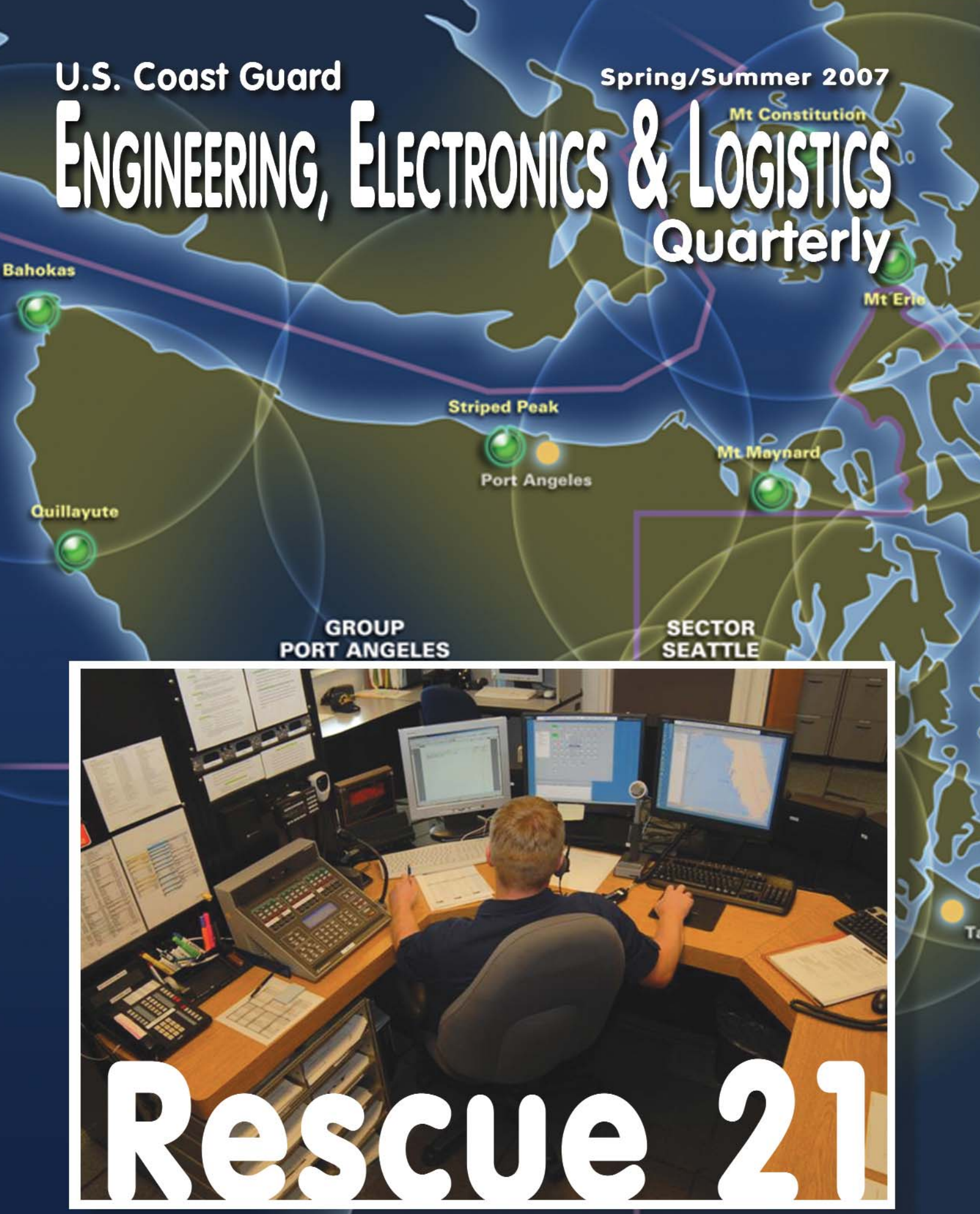
U.S. Coast Guard

Spring/Summer 2007

Engineering, Electronics & Logistics Quarterly



Rescue 21

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Articles should be about 500 words long; however, C4IT, engineering and logistics specific articles can be up to 2,000 words -- all acronyms must be spelled out when first used. To have your article considered for publication, photo(s) must accompany each article. Articles can be submitted by FedEx in hard copy and/or in Microsoft Word on a 3.5 disk, CD, or e-mailed electronically. Please submit original photographs and graphics. All slides, photos, graphics and illustrations should be in color where possible. Please include **by-line** when submitting article Let us know if you want your photos and graphics returned to you. Submit inquiries, letters, articles, and photographs to:

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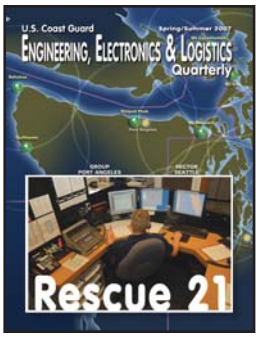


On the Cover: ***The overlay shows a watchstanders at the Rescue 21 console in St. Petersburg, FL. Note: The legacy NDRS is the small, non-visual box to the left of the watchstander. This image indicates the tower sites and communications coverage for Rescue 21 in Sector Seattle and Group Port Angeles. Image courtesy of General Dynamics***

Contents

2 From the Assistant Commandant

4 Systems of Interest

8 First National security Cutter Christened, *BERTHOLF*

14 First Coast Guard Maritime Patrol Aircraft Departs Spain ...

15 Arrives Later in E-CITY

16 Planning Your Engineering Career

18 Volunteer to be an ACE Reviewer

20 Metal Working: Old Meets New, as One Man Teaches and Serves

24 Lessons Learned from a 378 WHEC Turbine Change Out

30 Civil Engineering: A Key Player for Deepwater

34 The Evolution of the Coast Guard's Heavy Oil Pumping and Lightering Systems

42 Overhaul of the HH-60 and its Product Line

52 Training at an Engineering Command

56 Care and Feeding of the Uninterruptible Power Supply

66 Rescue 21

72 MLCA Web Development and Hosting Services

74 A One-on-One with Mr. Jeffery Orner

78 Emerging Technologies

Backcover ***Coast Guard Cutter BERTHOLF (WMSL 750), first National Security Cutter, is dressed and ready for its christening party. USCG photo by PA2 Brian N. Leshak***

From the Assistant Commandant

Welcome to another edition of the *Engineering, Electronics and Logistics Quarterly*. Since the last issue, Mission Support organization design efforts have begun in earnest. Under the direction of the flag level Mission Support Leadership Team (MSLT), the Mission Support Planning and Integration Team (MSPAIT) is developing a preliminary design of the entire Deputy Commandant for Mission Support organization from headquarters to the waterfront. Additionally, the Surface Forces Logistics Center Design Team has been chartered and is hard at work. For the latest information on the Logistics Organizational Alignment and other transformation initiatives, visit CG Central.

In my last column, I introduced the product line concept that is at the heart of the new Coast Guard Logistics Business model, but didn't have the space to explain the concept fully. Given the product line's importance, I'm going to devote the remainder of this column to describing the aircraft product line structure that exists at the Aircraft Repair and Supply Center (ARSC) today and that will be designed into our new Surface Forces Logistics Center. After reading this, you should have a better understanding of how a product line is organized and the functions it performs.

The Product Line organization places the elements essential to facilitate lifecycle management under the control of the Product Line Manager (PLM). At ARSC, the PLM is an operationally experienced Coast Guard Aeronautical Engineer who manages the product improvement process, standard aircraft configuration, and engages in forward-looking lifecycle sustainment decisions. The PLM is singly responsible for ensuring that the platform meets operational needs and maintains the flexibility and responsiveness to provide surge capability for national emergency and defense missions. The structure under his/her leadership includes 1) organic and contract engineering and technical support (including airframe and engine tech reps), 2) inventory management, 3) imbedded contract specialists, and 4) organic and contract Programmed Depot Maintenance support. The Product Line ensures clarity of roles and responsibilities, chain of command, technical authority, and accountability.

