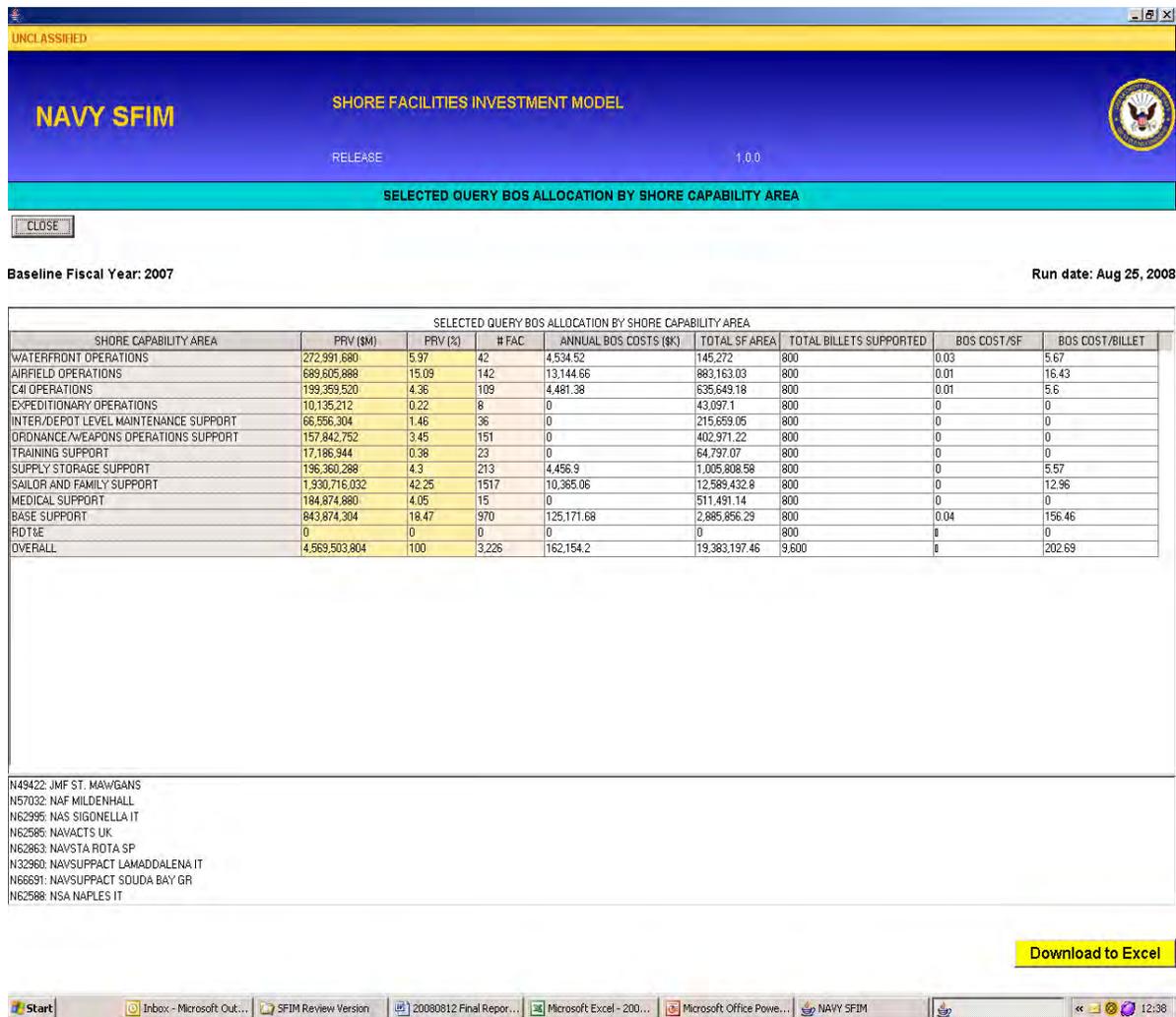
Figure 29. SFIM CPL installations capabilities report screen



This display shows the total obligations by shore capability area along with the IFOM CPL threshold results for that SCA. The scope of the query is shown in the text box located underneath.

The next query report provides the CPL allocation by SCA summary. Figure 30 shows an example of this report.

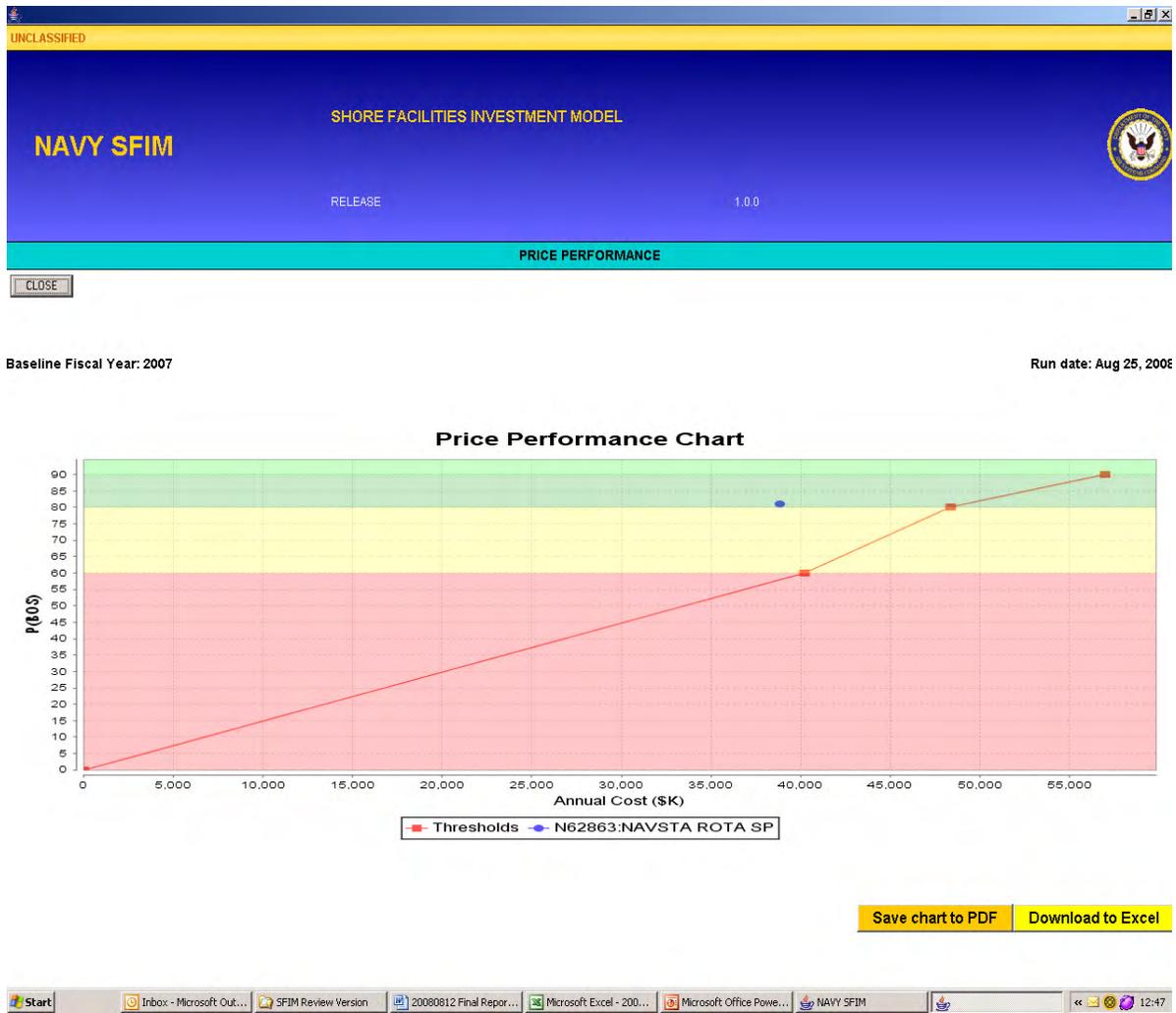
Figure 30. SFIM CPL installations allocation by SCA summary report



This report calculates the unit costs of CPL obligations for both the total square footage and the total authorized billets for the selected query.

The next query report generates CPL price curves, and can only be done for a single installation at a time. Figure 31 provides an example of this report.

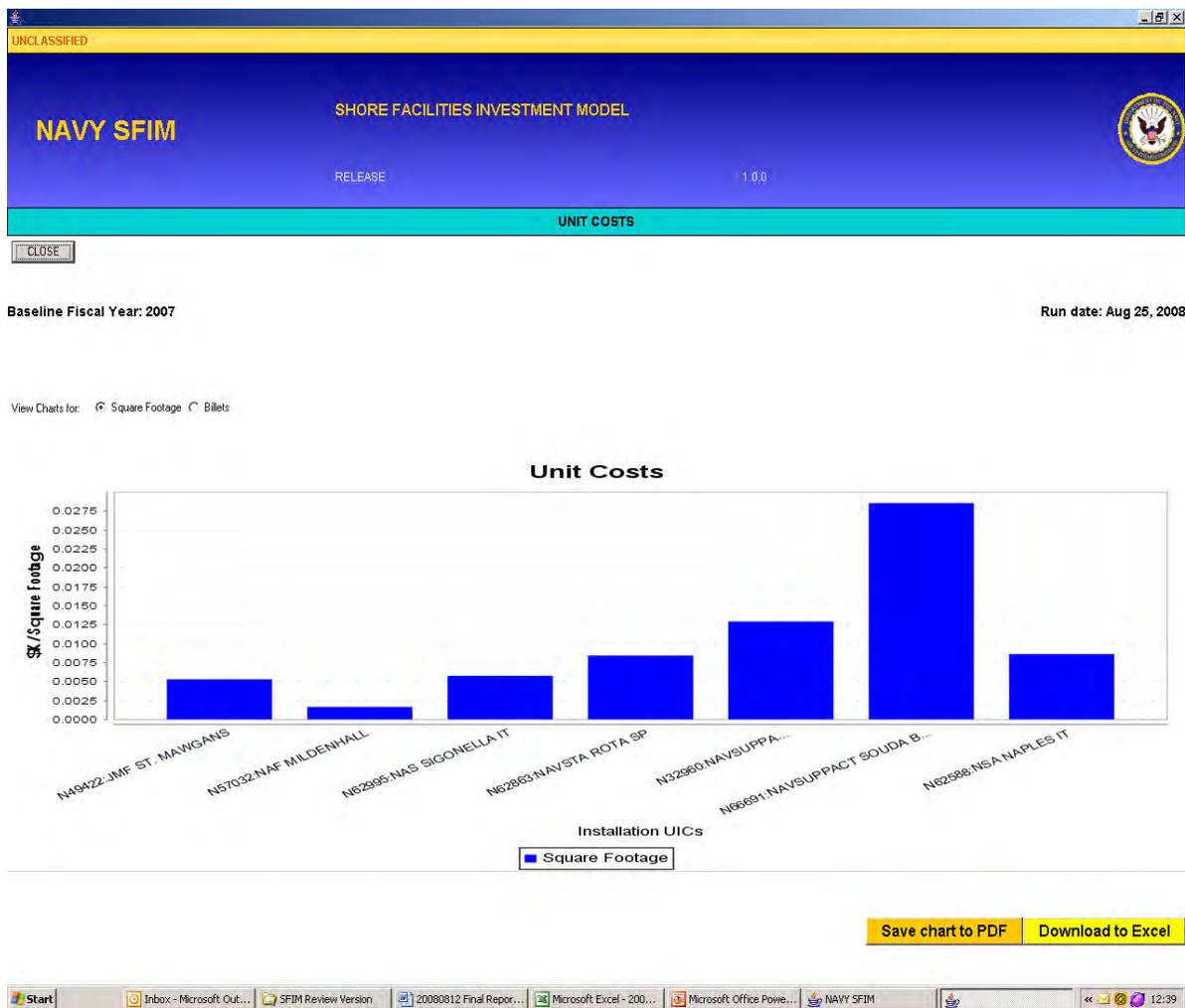
Figure 31. SFIM CPL installations price curve report



This chart plots the overall CPL actual annual cost and performance rating achievement in comparison to where the capabilities based budget (CBB) threshold attainment levels were established for that installation. It allows feedback to measure the accuracy of the previous budget cycle projections for price performance.

The next query report is the CPL unit costing display. Figure 32 provides an example of this information.

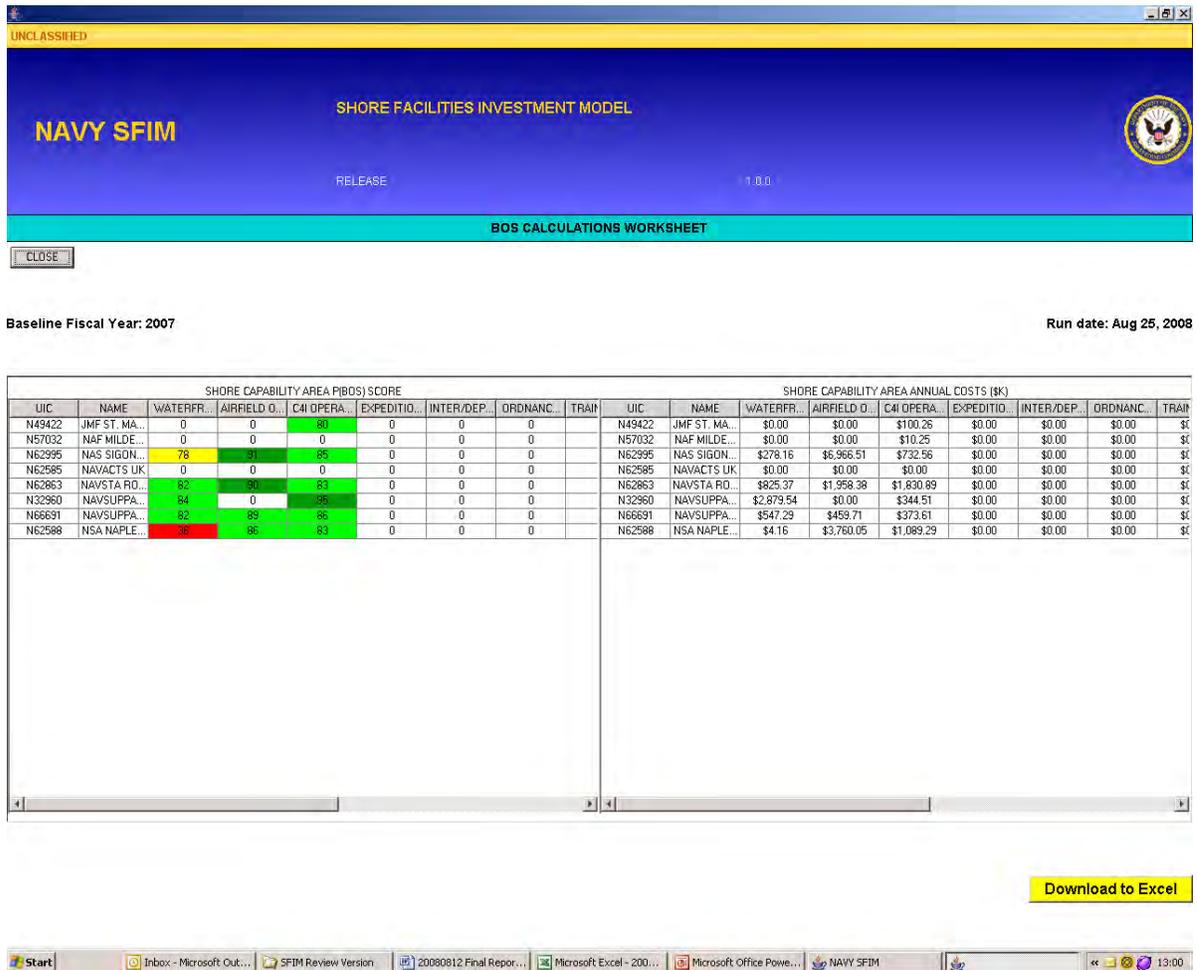
Figure 32. SFIM CPL installations unit costing display report



This display allows for a direct comparison between installations for their CPL unit costs by both square feet and authorized billets. Bars are generated equal to the number of installations selected within the query.

The next query report that the user can select is the calculation worksheet summary, which provides a table of CPL values that have been provided to the other SFIM modules as input. Figure 33 shows a section of this report. Since these reports are large, the tables have scroll bars built into them.

Figure 33. SFIM CPL installations calculation worksheet summary



This report allows for the direct comparison by SCA of the performance results to the total CPL obligations for each of the selected installations.

The next report is the installation by square feet (SF)/billet assignment view. Figure 34 provides a partial view of this screen display.

Figure 34. SFIM CPL installations SF/billet assignment report



Baseline Fiscal Year: 2007

Run date: Aug 25, 2008

TOTAL SQUARE FOOTAGE									TOTAL BILLETS								
UIC	NAME	WATERFR...	AIRFIELD O...	CAI OPERA...	EXPEDITIO...	INTER/DEP...	ORDNANC...	TRAI	UIC	NAME	WATERFR...	AIRFIELD O...	CAI OPERA...	EXPEDITIO...	INTER/DEP...	ORDNANC...	TRAI
N49422	JMF ST. MA...			184,634					N49422	JMF ST. MA...	100	100	100	100	100	100	1
N57032	NAF MILDE...		3,499						N57032	NAF MILDE...	100	100	100	100	100	100	1
N62995	NAS SIGON...	46,995	416,156	83,778.98	1,813	99,682	224,237	46.8	N62995	NAS SIGON...	100	100	100	100	100	100	1
N62863	NAVSTA RD...	49,027	166,121.03	118,073.08	41,284.1	108,675.05	111,442	13.6	N62863	NAVSTA RD...	100	100	100	100	100	100	1
N32960	NAVSUPPA...	322		450		216			N62863	NAVSTA RD...	100	100	100	100	100	100	1
N66691	NAVSUPPA...	0	85,149	9,448		4,689	65,816	4	N32960	NAVSUPPA...	100	100	100	100	100	100	1
N62586	NSA NAPLE...	48,928	212,238	239,265.12		2,397	1,476.22		N66691	NAVSUPPA...	100	100	100	100	100	100	1
									N62586	NSA NAPLE...	100	100	100	100	100	100	1

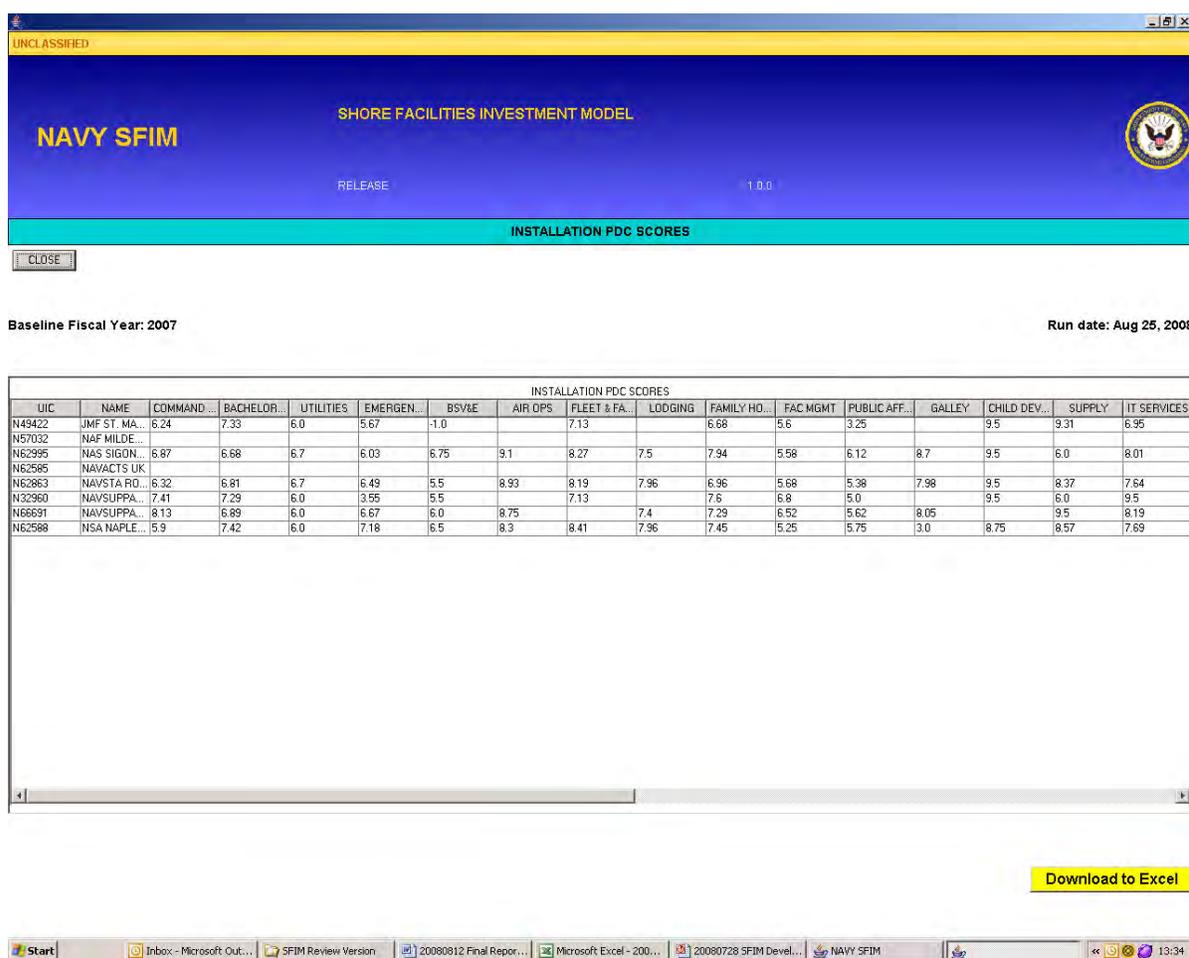
Download to Excel



This summary report provides the total building square footage and total authorized billets supported by SCA for the selected query.

