# Pacific Fleet Targets Shipboard Power Use with Meter Technology

## Continuous Monitoring Maximizes Energy Efficiency

It's impossible to maximize energy efficiency if you don't know how, where and when energy is being used. That's why the U.S. Pacific Fleet (PACFLT) has launched an ambitious effort to establish continuous monitoring of energy use by its ships, both pierside and underway.

Like a typical homeowner, the fleet has seen its energy bills rising steadily in recent years, and is striving for ways to reduce consumption as a means to control costs. Unlike members of a typical family, energy consumption by the fleet's components can vary greatly, as operational needs and conditions change. Energy use by the Navy also involves a far broader spectrum of activities, from buildings to industrial applications to "hotel services" provided to ships tied up at a Navy pier.

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Worldwide, about 75 percent of the Navy's energy use is tactical—primarily ships and aircraft, as opposed to 25 percent for shore use. In the Pacific, the split is 95 percent tactical, 5 percent shore because of "the tyranny of distance." When oil prices spiked in 2008, Navy energy bills skyrocketed. Since then, PACFLT has developed a pioneering integrated energy strategy that examines energy use and alternatives at sea and ashore.

"Real-time, remote monitoring is one of more than 25 initiatives that are part of our Pacific Fleet integrated sea/shore energy strategy," says Capt. Dan McNair, PACFLT deputy civil engineer and one of the officers charged with implementing the strategy.

To explore energy-saving opportunities, PACFLT hired Matthew Cohen in January 2009, a certified energy manager who brought more than 30 years of experience to the job.

Sailors man the rails aboard the guided-missile destroyer USS PAUL HAMILTON (DDG 60). PAUL HAMILTON was one of several ships to participate in PACFLT's ongoing energy monitoring efforts.

*MC2 Mark Logico*

One of Cohen's primary goals was to examine usage and trends to determine exactly how much power is consumed by vessels in port for varying durations.

"He helped us recognize that the traditional practice of manually reading pierside electrical meters once a month leaves far too much room for guesswork," says McNair. "The fleet requires real-time visibility of daily load profiles to effectively understand how energy is being used on specific ships to effectively implement technological system changes and conservation measures."

In San Diego a few years ago, the Naval Facilities Engineering Command (NAVFAC) Southwest began using an existing supervisory control and data acquisition (SCADA) system to take readings of energy use by ships in port every 15 minutes. Resource managers analyzed the data and worked with individual ships to reduce their electrical load.

The improvements were noteworthy. However, the San Diego SCADA system was already in place and not available at most fleet concentration areas, including Pearl Harbor, home of the Commander, U.S. Pacific Fleet.

With the enthusiastic support of the environmental, fleet maintenance and finance sections of the Pearl Harbor staff, the energy team launched a plan to automatically acquire and communicate electrical use data from existing power meters. Fifteen cellular phone system-based data acquisition units, which provide electrical consumption data in real time, have been installed into electrical substations servicing the Pearl



Remote utility data transmitters like these enable PACFLT to monitor the shore power being drawn by ships at Pearl Harbor.
*Mark Matsunaga*

## U.S. Pacific Fleet's Integrated Energy Strategy

**WITH ITS VAST** expanses of sea and sky, widely scattered bases and extended operational demands, PACFLT expects to burn about 11 million barrels of fuel in its ships and aircraft this year.

To conserve fuel—and taxpayer dollars—PACFLT has developed an integrated sea/shore energy strategy that combines ongoing and future energy conservation and alternative energy programs on the shore with energy conservation initiatives being implemented aboard ships and aircraft.

Developed over the last two years under the leadership of PACFLT Commander Adm. Patrick M. Walsh, this ground-breaking strategy moves all energy stakeholders and partners toward achieving energy security goals set by Secretary of the Navy (SECNAV) Ray Mabus and mandated through Federal Executive Orders over the last several years. In fact, Walsh has made SECNAV's energy security policy one of his top 10 strategic goals.

"The key is synergism," says McNair. "Integrating the sea and shore aspects of energy use and getting everyone involved is essential to getting the most out of every dollar we spend on energy."

The PACFLT energy strategy is supported by Commander, NAVFAC, Naval Sea Systems (NAVSEA) and Naval Air Systems Command.

More than 25 separate initiatives are being implemented across shore commands, aboard ships, and aircraft and all of them have been integrated to move the Navy toward achieving energy security goals.