The **Engineering Cell** Leader is also an operationally experienced Coast Guard Aeronautical Engineer. Whenever possible, this officer is a graduate of the Aircraft Structures post-graduate program. The Technical Services Branch provides technical

support to operational units and the asset Programmed Depot Maintenance line. Tech Services also works with the asset's Prime Unit on prototype installations and maintenance procedure card changes. Active duty Coast Guard aviation maintenance personnel make up the bulk of this element, with contracted support personnel providing special skills or industry linkage as necessary. Civilian equipment specialists coordinate the build-up of Time Compliance Technical Order (TCTO) parts kits, and provide first-look review of equipment associated with Unsatisfactory Reports (UR) or Quality Deficiency Reports (QDR), ensuring non-routine item deficiencies are brought to the attention of the Engineering Cell Leader for further action.

The **Supply Cell** Item Managers provide cost effective solutions for sub-component sustainment, ensuring asset-focused management oversight. When feasible, this includes a diversified portfolio of commercial repair and overhaul vendors to maintain competition. Additionally, they provide liaison with the product line's Tech Services Branch, and the Industrial Operations Division, to maintain organic repair capabilities should cost, schedule or performance issues with commercial venues drive an in-house solution to meet operational demands. The Item Managers interact directly with the operational customers and the platform Programmed Depot Maintenance Cell under the guidance of the Supply Cell Leader who answers directly to the PLM.

The **Contracts Cell** provides asset-focused contract specialist support for commercially out-sourced subcomponent repair, overhaul, and procurement. The Contract Specialists work for the platform Contracts Cell Contracting Officer, who coordinates directly with the PLM, and reports to the ARSC Chief of the Contracting Office (COCO).

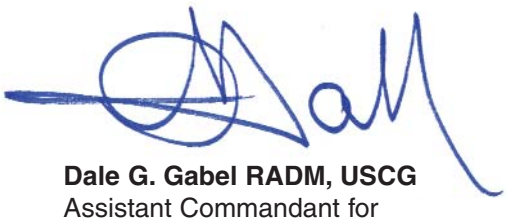
The Programmed Depot Maintenance Cell ensures platform structural health through scheduled overhaul. The environment the aircraft operates in drives the schedule, and depot maintenance provides visibility to the Product Line technical experts on emergent aging aircraft issues (corrosion, fatigue, sub-component obsolescence, etc.), as well as ongoing corrosion monitoring.

Support and operations functions common to all assets are placed in support divisions. Although these functions are managed by active duty Coast Guard officers and have an organic component, the Coast Guard workers are significantly augmented by contractor personnel. The divisions that make up the **product line support structure** include:

- ✔ The *Industrial Operations Division* which is responsible for the Paint, Strip, Gearbox, Avionics, Engine Overhaul, Engine Test, Upholstery, Composite Repair, Hydraulic, Electrical, Wiring Harness, and Machine Shops.
- ✔ The *Information Systems Division* which oversees the Aviation Logistics Management Information System.
- ✔ The *Engineering and Industrial Support Division* which provides Aircraft Technical Publications, Engineering Support, Vibration Analysis, Wiring Configuration, Aviation Sensors Engineering, Aviation Life Support Equipment, and Contract Field Team Management.
- ✔ The *Aviation Logistics Division* which supports warehouse operations, supply chain analysis, and fiscal operations.

So that's an example of a product line in a nutshell. As I mentioned earlier, the product line concept lies at the heart of the new CG Logistics Business Model, providing the fleet-wide lifecycle perspective, total asset visibility, and centralized management approaches that are the key to the customer focused logistics system we are building.

Thank you for your dedication and commitment. Keep up the great work!



Dale G. Gabel RADM, USCG
Assistant Commandant for
Engineering and Logistics

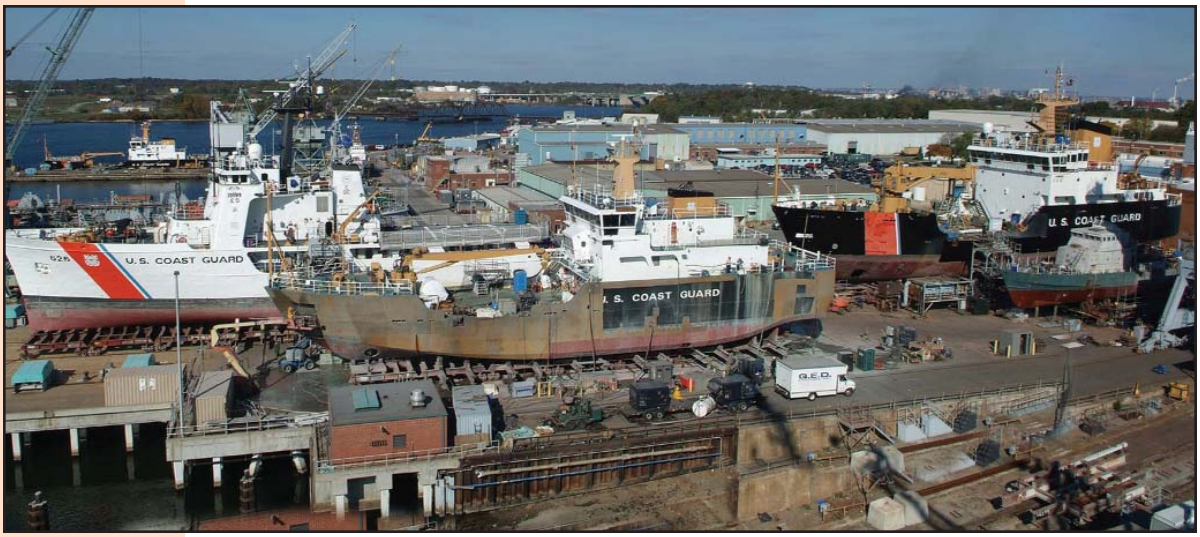
Yard Welcomes First Pacific Area 110' MEP Cutter (Yard)

In fall 2006, the Yard welcomed the Coast Guard Cutter CUTTYHUNK homeported in Port Angeles, Washington. The cutter transited the Panama Canal to make the 60 day journey to the east coast. The voyage included several port calls for fuel and groceries. While at the Yard for the next year, the cutter will receive the 110' Mission Effectiveness Project (MEP) upgrade package. The MEP is designed to replace aging systems on board select ships in order to improve reliability, reduce future maintenance costs, and meet required mission hours. The modernization project is intended to maintain effective missions for the 110' cutters for an additional 15 years until their decommissioning. Replacements for the fleet will be deployed under the

Coast Guard's Deepwater project. CGC CUTTYHUNK is the third 110' cutter to enter the MEP at the Yard. Work is expected to be completed in October 2007.

Shiplift (Yard)

The Yard's shiplift is the largest land-based ship handling facility in the continental United States. Offering lower maintenance costs than traditional dry docks, the shiplift is environmentally friendly and allows the Yard to work concurrently on five vessels -- four on the concrete working platform; one the elevator platform. In addition to work for the Coast Guard's Mission Effectiveness Project, the Yard provides emergency and routine repairs to accommodate the Service's vessel repair availabili-



ty schedule for its Atlantic Area cutters. The Yard averages 20 availabilities annually. In the photo, the shiplift cradles four vessels in fall 2006: (clockwise from upper left) Cutters DEPENDABLE, WILLOW, TYBEE, and ABBIE BURGESS are positioned on the shiplift's 50,000 square foot concrete platform and ready for work by the skilled hands of the Yard.

64-Foot Aids to Navigation Boat (MLCLANT)

Coast Guard 64' Aids to Navigation Boats (AtoN's) are a relatively unknown and hard-working non-standard boat class. Originally designed by Overing Yacht Designs in 1995, only three of these 115 long-ton platforms were built before construction was halted in 1997. Built principally for the Eighth District, these unique platforms are currently stationed in Corpus Christi, TX; Colfax, LA; and Eufaula, Al; each with unique capabilities and operating in slightly different environments. As a result of these unique capabilities, as well as major operational hours and limited technical data, these river tender and barge-in-one platforms became difficult for the District and/or crews to maintain. The Centralized Boat Maintenance Management Program (CBMMP) passed this maintenance planning and execution responsibility to the Maintenance and Logistics Command Atlantic (MLCA).