The next query based report is the installation performance data call (PDC) scores. Figure 35 provides an example of this report.

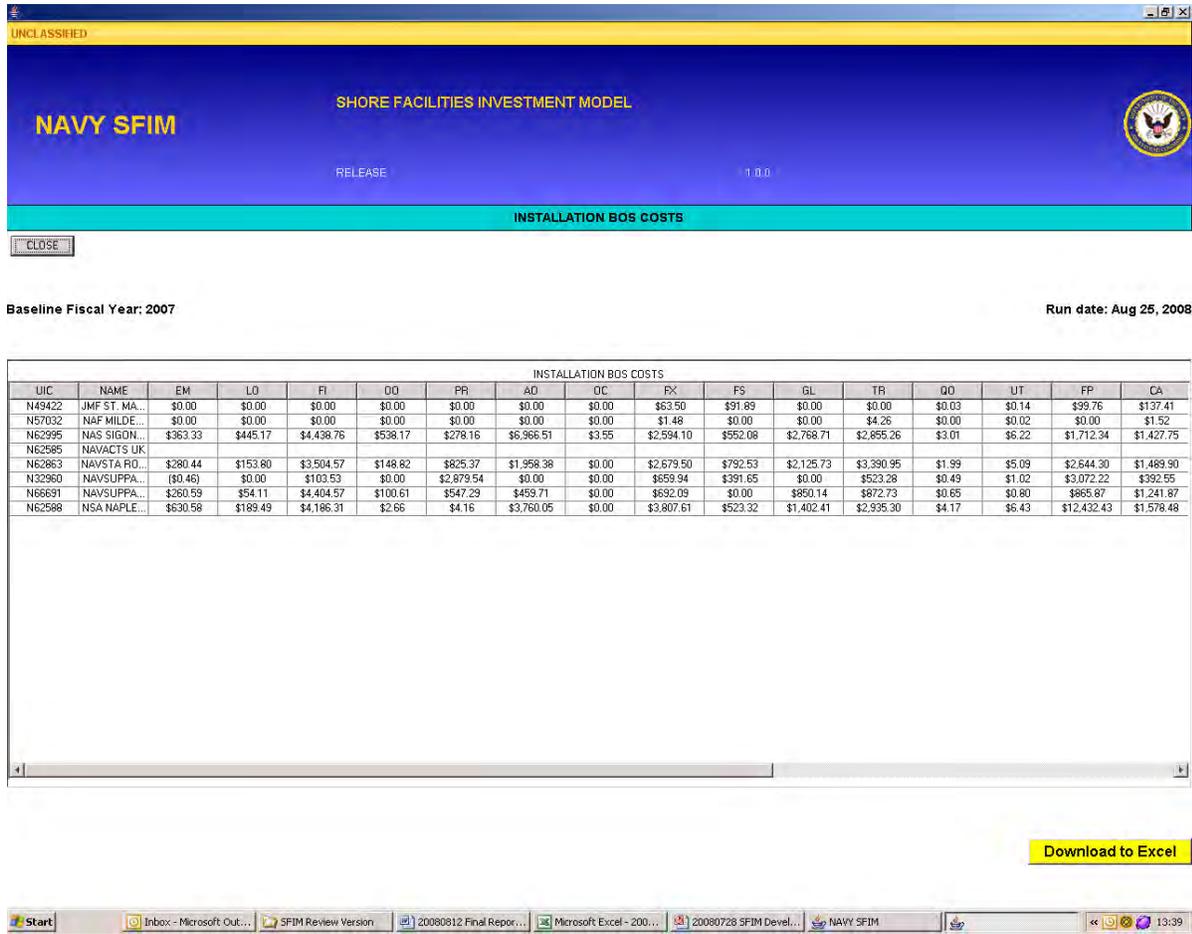
Figure 35. SFIM CPL installations PDC score report



Since there is a large number of PDC categories, the user must utilize the scroll bar on the bottom of the display to see the remaining entries. This summary report provides the actual raw PDC quality performance ratings as submitted by the installations.

The next query based report is the installation CPL annual obligations summary. Figure 36 provides a sample of this report display.

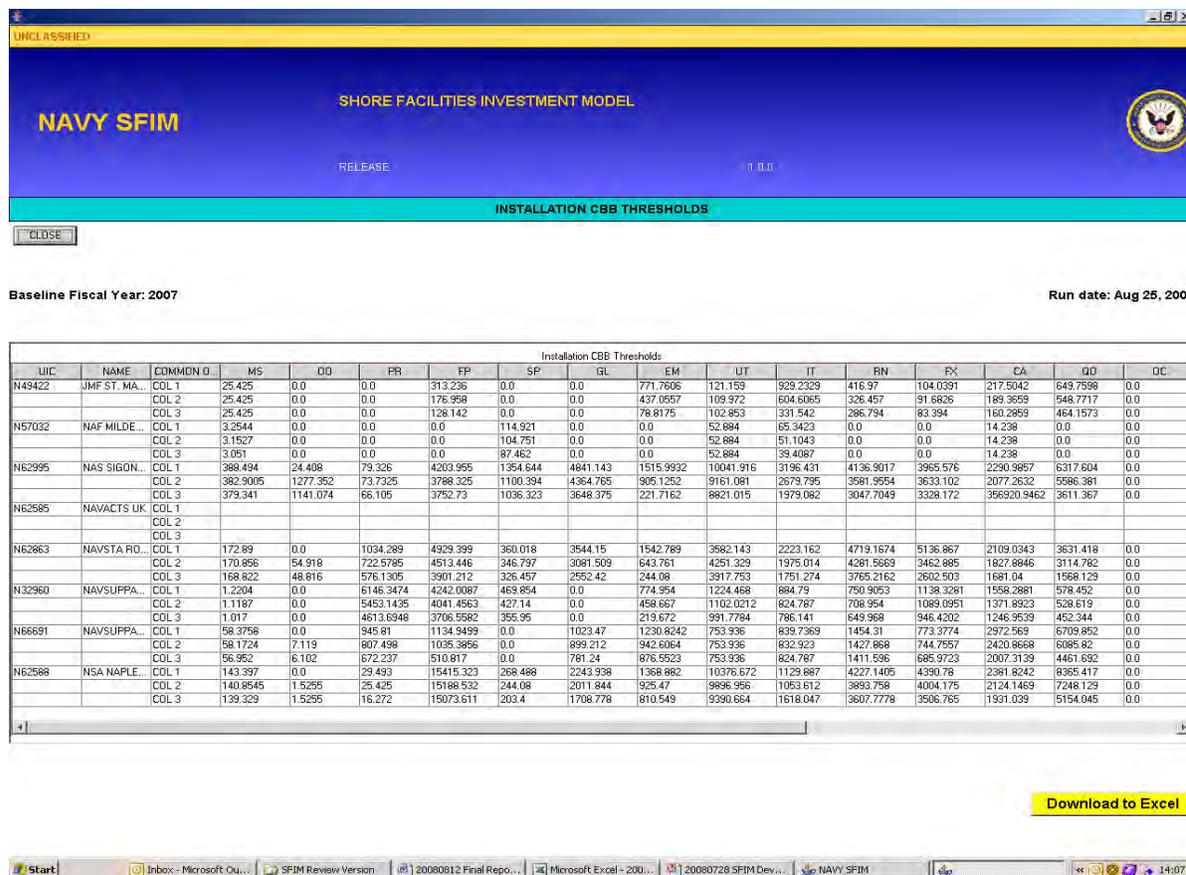
Figure 36. SFIM CPL installations annual obligations report



This report provides the actual CPL obligations by special interest code (SIC) as found in the installations core business model for the selected query. These are the basic input information data elements that are then mapped to SCAs.

The final query-based report is the installation CBB price performance annual inputs. Figure 37 provides an example of this report display.

Figure 37. SFIM CPL installations CBB report



This report is very large and sometimes requires use of scroll bars in both directions. The summary provides the projected funding required for reaching the COLs for every SIC at each of the selected query installations. This information is used to generate the projected price performance curve in the earlier report.

This completes our discussion of the CPL installations input tool module.

## Capital investment impact assessment

The capital investment impact assessment module is the heart of the model. It has three databases and two support generator applications. The total investment dataset of military construction, special projects, and demolition projects are entered into a master project database. This also includes a facility impact table that lists all of the facilities that are impacted by a project and the extent to which they are affected. Each facility has a breakdown of how much of the project current working estimate (CWE) value is used for new footprint, restoration and modernization, and demolition for that facility. It also has the square footage of floor space impacted in each of these categories if the facility unit of measure is in SF. Typically buildings are measured in SF and structures have other measures such as square yards, linear feet, gallons, etc.

There is a total obligation authority (TOA) funding level database that captures the proposed funding levels in each of the investment areas for each proposed COA. The third database captures the proposed project investments as a COA and stores these different investment scenarios. The support generator application included a demand signal scoring generator as well as an optimizer application<sup>11</sup> that picks projects based upon the funding available and the contribution to the value of the IFOM output measure. The module produces the anticipated IFOM impact based on the investment COA project profile and funding allocations. These results can then be evaluated as to whether they are risk acceptable or not, and alternative funding levels and project mixes can be explored. The capital investment impact assessment module is also accessed through the

---

11. The current optimizer used by the Navy is an advanced iterative matrix solver (AIMS) COTS business software. It optimizes the quality improvement to shore capability areas at the end of the FYDP to the amount of the investment dollars by adjusting the mix of military construction, special projects, and demolition projects that are available for programming.

main selection screen. Figure 38 provides a view of the initial input/output screen.

Figure 38. SFIM future capital investment impact entry screen

UNCLASSIFIED

**NAVY SFIM** SHORE FACILITIES INVESTMENT MODEL  
RELEASE 1.0.0

**FUTURE CAPITAL INVESTMENT IMPACT ASSESSMENT**

BACK

THIS MODULE PROVIDES FOR THE BALANCING OF INFRASTRUCTURE CAPITAL INVESTMENT ACCOUNTS BASED ON ASSESSMENTS OF ALTERNATE SCENARIOS USING AVAILABLE FUNDS AND ANTICIPATED INVENTORY QUALITY IMPACT RESULTS THROUGHOUT THE FYDP.

**GENERATE A REPORT**

INPUT: POM: POM-10 COA: 0 - FY08 PROGRAM Baseline Year: 2008

SPECIAL PROJECTS		MILITARY CONSTRUCTION		DEMOLITION	
# of Projects	Total CME (\$K)	# of Projects	Total CME (\$K)	# of Projects	Total CME (\$K)
33	211,057	60	1,148,512	56	74,479

OUTPUT: Select a Report: IFOM Assessment View Go

**MANAGE DATA**

Available TOAs:

- 0 - FY08 PROGRAM
- 1 - FY09 PROGRAM
- 2 - PROGRAM OF RECORD
- 3 - OPTIMIZED LIST
- 4 - N4 ASSESSMENT
- 5 - FULL REQUIREMENT
- 6 - SPP
- 7 - T-POM
- 8 - NAVY POM

POM: POM-10

- Create a New TOA
- Delete Selected TOA
- Edit Selected TOA

Go

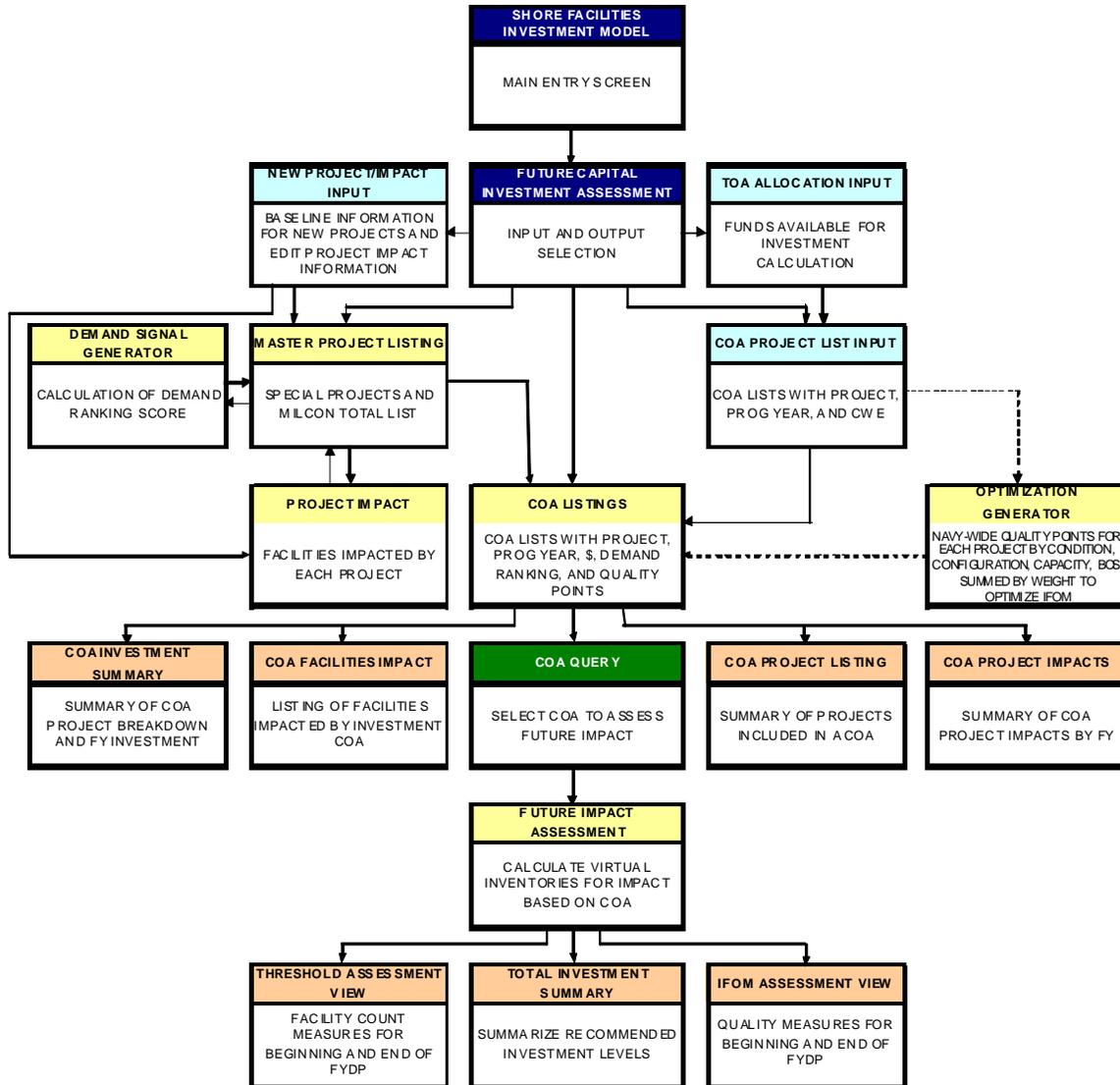
TOA POM Projects COA

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The screen is segmented into two sections. The first allows for the generation of various reports based on the POM cycle selected and COA scenario. The bottom section is for managing the data input into the module. New entries can be added, edited, or deleted. It has four tabs located at the bottom to select between TOA, POM, projects or COAs. for COA queries that can generate specific inventory impact

reports related to each COA. Figure 39 provides a functional block diagram for the module.

Figure 39. SFIM capital investment impact assessment functional block layout



This module is the most complex of the different applications that make up the SFIM. At the beginning of the fiscal year all pending military construction projects, special projects, and demolition projects are loaded into the master project listing. Figure 40 displays the typical entries that are made for each project.

Figure 40. SFIM capital investment impact new project input

FIELD	ENTRY
PROJECT ID	3752
SOURCE TYPE	SP
PROJECT NO	RMD9-08
PROJECT TITLE	CONSTRUCT BARRIERS AT CENTREX BUILDING
PROJECT LOCATION	SUBASE KINGS BAY GA
PROJECT SCOPE	CONSTRUCT CRASH BARRIERS, LAMINATED GLASS, AND HARDENED DOORS.
FUNDING SOURCE	OMN RM
PRIME USE CAT CODE	13140
DOD SITE	154
TOTAL CWE (\$K)	\$438
DEMAND RANKING	0.10123
SHORE CAPABILITY AREA ID	4
INSTALLATION UIC	N42237
TOTAL NEW FOOTPRINT (SF)	0
TOTAL RESTORATION (SF)	11,347
TOTAL DEMOLITION (SF)	0
ENTERPRISE CODE	USE
PROGRAM SHORT TITLE	FORCE PROTECTION

At the same time that a project is loaded into the master project listing, the individual facilities that are impacted by the project are also loaded. Figure 41 provides a sample of the information that is loaded for each facility. Some projects only impact one facility, while other

projects can affect numerous facilities. After a project is loaded into

Figure 41. SFIM capital investment impact new project facility impact input

FIELD	ENTRY
FACILITY IMPACT ID	3679
PROJECT ID	3752
FACILITY ID	NFA100000928525
FAC NEW FOOTPRINT CWE (\$K)	\$0
FAC RM CWE (\$K)	\$438
FAC DEMO CWE (\$K)	\$0
FAC NEW CONST (SF)	0
FAC RESTORATION (SF)	11,347
FAC DEMOLITION (SF)	0

the master project listing, the demand signal can be calculated using

the demand signal generator. Figure 42 shows the control screen for this application.

Figure 42. SFIM capital investment impact demand signal generator

**Project Demand Signal Ranking Generator** (UNCLASSIFIED)

**NAVY SFIM** SHORE FACILITIES INVESTMENT MODEL

RELEASE 1.0.0

**PROJECT DEMAND SIGNAL RANKING GENERATOR**

Baseline POM: Input Date: Sep 18, 2008

PROJECT ID NUMBER: 1338  
 PROJECT NUMBER: P156  
 PROJECT TITLE: E-2 ADVANCED HAWKEYE RDT&E FACILITY  
 PROJECT LOCATION: NAS PATUXENT RIVER MD

THIS MODULE GENERATES A NAVY-WIDE DEMAND SIGNAL RANKING BASED ON STRATEGIC ALIGNMENT, GUIDING PRINCIPLES, MISSION DEPENDENCY INDEX, AND INFRASTRUCTURE FIGURE OF MERIT VALUES FOR EACH PROPOSED CAPITAL INVESTMENT PROJECT.

STRATEGIC ALIGNMENT/GUIDING PRINCIPLES	
CRITERIA	RATING
Mission Alignment	0.65
Stabilize BOS	0.013
Condition based Maintenance/Recapitalization	0.5
Quality of Service Support	0.739
Joint and Community Integration	0.775
Reduce Excess Capacity	1.0
Agile Infrastructure	1.0

Rating range = 0.000 to 1.000

CAPABILITY BASED ASSESSMENT		
SHORE CAPABILITY AREA	MDI	SSI
WATERFRONT OPERATIONS		
AIRFIELD OPERATIONS		
C4I OPERATIONS		
EXPEDITIONARY OPERATIONS		
INTERDEPOT LEVEL MAINTENANCE SU...		
ORDNANCE/WEAPONS OPERATIONS S...		
TRAINING SUPPORT		
SUPPLY STORAGE SUPPORT		
SAILOR AND FAMILY SUPPORT		
MEDICAL SUPPORT		
BASE SUPPORT		
RDT&E	66.0	28.0

Rating range = 0 to 100

INFRASTRUCTURE FIGURE OF MERIT	
QUALITY MEASURE	RATING
Capacity (PCAP)	65.76
Capability Performance Level (PBOS)	0
Condition (PC)	65
Configuration (PCOI)	77

Rating range = 0 to 100

DEMAND SIGNAL RANKING SCORE			
SAGP (score)	MAI (score)	IFOM (score)	FINAL SCORE
0.34058	0.06916	0.075361	0.475121

OK Cancel

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The application pulls the SCA and MDI/SSI values from the facility table as well as the project id, number, title, and location. It calculates a composite MDI, SSI, capacity, CPL, condition, and configuration score based on the number and nature of facilities that are impacted by the project. If there is only one facility impacted by the project, then the composite scores are the same as the facility values. The strategic alignment/guiding principles (SAGP) ratings are developed by the Navy for each project through the use of a pair-wise comparison analytical hierarchy process<sup>12</sup> and were provided on Excel spread-

sheets for the model. They vary from 0 to 1 in value. The following formulas are used to calculate the demand signal ranking score.

$$\text{Total Project (score)} = \text{Strategic Alignment/Guiding Principles (SAGP) (score)} + \text{Mission Alignment Index (MAI) (score)} + \text{Infrastructure Figure of Merit (IFOM) (score)} \quad (11)$$

Total project (score) ranges from 0 to 1.00000. A higher score reflects greater support of Navy shore infrastructure vision and goals. The three elements are weighted so their contribution can be directly summed to calculate the total score. Table 10 provides the weights that were assigned by the SRBOD.

Table 10. Total project (score) element weights

Element	Short title	Weight
Strategic alignment/guiding principles	SAGP	0.577
Mission alignment index	MAI	0.269
Infrastructure figure of merit	IFOM	0.154

The SAGP element is the one subjective element where each project has to be individually reviewed and values assigned for each of the seven criteria that were selected for evaluation. A rating score from 0 to 1.000 is assigned to each of the criteria depending on how much the project contributes in that area; a higher score reflects greater support in that area. Table 11 provides the weights assigned by the SRBOD.