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Harbor Naval Station and the Submarine Base piers. The data are transmitted and displayed continuously on a user-friendly, password-protected web site providing all users and stakeholders visibility of consumption. In addition to kilowatts and kilowatt hours (kWh), the web site provides the means to visually compare electrical use by a ship to its own historical use or to other ships in its class. The software also has the capability to detect and communicate out-of-spec conditions.

"The monitoring improvements are a vital part of our integrated sea/shore energy program," says McNair, who has partnered with Capt. Steve Reimers to lead the shipboard energy conservation program as well as other operational energy conservation initiatives under the strategy.

"These data sets provide the fleet with the means to communicate to the ship how much (shore power) it's using and how much it costs, which is critical to making on-the-spot changes to optimize energy use by ship's crew," says Reimers, PACFLT maintenance officer, who is leading the at-sea implementation of the energy strategy.

Results of data are available to each ship's commanding officer and chief engineer, who are responsible for addressing on-board energy consumption issues.

Baseline energy use is unique to each vessel, and will vary with its location, age, readiness status and adherence to established maintenance procedures.

Ultimately, measurements allow PACFLT to record degrees of predictability resulting from air conditioning, lighting, water pump, weapons and radar systems operation. That information can then be used to identify specific consumption-reducing opportunities. For example, assume Destroyer A consumes an average of 40,000 kWh of electricity pierside in Pearl Harbor each day, while Destroyer B of the same squadron consumes an average of 35,000 kWh. Pinpointing the reasons for the difference can help save energy. It might be as simple as modifying behavior to turn off power to lighting in unused spaces, or as complex as determining that seawater-cooled condensers are fouled, causing the air-conditioning plants to use more kilowatts for each ton of cooling.

## U.S. Pacific Fleet's Other Participating Ships

**A NUMBER OF** Pearl Harbor-based ships homeported in Hawaii participated in PACFLT's power monitoring initiatives. Those include the 11 combatant ships assigned to Surface Group Mid-Pacific as well as other ships that tie up and draw shore power from Pearl Harbor's Bravo Piers 22 through 26 and Mike Piers 1 through 4. Monitoring capabilities will be expanded to include submarine berthing spaces at Pearl Harbor in the future. Surface Group Mid-Pacific consists of the following ships:

**Cruisers**

- USS CHOSIN (CG 65)
- USS PORT ROYAL (CG 73)
- USS LAKE ERIE (CG 70)

**Destroyers**

- USS O'KANE (DDG 77)
- USS CHUNG-HOON (DDG 93)
- USS CHAFEE (DDG 90)
- USS RUSSELL (DDG 59)
- USS HOPPER (DDG 70)
- USS PAUL HAMILTON (DDG 60)

**Frigates**

- USS REUBEN JAMES (FFG 57)
- USS CROMMELIN (FFG 37)

USS PAUL HAMILTON, pierside at Pearl Harbor, is connected to cables that carry shore power from the turtleback at left onto the ship.
*Mark Matsunaga*

Today, throughout its worldwide footprint, the Navy maintains tens of thousands of conventional electric meters. They are being replaced with advanced Ethernet-enabled meters. This new Advanced Meter Infrastructure (AMI) program eventually will provide more and more granular electric meter data to the NAVFAC utilities department. The AMI system design can provide daily load profiles, but will be delayed by at least four hours. To maintain PACFLT access to real-time data, NAVFAC will connect the cell phone-based data units to the new AMI meters as they are installed.

"Our vision is to provide all Navy ports with pierside meter monitoring systems that can provide visibility to actionable energy information in real time," says Reimers.

What about ships at sea? When they're not drawing shore power, Navy ships produce their own electricity with onboard generators. PACFLT is working with NAVSEA and the Naval Ship Systems Engineering Station to adapt what's called the Integrated Component Assessment System (ICAS) to acquire and analyze electrical data.

ICAS provides real-time remote monitoring of subsystems aboard a ship. Originally designed to detect and diagnose equipment faults, ICAS capability is being expanded and exploited to optimize energy use.

## ICAS: Monitor from Shore to Shore

**ON A STANDARD** naval vessel, there are about 10,000 data points collected from sensors in the ship's systems. These sensors give feedback regarding equipment status and provide the ship's chief engineer with measurements including voltage, amperage, pressure, temperature, fuel flow, status and other critical parameters. Of those thousands of sensors, about 1,500 are connected to ICAS for the purpose of detecting system faults and out-of-specification conditions.