Photos by MK1 Brett Williams

The CBMMP was mandated by G-CCS to start CG-wide this year. Atlantic Area Command directed implementation beginning in Fiscal Year 2005 (FY05), and these 64' AtoN Boats were among the first to benefit from the centralized boat maintenance. The program purposefully pulled boat maintenance dollars from the Districts and focused those dollars directly on the highest needs of standard and non-standard boat depot level maintenance. Small Boat Depot Level Maintenance is now planned, scheduled, and is being implemented LANT-wide, with a huge positive affect on the remaining service life of our boats. As with most non-standard boats, depot level maintenance for these platforms was complicated by the limited configuration and technical data, as well as supply support. During FY05, all three boats completed their first major dry-dock since initial construction, including major repairs to all hull, mechanical and electrical systems at a cost of over $489,000. As part of the continuing logistics support for these assets, members of MLCA evaluated the "Queen of the 64's," 643502, in Corpus Christi for maintenance to be accomplished during her availability next spring. Crews and maintenance support staff have kept the boats in great shape, leaving only expected preservation of hull and superstructure, cleaning of tanks and voids, and a few planned system upgrades for this hard-working CG asset. Ultimately the Integrated AtoN Platform Modernization Project may systematically replace these boats, but until then, the CBMMP and MLCA will sustain the mission effectiveness of these operating assets throughout their service lives.

Story by LTJG Krysten Pizzurro and Michael Meador, Naval Engineering Division.

Now In Its Fourth Year ...
(Yard)

Baltimore Area Coast Guard Naval Engineers Reach Out for New Recruits

In an effort to interest high school and college students in the field of Coast Guard naval engineering, naval engineers at the Yard and its tenant commands have engaged in local and long distance travel to reach potential audiences with their message. The outreach initiative began in 2003 and has covered six local high schools, the State University of New York (SUNY) Maritime College in New York City, and the U.S. Merchant Marine Academy (USMMA) in Kings Point, New York.

Among past visits, LT James Flannery, Yard Industrial Department, traveled to the Bronx to discuss the field of Coast Guard naval engineering to students at SUNY Maritime. Last fall, Industrial Department engineers, LTJG Scott Kramer and LTJG Al Giordano, attended a local high school college fair in Baltimore City and the Military Information Night at USMMA, respectively. LCDR Mike Paradise of the Coast Guard Engineering Logistics Center attended one of the largest Baltimore area parochial high school college fairs in October [2006]. The naval engineers offer information about their personal career paths as well as the curriculum and career opportunities for Coast Guard naval engineers. Whether entrance to the program is through the Coast Guard Academy, Officer Candidate School, or the Direct Commission Engineering Program, Baltimore area Coast Guard engineers are serving as role models for a potential community of new Coast Guard naval engineers. And the outreach initiative continues as plans are underway for attendance at local college fairs and military information nights this spring.

LTJG Al Giordano speaks to midshipmen about future careers in Coast Guard naval engineering during Military Information Night at the U.S. Merchant Marine Academy on October 5, 2006.

LCDR Mike Paradise converses with a student and his parent about the field of Coast Guard engineering at a Baltimore high school college fair. This high school senior was one of dozens of students throughout the evening expressing interest in attending the Coast Guard Academy, several exploring a naval engineering major.

Region 10's 2006 Champions of Environmental Leadership and Green Government Recognition Program - Honorable Mention :ISC Seattle (CG-443)

Integrated Support Command (ISC) Seattle continues to see a downward trend in its waste disposal, reaffirming its source reduction programs are working. ISC has dropped its production of recurring hazardous wastes to 15,178 pounds for the reporting year 2005. This represents an overall 50% reduction in hazardous waste generated in the last 5 years. In 2001, ISC Seattle generated 30,899 pounds of hazardous waste.

In 2003, units located at ISC Seattle generated approximately 16,000 pounds of oily rags that were sent off to the landfill as non-regulated waste. This equates to approximately $44,000 in disposal costs. In April 2004, ISC Seattle implemented the Shop Towel Program. The Shop Towel program services are a very successful, cost effective method of reducing one of the Coast Guard's larger waste streams, oil and paint rags.

Currently, shore units are saving operating funds by paying for shop towels instead of buying baled rags and paper wipers. Shop towels, towel for towel, cost less than half the price of baled rags, absorbency rates are equal or better, and disposal fees are eliminated.

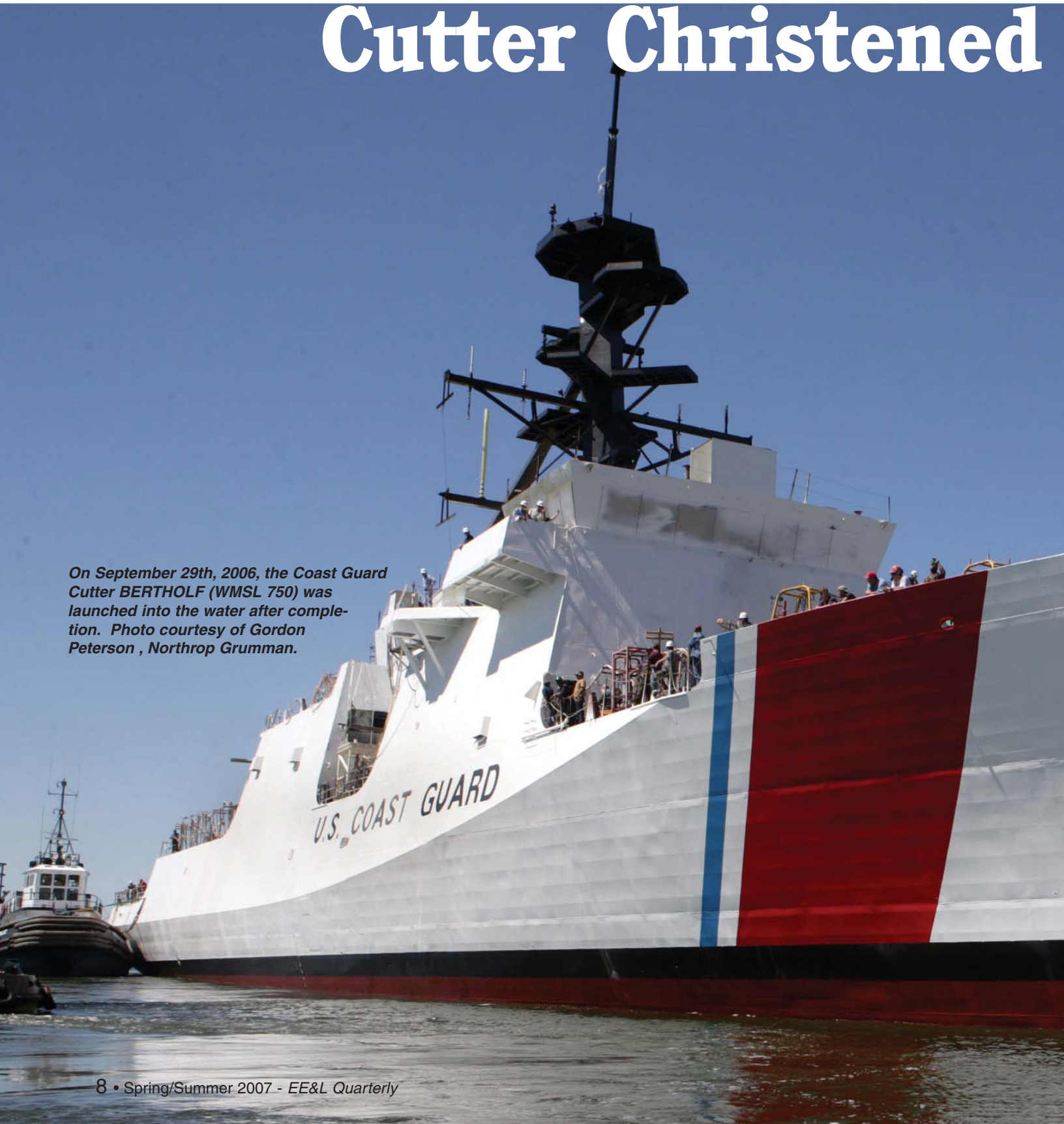
The vendor supplies red vendor owned towels, at a cost of seven cents each. These towels are used for wiping oil, grease, solvents, or paints. Practically anything can be absorbed with the exception of corrosive and acid materials. The vendor delivers clean towels and picks up the soiled towels from the facility on a weekly basis.

Units that generate rag waste are encouraged to utilize this service to reduce unnecessary waste. The reduction of approximately, 3,000 pounds of oily rags which equates to $8,000 in disposal costs were achieved for 2004. The total cost to the Coast Guard was $657. This is all due to the implementation of this program and the cooperation of the shore units at ISC Seattle.