Table 11. SAGP criteria weights

Criteria	Weight
Mission alignment	0.40
Stabilize BOS	0.16

12. The Navy convened a Shore Mission Integration Group (SMIG) working group to assess each new submitted project on a project-by-project basis as part of the programming process.

Table 11. SAGP criteria weights

Criteria	Weight
Condition based maintenance/recapitalization	0.13
Quality of service support	0.11
Joint and community integration	0.08
Reduction of excess capacity	0.08
Agile infrastructure	0.04

The second and third elements are quantitative and based on the nature of the project itself. The MAI is determined by the primary SCA and composite MDI or SSI<sup>13</sup> of the facilities impacted by the project. The MDI (project rating) is calculated as follows:

$$\text{MDI (project rating)} = [((\text{MDI (facility 1)} * \text{PRV 1} + \text{MDI (facility 2)} * \text{PRV 2} + \dots) / \sum \text{PRVi}) / 100] \quad (12)$$

The MDI (rating) is multiplied by the weight assigned to the SCA and then normalized by dividing by the SCA highest weight since only one area is used in the calculation. Table 12 provides the SCA list with weights assigned by the SRBOD for POM-10 calculations.

Table 12. MAI element weights

SCA	Weight
Waterfront operations	0.15
Airfield operations	0.11
C4I operations	0.13
Expeditionary operations	0.06
Maintenance support	0.07
Ordnance support	0.08
Training support	0.08
Supply storage support	0.03
Sailor and family support	0.08
Medical	0.05

13. The SSI is used in the same manner as the MDI when the project involves new construction where there is no existing facility to evaluate for a MDI.

Table 12. MAI element weights

SCA	Weight
Base support	0.11
RDT&E	0.05

The final element is also quantitative and based on the composite IFOM ratings of the facilities impacted by the project. The rating for each of the four criteria areas is determined by the composite capacity, CPL, configuration, and condition scores of the involved facilities. The rating for each of the criteria areas is calculated as follows:

$$\text{Criteria (rating)} = ((100 - ((P(\text{facility 1}) * PRV1 + P(\text{facility 2}) * PRV2 + \dots) / \sum PRVi)) / 100) \quad (13)$$

Table 13 provides the IFOM criteria areas and weights assigned by the SRBOD for POM-10 calculations.

Table 13. IFOM element weights

IFOM (current)	Weight
Capacity (PCAPI)	0.36
Capability Performance Level (PCPL)	0.25
Condition (PCI)	0.22
Configuration (PCOI)	0.17

Figure 43 provides an example of the demand signal calculation worksheet within the generator. Once the number is generated it is

captured within the master project database and does not have to be recalculated again.

Figure 43. SFIM project demand signal ranking number generator worksheet

 <b>PROJECT DEMAND SIGNAL RANKING GENERATOR</b>					
DEMAND SIGNAL CALCULATOR					
<b>PROJECT ID NUMBER:</b>	1338				
<b>PROJECT NUMBER:</b>	P-156				
<b>PROJECT TITLE:</b>	E-2 ADVANCED HAWKEYE RDT&E FACILITY				
<b>PROJECT LOCATION:</b>	NAS PAUTUXANT RIVER, MD				
STRATEGIC ALIGNMENT					
CRITERIA	WEIGHT				
Mission Alignment	<b>0.40</b>	0.650	0.26000		
Stabilize BOS	<b>0.16</b>	0.013	0.00208		
Condition based Maintenance/recapitalization	<b>0.13</b>	1.000	0.13000		
Quality of Service Support	<b>0.11</b>	0.738	0.08118		
Joint and Community Integration	<b>0.08</b>	0.775	0.06200		
Reduce Excess Capacity	<b>0.06</b>	0.000	0.00000		
Agile Infrastructure	<b>0.04</b>	0.250	0.01000		
			<u>0.54526</u>	<b>WEIGHT</b>	<b>0.577</b> 0.31462
CAPABILITY BASED ASSESSMENT					
SHORE CAPABILITY AREA	WEIGHT				
Waterfront Operations	<b>0.15</b>	0	0	0.00000	
Airfield Operations	<b>0.11</b>	0	0	0.00000	
C4I Operations	<b>0.13</b>	0	0	0.00000	
Expeditionary Operations	<b>0.06</b>	0	0	0.00000	
Maintenance Support	<b>0.07</b>	0	0	0.00000	
Ordnance Support	<b>0.08</b>	0	0	0.00000	
Training Support	<b>0.08</b>	0	0	0.00000	
Supply Storage Support	<b>0.03</b>	0	0	0.00000	NORMALIZE
Sailor & Family Support	<b>0.08</b>	0	0	0.00000	0.22000
Medical	<b>0.05</b>	0	0	0.00000	
Base Support	<b>0.11</b>	0	0	0.00000	
RDT&E	<b>0.05</b>	66	66	0.03300	
				<u>0.03300</u>	<b>WEIGHT</b> <b>0.269</b> 0.05918
INFRASTRUCTURE FIGURE OF MERIT					
QUALITY MEASURE	WEIGHT				
Capacity (PCAP)	<b>0.36</b>	60	0.40000	0.14400	
Capability Performance Level (PBOS)	<b>0.25</b>	75	0.25000	0.06250	
Condition (PCI)	<b>0.22</b>	66	0.34000	0.07480	
Configuration (PCOI)	<b>0.17</b>	42	0.58000	0.09860	
				<u>0.37990</u>	<b>WEIGHT</b> <b>0.154</b> 0.05850

The TOA input allows the user include the different funding levels for a specific COA scenario. The user loads the total shore readiness obligation authority for both active and reserves available for allocation in the investment cycle across the FYDP. Other infrastructure support fund levels are subtracted out. These include: family housing, other procurement Navy support, other O&M support, and other budget submitting office requirements.

In addition, the annual infrastructure operating funds of facilities sustainment, and BOS are set at the expected support levels thereby reducing the amount available for project investment. Finally, the military construction planning and design and urgent minor construction amounts are subtracted leaving the final amount by fiscal year available for project investment in special projects and military construction. Each COA has its own TOA funding allocation breakdown linked directly to it in the model. The project investment

amount is then used to generate the project lists for that COA. Figure 44 shows the format for the actual TOA allocation input screen.

Figure 44. SFIM capital investment impact TOA allocation input screen

 <b>FUTURE CAPITAL INVESTMENT IMPACT ASSESSMENT</b>									
<b>TOTAL OBLIGATION AUTHORITY (TOA) ALLOCATION</b>									
BASELINE FISCAL YEAR FOR POM		2007		COA:		0		INPUT DATE: 22-Sep-08	
<b>INFRASTRUCTURE INVESTMENT ALLOCATION</b>									
<b>AVAILABLE TOTAL SHORE READINESS OBLIGATION AUTHORITY</b>									
SHORE READINESS TOA (\$K)	ACTIVE	POR		FYDP					
		2008	2009	2010	2011	2012	2013	2014	2015
		\$7,645,073	\$9,373,803	\$7,917,562	\$7,719,927	\$8,020,228	\$8,036,071	\$8,195,293	\$8,357,311
SHORE READINESS TOA (\$K)	RESERVE	POR		FYDP					
		2008	2009	2010	2011	2012	2013	2014	2015
		\$350,770	\$355,000	\$355,000	\$355,000	\$355,000	\$355,000	\$355,000	\$355,000
<b>OTHER INFRASTRUCTURE SUPPORT FUNDS</b>									
FAMILY HOUSING (\$K)		\$419,230	\$461,147	\$374,097	\$377,544	\$363,676	\$391,811	\$399,646	\$407,639
OPN SUPPORT (\$K)		\$187,057	\$181,580	\$135,587	\$136,840	\$140,339	\$114,554	\$117,151	\$119,495
OTHER O&M SUPPORT (\$K)		\$463,841	\$878,570	\$780,087	\$803,987	\$829,956	\$850,466	\$867,475	\$884,822
OTHER BSO (\$K)		\$28,872	\$25,957	\$11,220	\$10,584	\$10,773	\$10,987	\$11,208	\$11,434
<b>ANNUAL INFRASTRUCTURE OPERATING FUNDS</b>									
FACILITIES SUSTAINMENT (\$K)	ACTIVE	\$1,072,695	\$1,409,153	\$1,261,033	\$1,302,393	\$1,320,158	\$1,332,800	\$1,361,055	\$1,389,873
FACILITIES SUSTAINMENT (\$K)	RESERVE	\$79,066	\$80,000	\$80,000	\$80,000	\$80,000	\$80,000	\$80,000	\$80,000
BASE OPERATING SERVICES (\$K)	ACTIVE	\$4,124,448	\$4,187,288	\$3,757,355	\$3,805,426	\$3,868,548	\$3,950,543	\$4,033,554	\$4,118,229
BASE OPERATING SERVICES (\$K)	RESERVE	\$237,200	\$200,000	\$200,000	\$200,000	\$200,000	\$200,000	\$200,000	\$200,000
<b>AVAILABLE CAPITAL INVESTMENT AUTHORITY</b>									
MCON PLANNING & DESIGN (\$K)	ACTIVE	\$49,943	\$239,128	\$53,300	\$39,400	\$44,100	\$40,100	\$39,400	\$38,600
MCON PLANNING & DESIGN (\$K)	RESERVE	\$1,390	\$1,202	\$1,143	\$1,298	\$1,340	\$1,340	\$1,340	\$1,340
MCON URGENT MINOR CONST (\$K)	ACTIVE	\$10,000	\$13,670	\$15,000	\$15,000	\$15,000	\$15,000	\$15,000	\$15,000
MCON URGENT MINOR CONST (\$K)	RESERVE	\$0	\$0	\$4,500	\$3,170	\$1,490	\$4,500	\$0	\$0
AVAILABLE FOR INVESTMENT (\$K)	ACTIVE	\$1,288,987	\$1,977,310	\$1,529,883	\$1,228,753	\$1,407,678	\$1,329,810	\$1,350,804	\$1,372,219
AVAILABLE FOR INVESTMENT (\$K)	RESERVE	\$33,114	\$73,798	\$69,357	\$70,532	\$72,170	\$69,160	\$73,660	\$73,660
RM SPECIAL PROJECTS (\$K)	REGULAR	\$310,752	\$500,132	\$205,483	\$197,972	\$205,251	\$192,846	\$197,435	\$204,804
RM SPECIAL PROJECTS (\$K)	RESERVE	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
DE SPECIAL PROJECTS (\$K)	REGULAR	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
DE SPECIAL PROJECTS (\$K)	RESERVE	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
MILITARY CONSTRUCTION (\$K)	REGULAR	\$1,062,068	\$766,623	\$367,540	\$137,280	\$327,383	\$373,360	\$343,190	\$373,390
MILITARY CONSTRUCTION (\$K)	RESERVE	\$25,000	\$25,000	\$24,500	\$20,000	\$29,400	\$28,458	\$27,600	\$24,000
BALANCE AVAILABLE (\$K)		-\$75,719	\$759,353	\$1,001,717	\$944,033	\$917,814	\$804,306	\$856,239	\$843,685

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The balance available is also used by the project optimizer generator. The project selection optimization algorithm solves for the combination of projects that maximizes the averaged post-project infrastructure quality point scores constrained to an overall funding support level. The solver makes the optimal selection by considering the magnitude of project impacts, a project's marginal value relative to its esti-

mated cost, weighted quality preferences, and measured trade-offs from constructing a new facility to restoration of an existing facility. This generator produces a COA investment scenario that is based on maximizing the IFOM output based on the best mix of special and military construction projects. Each project has quality points  $Q_P$  calculated by facility for condition, configuration, capacity and CPL impact based on the project scope of work. These  $Q_P$  are added to the projected values that exist at the beginning of the FYDP.

**Condition and configuration  $Q_P$  calculation** — There are three different procedures for calculating these values depending upon whether the project is restoration and modernization, new footprint construction, or demolition. For restoration and modernization formula number 14 is used:

$$\text{Project } Q_{P(RM)} = \text{Minimum} [100, P_{(CI \text{ or } COI)} + (\text{Project}_{(CWE)}/\text{PRV}) * 100] \quad (14)$$

For new footprint construction projects, a data element will be generated that has a score of 100 for both condition and configuration. The value of the new element is equal to the current working estimate of the project for new construction.

$$\text{Project } Q_{P(\text{New Const})} = 100 \quad (15)$$

The impact of a demolition project for any facility will result in the facilities condition and configuration scores being zeroed out.

$$\text{Project } Q_{P(\text{Demo})} = 0 \quad (16)$$

**Capacity  $Q_P$  calculation** — There is only one procedure for calculating these values because restoration and modernization projects have no impact upon capacity. The capacity rating is measured at the category code level for a specific site and is the measure of total asset space divided by the authorized space. This can result in values over 100, which is excess capacity. Therefore, the quality impact of any project for new footprint construction and demolition will be the area added or removed from the total asset space divided by the authorized space. New mission construction projects are not counted

as the authorized space is assumed to change equally with additional new space. The formula used is:

$$\text{Project } Q_{P(\text{Cap})} = \text{Minimum [100, (available assets + change in assets)/authorized assets]} \quad (17)$$

**Capability performance level  $Q_p$  calculation** — There is again only one procedure for calculating these quality point impacts because restoration and modernization projects have minimal impact upon the cost of annual operations. This calculation is done at the installation level. For each project, we multiply the actual annual operations cost per unit of area (usually SF) for an installation by the change in area to get a change in servicing costs. We then take the total cost of servicing an installation and divide it by its present CPL score. This gives us the cost of servicing an installation for each point of CPL. If we divide the two measures together we get the project's impact on an installation in points. The formula is as follows:

$$\text{Project } Q_{P(\text{CPL})} = [\text{Initial } P_{(\text{CPL})} + ((\text{installation unit CPL cost per unit of area}) * (\text{change in area}) * (\text{Initial } P_{(\text{CPL})})) / \text{total cost of servicing}] \quad (18)$$

These scores are calculated once and stored for each project since they do not change during the current cycle.

The optimizer selects the highest scoring projects based on the below formula until a fiscal year program reaches the funding available, then moves to the next year and so on throughout the FYDP.

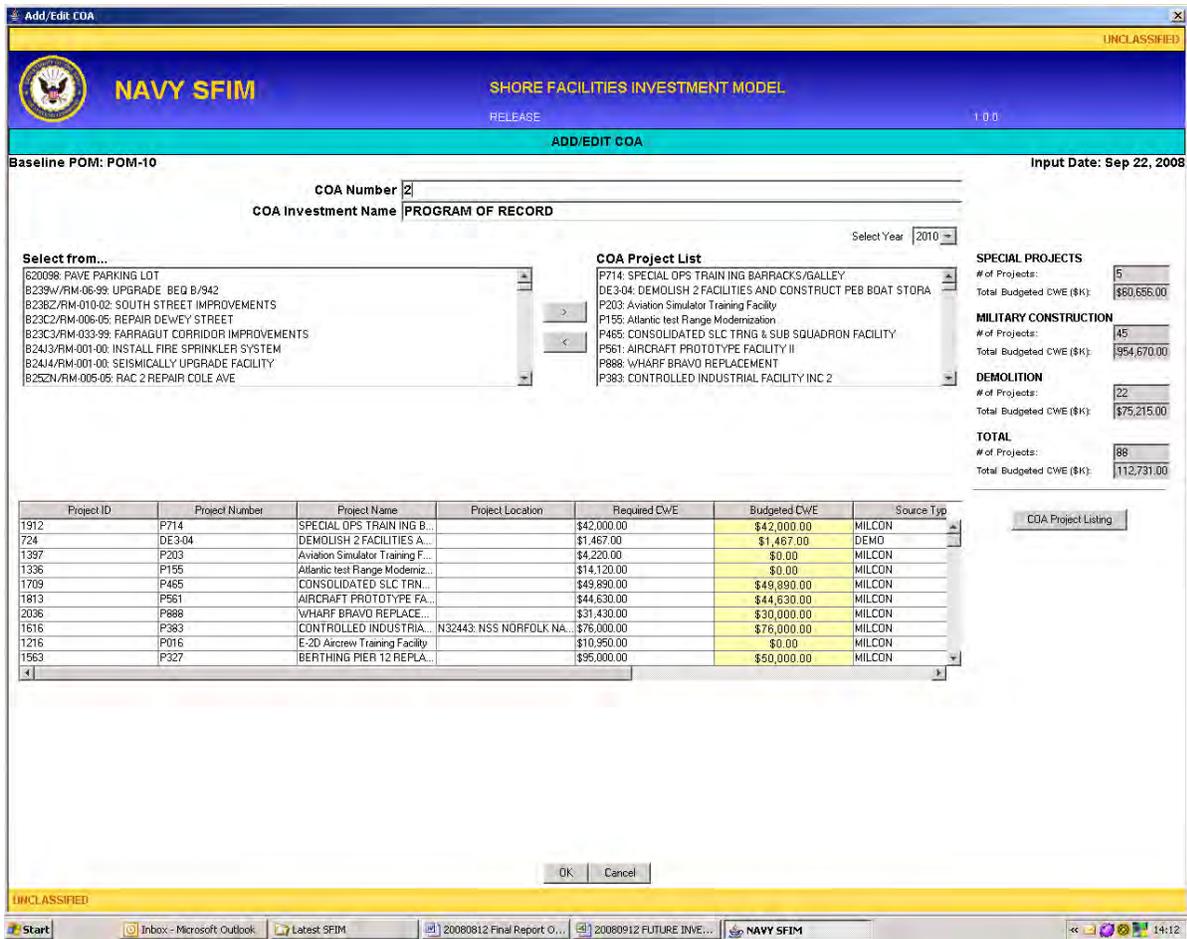
$$\text{Output coefficient [0.36 * capacity } (Q_p) + 0.25 * \text{CPL } (Q_p) + 0.17 * \text{Configuration } (Q_p) + 0.22 * \text{Condition } (Q_p)] + \text{demand coefficient (project demand ranking score)} \quad (19)$$

The current settings are 0.80 for the output coefficient and 0.20 for the demand coefficient. These can be adjusted depending upon the emphasis on either output impact or user demand signal. The final output is a filtered project list assigned to the FYDP fiscal year, which

optimizes the output results based on investment funding level available and the inventory of projects to draw upon.

The next portion of the module to discuss is the COA listing database. This section stores the different COA combinations of projects and funding levels under review. These lists are generated using the COA list input screen as shown in figure 45.

Figure 45. SFIM capital investment impact COA input screen



The module produces four reports that describe the contents of individual COAs. The first report is a project listing of the individual

projects that make up that COA. A sample report is shown in figure 46.

Figure 46. SFIM capital investment impact COA project listing report

 <b>FUTURE CAPITAL INVESTMENT IMPACT ASSESSMENT</b>						
<b>COURSE OF ACTION PROJECT LISTING</b>						
POM CYCLE:		2010	COURSE OF ACTION:		2	RUN DATE: 22-Sep-08
NUMBER OF PROJECTS:		SPECIAL PROJECTS		MILITARY CONSTRUCTION		TOTAL
		183		170		353
INVESTMENT CWE (\$K):		\$624,759		\$4,648,579		\$5,273,338
<b>COA PROJECT LISTING</b>						
PROJECT ID	SOURCE TYPE	PROJECT NUMBER	PROJECT NAME	PROJECT LOCATION	COA FUNDING PLAN CWE (\$K)	COA PROGRAM FY
34	DEMO	DE002-05	DEMOLISH WHIRLTOWER STRUCTURE	NAWS CHINA LAKE CA	\$320	2010
41	DEMO	DE003-06	DEMOLISH BUILDING 839	PUGET SOUND NAVAL SHIPYARD, B	\$1,642	2010
42	DEMO	DE003-06	DEMOLISH BUILDINGS 49 AND 93, AND REPLACE WTH	SUBASE SAN DIEGO CA	\$981	2010
44	DEMO	DE004-06	DEMOLISH BUILDINGS 2, 10 & 59 - FASW	SUBASE SAN DIEGO CA	\$4,943	2010
49	DEMO	DE008-07	DEMOLISH VARIOUS FAA FACILITIES AT NCTS	NAVBASE GUAM GG	\$920	2010
53	DEMO	DE01-04	DEMOLISH 5 STRUCTURES	NATNAVMEDCEN BETHESDA MD	\$590	2010
82	DEMO	DE037-06	DEMOLISH BUILDINGS 605/731/894/476	PUGET SOUND NAVAL SHIPYARD, B	\$184	2010
85	DEMO	DE038-08	DEMOLISH EXCESS STORAGE/WAREHOUSE FACILITIE	NAWS CHINA LAKE CA	\$257	2010
90	DEMO	DE100-07	DEMOLISH 4 BUILDINGS AT CARDEROCK	NSA NORTH POTOMAC DC	\$400	2010
97	DEMO	DE1-06	CONSOLIDATE SAN NICOLAS ISLAND, SNI	NAVBASE VENTURA CTY PT MUGU	\$1,950	2010
120	DEMO	DE137-08	DEMOLISH LAUNDRY/DRMO FACILITIES	NAVSTA SAN DIEGO CA	\$1,224	2010
124	DEMO	DE139-08	DEMOLISH BUILDINGS 73 AND 91	NAVSTA SAN DIEGO CA	\$2,031	2010
132	DEMO	DE141-08	DEMOLISH DDDC WAREHOUSE B-3302	NAVSTA SAN DIEGO CA	\$4,092	2010
150	DEMO	DE194-07	DEMOLISH PIER 2	NAVSTA NEWPORT RI	\$25,000	2010
175	DEMO	DE272-07	DEMOLISH PIER 1	NAVSTA NEWPORT RI	\$25,000	2010
179	DEMO	DE3-04	DEMOLISH 2 FACILITIES AND CONSTRUCT PEB BOAT	SNAS NORTH ISLAND SAN DIEGO CA	\$1,467	2010
184	DEMO	DE3-07	CONSOLIDATE INDOOR FITNESS FACILITIES, POINT MUGU	NAVBASE VENTURA CTY PT MUGU	\$460	2010
192	DEMO	DE317-07	DEMOLISH 3 BUILDINGS, GOLF COURSE	NAVWPNSTA SEAL BEACH CA	\$515	2010
195	DEMO	DE4-04	DEMOLISH MULLENWEBER ANTENNA STC	NAS NORTH ISLAND SAN DIEGO CA	\$453	2010
197	DEMO	DE4-07	CONSOLIDATE NCTC BUILDING TRAINING MATERIAL S	NAVBASE VENTURA CTY PT MUGU	\$498	2010
201	DEMO	DE5-07	DEMOLISH 12 EXCESS FACILITIES, POINT MUGU	NAVBASE VENTURA CTY PT MUGU	\$819	2010
202	DEMO	DE5-07	DEMOLISH 2 PIERS	NSA WASHINGTON DC	\$1,215	2010
206	DEMO	DE508-08	DEMOLISH BUILDING 105	SUBASE SAN DIEGO CA	\$573	2010
299	N&F	P010	UAS, SYS INTEGRATION & WEAPONIZATION SUP FAC	NAWS CHINA LAKE	\$0	2010
308	N&F	P013	SURFACE SHIP WEAPON SYS INTEGRATION TEST FAC	NAVBASE VENTURA CTY PT MUGU	\$0	2010
311	N&F	P016	E-2D AIRCREW TRAINING FACILITY	NS NORFOLK	\$0	2010
333	MCN	P041	SPACE SYSTEMS TECHNOLOGY LABORATORY	NAVAL SUPPORT ACTIVITY WASH	\$48,540	2010

The second report provides a COA investment summary for the projects within the COA. Figure 47 shows what this report looks like.