The Navy is outfitting new ships (and retrofitting existing ships) with ICAS technology to identify equipment problems before they fail or become inefficient. Operational both in port and at sea, this technology transfers packets of data containing energy information in four-hour intervals to a centrally located server, from wherever the ship is located.

What makes ICAS so important is it enables fleet and NAVSEA engineers to look at an individual ship or at the entire fleet remotely. While pier-side energy monitoring has been steadily improving, PACFLT's use of ICAS produces data from ships at sea that were previously unavailable, opening up a new realm of energy management and potential savings.

**PACFLT is conducting an investment-grade energy study of destroyers and dock landing ships to measure electrical use throughout the ships.**


Sample dashboard shows real time energy use, load profile, daily consumption in a month and target levels for a shore power meter at Pearl Harbor.
*Greenview Energy Management Systems*

PACFLT is conducting an investment-grade energy study of destroyers and dock landing ships. The study will measure electrical use throughout the ships under all states of mission readiness. Energy conservation opportunities will be identified, quantified, and analyzed for financial and physical applicability. In addition, these studies are expected to identify additional data points that will be added to the ICAS system.

The ability of ICAS to provide a continuous stream of data no matter where a ship is located raises great possibilities for improving energy efficiency.

"Destroyers, cruisers and aircraft carriers are floating buildings with complex, energy intensive chilled water systems that must keep mission-critical weapons systems cool," Reimers says. "ICAS can detect and communicate the need for corrective action before equipment capability falls below specifications."

## Department of the Navy Energy Goals

**IN OCTOBER 2009,** Secretary Mabus announced the following energy goals for the Department of the Navy (DON):

1. By 2020, 50 percent of total DON energy consumption will come from alternative energy sources.
2. By 2020, DON will produce at least 50 percent of shore-based energy requirements from alternative sources; 50 percent of DON installations will be net-zero.
3. DON will demonstrate a Green Strike Group in local operations by 2012 and sail it by 2016.
4. By 2015, DON will reduce petroleum use in the commercial vehicle fleet by 50 percent.
5. Evaluation of energy factors will be mandatory when awarding contracts for systems and buildings.


LEFT: Each capable of handling 400 amps, cables connect a ship to a "turtle back" shore-power source at Pearl Harbor.

ABOVE: PACFLT energy leaders, from left, Capt. Steve Reimers, Matthew Cohen and Capt. Dan McNair check on the shore power being drawn by USS PAUL HAMILTON (DDG 60) pierside at Pearl Harbor.

*MC2 Mark Logico*

Eventually, ICAS could also be used to cross check and verify pier-side shore power meter readings. That capability is unlikely to become a reality for several years, however. Meanwhile, PACFLT will continue working with the Navy's ships technical engineers at NAVSEA to upgrade ICAS and other technologies to improve the data and help the Navy make the best use of the energy it consumes. ⚓

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## The Basics About U.S. Pacific Fleet

**PACFLT, THE WORLD'S** largest fleet command, encompasses 100 million square miles, more than half the Earth's surface, from the west coast of the United States into the Indian Ocean. PACFLT consists of approximately 180 ships, nearly 2,000 aircraft and 125,000 Sailors, Marines and civilians.

Adm. Patrick M. Walsh is the current PACFLT commander. He is the 32nd Navy officer to command PACFLT since it was established in February 1941 with headquarters at Pearl Harbor, Hawaii. Past commanders of PACFLT include such naval giants as Fleet Admiral Chester Nimitz and Admiral Raymond Spruance.

The Navy's history in the Pacific actually spans more than a century and a half. Through the years, the PACFLT commander's vision, mission and guiding principles have evolved as its challenges have changed. But many Navy customs and traditions have continued over the years, making the Navy unique among the services.

Under the current organization and command structure, the PACFLT staff reports administratively to the Chief of Naval Operations and operationally to the U.S. Pacific Command, whose headquarters are at nearby Camp H.M. Smith. Commands that fall directly under PACFLT include "type" commands for surface ships, submarines and aircraft as well as Navy construction. Operational commands that report directly to PACFLT include Third Fleet in the Eastern Pacific and Seventh Fleet in the Western Pacific and Indian Ocean.