During Fiscal Year 2005, the total amount of disposal cost avoidance for ISC Seattle totaled approximately $41,000 up from the $26,000 that was reported in Fiscal Year 2004 (FY04). This figure attributed to the reutilization efforts of hazardous materials no longer needed and deemed excess within the units serviced by the ISC Seattle. This material was reissued to customers at no charge, thus eliminating the need of disposing it unnecessarily.

This accumulated reduction is due in part to the implementation of the Hazardous Minimization Center (HAZMIN Center). The HAZMIN Center purchases, inventories, manages, and disposes of all hazardous substances that are purchased for ISC Seattle and Tenant commands. The HAZMIN Center continues to save time and money for all units stationed at ISC Seattle.

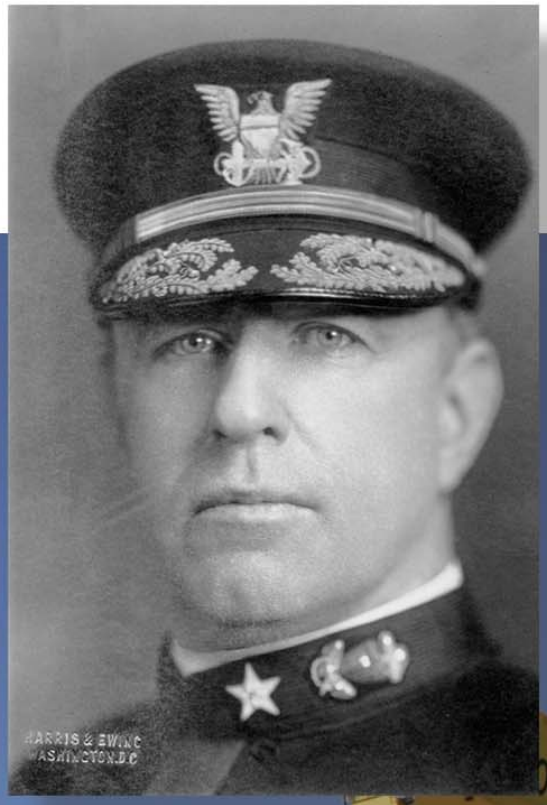
First National Security Cutter Christened



On September 29th, 2006, the Coast Guard Cutter BERTHOLF (WMSL 750) was launched into the water after completion. Photo courtesy of Gordon Peterson , Northrop Grumman.

BERTHOLF Honors First Coast Guard Commandant

by Gordon I. Peterson
DEEPWATER



The Deepwater Program's progressive modernization and recapitalization of the Coast Guard's aging legacy fleet marked a significant milestone on Veterans Day when the first of eight National Security Cutters (NSC) was christened BERTHOLF (WMSL 750) at the Northrop Grumman Ship Systems shipyard in Pascagoula, Miss.

"In the name of the United States of America, may God bless this ship and all who sail in her," said Mrs. Meryl Chertoff, the BERTHOLF's sponsor and wife of Secretary of Homeland Security Michael Chertoff, as she smashed a bottle of champagne across a strike plate mounted to the cutter's bow. The audience of more than 1,000 guests erupted in applause, accompanied by the Coast Guard Band's spirited rendition of Semper Paratus, the Coast Guard's service song.

The BERTHOLF was the first major cutter to be christened for Coast Guard service since the 378-foot high-endurance cutter USCGC MIDGETT was launched 35 years ago.

During the nearly two-hour ceremony, speakers recognized Coast Guard veterans dating to World War II who were in attendance, praised shipyard workers who overcame the devastation of Hurricane Katrina to resume work on the cutter with minimal delay, and saluted the men and women of the Coast Guard for their continued vigilance and service to the nation in all of their maritime missions. "Our people cannot be effective without the proper tools," said ADM Thad W. Allen, the commandant of the Coast Guard. "BERTHOLF and her successors will be the most capable and interoperable cutters the service has ever had."

Rep. Gene Taylor (D-Miss.), a Coast Guard veteran, noted the time would come when the Coast Guard would again be called to respond to a major attack on the U.S. homeland. "So it is fitting that our nation is providing you with a great ship and great training, but at the end of the day it's going to take the great people that you are to make those things work," he said.

Flagship of the Fleet

At 418 feet, the lead ship in the new Legend-class of National Security Cutters is designed to be the flagship of the U.S. Coast Guard's fleet, capable of executing the most challenging maritime security missions and being

supportive of a shared Coast Guard-Navy commitment to the mission requirements of the joint U.S. combatant commanders. The NSC is the largest and most technically advanced class of the Integrated Deepwater System (IDS) program's three major classes of cutters.

BERTHOLF is named in honor of Commodore Ellsworth P. Bertholf, the Coast Guard's first Commandant. Appointed to lead the Revenue Cutter Service in 1911, he was re-appointed to the same office in 1915 when President Wilson created the U.S. Coast Guard by merging the Revenue Cutter Service with the Life-Saving Service. Commodore Bertholf, honored in his day for the heroic rescue of more than 200 whalers stranded in the Arctic in 1897, also led the Coast Guard with distinction during World War I.

RADM Gary T. Blore, program executive officer of the Integrated Deepwater System, noted parallels between Bertholf's leadership of the Coast Guard nearly 100 years ago with the Deepwater Program today. "Beyond matters of personnel, administration, and training," he said, "Commodore Bertholf guided the transition of the Coast Guard's inventory of cutters and boats to a wartime footing." Blore said Bertholf advocated close cooperation between the Coast Guard and the U.S. Navy -- presaging today's National Fleet Policy -- and later paved the way for the creation of Coast Guard aviation.

"In the name of the United States of America, may God bless this ship and all who sail in her."

Mrs. Meryl Chertoff

Mrs. Meryl Chertoff, sponsor of the cutter BERTHOLF (WMSL 750), christens the first in class National Security Cutter at Northrop Grumman Ship Systems Pascagoula, Miss., shipyard on Veterans Day. Northrop Grumman Photo.

"I am confident that our mission and vision for the Deepwater Program would resonate strongly with Commodore Bertholf were he with us here today," Blore said. "We again face a time of great danger to our nation's security; we again are acquiring and delivering more capable and interoperable cutters, aircraft, and systems; we again are called upon to assist Coast Guard operational forces in executing their challenging missions."