Figure 47. SFIM capital investment impact COA project summary report

INVESTMENT AREA		2008		2009		2010		2011		2012		2013		2014		2015		FYDP	
SPECIAL PROJECTS		# PRJ	CWE (\$K)	# PRJ	CWE (\$K)	# PRJ	CWE (\$K)	# PRJ	CWE (\$K)	# PRJ	CWE (\$K)	# PRJ	CWE (\$K)	# PRJ	CWE (\$K)	# PRJ	CWE (\$K)	# PRJ	CWE (\$K)
NF(NM)		10				2	\$240,000	1	\$10,000									3	\$250,000
NF(CM)		8				1	\$10,000	1	\$12,000									2	\$22,000
RM		124				123	\$285,000	1	\$155,000									124	\$440,000
DEMO		30				45	\$55,000	1	\$25,000									46	\$90,000
TOTAL		172	\$0	0	\$0	171	\$590,000	4	\$202,000	0	\$0	0	\$0	0	\$0	0	\$0	175	\$792,000
MILITARY CONST		# PRJ	CWE (\$K)	# PRJ	CWE (\$K)	# PRJ	CWE (\$K)	# PRJ	CWE (\$K)	# PRJ	CWE (\$K)	# PRJ	CWE (\$K)	# PRJ	CWE (\$K)	# PRJ	CWE (\$K)	# PRJ	CWE (\$K)
NF(NM) [N08F]				5		8	\$450,000											8	\$450,000
MCON				0		2	\$0											2	\$0
TOTAL		0	\$0	5	\$0	10	\$450,000	0	\$0	0	\$0	0	\$0	0	\$0	0	\$0	10	\$450,000
OVERALL		172	\$0	5	\$0	181	\$1,040,000	4	\$202,000	0	\$0	0	\$0	0	\$0	0	\$0	185	\$1,242,000

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The third report is a COA project impact report that shows the quality points contributed to the inventory for each project within the COA. Figure 48 provides an example of this.

Figure 48. SFIM capital investment impact COA project impact report

 <b>FUTURE CAPITAL INVESTMENT IMPACT ASSESSMENT</b>												
<b>COURSE OF ACTION PROJECT IMPACT LISTING</b>												
POM CYCLE:		2010		COURSE OF ACTION:		0		RUN DATE:		22-Sep-08		
NUMBER OF PROJECTS:				SPECIAL PROJECTS		MILITARY CONSTRUCTION		TOTAL				
INVESTMENT CWE (\$K):				\$1,203,791		\$2,059,501		\$3,263,292				
COA PROJECT LISTING												
PROJECT ID	PROJECT NUMBER	PROJECT NAME	PROJECT LOCATION	DEMAND RANKING	QUALITY POINTS (CAPACITY)	QUALITY POINTS (CONFIG)	QUALITY POINTS (CONDITION)	QUALITY POINTS (BOS)	QUALITY POINTS (FOM)	COA FUNDING PLAN CWE (\$K)	COA PROGRAM FY	
	P973E	LAPSC INCR	NAVAL BASE HITSAP	0.03455	0.023	5.160	-6.345	6.500	6.700	\$89,500	2010	
	P356A	CYN MAINTENANCE PIER INCR 2 OF 2								\$71,200	2010	
	P587	PACFLT SUB DRIVE-IN MAGNETIC SILENCING FACILITY	NAVSTA PEARL HARBOR HI							\$9,000	2010	
	P977	WATERFRONT SECURITY ENCLAVE INCR 2	BANGOR WA							\$70,000	2010	
	P985	DDG 1000 TRAINING FACILITY	NS NORFOLK							\$8,880	2010	
	P912	PAVE EXTERNAL ROADS PDM-II	CAMP LEMONIER DJIBOUTI							\$2,580	2010	
	P916	INTERIOR PAVED ROADS PHASE A	CAMP LEMONIER DJIBOUTI							\$2,600	2010	
1938	P750	ROTARY HANGAR	NAS NORTH ISLAND SAN DIEGO CA							\$37,500	2010	
1366	P182	MISSILE MAGAZINES (S), WEST LOCH	NAVSTA PEARL HARBOR HI							\$26,280	2010	
	P327	PIER 12 REPLACEMENT INCR	NAVSTA SAN DIEGO CA							\$50,000	2010	
	P600	RESERVE CENTER MOVE TO LUKE AFB (MCNR)	NOSC PHOENIX AZ							\$12,000	2010	
	P680	AFRC AT AIRPORT (MCNR)	NOSC PITTSBURGH PA							\$12,500	2010	
1680	P450	SQUADRON OPERATIONS FACILITY	NAS CORPUS CHRISTI TX							\$21,543	2010	
1886	P630	MODIFY FACILITIES FOR P-8A MMA CONUS MOB #1	NAS JACKSONVILLE FL							\$6,410	2010	
	P266	PROVIDE T6B STUDENT SOLO CAPABLE OLF	NAS WHITING FLD MILTON FL							\$46,870	2010	
1216	P016	E-2D AIRCREW TRAINING FACILITY	NS NORFOLK							\$10,950	2010	
1989	P638	FACILITY UPGRADES FOR THE E-2D PROGRAM	NS NORFOLK							\$6,610	2010	
	P263	NAVY MARINE CORPS UAS CENTER OF EXCELLENCE	NAS PATUXENT RIVER MD							\$88,030	2010	
3019	WR201035	RUNWAY 16-34 OVERLAY	PACMSRANFAC HAWAIIAN AREA							\$25,550	2010	
2359	RM005-06	REPAIR TAXWAYS	NAVSTA MAYPORT FL							\$2,687	2010	
2594	RM162-04	REPAIR LP AREA TAXWAYS AND STORM DRAINS	NAVSTA NORFOLK VA							\$21,861	2010	
2563	RM142-02	LIFE EXTENSION TO HANGAR 110	NAS PATUXENT RIVER MD							\$22,070	2010	
2630	RM202-06	TAXWAY ALPHA LIGHTING	NAS OCEANA VA							\$1,800	2010	
2294	RM011-00	REPAIR RUNWAY 13L-31R	NAS CORPUS CHRISTI TX							\$1,447	2010	
2508	RM104-06	REPAIRS AND ALTERATIONS TO CDF GALLEY	NAVSTA PEARL HARBOR HI							\$3,200	2010	
2484	RM100-07	RENOVATE BLDG 57 FOR LCSRON	NAVSTA SAN DIEGO CA							\$6,000	2010	
2730	RM38-07	CRITICAL ELECTRICAL AND MECHANICAL REPAIRS JIC	NAVSTA PEARL HARBOR HI							\$6,308	2010	
	RM303-08	HEADQUARTERS COMMAND FOR COMMANDER NAVY	NSA NAPLES							\$30,000	2010	
3772	ST106-08	REPAIR CAISSON DRY DOCK 8	NSA NORFOLK NSY							\$8,000	2010	
2518	RM110-08	REPAIR WALLS AND FLOOR DRY DOCK 8	NSA NORFOLK NSY							\$31,000	2010	
2654	RM212-07	DRY DOCK #2 CAISSON AND OUTER SILL REPAIRS	NSS PORTSMOUTH NAVY SHIPYARD							\$19,871	2010	
2472	RM052-05	REPAIR SEAWALLS AT SUMAY, CLIPPER LANDING CQ	NAVBASE GUAM							\$13,200	2010	

The fourth report is a COA facilities impact listing that names each facility impacted by projects within the COA and gives the improve-



impact report which shows an IFOM assessment view for the selected COA.

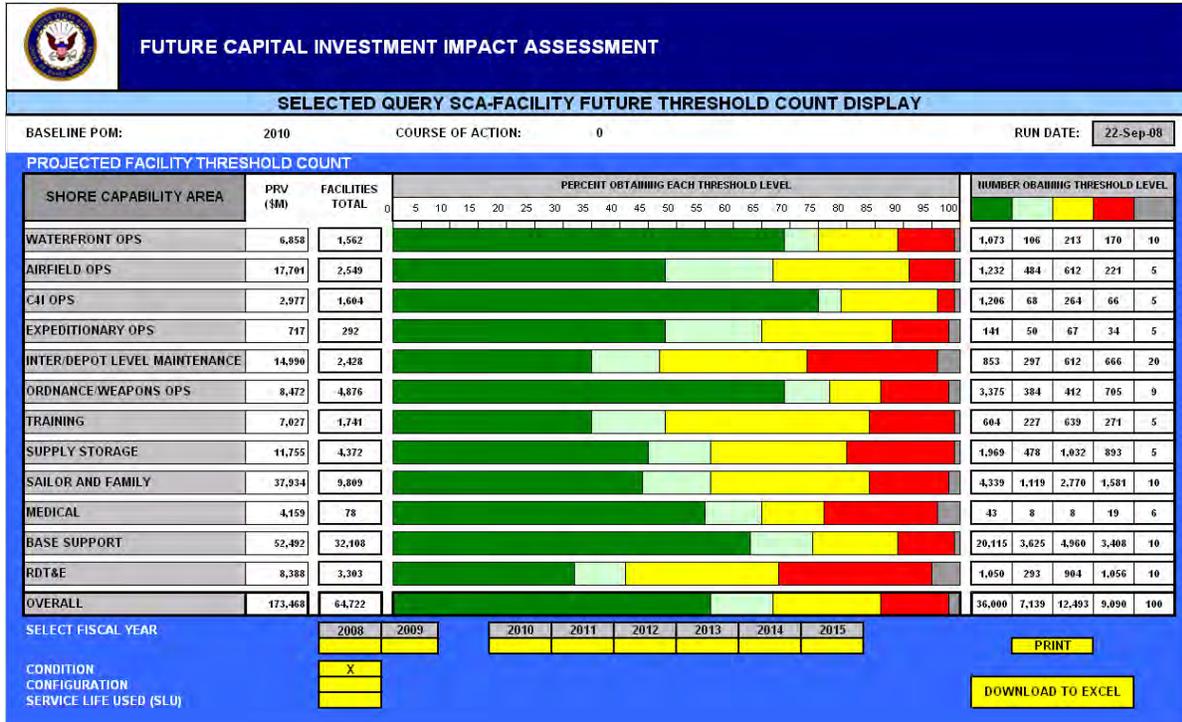
Figure 50. SFIM capital investment impact selected COA query IFOM assessment screen

 <b>FUTURE CAPITAL INVESTMENT IMPACT ASSESSMENT</b>										
SELECTED QUERY SCA-IFOM FUTURE ASSESSMENT DISPLAY										
BASELINE POM:		2010		COURSE OF ACTION:		0		RUN DATE:		22-Sep-08
PROJECTED INFRASTRUCTURE FIGURE OF MERIT (IFOM)										
Shore Capability Area	PRV (\$M)	PRV (%)	# FAC	P <sub>(CAPACITY)</sub> RATING	P <sub>(CONFIGURATION)</sub> RATING	P <sub>(CONDITION)</sub> RATING	P <sub>(BOB)</sub> RATING	Overall SCA P <sub>(IFOM)</sub> RATING		
Waterfront Ops	4,872	4.2	1,432	68	67	89	85	77		
Airfield Ops	11,672	10.0	2,352	77	74	78	82	78		
C4I Ops	2,700	2.3	1,834	97	82	86	68	85		
Exped Ops	700	0.6	287	50	89	82	82	72		
Maint Support	11,250	9.7	2,401	77	68	77	75	75		
Ordnance Support	5,315	4.6	4,878	70	84	83	82	78		
Training Support	6,273	5.4	1,733	78	83	70	70	75		
Supply Storage Support	5,385	4.6	4,118	70	75	68	70	70		
Sailor & Family Support	19,391	16.6	9,443	70	89	72	78	76	90->	
Medical	140	0.1	37	95	85	86	78	89	80 - 89	
Base Support	41,593	35.7	35,150	70	84	81	78	77	61 - 79	
RDT&E	7,175	6.2	3,337	70	87	67	70	72	<60	
Overall	116,466	100.0	67,002	72	81	77	77	76	IFOM VALUE	
UNCLASSIFIED				36%	17%	22%	25%	WEIGHTED VALUE		
SELECT FISCAL YEAR		2008	2009	2010	2011	2012	2013	2014	2015	
PRINT		DOWNLOAD TO EXCEL								

This display allows the user to scroll through each year of the FYDP and determine the post-project aggregate impact of the investment

program upon the overall Navy inventory by SCA. The next report example, figure 51, provides an individual facilities threshold view.

Figure 51. SFIM capital investment impact COA threshold assessment screen



This display shows the impact of the COA investment upon each of the facilities that have changed performance score thresholds for condition, configuration, and SLU over each year of the FYDP.

The final report is a total investment summary report for the selected COA, which shows the total funding allocation for that COA and total

dollar amounts in each area. Figure 52 provides an example of this display.

Figure 52. SFIM capital investment impact COA total investment summary screen

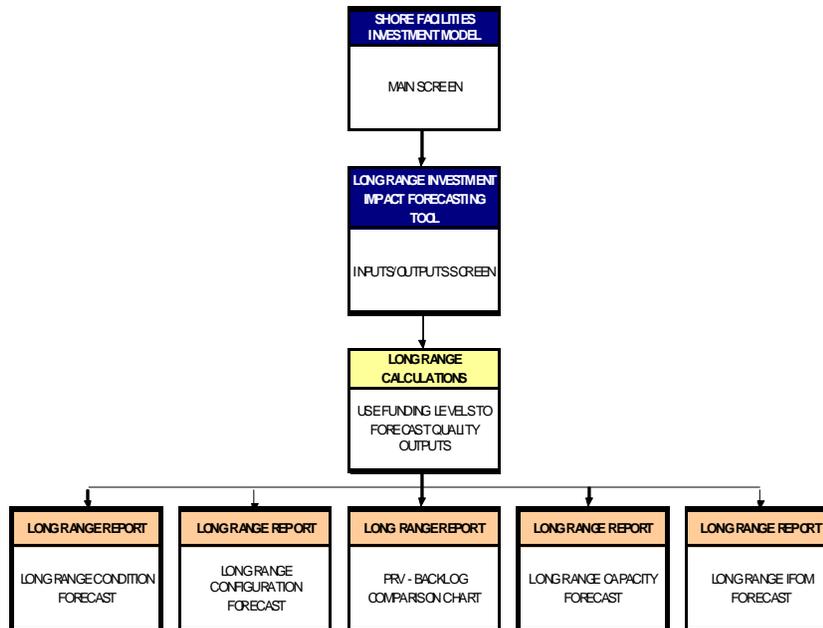
 <b>FUTURE CAPITAL INVESTMENT IMPACT ASSESSMENT</b>										
<b>TOTAL INVESTMENT SUMMARY</b>										
BASELINE POM:		2010		COURSE OF ACTION:		0		RUN DATE:		22-Sep-08
<b>INFRASTRUCTURE INVESTMENT ALLOCATION SUMMARY</b>										
<b>AVAILABLE TOTAL SHORE READINESS OBLIGATION AUTHORITY</b>										
SHORE READINESS TOA (\$K)		POR		FYDP						
		2008	2009	2010	2011	2012	2013	2014	2015	
		REGULAR	\$7,645,073	\$9,373,803	\$7,917,562	\$7,719,927	\$8,020,228	\$8,036,071	\$8,195,293	\$8,357,311
RESERVE	\$350,770	\$355,000	\$355,000	\$355,000	\$355,000	\$355,000	\$355,000	\$355,000		
<b>OTHER INFRASTRUCTURE SUPPORT FUNDS</b>										
FAMILY HOUSING (\$K)		\$419,230	\$461,147	\$374,097	\$377,544	\$383,676	\$391,811	\$399,646	\$407,639	
OPN SUPPORT (\$K)		\$187,057	\$181,580	\$135,587	\$136,840	\$140,339	\$114,554	\$117,151	\$119,495	
OTHER O&M SUPPORT (\$K)		\$463,641	\$878,570	\$780,087	\$803,987	\$829,956	\$850,466	\$867,475	\$884,622	
OTHER BSO (\$K)		\$28,872	\$25,957	\$11,220	\$10,584	\$10,773	\$10,987	\$11,208	\$11,434	
<b>ANNUAL INFRASTRUCTURE OPERATING FUNDS</b>										
FACILITIES SUSTAINMENT (\$K)	REGULAR	\$1,072,695	\$1,409,153	\$1,261,033	\$1,302,393	\$1,320,158	\$1,332,800	\$1,361,055	\$1,389,873	
	RESERVE	\$79,066	\$80,000	\$80,000	\$80,000	\$80,000	\$80,000	\$80,000	\$80,000	
BASE OPERATING SERVICES (\$K)	REGULAR	\$4,124,448	\$4,187,268	\$3,757,355	\$3,805,428	\$3,868,548	\$3,950,543	\$4,033,554	\$4,118,229	
	RESERVE	\$237,200	\$200,000	\$200,000	\$200,000	\$200,000	\$200,000	\$200,000	\$200,000	
<b>CAPITAL INVESTMENT ALLOCATION</b>										
MCON PLANNING & DESIGN (\$K)	REGULAR	\$49,943	\$239,128	\$53,300	\$39,400	\$44,100	\$40,100	\$39,400	\$38,600	
	RESERVE	\$1,390	\$1,202	\$1,143	\$1,298	\$1,340	\$1,340	\$1,340	\$1,340	
MCON URGENT MINOR CONST (\$K)	REGULAR	\$10,000	\$13,670	\$15,000	\$15,000	\$15,000	\$15,000	\$15,000	\$15,000	
	RESERVE	\$0	\$0	\$4,500	\$3,170	\$1,490	\$4,500	\$0	\$0	
RM SPECIAL PROJECTS (\$K)	REGULAR	\$310,752	\$500,132	\$205,483	\$197,972	\$205,251	\$192,846	\$197,435	\$204,804	
	RESERVE	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	
DE SPECIAL PROJECTS (\$K)	REGULAR	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	
	RESERVE	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	
MILITARY CONSTRUCTION (\$K)	REGULAR	\$1,062,068	\$766,623	\$367,540	\$137,280	\$327,383	\$373,360	\$343,190	\$373,390	
	RESERVE	\$25,000	\$25,000	\$24,500	\$20,000	\$29,400	\$28,458	\$27,600	\$24,000	
OVER/UNDER PROGRAMMED (\$K)		<b>-\$46,847</b>	<b>\$785,310</b>	<b>\$1,012,937</b>	<b>\$954,617</b>	<b>\$928,587</b>	<b>\$815,293</b>	<b>\$867,447</b>	<b>\$855,119</b>	

## Long-range investment level impact forecasting tool

To supplement the precise impact assessment of the proposed project investments during the FYDP, we also designed a longer time period estimating tool. The long-range investment level impact forecasting

tool module is accessed through the main selection screen. Figure 53 provides a functional block diagram for this module.