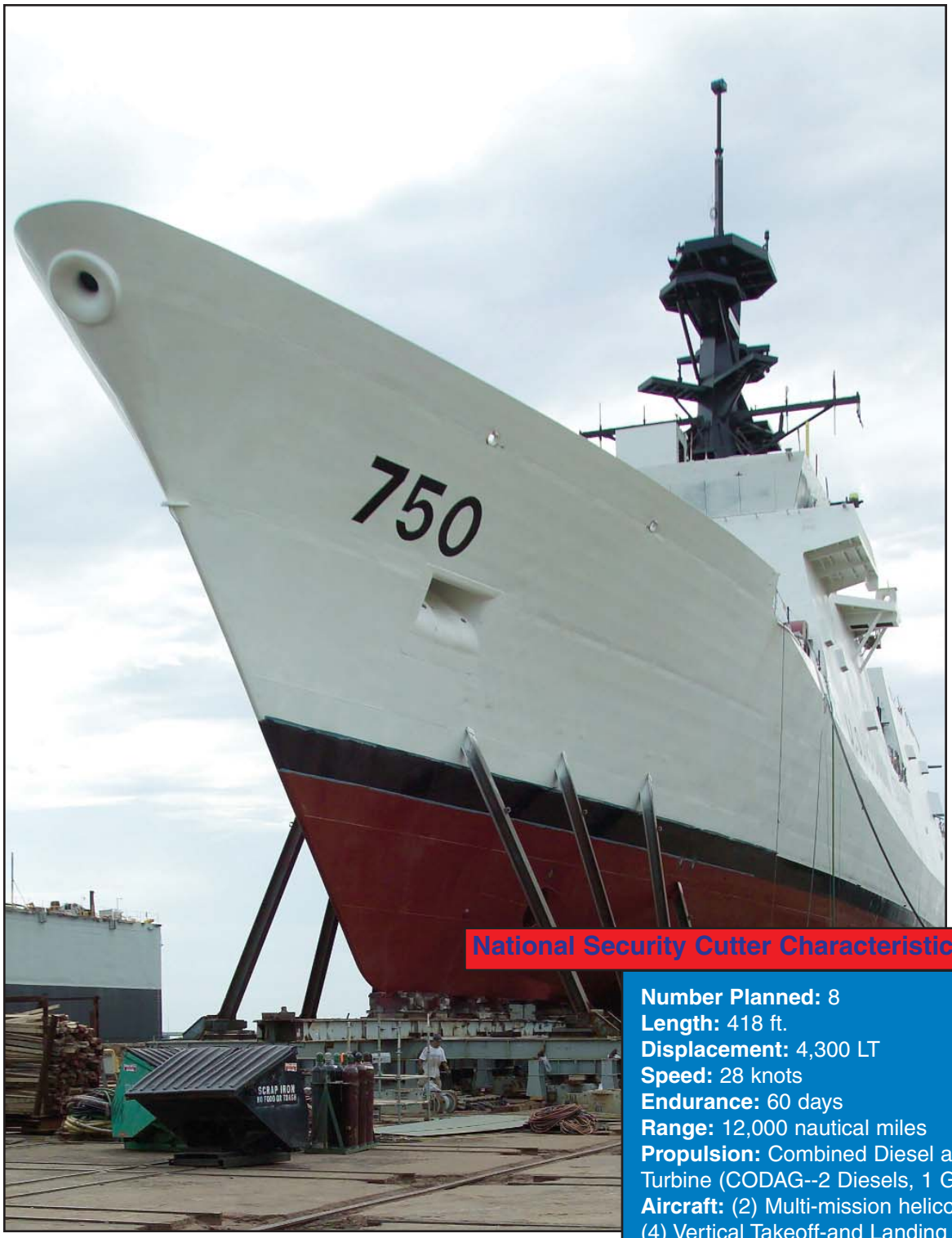
Shipyard Workers Praised

Blore also recognized the important roles played by the Congress and the Department of Homeland Security in translating the Deepwater Program from vision to reality. "Even the best-laid plans to rebuild the Coast Guard would come to naught without the tremendous support we have received both from our Service secretary and from our elected representatives," he said.

"Speaking for the men and women of our Service who are on patrol today -- and those who will follow during the years ahead -- I express our deep appreciation to our Department and our Congress for providing the critical funding necessary to sustain the Deepwater Program in the face of many competing priorities."

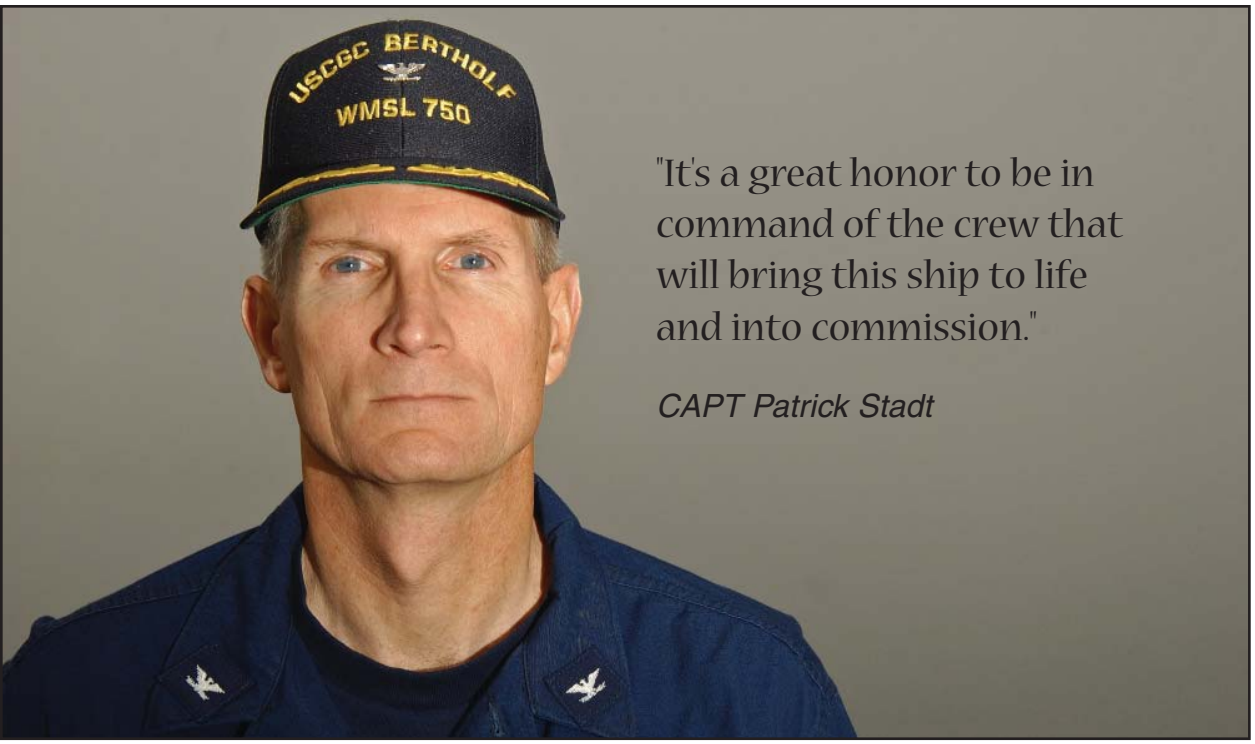
Rep. Taylor, Secretary of Homeland Security Michael Chertoff, and other speakers singled out Northrop Grumman's shipyard workers for their resilience and commitment in the wake of Hurricane Katrina last year.

"When these shipbuilders leave every day, they are tired and dirty and I can assure you, they have given the citizens of this nation and



National Security Cutter Characteristics:

Number Planned: 8
Length: 418 ft.
Displacement: 4,300 LT
Speed: 28 knots
Endurance: 60 days
Range: 12,000 nautical miles
Propulsion: Combined Diesel and Gas Turbine (CODAG--2 Diesels, 1 Gas Turbine)
Aircraft: (2) Multi-mission helicopter (MCH, or (4) Vertical Takeoff-and Landing Unmanned Aerial Vehicles (VUAVs), or (1) MCH and (2) VUAVs
Boats: (1) Long-Range Interceptor (LRI) and (1) Short-Range Prosecutor (SRP)
SLQ-32 Electronic Warfare System
Armament: 57mm gun and Gunfire Control System, Close-In Weapons System (CIWS), SRBOC/NULKA countermeasures, chaff/rapid decoy launcher



Captain Patrick Stadt is the commanding officer of the Coast Guard Cutter BERTHOLF that will be christened November 11, 2006 and commissioned late 2007. BERTHOLF is the first new ship delivered under the Integrated Deepwater System, a 25-year program designed to replace aging ships, aircraft, and communications systems. USCG photo by PA2 Brian N. Leshak.

Northrop Grumman a full day's work for what they got paid that day," said Taylor.

"I want to thank everyone at our shipyard and most particularly the fitters and welders and the fine job that they've done leading up to the christening of this vessel," said Secretary Chertoff. "It is often said that everybody is able to accomplish what they do only because we stand on the shoulders of giants. That is of course very true with respect to the accomplishment of building and christening this cutter."

Secretary Chertoff emphasized the important role the BERTHOLF and future National Security Cutters would play in the Coast Guard's multiple maritime missions. "This ship is very much a tangible symbol of our unwavering commitment as a Department to make the necessary investments in the Coast Guard and our other border forces to make sure that we can continue to keep this country strong."

"I can't predict what the next attack will be, and I cannot predict when the next hurricane will come, but I will tell you whenever a natural disaster or act of terror approaches, this ship and its crew -- and the entire Coast Guard and Department of Homeland Security -- will be there at the ready, at the ramparts to defend and protect the citizens of this region and this country," said Chertoff.

More than 70 crewmembers have reported to the BERTHOLF so far, with the balance of the crew scheduled to arrive this spring. All are now undergoing extensive training at various locations. Late this spring, BERTHOLF's crew will move to Pascagoula for additional shore training at Northrop Grumman's facilities and aboard the ship. This will lead to builders and acceptance trials and, finally, formal delivery of BERTHOLF to the Coast Guard.

"It's a great honor to be in command of the crew that will bring this ship to life and into commission," CAPT Patrick Stadt, the cutter's prospective commanding officer, said recently. "The crew is extremely excited about taking delivery next year [2007], and they are fully entrenched in training for the new systems and operation of Bertholf. In less than a year from now, we will have the most capable Deepwater asset ever built added to our inventory and ready to answer all bells."