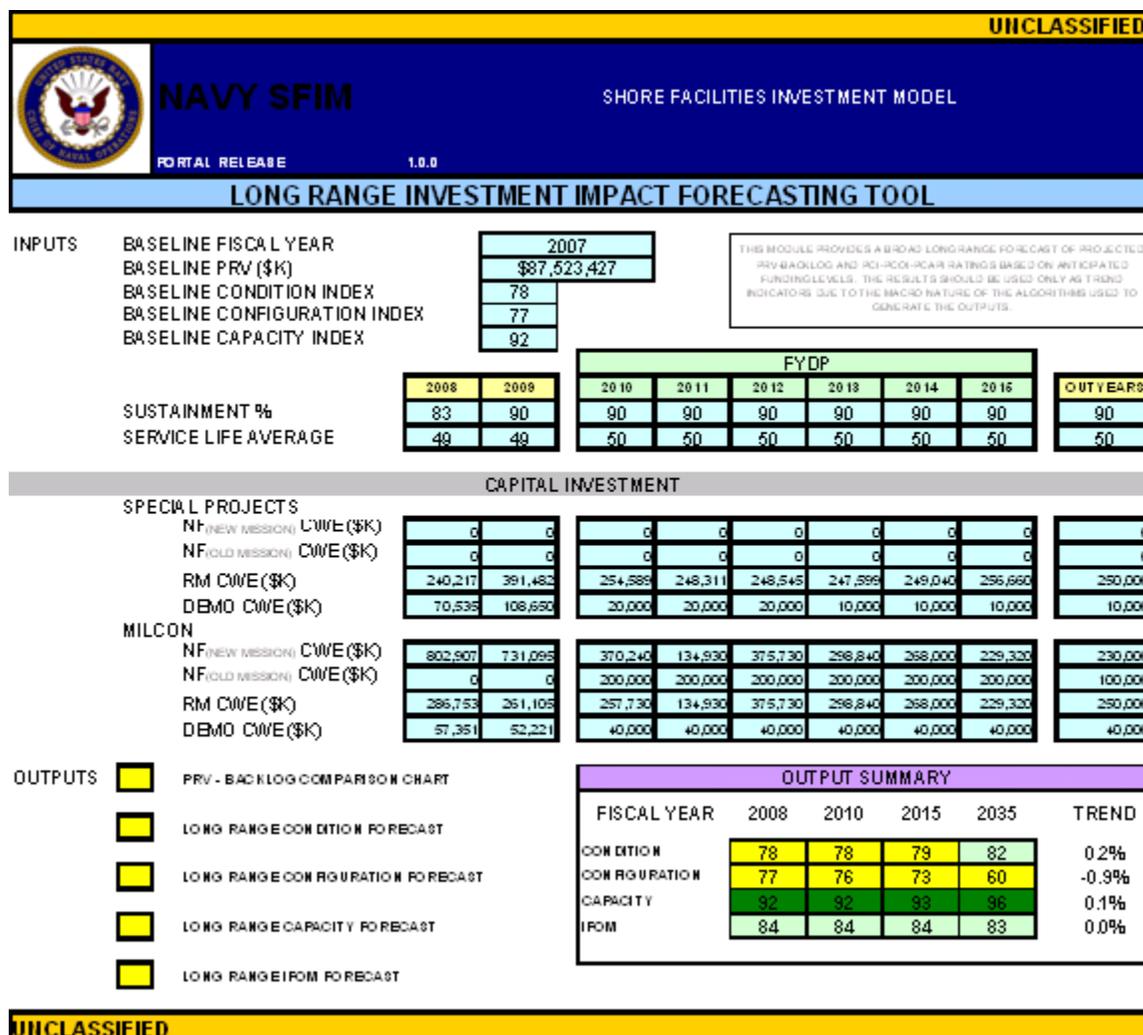
Figure 53. SFIM long-range impact forecasting module functional block layout



The first functional block of this module provides both the input tables to be filled in as well as an output summary that shows the projected performance outcomes based on the funding levels provided

for sustainment and capital investment. Figure 54 provides an example of the long-range impact module input/output screen.

Figure 54. SFIM long-range impact forecasting module input/output screen



The screen is divided into three sections. The top section provides for the entry of the baseline fiscal year's total PRV amount, condition index, configuration index, and capacity index as well as sustainment funding percentage and the service life average in years for the inven-

tory being analyzed. This information allows for the creation of a baseline starting point and degradation rates for both condition and configuration. The middle section provides the capability to enter different funding levels for capital investment. The bottom section allows for the quick review of output summary results with a trend measurement. The user can also select one of the five more detailed charts that provide long-term plots of the impact resulting from the entered funding levels.

The calculations worksheet handles each fiscal year in sequence beginning with the first investment year, which, in this example, is FY 2008. Table 14 provides a summary of the modeling steps.

Table 14. SFIM long-range investment impact modeling steps

Row title	Operation performed	FY 2008 example value
<b>BEGINNING INVENTORY VALUES</b>		
PRV (\$K)	Transfer input value from entry screen	\$87,523,427
P <sub>CI</sub>	Transfer input value from entry screen	78.0
P <sub>COI</sub>	Transfer input value from entry screen	77.0
P <sub>CAPI</sub>	Transfer input value from entry screen	92.0
P <sub>IFOM</sub>	$0.29P_{CI} + 0.23P_{COI} + 0.48P_{CAPI}$	84.5
Total condition requirement (\$K)	$((100 - P_{CI})/100)PRV$	\$19,255,154
Total configuration requirement (\$K)	$((100 - P_{COI})/100)PRV$	\$20,130,388
Total capacity requirement (\$K)	$((100 - P_{CAPI})/100)PRV$	\$7,001,874
NF full requirement (\$K)	= Total capacity requirement	\$7,001,874
M&R full requirement (\$K)	= Maximum[Total condition requirement, Total configuration requirement]	\$20,130,388
<b>INVENTORY DEGRADATION</b>		
Sustainment percent	Transfer input value from entry screen	83.0
Service life average	Transfer input value from entry screen	49.0
P <sub>CI</sub> degradation	$-4.0(100 - \text{Sustainment percent})/100$	-0.7
P <sub>COI</sub> degradation	$-60/\text{Service life average}$	-1.2
<b>SPECIAL PROJECT IMPACT</b>		
NF <sub>(NEW)</sub> CWE (\$K)	Transfer input value from entry screen	\$0
NF <sub>(OLD)</sub> CWE (\$K)	Transfer input value from entry screen	\$0
R&M CWE (\$K)	Transfer input value from entry screen	\$240,217
DEMO CWE (\$K)	Transfer input value from entry screen	\$70,535

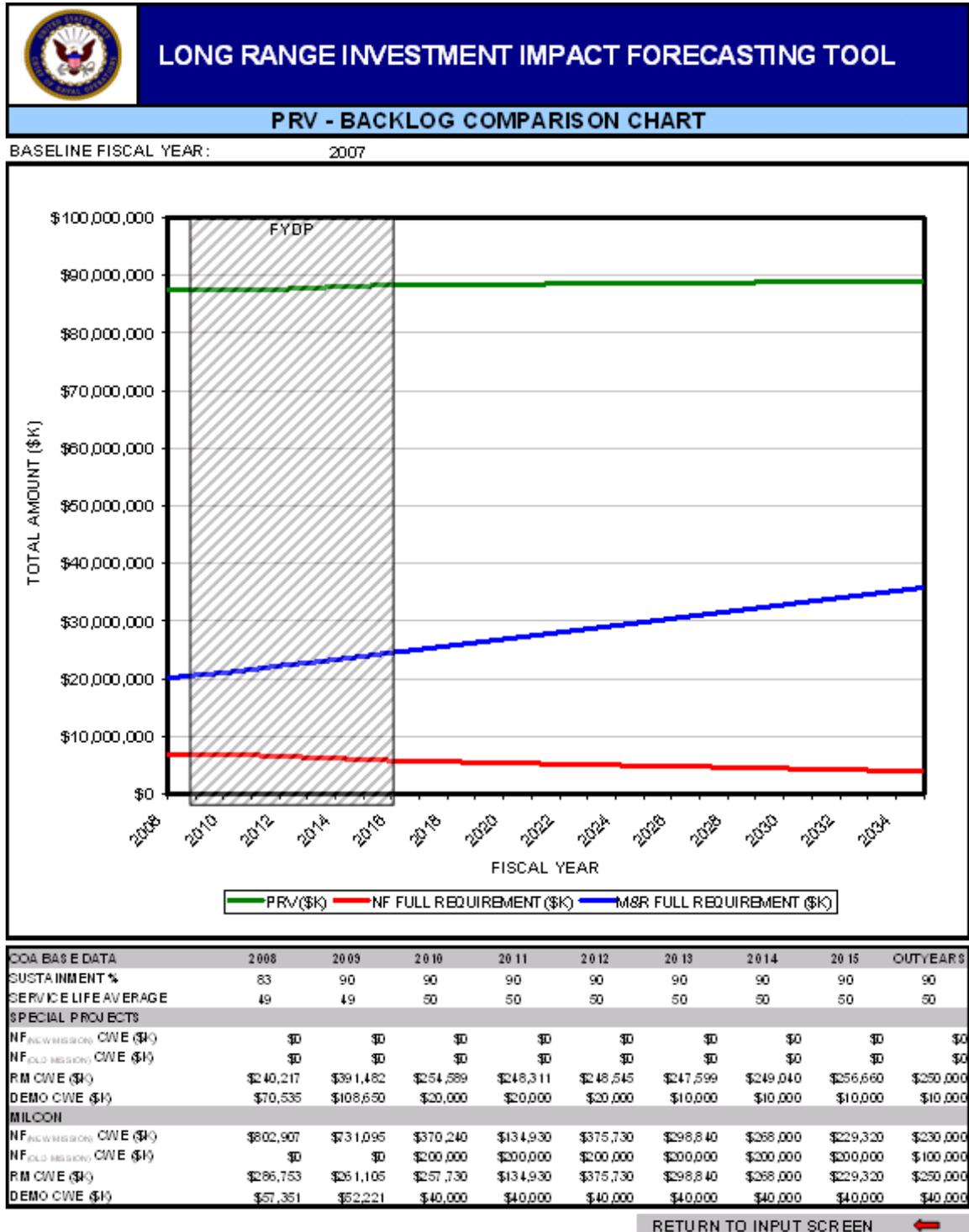
Table 14. SFIM long-range investment impact modeling steps

Row title	Operation performed	FY 2008 example value
Total SP funding (\$K)	$NF_{(NEW)} \text{CWE} + NF_{(OLD)} \text{CWE} + \text{R\&M CWE} + \text{DEMO CWE}$	\$310,752
Inventory adjustment (\$K)	$(NF_{(NEW)} \text{CWE} + NF_{(OLD)} \text{CWE} - (5.87 \text{DEMO CWE}))$	-\$414,040
$P_{CI}$ improvement	$(\text{R\&M CWE}/\text{PRV})100$	0.3
$P_{COI}$ improvement	$(\text{R\&M CWE}/\text{PRV})100$	0.3
$P_{CAPI}$ improvement	$(NF_{(OLD)} \text{CWE}/\text{PRV})100$	0.0
<b>MILCON PROJECT IMPACT</b>		
$NF_{(NEW)} \text{CWE}$ (\$K)	Transfer input value from entry screen	\$802,907
$NF_{(OLD)} \text{CWE}$ (\$K)	Transfer input value from entry screen	\$0
R&M CWE (\$K)	Transfer input value from entry screen	\$286,753
DEMO CWE (\$K)	Transfer input value from entry screen	\$57,351
Total MCON funding (\$K)	$NF_{(NEW)} \text{CWE} + NF_{(OLD)} \text{CWE} + \text{R\&M CWE} + \text{DEMO CWE}$	\$1,147,011
Inventory adjustment (\$K)	$(NF_{(NEW)} \text{CWE} + NF_{(OLD)} \text{CWE} - (5.87 \text{DEMO CWE}))$	\$466,257
$P_{CI}$ improvement	$(\text{R\&M CWE}/\text{PRV})100$	0.3
$P_{COI}$ improvement	$(\text{R\&M CWE}/\text{PRV})100$	0.3
$P_{CAPI}$ improvement	$(NF_{(OLD)} \text{CWE}/\text{PRV})100$	0.0
<b>End-of-Year (EOY) VALUES</b>		
Total investment (\$K)	= Total SP funding + Total MCON funding	\$1,457,763
New PRV (\$K)	= PRV + SP inventory adjustment + MCON inventory adjustment	\$87,575,643
New $P_{CI}$	= $P_{CI}$ + $P_{CI}$ degradation + $P_{CI}$ SP improvement + $P_{CI}$ MCON improvement	77.9
New $P_{COI}$	= $P_{COI}$ + $P_{COI}$ degradation + $P_{COI}$ SP improvement + $P_{COI}$ MCON improvement	76.4
New $P_{CAPI}$	= $P_{CAPI}$ + $P_{CAPI}$ degradation + $P_{CAPI}$ SP improvement + $P_{CAPI}$ MCON improvement	92.0
New $P_{IFOM}$	$0.29(\text{New } P_{CI}) + 0.23(\text{New } P_{COI}) + 0.48(\text{New } P_{CAPI})$	84.3
CI/COI backlog reduction (\$K)	SP R&M CWE + MCON R&M CWE	\$526,970
CAPI backlog reduction (\$K)	SP $NF_{(OLD)} \text{CWE} + \text{MCON } NF_{(OLD)} \text{CWE}$	\$0
New NF full requirement (\$K)	NF full requirement - CAPI backlog reduction	\$7,001,874
New M&R full requirement (\$K)	M&R full requirement - CI/COI backlog reduction	\$19,603,418

The new EOY values are then rolled over to the next fiscal year as starting points for the next calculation cycle. This calculation cycle is repeated until FY 2035 is reached. The same linear 0.0 to 4.0 point condition degradation scale, based on a 100 to 0 percent sustainment and as found in the future impact module, is also used for the annual degradation calculation in this module [8]. Navy historical studies have shown that recent demolition projects result in a PRV reduction of 5.87 times the CWE. As the input funding levels are changed, the output summary results are automatically adjusted to the new values.

The first output report is a PRV—backlog comparison chart. Figure 55 provides an example of this display.

Figure 55. SFIM long-range impact module PRV—backlog comparison chart



This report shows how the total PRV changes over the 28 year time period in comparison to the growth or decline in the new footprint (NF) full-requirement and modernization and restoration (M&R) full-requirement. In this example the PRV is growing because the NF full-requirement is being reduced through investment in the NF<sub>(old)</sub> mission account. The M&R full requirement continues to grow due to degradation outpacing M&R investment levels.

The remaining reports provide individual summaries of trends for condition, configuration, capacity, and IFOM. Figures 56, 57, 58, and 59 provide examples of these charts.

Figure 56. SFIM long-range impact module condition trend chart

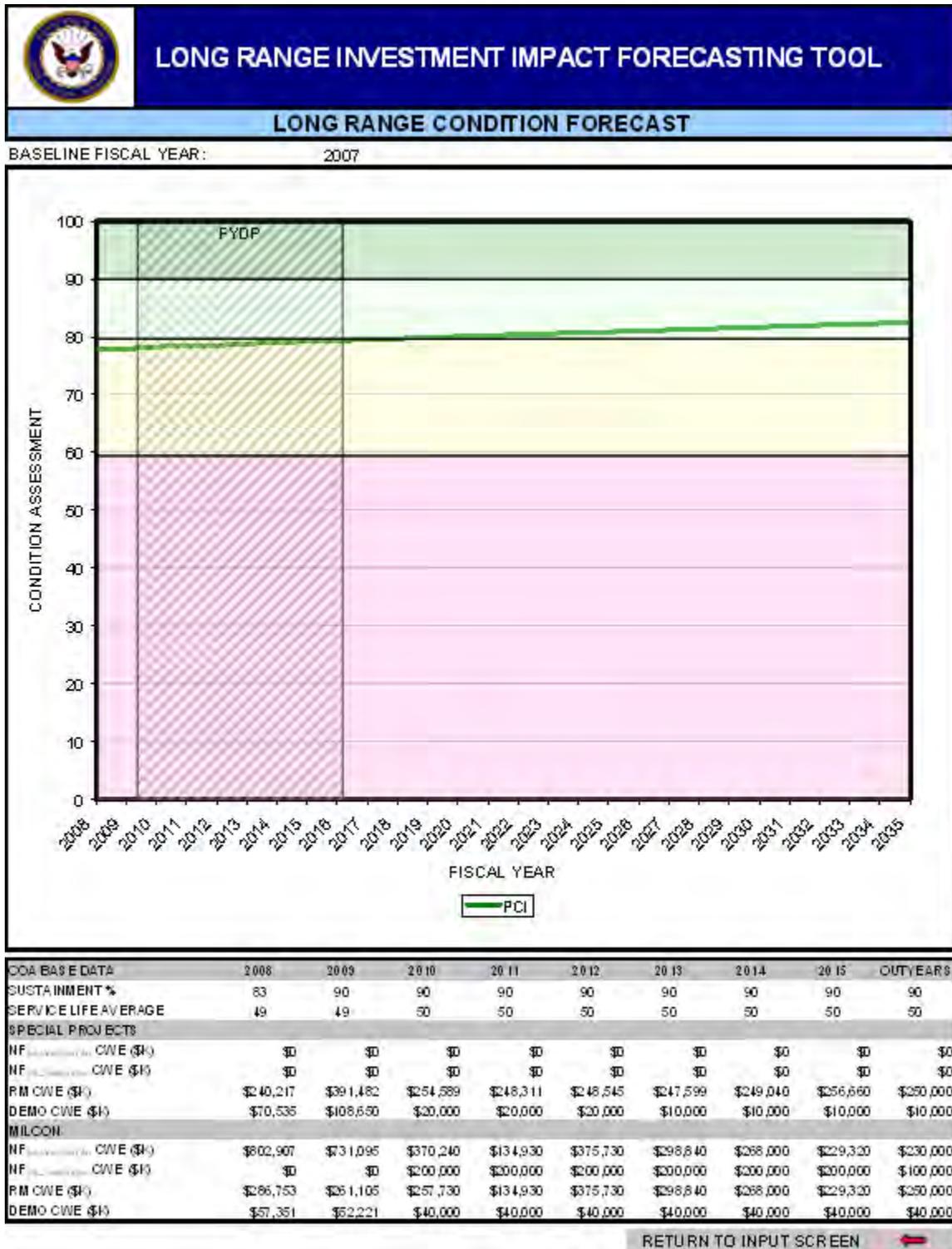


Figure 57. SFIM long-range impact module configuration trend chart

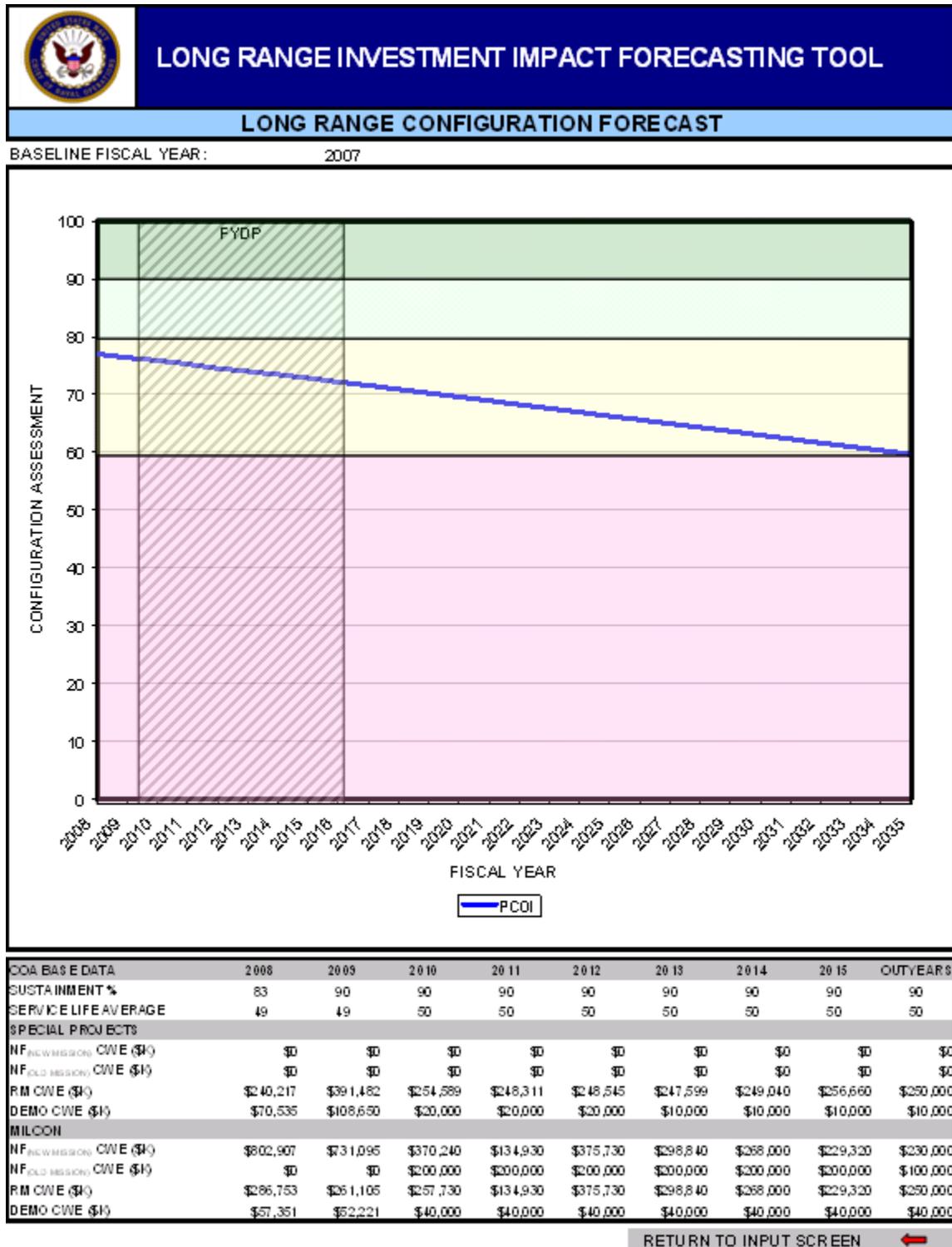


Figure 58. SFIM long-range impact module capacity trend chart

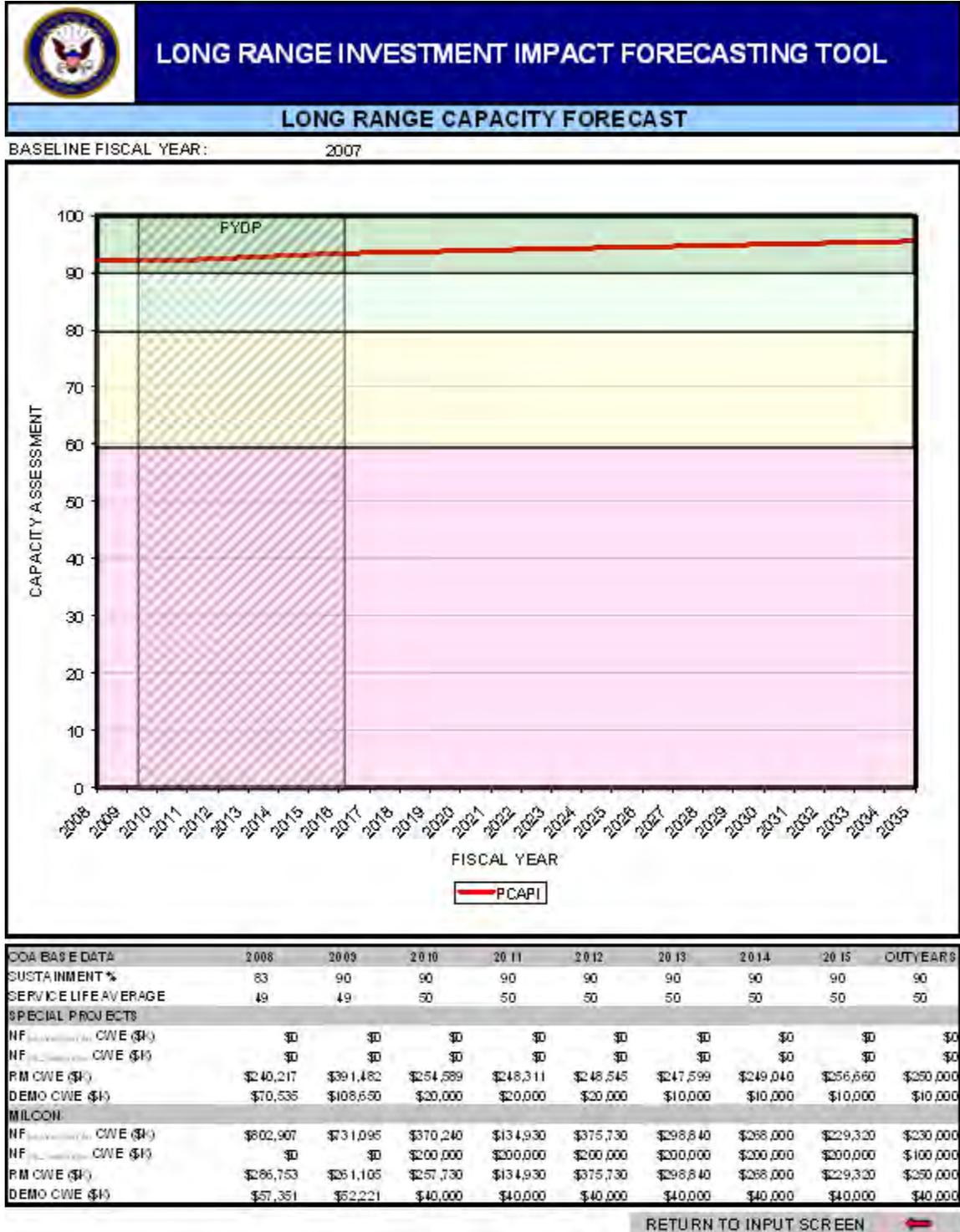
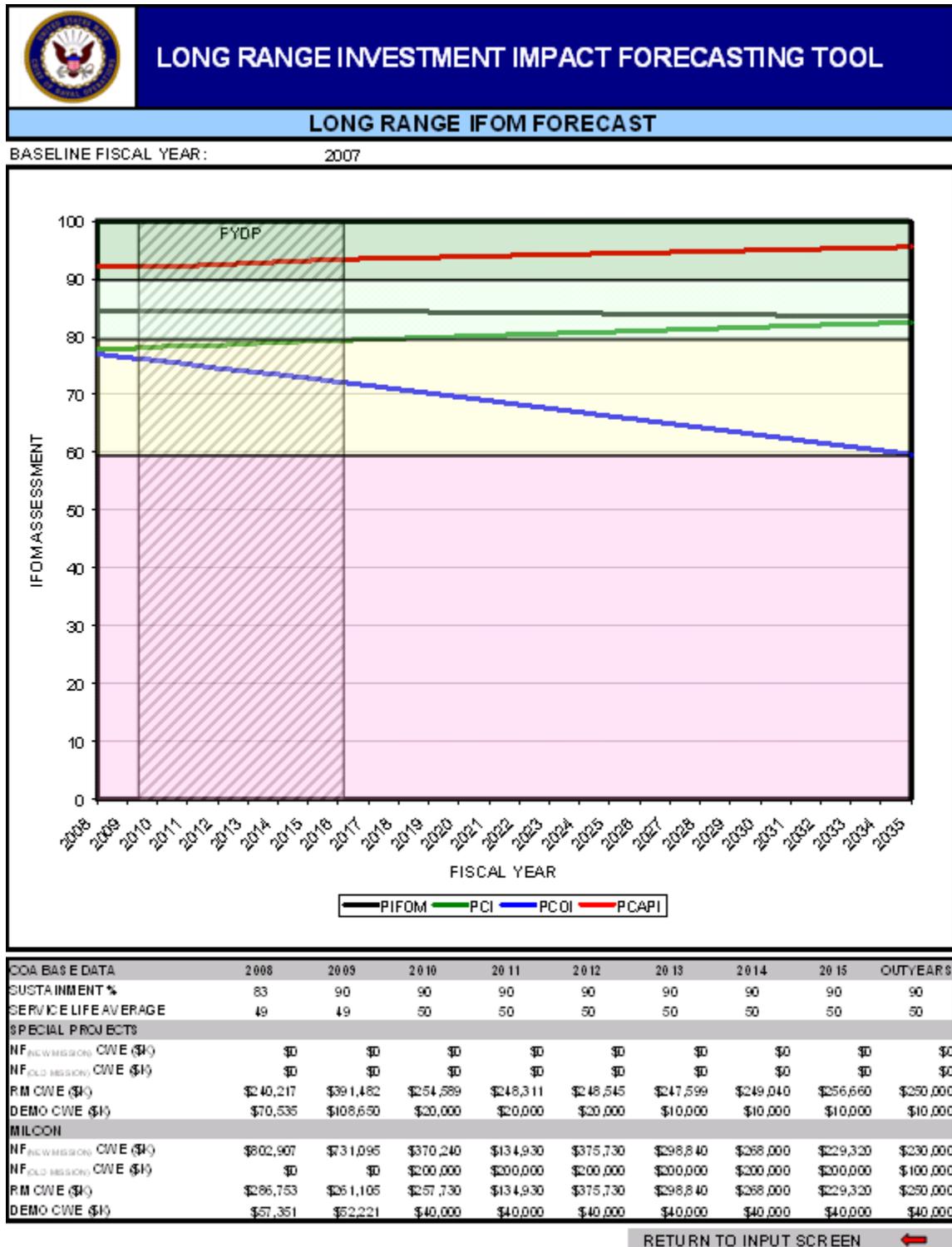


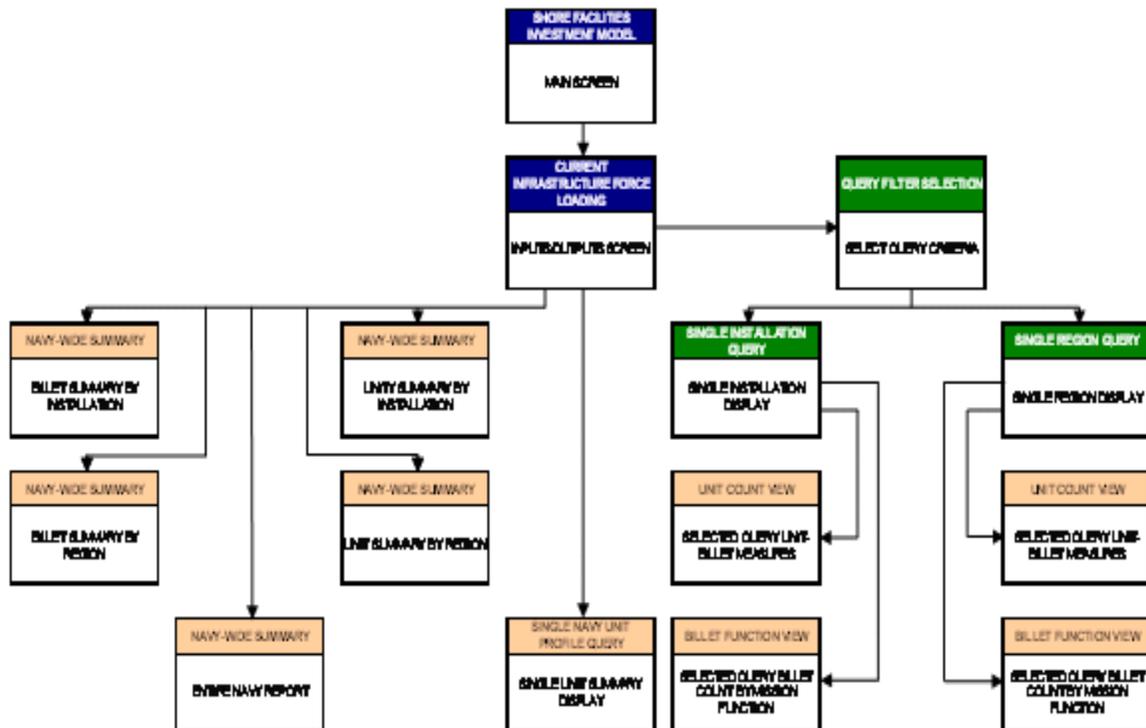
Figure 59. SFIM long-range impact module IFOM trend chart



## Current force loading

The final application that can be accessed from the main selection screen is the current infrastructure force loading module, which was developed to produce individual profiles for installations and regions. These installation profiles can be used by shore investment programmers to determine the risk impact of investment changes on specific Navy units. Figure 60 provides a functional block diagram.

Figure 60. SFIM force loading module functional block layout



For this application the query selections were embedded within the input/output control panel. Figure 61 provides a view of this screen.

Figure 61. SFIM force loading module input/output control screen

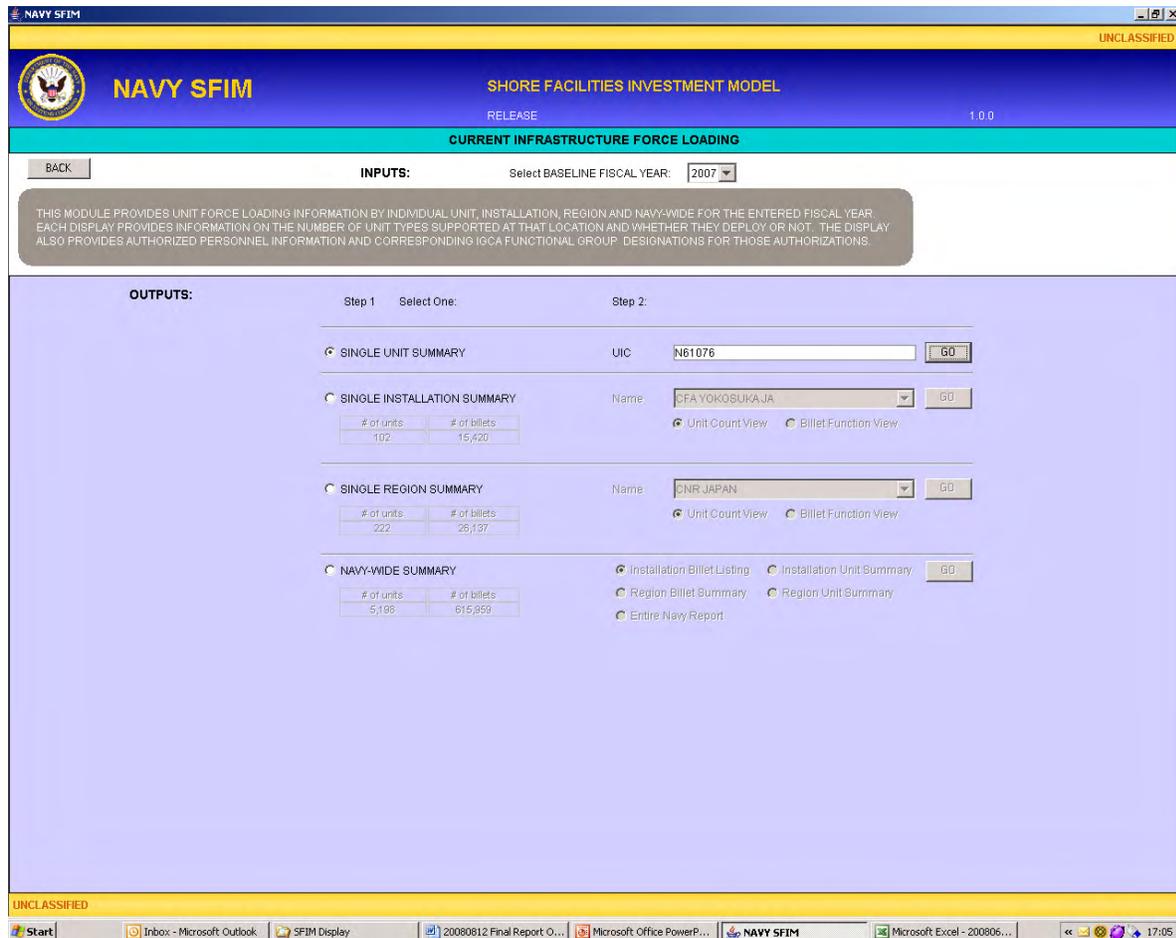
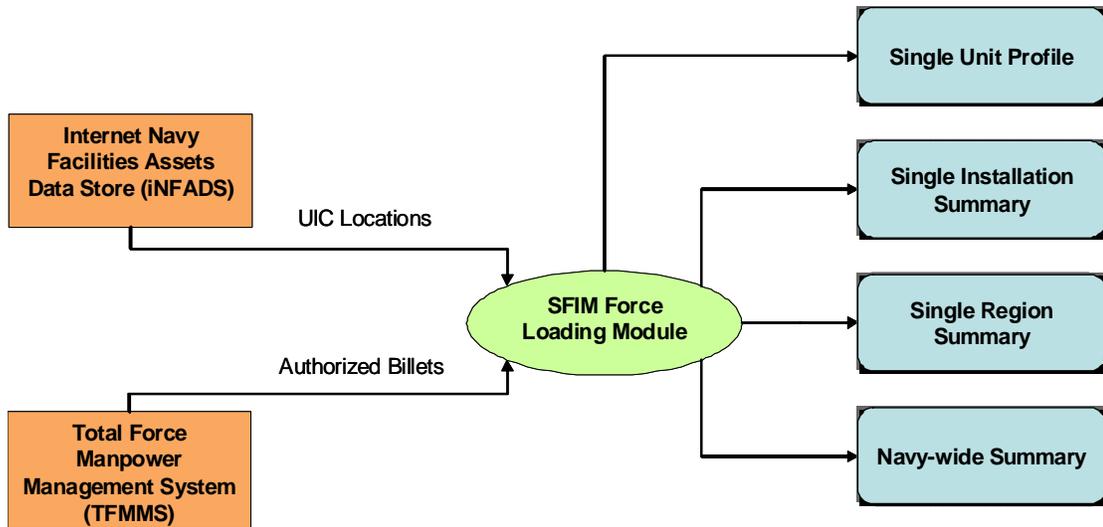


Figure 62 provides a design view of how the information is processed with this module. Note that the unit locations are provided from iNFADS and the authorized billets for each unit come from TFMMS.

This information is linked together in SFIM and realigned to provide force loading profiles Navy-wide and by installation and region.

Figure 62. SFIM force loading module design



There are four basic types of force loading profile reports. The user can screen for an individual Navy unit by entering in the UIC. Figure

63 provides an example of the type of information that is provided for an individual unit.

Figure 63. SFIM force loading module individual unit profile

The screenshot displays the NAVY SFIM (Shore Facilities Investment Model) interface. The main title is 'SHORE FACILITIES INVESTMENT MODEL' with a release version of 1.0.0. The current view is the 'INDIVIDUAL UNIT FORCE LOADING SUMMARY' for unit 'COMNAVREG JAPAN' at 'CFA YOKOSUKA JA'. The unit profile includes the following details:

- UNIT PROFILE:**
  - FIELD: UNIT TYPE (SHORE)
  - FIELD: DEPLOYMENT TYPE (NON DEPLOYABLE)
  - FIELD: DEPLOYMENT DESCRIPTION (OVERSEAS SHORE DUTY)
  - FIELD: MISSION CLAIMANT (CNI)
  - FIELD: ENTERPRISE CODE (INSTL)
- PERSONNEL AUTHORIZATION PROFILE:**

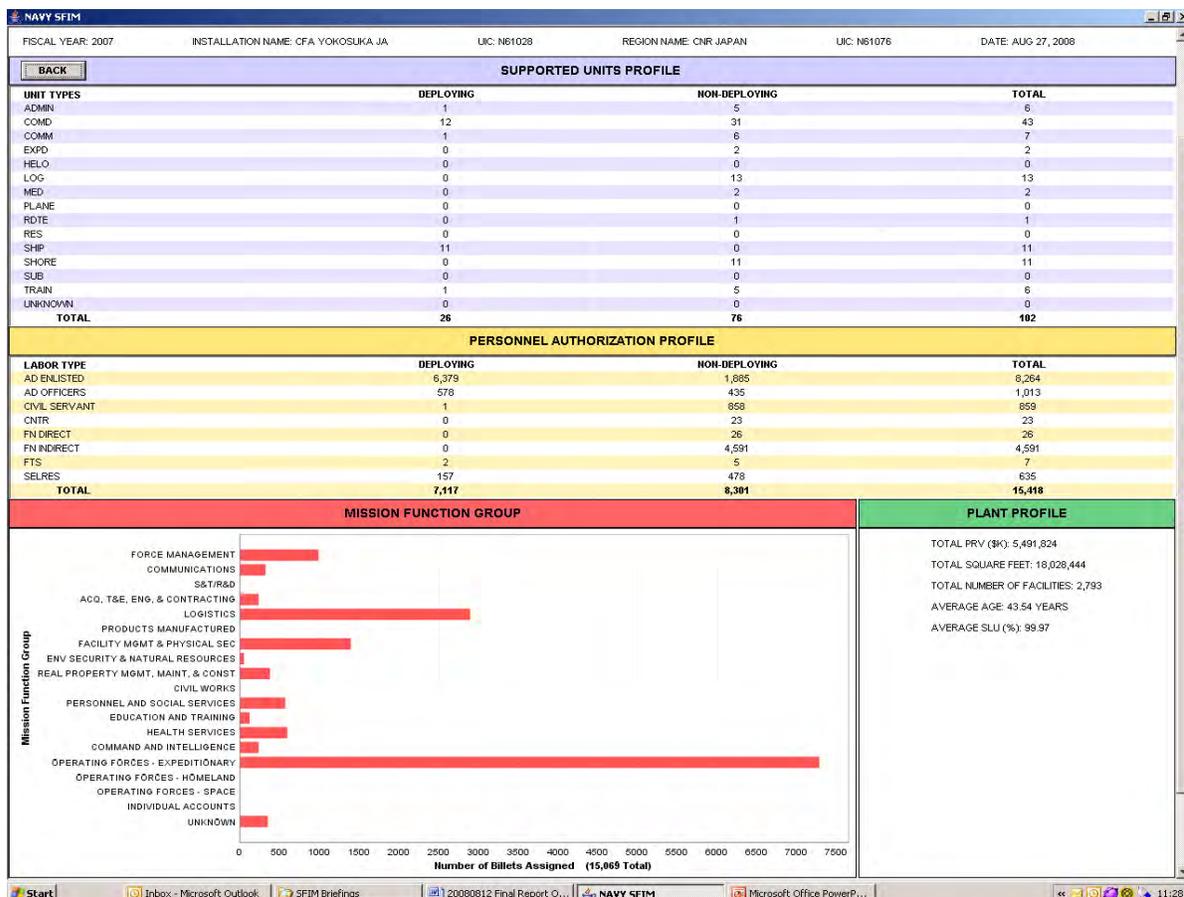
LABOR TYPE	DEPLOYING	NON-DEPLOYING	TOTAL
AD ENLISTED	0	3	3
AD OFFICERS	0	3	3
CIVIL SERVANT	0	123	123
CNTR	0	0	0
FN DIRECT	0	1	1
FN INDIRECT	0	734	734
FTS	0	0	0
SELRES	0	2	2
<b>TOTAL</b>	<b>0</b>	<b>866</b>	<b>866</b>
- BILLET FUNCTIONAL COUNT:**