Mr. Peterson is a senior technical director for General Dynamics Information Technology supporting the Deepwater Program.

First Coast Guard Maritime Patrol Aircraft Departs Spain ...

SEVILLE, Spain, December 18, 2006 – The Coast Guard crew from Aviation Training Center Mobile departed from Spain on Saturday [16 December 2006] bound for the United States aboard its first Deepwater medium-range surveillance maritime patrol aircraft. The crew made stops in the Canary Islands, Brazil, Barbados, and Florida before arriving in Elizabeth City, NC, on Thursday [21 December 2006] where the HC-144A aircraft's mission system pallet will be integrated at the Coast Guard Aviation Repair and Supply Center.

Arrives Later in E-CITY

Landing: The HC-144A, piloted by CDR Doug Nash and LCDR Travis Burns, touched down at 11:35 a.m. after a fly by for the many spectators lining the runway.

Cockpit: Pilot CDR Nash and co-pilot LCDR Travis Burns proudly pose in the all new 'glass' cockpit of the HC-144A after their four-day journey home from Spain.

ELIZABETH CITY, N.C., December 22, 2006 – All hands were on the flight line yesterday at Coast Guard Air Station Elizabeth City for the historic arrival of the first new Deepwater medium-range surveillance maritime patrol aircraft, the HC-144A.

"Watching the touchdown of this new aircraft today was the culmination of years of work by hundreds of people to make this day possible," said CAPT Matthew Sisson, Deepwater aviation domain lead. "I was honored to be the guy who happened to be here when it all came together."

Manufactured in Seville, Spain, by EADS CASA, the aircraft safely concluded its four-day journey with a warm reception of friends and family; fitting, following the crew's warm flight path via the Cape Verde islands, Brazil, Barbados, and Miami.

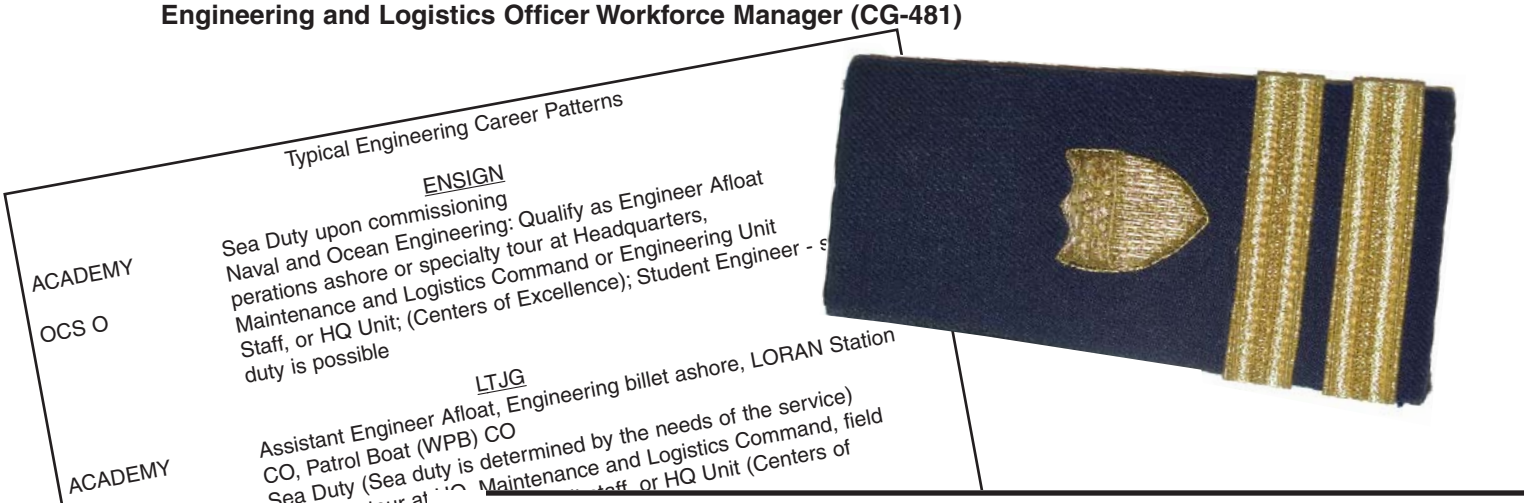
"The trip was extremely fun," said pilot CDR Doug Nash. "The airspeed handling capability of this bird is amazing and the situational awareness I have now in this aircraft is more than I ever could have imagined."

"It is a great airplane and a great day in Coast Guard aviation to see her land here for her next phase of development," said CAPT Sisson.

That next phase of development will integrate the aircraft's palletized C4ISR mission system. The crew will then fly the fully missionized aircraft to Coast Guard Air Station Mobile, Ala., for operational tests and evaluation.

Planning Your Engineering Career

by LCDR James Kammel
Engineering and Logistics Officer Workforce Manager (CG-481)



Over the last year, I have been given the opportunity to speak to a wide range of engineering, logistics, and C4IT officers regarding careers, competencies, specialties, and the future of the Coast Guard's sustainment communities. In every venue, I get asked questions regarding career guidance, professional growth, and promotion opportunities. Because careers are very diverse and individually focused, I always shy away from saying what a career path should look like. Instead I focus pn performance and professional development. In this article I will address the latter as it applies to those of us in the engineering, logistics, and C4IT communities.

Professional competence - the ability to acquire, apply, and share technical and administrative knowledge and skills associated with description of duties.

Technical Proficiency - Coast Guard leaders' technical knowledge, skills and expertise allow them to effectively organize and prioritize tasks and use resources efficiently. Always aware of how their actions contribute to overall organizational success, leaders demonstrate technical and functional proficiency. They maintain credibility with others on technical matters and keep current on technological advances in professional areas. Successful leaders work to initiate actions and competently maintain systems in their area of responsibility.

Engineering Body of Knowledge (EBOK) - To continue to provide the same outstanding service to our organization in an increasing dynamic environment, engineers must continue throughout their careers to mature their knowledge and demonstrated ability. To accomplish that task is a career long journey.

The first statement was taken directly from block 3.e of the Officer Evaluation Report and the second from the 28 leadership competencies, and the third was from ENGLOGINST 3502.1, the Engineering Body of Knowledge (EBOK). Each of these documents would indicate the Coast Guard expects their officers of any specialty, and especially from the engineering specialties, to continue to develop their professional skills, knowledge, and abilities.

One of the most important aspects of our profession as engineers is to stay current with technology, practices, and new knowledge as it becomes available. In each of our engineering development programs (EOIT program COMDTINST 3502.11, the civil engineering Yellow Book, Aviation Maintenance Officer Training program), there is a definite progression from entering the program with limited knowledge and understanding to higher levels of experience. This allows an officer to progressively get positions of greater responsibility. Increased understanding of your world of work coupled with increased responsibility should make an officer more promotable.

Professional licensing is another way to demonstrate a commitment to professional growth. Although not required within the Coast Guard, having a professional license puts one on the same level as our contemporaries in the private sector, and adds credibility to our efforts as the sustainment agents within the Coast Guard. Within the civil engineering community, there are several positions that it is recommended to have your professional license (see the Yellow Book Professional Development Matrix). Additionally, the EBOK, encourages all Coast Guard engineers to strive for and receive their license as well as participate in professional organizations to continue to develop their understanding of the profession and stay abreast of the new technology and practices. Professional licensing requirements differ by state, but a good resource for this is the National Council of Examiners for Engineering and Surveying. The link below will point you in the right direction to start work on getting your license.

Finally, earning an engineering specialty does not end with completing your first tour in that specialty, or even earning the competencies needed for your current position. As you can see from the specialty templates there is an expectation that you continue to develop your technical abilities through other competencies, training, and experience.

Anthony D'Angelo once said, "Never stop learning; knowledge doubles every fourteen months." This is also true within our organization. Processes change, technical understanding grows, and the world of knowledge in any profession expands. It is imperative as engineers we continue to look for opportunities to keep up with our fields. The Coast Guard gives its member many ways to pursue knowledge and understanding. Start with your individual development plan to create a path for professional growth. Then take advantage of the many programs available to you. Tuition assistance allows you to continue to work while taking classes that are partly funded by the Coast Guard. Additionally the engineering communities sponsor a wide range of advanced education programs. Take a look under the learning tab in CG Central for more information on these programs.