MISSION FUNCTION GROUP	Labor Class Numbers					Labor Class Percentages				
	AD	RES	CIV	CNTR	TOTAL	AD	RES	CIV	CNTR	TOTAL
FORCE MANAGEMENT AND GENERAL SUPPORT	2	0	59	0	61	0.0	0.0	7.0	0.0	7.0
COMMUNICATIONS, COMPUTING AND OTHER INFORMATION SERVICES	0	0	65	0	65	0.0	0.0	8.0	0.0	8.0
SCIENCE AND TECHNOLOGY (S&T) AND RESEARCH AND DEVELOPMENT (R&D) MANAGEMENT AND SUPPORT	0	0	0	0	0	0.0	0.0	0.0	0.0	0.0
SYSTEMS ACQUISITION, TEST AND EVALUATION, ENGINEERING, AND CONTRACTING	0	0	0	0	0	0.0	0.0	0.0	0.0	0.0
LOGISTICS	0	0	0	0	0	0.0	0.0	0.0	0.0	0.0
PRODUCTS MANUFACTURED OR FABRICATED	0	0	0	0	0	0.0	0.0	0.0	0.0	0.0
INSTALLATION/FACILITY MANAGEMENT AND PHYSICAL SECURITY	1	0	598	0	599	0.0	0.0	70.0	0.0	70.0
ENVIRONMENTAL SECURITY AND NATURAL RESOURCE SERVICES	0	0	7	0	7	0.0	0.0	1.0	0.0	1.0
REAL PROPERTY PROJECT MANAGEMENT, MAINTENANCE AND CONSTRUCTION	0	0	1	0	1	0.0	0.0	0.0	0.0	0.0
CIVIL WORKS	0	0	0	0	0	0.0	0.0	0.0	0.0	0.0
PERSONNEL AND SOCIAL SERVICES	3	2	116	0	121	0.0	0.0	14.0	0.0	14.0

The user can generate the following profile for a single installation. This has the same information as the individual unit profile, but it is aggregated for all the units assigned to that installation. A type of unit summary is also added to reflect the nature and number of units supported by that installation. Key infrastructure metrics are also added

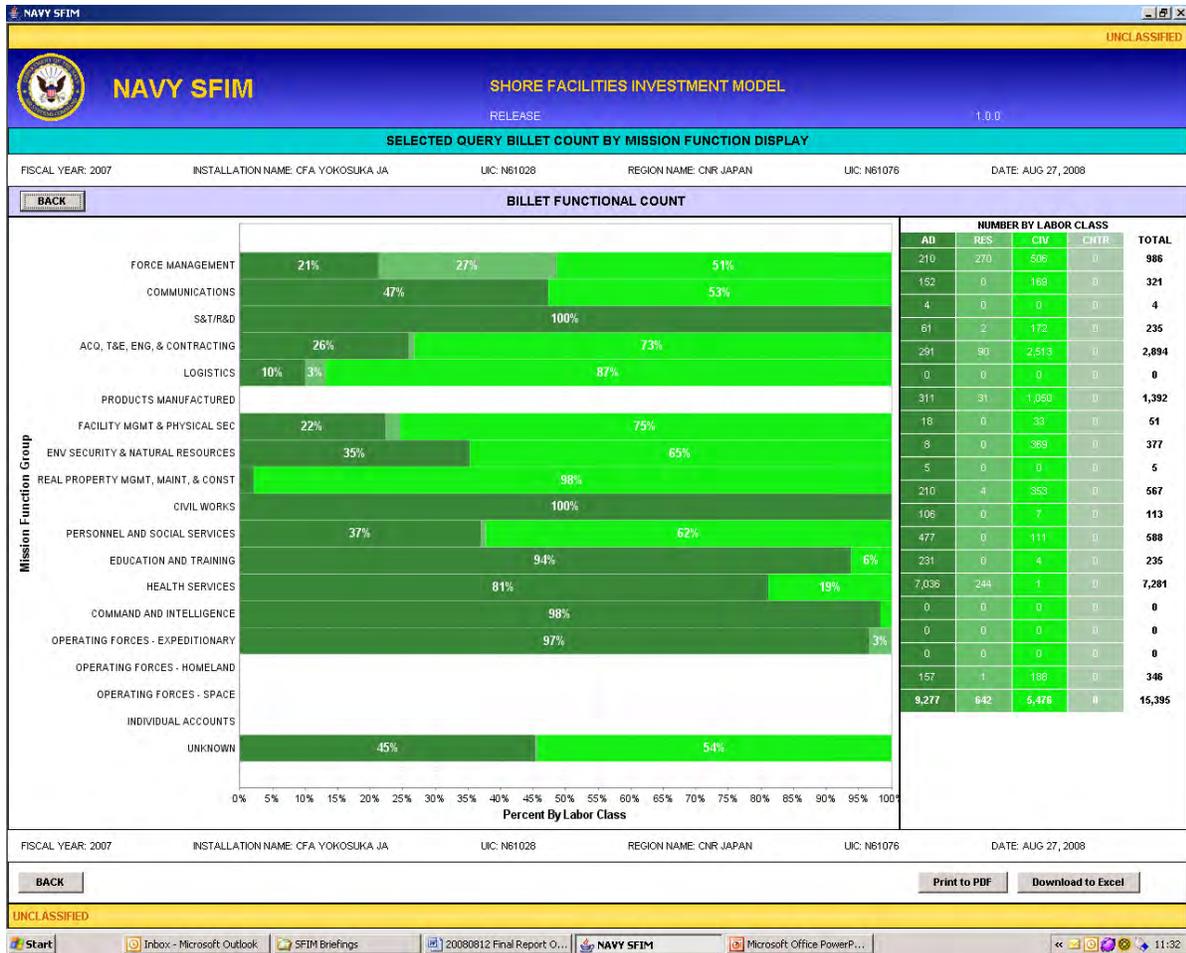
to the profile to allow for quick reference while reviewing the profile. Figure 64 provides an example of this type of display.

Figure 64. SFIM force loading module installation summary unit count view



There is an additional view that can be accessed to provide additional information about force loading at that installation. Figure 65 provides an example of this billet function display.

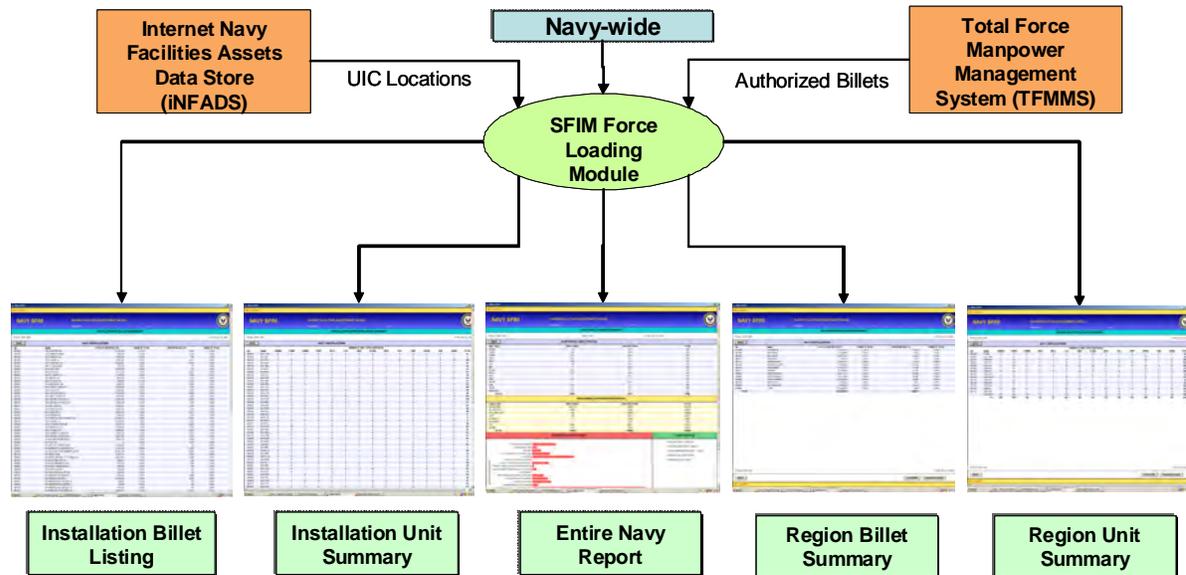
Figure 65. SFIM force loading module installation summary billet function view



The regional profiles provide the same type of information as the installation summaries in two views, but they are aggregated at the region level. The final series of profile reports are at the Navy-wide

level and summarize the aggregate unit information into various displays. Figure 66 provides a summary of what these reports cover.

Figure 66. SFIM force loading module Navy-wide summary views



These reports can be used to help refine and validate the force loading information and to make comparisons between installations and regions. This tool is expected to help respond to the “so what” questions for shore investment decisions by linking specific project investments to the number and type of Navy units that are impacted by the proposed work and by broadly gauging the risk associated with program changes.

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## Navy input data sources

One of the key requirements for the model is that it has to use official existing Navy data sources since it is to be an enduring model that can't be dependent upon specific Navy-wide data calls. Each of the key data source drivers that we used are discussed below.

### Internet Navy Facilities Assets Data Store (iNFADS)

The iNFADS database is the authoritative infrastructure data source for the Department of the Navy. NAVFAC created iNFADS to fulfill the requirements of DoDINST 4165.14, DoD Financial Management Regulation (FMR) Volume 4 Chapter 6, and FMR 102-84 which mandated the establishment of a system that could meet the RPI and reporting requirements for Navy facilities. iNFADS is used throughout the Navy and Marine Corps as the primary authority for facilities data.

It is a comprehensive web-based system that allows users to query, view, summarize, and export RPI data. iNFADS has a flexible reporting tool that allows users to perform advanced queries by filtering facility data by a variety of location or category attributes.

iNFADS consists of the following modules:

- Facility: contains data on each existing facility
- Activity: contains installation level data
- Category code: describes category codes, units of measure, facilities analysis codes (FACs), and construction cost factors
- Planning: contains facility requirements

iNFADS is the primary data source for the SFIM and it provides the comprehensive list of facilities and their associated RPI characteristics, such as facility name, installation name, PRV, region, year built,

area, assets, and BFR. The SFIM utilizes the Facilities, Quantity, and Utilization tables from iNFADS. These tables are exported directly from iNFADS as comma separated values (CSV). The CSV file is then imported into the SFIM database without any transformations.

While NAVFAC has the primary responsibility over iNFADS, the following organizations participate in the update and review process:

- Installation management components (IMCs) includes: CNIC, Bureau of Naval Medicine (BUMED), and the Marine Corps, mission claimants, regional commanders, and Navy/Marine Corps shore installation commanders
- Commandant, Marine Corps (CMC)
- NAVFAC iNFADS Center of Expertise (COE) commands (NAVFAC ATLANTIC, NAVFAC PACIFIC, NAVFAC SOUTHWEST, SOUTHERN DIVISION NAVFAC)
- NAVFAC Facilities Engineering Commands: Facilities Planning, Real Estate, Design, and Financial business lines
- Property Accounting Installations (PAIs)
- NAVFAC Information Technology Center (NITC)
- NAVFAC Headquarters

iNFADS is a real-time property inventory, and updates to the iNFADS data occurs as necessary according to the responsibilities and procedures outlined in the Real Property Inventory Procedures Manual. IMCs (CNIC, BUMED, and CMC), Navy regions, NAVFAC, NITC, and the NAVFAC COE commands meet regularly to solicit, coordinate, and prioritize the various changes required by the users.

## **Master project listing with impacts**

The projects list is a master list of roughly 2,000 construction, maintenance, repair, and demolition projects, and it is used to support programming for “Special Projects” (including restoration and modernization as well as demolition) and “Military Construction” budget items. OPNAV N46 collects, oversees, and maintains the project list-

ings, and issues a new data call annually for updates as part of the program planning and budgeting system (PPBS) process. This list is the result of submissions by the CNIC regional commanders on all required projects. The listing includes data elements such as project scope, location, facility name, cost, SCA, and funding source. This projects listing is collected via a data call in MS Excel<sup>14</sup>. The data are compiled by N46 and imported directly into the SFIM database.

This master projects list is reviewed by N46 and undergoes a prioritized ranking process to determine which projects will be programmed. The investments projects list is an output of the SFIM capital investment impact assessment module. This module allows the user to run a variety of COAs using different project combinations, including an optimized list based on project impacts to the IFOM. The final investment selection is passed up to N4, N80, Office of Budget, OSD, and finally Office of Management and Budget (OMB) as a part of the budget submission.

Military construction projects are submitted as individual line items into the budget, whereas special projects are submitted as funding requirements in the O&M,N and O&M,NR new footprint (NF), restoration & modernization (RM), and demolition (DE) accounts.

## **Quarterly Performance Data Call (QPDC)**

The QPDC is a quarterly survey distributed at the CNIC regional level to measure base operating service performance based on COLs. Regions forward the surveys to the appropriate installations for completion. The web-based survey includes a series of questions and answers for a series of QPDC programs. The scores range from 0-10 and are tiered into four common output levels. The QPDC scores and programs are mapped to the SFIM as an input to the calculation of the CPL score.

The QPDC surveys are collected at the installation level with direction from CNIC N5. After surveys are completed, there is a thorough eval-

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14. Starting for PR-11, the field submissions will be inputted into the Integrated Priorities List (IPL) module of iNFADS.

uation process. The QPDC results serve as the authority for Navy CPL performance data and are tied to COLs. The performance data are exported to MS Excel from the QPDC data collection on the Navy Information Clearinghouse. The QPDC programs and scores are mapped to support the SFIM.

## **Resource Management Knowledge System (RMKS)**

RMKS is a CNIC financial management tool that provides up-to-date current year funding execution. Official accounting data in RMKS are pulled from the Standard Accounting Reporting System - Field Level (STARS-FL). RMKS is a reporting mechanism for STARS, which is the system for general fund accounting and reporting for the Navy, Marine Corps, Air Force, and Defense Agencies. DoD Financial Management Regulation Volume 6, Chapter 5 General Purpose Reporting establishes the policy for reporting trial balance reports through STARS-FL. The data are organized into a series of reports that provide cost execution data such as certified obligations, spent-to-date, burn rate, and annual projections.

The SFIM utilizes RMKS in support of the CPL module to provide certified obligation data for the fiscal year. Report PD0554 “Enterprise Status of Fund by Activity” is generated through RMKS for O&M,N and O&M,NR. The data are exported to MS Excel through RMKS, and the outputs are categorized by SICs. For use in the SFIM, the SIC is mapped to an SCA.

## **Capability Based Budgeting (CBB)**

The CBB is the result of an annual CNIC data call to identify essential costs, full-time equivalents (FTE), and end strength necessary to produce the products required for each of the base operating services COLs. CNIC HQ issues the data call and performs oversight of the data quality. It is a web-based data collection system that was been used annually from 2004-2006 to support POM-08.

The CBB data are used in the SFIM for calculating the  $P_{(CPL)}$  score. The CBB provides the dollar amounts required to achieve the lowest

point of the COL 1, 2, and 3 standards. These low points represent thresholds for CPL performance.

The data were collected via an online data collection interface through the Navy Information Clearinghouse under data collections. These data are exported to MS Excel and then imported into the database. Because the most recent data identified are from 2006, the SFIM model multiplied the FY 2006 budget data by an inflation factor that is provided within the CBB file.

## **Total Force Manpower Management System (TFMMS)**

TFMMS is an information system designed to support the DCNO, Manpower and Personnel (N1). TFMMS provides a single authoritative source for Navy manpower data, and the ability to track manpower resources, and requirements and authorizations for active military (officer and enlisted), reserves, civilians, contractors, and other categories of manpower. It provides a mechanism to store and retrieve all manpower types. It also stores and retrieves historical, current, budget, and out-year manpower data. TFMMS is available online for resource sponsors, claimants, sub-claimants, and others, and it provides storage and retrieval of transaction history.

The TFMMS data are used to support the SFIM current force structure module. The end-of-fiscal year billet authorizations are extracted as a MS Access data file, which is loaded directly into the SFIM database.

## **OSD Facilities Sustainment Model (FSM)**

The OSD-managed FSM, forecasts annual facility sustainment costs for all DoD facilities through the budget and FYDP years. Facilities sustainment provides resources for maintenance and repair activities necessary to keep a typical inventory of facilities in good working order over a 50-year service life. It is updated annually and provides the estimated sustainment cost for each facility based on the 30 September end-of-year RPI using the following formula.

$$\text{Sustainment} = (\text{RPI Asset Quantity} * \text{unit costs}) \quad (20)$$

Where the unit cost is DoD sustainment cost factors (commercial benchmarks, Means, Virginia Department of Transportation (VDOT), Whitestone, etc) with location and inflation adjustments.

These data are extracted for the Navy in a MS Excel file and imported directly into the SFIM. The information is used in the current inventory module to calculate the current sustainment requirement and display on the individual facility profile.

## Future capabilities

As with the development of any new analytical model, there are some reality adjustments that have to be made during the design process. And, while additional capabilities are desirable, time and circumstances do not always allow for their inclusion.

In the next section, we discuss the planned mitigations to help address the observed SFIM shortcomings, and we provide the pending processes and business issues that still linger after the completion of the model.

## Mitigation of model shortcomings

The SFIM was designed to be flexible and adaptable to different programming scenarios. Certain model design verification, validation, and accreditation (V,V&A) risks were identified and mitigation strategies developed in support of future capability development. The primary risks noted include the following:

- (Risk) SFIM development continues during and beyond the V,V&A process as the shore investment strategy matures.

(Mitigation) Maintain strict configuration control to track and prioritize modifications and ensure key requirements and design features remain intact.

- (Risk) Output feedback loop requires two years of execution data prior to comparison with model predicted values.

(Mitigation) Due to a lack of depth in historical data, the Navy should seek accreditation to support continued SFIM use based on verification with existing OSD models and general industry standards until proper data can be obtained.

- (Risk) Current SFIM algorithms may need to be adjusted based on future study results.

(Mitigation) Continue to refine the metric calculations and weights based on experience, industry standards, and future results while maintaining model configuration management.

- (Risk) Inaccuracies and gaps in source data (FCI, BFR, etc.).

(Mitigation) CNIC, in conjunction with NAVFAC Asset Management, will review/study input data validity with a focus on quality improvement and closure of data gaps.

- (Risk) Insufficient depth of government experience with SFIM use.

(Mitigation) Provide user manual and schedule hands-on training workshops for model prior to PR-11 programming effort.

Specific SFIM future capabilities that should be considered include: enabling geographic segmentation down to the site level, and functional segmentation down to the facility category code level. This would allow for greater granularity and selectivity in assessing quality performance metrics. One more desirable model calculation capability would be to produce the OSD Q-rating in the same displays as the current IFOM views.

## Issues that need to be addressed

There are also some lingering development issues that should be addressed eventually by the Navy. While they do not directly affect how the model operates, these issues do result in less precise model results. SFIM is heavily dependent upon the quality of the source data and each of these issues is related to the capture and development of accurate input information. The following recommendations suggest areas for improvement.

## **iNFADS number listing on project 1391 forms**

One suggestion is to change the Navy business rules for DoD Form 1391<sup>15</sup> development to include listing the unique facility iNFADS numbers as well as the local building numbers within the project justification and description. The future impact module requires the Navy to identify each affected facility by its unique iNFADS number so it can be referenced in the project impact table. Since facility numbers are not unique and sometimes not included within the narrative, it is difficult at times to determine the full impact of a proposed investment project.

## **BFR updates**

The surplus capacity values remain high for the baseline inventory. We discovered that the BFR updates are only roughly 50 percent current. (A BFR is considered current if it has been updated within the past five years.) Since both the current capacity and surplus capacity metrics are based on the ratio to authorized space within the BFR it is very important to maintain this measure in a current status. The Navy should review the schedule for updates to the BFRs.

## **Configuration deficiency inspection updates**

It also appears that the configuration scores within iNFADS are not as current as they should be. NAVFAC is implementing a new configuration deficiency inspection process that will be completed this summer. This information needs to be loaded into iNFADS so it can be extracted into SFIM for the PR-11 programming effort.

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15. The Military Construction Project Data Sheet (DD Form 1391) is used to state requirements and justifications in support of funding requests for military construction projects. It is submitted for all projects requiring OSD approval, including major and minor new construction and certain projects involving Operations and Maintenance, restoration of damaged facilities, and non-appropriated fund construction. It is also used by the Navy to document all special new footprint, restoration, modernization, and demolition projects.

## **Facilities condition assessment program (FCAP)**

Finally, the Navy has multiple programs for determining the condition ratings for facilities. NAVFAC has been developing FCAP for the past several years. It was intended to replace the former AIS reporting, which was terminated in 2005, however is still not fully implemented. It is an engineered modeling program that calculates the ratio of facility defects within component groupings of individual assets within a single building. These component ratings are weighted by the component replacement value share to calculate an overall building condition index.

Specialized inspection programs are used for structures such as piers, dry docks, bridges, airfields, pavements, and antennas. These programs produce condition information in different formats and under different inspection cycles. Additionally, both family housing and BUMED related facilities also have different condition assessment programs.

The accuracy of the SFIM would be improved if the condition related assessment data for all Navy facilities was consolidated under one organization to ensure consistency in results and common data formats.

## Conclusion

The SFIM development allows the Navy to execute the shift from the current level-of-effort, bottom-up, IPL-based programming methodology to a risk-based, output-dependent investment program as directed by the Navy shore investment strategy. It provides a powerful analytical tool to examine the changes of output performance levels within the shore infrastructure from year to year and it assesses various investment scenarios as to their anticipated impact over the FYDP. It also allows the Navy to review incremental changes to the funding allocations and investment project mixes to determine feasibility and risk assumption. A copy of the prototype software tool is attached to this report (appendix D).

As part of the initial development process, the SFIM was submitted on 7 August 2008 for accreditation under the OPNAV N81 V,V&A process. This accreditation will certify SFIM's use as a programming model for OPNAV N46 to use in determining the right balance and amount of shore investment for the Navy.

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# Appendix A: Strategic vision for the Navy shore infrastructure task force

ATTORNEY WORK PRODUCT

11 June 2007

## ACTION MEMO

FOR: DIRECTOR, ASHORE READINESS DIVISION (OPNAV N46)

FROM: VADM M. K. LOOSE, Deputy Chief of Naval Operations (Fleet Readiness and Logistics) (N4)

SUBJ: STRATEGIC VISION FOR THE NAVY SHORE INFRASTRUCTURE TASK FORCE

1. You are hereby directed to immediately establish a dedicated Task Force to develop a Strategic Vision for the Navy Shore Infrastructure as part of the POM10 process. To assist the CNO in refining and finalizing PR09, all deliverables will be completed prior to 15 August 2007. The Task Force will be led by OPNAV N46 with dedicated, full time members from CFFC, CNIC, NAVFAC, N81, and CNA.
2. The Task Force shall develop a comprehensive Shore Investment strategy that is based on the CNO's Vision / End State and Desired Effects, future Force Structure, Mission, and People (total force plus families), and NAV2035, maximizes utilization of Global Shore Infrastructure Plans (GSIPs), and is linked to the War Fighting output of each Navy Enterprise. The initial document produced by the Task Force will be strategic in nature and will focus on the development of the set of desired effects that will serve as the guide to the overall Shore Infrastructure investment in POM10 and beyond. The primary effect desired is to create and sustain a shore infrastructure that aligns / links to and markedly improves and sustains Fleet readiness, mission accomplishment, and Quality of Service (QoS) and is continuously and properly sized and sustained. This work will be completed by 9 July 2007. This foundational piece will enable the development of more tactical documents that include, but are not limited to: NAV 2035, POM10 Planning Orders, a comprehensive Condition Based Assessment of the shore infrastructure, Global Shore Infrastructure Plans/Regional Shore Infrastructure Plans (GSIP/RSIP) protocols, Installation Master Plans and Capital Improvement Plans, Long Range Maintenance Plans and Annual Maintenance Plans, modernization of models used to support shore investment, development of specific output metrics for shore investment, and the establishment of clear/comprehensive roles and responsibilities and accountability of all parties (CFFC, FRT, Provider Enterprise, OPNAV N4, CNIC, NAVFAC, Regional Commanders, and Installation COs) in the emergent investment strategy and shore infrastructure execution.
3. Additional guidance and tasking includes:
  - Develop a comprehensive set of actionable guiding principles and a specific investment strategy for sustained Staffing Levels, Planning, MII CON, Sustainment, Restoration and Modernization, Demolition, and Base Operation Support.
  - Utilize a "systems engineering" approach that is linked to output and has the ability to (1) create and maintain an accurate picture of the "as is" conditions; (2) define and measure risk and (3) measure risk/reward ratios to manage investment trade-offs.

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- The general outline of the strategy follows:
  - i. CNO's Vision ... End State / Desired Effects
    1. Past Mindset
    2. Expected Mindset
  - ii. What is today's baseline assessment (capability, i.e., criticality, capacity, condition, and configuration)?
    1. Summarize - Focus on the gaps and excesses
  - iii. What guiding principles do we embrace for each part of the Shore Infrastructure?
    1. The principles are tailored for each element of investment.
    2. The principles should support the "effects-based" end state at the lowest cost of ownership and life-cycle cost.
    3. The principles shall address the specific relationship of the investment to the Navy Mission set in the Enterprise framework
  - iv. For each element of the investment strategy
    1. What is the prioritized, time phased cost?
    2. What specific net effects will be achieved?
- 4. The deliverables of the Task force, beyond the strategic vision piece outlined in paragraph 2 above, are as follows:
  - Investment principles will be reviewed and approved by the CNO. The principles will align to Warfighting and QoS requirements and establish maintenance protocols that will ensure all facilities reach their projected service life.
  - POM10 Planning Guidance for use by all Stakeholders
  - POA&M for upgrade/modernization of the performance based models used to develop and assess the PPBES inputs
  - POA&M for complete migration of the management of planning for the Shore Infrastructure to the GSIP framework
  - A definitive process to establish and maintain detailed situational awareness of the condition of the Shore Infrastructure
- 5. The initial strategic vision document is due 9 July 2007. The balance of the deliverables are due NLT 15 August 2007. The Task Force shall report progress to N4 in written form on a weekly basis. Face-to-face progress reviews shall be scheduled with N4 no fewer than four times during the Task force period of performance.



M. R. LOOSE  
 Vice Admiral, CEC, U. S. Navy  
 Deputy Chief of Naval Operations  
 (Fleet Readiness and Logistics)

# Appendix B: CNO Navy shore investment strategic guidance

10 September 2007

## CNO Navy Shore Investment Strategic Guidance



### Extension of Warfighting Platforms

#### I. VISION

To provide "world class" facilities for our Sailors and families through a prudent, sustained resource investment strategy.

#### II. CHALLENGE

The Navy has historically taken significant risk in shore infrastructure investment to increase investment in afloat readiness and future platforms and weapons systems. In recent years, investment in the shore infrastructure has been further reduced to create resources to finance the Global War on Terror, Homeland Defense, Theater Security Cooperation, humanitarian assistance, and peacekeeping operations requirements. As a result, the condition, capability, and current and future readiness of our Shore platforms have degraded to an unacceptable level. The Navy Shore Investment Strategy will arrest and reverse this decline in capability, condition, and readiness by increasing and aligning shore investments with warfighting requirements and improving Sailor and family readiness.

#### III. COMMANDER'S INTENT

- Implement a systematic and consistent approach to assessing the material condition of our shore establishment resulting in the development of comprehensive investment strategy that arrests and reverses the decline of our shore facilities.
- Provide the right facilities at the right places with the right capabilities to optimize support to our Navy's warfighters.
- Improve the workplace to enhance our workforce's productivity and effectiveness and to motivate our Sailors, Civil Service employees, and their families to "Stay Navy."
- Provide a shore infrastructure environment that attracts, retains, and enhances the capability and productivity of our 21st century workforce.
- Operate shore installations as seamless extensions of our warfighting platforms to train, maintain, refit, and surge tomorrow's Adaptable Force Packages into the fight, ready-for-tasking.
- Enhance and maintain installations to support future Joint Region and Joint Basing Capabilities.

#### IV. END STATE

- Navy shore infrastructure investments are aligned with the Fleet Readiness Enterprise and Provider Enterprise outputs to support the warfighting mission and directly contribute to current and future Fleet readiness.
- Shore investment drives Sailor and family readiness through informed investments using output metrics that are aligned to Fleet requirements.

- Navy shore installations planning and investment strategies continually ensure installations and facilities are properly sized, configured, sustained, and aligned to the Navy Strategic Plan



## V. DESIRED EFFECTS/INVESTMENT PRINCIPLES

***Informed, Capabilities-Based Investment*** –The shore infrastructure will be improved through a systems-based approach that addresses global requirements through a comprehensive assessment of mission contribution, condition, capacity, configuration, and capability of installations linked to Navy Mission Essential Tasks. An adaptive planning process will be institutionalized and sustained to provide an informed Shore Investment Strategy to deliver the required readiness at the lowest life cycle cost.

- Shore infrastructure investments shall be managed through a governance structure and disciplined processes that achieve program objectives and readiness consistent with risk.
- Shore infrastructure investments shall be optimized to deliver required capabilities over the life of a facility through condition-based maintenance and repair and recapitalization at the lowest life-cycle cost.
- Shore infrastructure investments shall be prioritized and targeted to selected categories of the Navy infrastructure portfolio to optimize readiness, mission, and Quality of Service.
- Shore infrastructure investments shall be targeted throughout the PPBES process to arrest the decay of our facilities and properly sustain them to fully achieve their designed service life.
- Shore infrastructure investments shall be informed by a family of capabilities-based, output metrics and performance models to support identification and prioritization of requirements through the full PPBES process.

***Mission Alignment and Readiness*** – The Navy Shore Infrastructure will be properly sized and configured to support Joint Region/Basing capabilities, the Navy's current and future force structure, force lay-down, and operational concepts in an adaptive, warfighting environment. It will support the Fleet's warfighting capabilities and operational availability by extending the warfighting platform and ensuring installations and forces are ready-for-tasking.

- Shore infrastructure investments shall be continuously sized and aligned to where the Fleet operates, trains the force, and maintains its platforms.
- Shore infrastructure investments shall be targeted to maximize warfare enterprise output.

- Shore infrastructure investments shall be determined by a disciplined process that ensures validated facility requirements will not be exceeded and excess infrastructure is divested.
- Shore infrastructure investments shall be targeted towards agile infrastructure that is capable of transforming with evolving platforms and missions.
- Shore infrastructure investments shall be tiered according to required readiness levels, including surge capability.
- Shore infrastructure investments shall be targeted to promote development of future Navy capabilities for our weapons platforms and 21st century leaders.

**Quality of Service (QOS)** The Navy Shore Infrastructure is integral to our warfighting mission. Our facilities must work in three dimensions: (1) have the capability to maintain our warfighting platforms; (2) train our Sailors to perform their warfighting mission; and (3) provide the support facilities/network essential for the physical and emotional needs of our Navy families. Prudent investment along these three dimensions will provide the required QOS for our Naval force.

- Shore infrastructure investments shall be targeted towards Fleet concentration areas to leverage maintenance, training, and ordnance capability and to facilitate Sailor and family stability.
- Shore infrastructure installation services shall create an environment of military community and family support through an optimal mix of Navy and private investment to enhance family quality of life and provide peace of mind for our deployed warfighters.
- Shore infrastructure installation services shall augment, complement, and leverage surrounding community and private sector capabilities to provide quality, convenient, and affordable family support.
- Shore infrastructure investments shall provide a professional workplace environment commensurate with the level of service expected of our 21st century workforce.
- Community support investments shall be time-phased starting in those locations where demand is highest and off-base support is not present or is unsuitable.

**Joint and Community Integration** – Navy Shore Infrastructure investment and operations and Joint Warfighting capabilities are optimized through innovative and effective partnering with the surrounding communities, other Services, and our regional commands to achieve mission readiness and QOS.

- Invest in services on Navy Installations only when services cannot be provided more cost effectively by the local community, other Services, or regional command.
- Invest per Joint Basing Common Output Levels of Service to achieve standardization and interoperability of installation infrastructure and to enable Joint operational capabilities.
- Aggressively utilize alternative investments such as Public-Private Ventures and Enhanced Use Leasing to leverage Navy resources and underutilized infrastructure.
- Shore infrastructure investments shall be based on functional land use plans that thwart encroachment and leverage the surrounding community to increase efficiency and maximize Sailor productivity.



M. G. MULLEN  
Admiral, U.S. Navy

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## Appendix C: VCNO POM-10 shore investment guiding principles

### ACTION MEMO

30 August 2007

FOR: VICE CHIEF OF NAVAL OPERATIONS

FROM: VADM M. K. LOOSE, Deputy Chief of Naval Operations (Fleet Readiness and Logistics)

SUBJECT: POM-10 SHORE INVESTMENT GUIDING PRINCIPLES

- The purpose of this action memo is to obtain your approval for the Shore Investment Guiding Principles to be used in developing infrastructure investment decisions for POM-10. These Principles will form the basis of the N4 POM-10 Planning Order for Shore Investments.
- The Navy Enterprise Executive Committee (NE EXCOMM) brief on 16 August addressed the CNO's direction to develop and implement a Navy shore investment strategy to arrest and reverse the decline of the shore infrastructure. Implementation of the renewed shore investment strategy will form the cornerstone of the N4 POM-10 effort. The desired effect is to develop a clear understanding of the Navy's shore infrastructure in terms of capacity, condition, and configuration. The current advocacy based, bottom-up, IPL driven investment process will be replaced with a top-down, data driven, capabilities based process that aligns investments with (1) Warfighter Enterprise Outputs, (2) Improved Quality of Service and (3) Joint Capability Requirements.
- The proposed POM-10 guiding principles begin the three-year transition toward an informed shore infrastructure investment strategy.
- POM-10 Shore Investment Guiding Principles.
  - **Reduce Excess Capacity.** The Fleet Readiness Enterprise (FRE) and Provider Enterprise (PE) will work aggressively in the planning process to identify excess and surge infrastructure and will immediately take the necessary steps to consolidate and discontinue use of excess infrastructure. CNIC will terminate expenditure of funds on all identified excess infrastructure except as required for proper, real property disposal. Within the POM-10 FYDP, CNIC will eliminate infrastructure identified as excess and will lay-up, or employ other options, to preserve surge infrastructure for future use.
  - **Strengthen Planning Capabilities.** Implementation of the Shore Investment Strategy requires institutionalizing and sustaining robust planning capabilities to drive the Enterprise led requirements determination and prioritization process. Develop and maintain the full range of plans necessary to implement this strategy starting with Integrated Global Shore Infrastructure Plans (GSIPs). As a first principle of this process, conduct and maintain a comprehensive assessment of infrastructure condition, capacity, configuration, and mission criticality.
  - **Transition to Condition-based Maintenance.** To enable prudent use of scarce resources, begin immediate transition to a condition-based maintenance program that properly sustains facilities to achieve their designed service life, consistent with Enterprise

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capability demand signal and at the lowest life cycle costs. In POM-10, give priority to correcting the deficiencies of those facilities where mission dependency is highest and readiness condition is lowest. Apply disciplined governance to avoid migration of funds in execution.

- **Align and Integrate the Shore Planning Process.** The FRE and the PE will use the GSIP process to develop integrated capital investment programs for use in building POM-10. The FRE will provide infrastructure capital investment programs that are integrated and prioritized across all Warfare Enterprises (WEs) and their supporting Provider Enterprises. The FRE plan will include all direct mission support facilities, ordnance and weapons handling facilities, maintenance and Fleet Training facilities, and direct support logistics and utility infrastructure. CNIC will provide capital investment programs for all other Sailor and Family Readiness and Base Support infrastructure.
- **Emphasize Quality of Service (QOS).** Navy Shore Infrastructure directly contributes to attracting and retaining the high quality workforce required for the future. POM-10 investments will focus on providing a professional workplace environment that enhances the productivity and effectiveness of our 21<sup>st</sup> Century workforce and on improving Sailor and Family readiness. CNIC will develop plans to meet CNO established standards for the 21<sup>st</sup> Century workplace and achieve approved end states for QOS programs including Bachelor and Family housing, Fitness Centers, Child Development Centers, and Fleet and Family Service and Family Centers.
- **Align infrastructure investments with ACATI Programs of Record.** Make certain each ACATI program in POM-10 is fully complemented with the appropriate infrastructure support in alignment with new platform delivery milestones.
- **Stabilize Base Operating Support (BOS) Funding.** Adjust the BOS baseline to incorporate Joint Basing standards and address CNO approved QOS standards and expectations. CNIC will establish Common Output Levels of Service that are linked to mission essential tasks to allow targeted increases/decreases in specific capabilities. Establish appropriate funding levels based on risk throughout the FYDP and apply disciplined governance to avoid migration of funds in execution.
- The POM-10 Shore Investment Guiding Principles will serve as the foundation for N4's WARNORD and FRAGORDs related to POM-10 development and will be reflected in the POM-10 Integrated Readiness Zero Based Review.

RECOMMENDATION: VCNO concur with the POM-10 Shore Investment Guiding Principles.  
 Approved: SMJ 9/21/07 Disapprove \_\_\_\_\_

COORDINATION: None

## Appendix D: Navy shore facilities investment model

The Navy shore facilities investment prototype software model version 1.0.0 is attached to this report as an electronic Microsoft Access database with a Java based front-end. This model was built to support the POM-10 budget development cycle. The model has to be reset with new data in order to support later cycles.

### File attributes

File name: SFIM.exe

Date: 11 September 2008

Size: 441 KB

### Data folder

#### DB

File name: FIM model DB v2.java.mdb

Date: 21 November 2008

Size: 358 MB

File name: Fim.application.mdb

Date: 24 November 2008

Size: 243 MB

File name: Force\_Loading.mdb

Date: 24 November 2008

Size: 33.4 MB

File name: 20080415 Long range forecast tool.xls

Date: 29 July 2008

Size: 215 KB

File name: Excel worksheets directory

Date: 30 July 2008

Size: 2.66 MB

**Images**

File name: Images directory

Date: 24 June 2008

Size: 96 KB

**Lib folder**

File name: JAR library

Date: 19 September 2008

Size: 11.6 MB

# Glossary

ACQ	Acquisition
AD	Active Duty (Military)
ADMIN	Administrative Unit
AIS	Annual Inspection Summary
BFR	Basic Facility Requirements
BOS	Base Operating Services
BRAC	Base realignment And Closure
BSO	Budget Submitting Office
BUMED	Bureau of Medicine and Surgery
C4ISR	Command, Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance
CBB	Capabilities Based Budget
CI	Condition Index
CMC	Commandant, Marine Corps
CNA	Center for Naval Analyses
CNIC	Commander, Navy Installations Command
CNO	Chief of Naval Operations
CNR	Commander Navy Region
CNTR	Contractor

COA	Course of Action
COE	Center of Expertise
COIRP	Contractor-Operated Industrial Reserve Plant
COLs	Common Output Levels
COLS	Common Output Levels of Service
COMD	Command and Control Unit
COMM	Communications Unit
CORSTF	Contractor-Operated Research and Development Facilities
CPL	Capability Performance Level
CSV	Comma Separated Values
CT	Caretaker (CSO installations)
CVN	Carrier Vessel Nuclear
CWE	Current Working Estimate
DCNO	Deputy Chief of Naval Operations
DE	Demolition Program Element
DEMO	Demolition
DH	Defense Health
EOY	End of Year
EXPD	Expeditionary Unit
FAC	Facilities Analysis Code
FCAP	Facilities Condition Assessment Program
FCI	Facility Condition Index

FH, N	Family Housing, Navy
FIM	Facilities Investment Model
FMR	Financial Management Regulation
FN	Foreign National
FSM	Facilities Sustainment Model
FTE	Full-Time Equivalent
FTS	Full-Time Service (Reserve)
FY	Fiscal Year
FYDP	Future Year Defense Plan
GOCO	Government-Owned Contractor-Operated
HELO	Helicopter Squadron
HQ	Headquarters
IFOM	Installation Figure of Merit
IMC	Installation Management Components
iNFADS	Internet Navy Facilities Assets Data Store
INSTL	Installation
IPL	Integrated Priority List
LOG	Logistics Unit
MAI	Mission Alignment Index
M&R	Maintenance and Repair
MCAP	Mission Criticality Assessment Program
MCON	Military Construction

MDI	Mission Dependency Index
MED	Medical Unit
MILCON	Military Construction Projects
MISC	Miscellaneous
MS	Microsoft
MWR	Morale, Welfare, and Recreation
NAF	Naval Air Facility
NAF	Non-Appropriated Funds
NAVAIR	Naval Air Systems Command
NAVFAC	Naval Facilities Engineering Command
NAVSEA	Naval Sea Systems Command
NF	New Footprint Program Element
NFAID	Navy Facilities Asset Identification Number
NITC	NAVFAC Information Technology Center
NWCF	Navy Working Capital Fund
OG/L	Outgrantee/Lessor (Ingrant)
OMB	Office of Management and Budget
O&M, N	Operations and Maintenance, Navy
O&M, NR	Operations and Maintenance, Navy Reserve
OPN	Other Procurement Navy
OPNAV	Office of the Chief of Naval Operations
OSD	Office of the Secretary of Defense

OTH	Other
OTHDoD	Other Department of Defense
OUTSRC	Outsourcing
PAI	Property Accounting Installation
PDC	Performance Data Call
PLANE	Airplane Squadron
POL	Petroleum, Oil and Lubricants
POM	Program Objective Memorandum
PPBS	Program Planning and Budgeting System
PPVEN	Public Private Venture
PR	Program Review
PREP	Program Requirement Evaluation Process
PRV	Plant Replacement Value
QPDC	Quarterly Performance Data Call
RDTE	Research, Development, Testing, and Evaluation Unit
R&D	Research and Development
RDT&E	Research, Development, Testing, and Evaluation
RDT&E,N	Research, Development, Testing, and Evaluation, Navy
RES	Reserve Unit
RM	Restoration and Modernization Program Element
RMKS	Resource Management Knowledge System
RPI	Real Property Inventory

SAGP	Strategic Alignment/Guiding Principles
SCA	Shore Capability Area
S&T	Science and Technology
SEAL	Sea, Air, Land
SELRES	Selected Reserve
SF	Square Feet
SFIM	Shore Facilities Investment Model
SIC	Special Interest Code
SLU	Service Life Used
SMIG	Shore Mission Integration Group
SP	Special Project
SPP	Sponsor Program Proposal
SRBOD	Shore Readiness Board of Directors
SSI	Strategic Support Index
STARS-FL	Standard Accounting Reporting System - Field Level
TE	Test and Evaluation
TFFMS	Total Force Manpower management System
TOA	Total Obligation Authority
T-POM	Tentative Program Objectives Memorandum
UIC	Unit Identification Code
UNKWN	Unknown
USMC	United States Marine Corps

VCNO Vice Chief of Naval Operations  
VDOT Virginia Department of Transportation  
V,V&A Verification, Validation and Accreditation

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