Professional development is a critical part of career planning and progression. Technical, managerial, and leadership understanding are all critical to ensuring an officer's promotability. Maintaining proficiency in our technical, managerial, and leadership roles, will help our communities ensure "superior mission execution through engineering, C4IT, and logistics excellence."

Links of interest:
Advanced Education:
http://cgcentral.uscg.mil/mycg/portal/ep/programView.do?pageTypeId=1618789889&programId=1618988553&channelId=-1610641399

Specialties:
http://cgcentral.uscg.mil/mycg/portal/ep/channelView.do?pageTypeId=1610622433&channelId=-1610623565

Professional Licensing:
http://www.ncees.org/exams/professional/

Volunteer to be an ACE Reviewer

by MAT4 Rusty Huyck, CG-481

USCG photo by PA1 John Gaffney

Why volunteer to be a member of an ACE review for your Rate/Specialty in the service? This is your chance in updating the American Council on Education (ACE) on reviewing your Rate/Specialty for college accreditation. Your Rate/Specialty may have evolved in the past few years into new areas of responsibilities and technological skills of higher learning. Just as any training course or occupation was developed; it must also be reviewed to keep up with advancement of knowledge or changes in technology. These advancements require new learning skills that can be measured and accredited for the ACE review.

Why are competencies important? It is in the interest of the Coast Guard to document our workforce's competencies. Specifically, this project goal is to identify, document, and electronically capture competency requirements for all Engineering and C4IT Rate/Specialty active duty personnel billets. This requires the Coast Guard to conduct an analysis of competency requirements for specialties/rates and deliver the competency requirements and database information for these positions. The project purpose is multi-fold:

(1) To better support program and unit job competency requirements and determine your actual needed skills/experience/education.

"Just as any training course or occupation was developed; it must also be reviewed to keep up with advancement of knowledge or changes in technology."

(2) To better manage the program's workforce by knowing what the "true" demand actually is. This will better facilitate advanced education management, Engineering and C4IT Rate/Specialty/ management, as well as better facilitate the assignment process.

(3) By better understanding your billet position requirements, the program will be able to better serve you in growing, training, accessing, assigning, and ultimately getting the right people into billets within your AOR.

You can help CG-481 by ensuring your competencies are up to date in Direct Access -- for more information look at ALCOAST 586/06 in CG Central.

What happens now? As a selected member you, and your team, will review the background matrix of your Specialty/Rate job tasks, or a new familiar term, competencies. A team, consisting of members in that Rate/Specialty with diverse experience within that occupation, would review and add to the matrix (reference for matrix is on file with the CG Institute) to ensure it's complete and up to date with current task requirements or competencies. Next, the team would meet with a visiting team from ACE, located in Washington, District of Columbia. ACE, through its Military Evaluations Program, evaluates military courses and occupations and recommends college-level credit for them. The Coast Guard Institute supports the coordination and resources the evaluation for credit recommendations every 10 years for each Rate/Specialty or newly developed one.

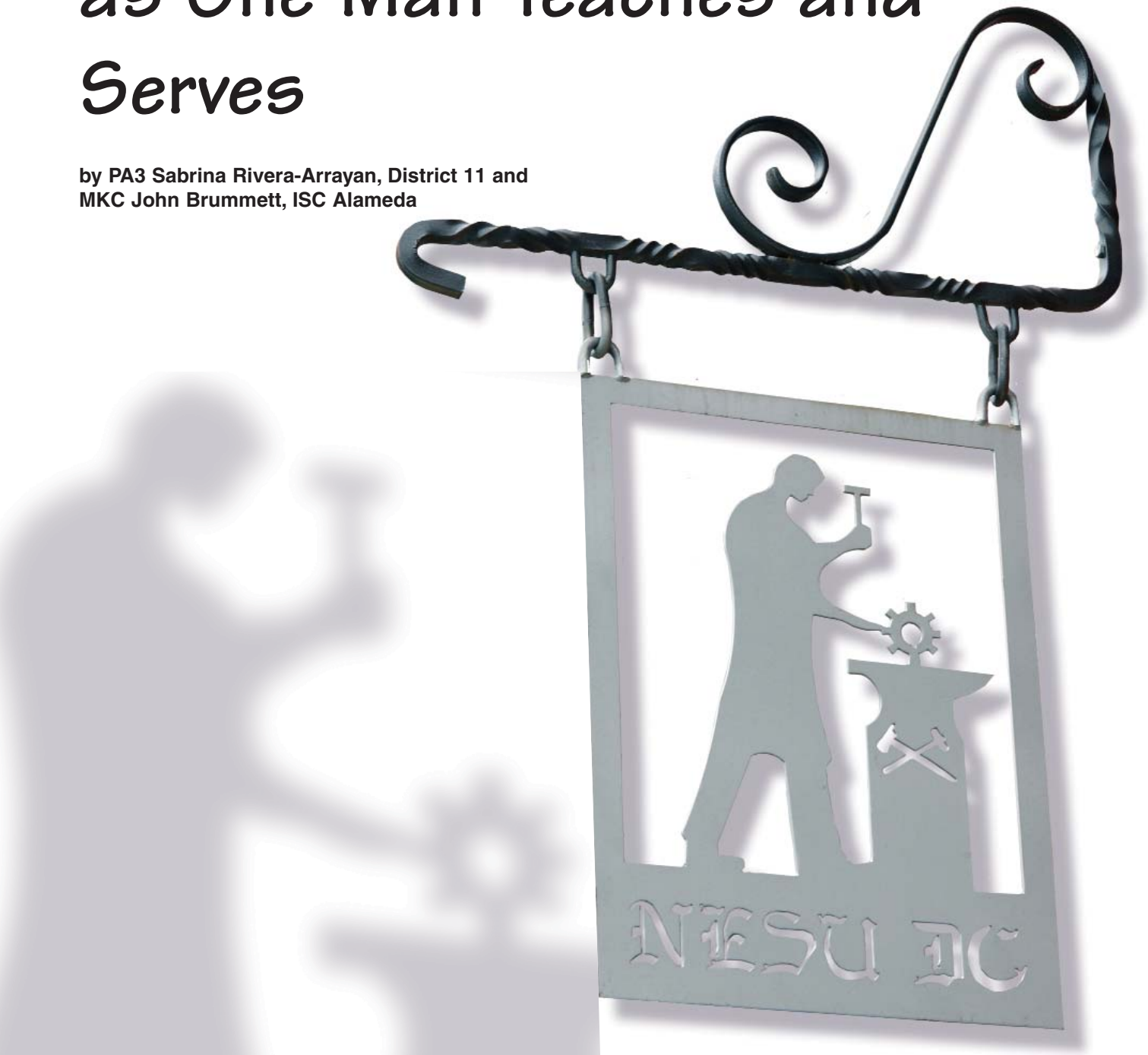
When evaluating occupations, teams of college faculty members meet with a group of individuals who are assigned to particular specialties. The purpose of these interviews is to determine whether a given military occupation contains the type of knowledge and skills that would be comparable to learning acquired in college-level courses. The process involves an ACE team of three -- subject-matter specialists meet with several individuals in each Rate/Specialty. These team members conduct a group interview located at a designated location or military facility. The interviews last approximately 50-60 minutes focusing on the responsibilities, functions, duties, and skills of the job. Please note that evaluations are of the job, rather than of you as an individual. The information and material that you present/provide helps the evaluators make informed decisions about the recommendations of college-level credits for that specialty.

The results of the interviews, combined with a thorough review of written job descriptions and other documentation, become the basis for possible recommendations of Lower Level (LL) or Upper Level (UL) college credit. The recommendations are based on the knowledge and skills required for each specialization. These recommendations are then published in the *Guide to the Evaluation of Educational Experiences in the Armed Services*, which is distributed to accredited educational institutions and all military education centers.

The advantage of this project is that many service members and veterans have been able to get equivalent credit at a college for their accomplishments in Military Service. Many service members at your unit, who are taking college courses, may have already benefited from this opportunity in credits toward a degree program. In closing, your helpfulness when selected for an ACE interview is a benefit to many service personnel and veterans. We appreciate your assistance in this worthwhile program, and for more information go to CG Central and search on ACE, Look for PDF Education Information … ACE National Registry Transcripts ….

Metal Working: Old Meets New, as One Man Teaches and Serves

by PA3 Sabrina Rivera-Arrayan, District 11 and
MKC John Brummett, ISC Alameda



Blacksmithing, the art of crafting crude metal into a useable implement, is one man's passion, expertise, and goal to pass on the skills of the trade.

Blacksmithing is one of the oldest crafts and a major cornerstone that helped build our modern world. It has been in existence since the Iron Age and used for everything from wagons, to farming tools, weapons, and even the first compass containing north and south poles. Blacksmithing has helped to teach mankind metallurgic properties such as melting points, hardening techniques, and how metal acts when hot. Today the craft has taken on a different role and is used in amusement parks, restored historical villages, and for more artistic uses such as metal sculptures.

Martin W. Taylor, Weld Maintenance Leader in the Engineering Department on Coast Guard Island in Alameda, Calif., has brought this ancient art to Integrated Support Command (ISC) Alameda's Industrial Metal Fabrication Shop. He has coupled the art with the shop's most modern piece of equipment, the Plasma CAM (a plasma cutting machine controlled by a computer), to serve operational units and to teach many people who are new to metal working.

The modern-day Plasma CAM (a plasma cutting machine controlled by a computer) displays the process of the plasma arch cutting a design, which is created in the computer onto metal. The machine was used by ISC Alameda Metal Fabrication shop on Coast Guard Island to create a 60-foot by 40-foot cradle for cutters during dry-dock, parts of the main gas turbine exhaust ducting for 378-foot cutters, 50-ton air conditioner salt water strainers, sections of foundations for the Global Positioning System (GPS) towers recently erected in Hawaii and San Diego, and shipboard ventilation systems. U.S. Coast Guard photo by PA3 Sabrina Rivera-Arrayan

The Plasma CAM is mainly used to cut metal into specific shapes. The first step in using the machine is to draw the shape that needs to be created. Then this sketch is uploaded or manually drawn into the computer. Once the drawing is final, the computer relays the information to the Plasma CAM. The machine then cuts the specified shapes into the metal plate using a plasma arch cutting unit, which is hot enough to cut through one inch steel.

The crew of the Metal Fabrication Shop increased

A 2-feet by 6-feet mural featuring two Coast Guard cutters and a helicopter surrounded by the Golden Gate Bridge.

their skill with the machine and the use of blacksmithing techniques by taking on small ornamental jobs. They designed two steel signs, one for the shop and one for the Naval Engineering Support Unit (NESU) Damage Control (DC) shop. Each sign consists of the unit's name lettering in Old English, the outline of a blacksmith, the gear to represent the Machinery Technician (MK) rating and two crossed hammers to represent the DC rating. The signs hang from iron rods above the entrance of each shop.

Another project was the creation of an outdoor stove made of steel for the Pacific Area Strike Team. The Plasma Cam was used to cut flames and the Coast Guard shield on the front of the oven.

Taylor and Frank Drenik, a Coast Guard crane operator and welder, created a 2-feet by 6-feet mural featuring two Coast Guard cutters and a helicopter surrounded by the Golden Gate Bridge. The aluminum masterpiece dresses the entrance to the shop's storage room on Coast Guard Island.

During the creation of a handrail for Air Station San Francisco, both the Plasma Cam and a blacksmith gas forge, which is a piece of equipment used to heat metal, created by Taylor, were used. Taylor and Petty Officer 2nd Class Crystal Reagan, a damage control specialist, created the handrail to correct the safety hazard present behind the Air Station's gym. The Plasma Cam was used to make the lettering for the unit's name in steel, and the forge was used to make the handrail. The use of old and new techniques turned out a finished product that was attractive and unique versus the prefabricated handrails available commercially.

"These projects and the knowledge give younger people, who are new to the trade, the capabilities of knowing what they can do with these skills, and it instills confidence in the work they accomplish," said Taylor.

The shop also fabricated a 40-feet by 60-feet dry-dock cradle for District Eleven's 87-foot patrol boats. The Plasma CAM was used to precisely cut usable parts from raw sheets of steel up to 5/8 inches thick, including rein-

Cradle fabricated by ISC Alameda's Industrial Metal Fabrication Shop, photo by MKC John Brummett.

forced openings and hundreds of large gussets (triangular inserts), to provide structural stability for the cradle. The forge was used to heat and form the large complex pieces used for the reinforced openings, which is similar to how blacksmiths of old formed the outer portion of wagon wheels.

The shop has completed many other important jobs for operational units, including salt water foundations and 50-ton air conditioner salt water strainers for 378-foot cutters, sections of foundations for the Global Positioning System (GPS) towers recently erected in Hawaii and San Diego, shipboard ventilation systems, and parts for 378-foot cutters' main gas turbine exhaust ducting.

In her experience, Reagan says, "I am able to incorporate the artistic side of blacksmithing into my everyday work which helps me turn out a product that is much more aesthetically pleasing and professional. Learning about the history and then holding a hammer in my hand, while pounding red hot metal, links me with a thousand years of craftsmen and their accomplishments. I feel pride in being part of such an important trade."

The projects completed showed pride in the work they've accomplished, and it has sparked an interest in hopes that the knowledge learned will be shared and passed on for generations to come.

USCG photo by PA2 Jacquelyn Zettles

Lessons Learned from a 378'

by LCDR Nate Moore and MK1 Tom Kostka, NESU Honolulu

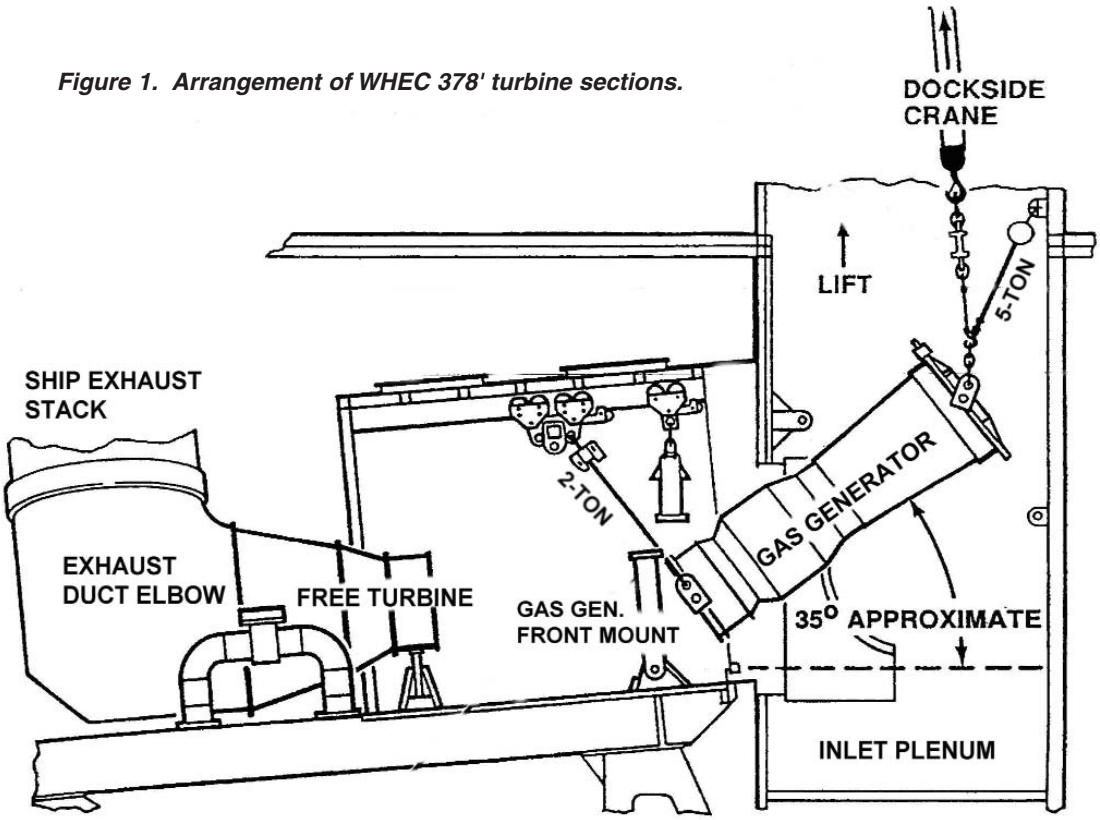
Removal of damaged gas generator through inlet plenum.

Following the catastrophic failure of the #2 main gas turbine on board CGC RUSH in May 2006, it was determined that a complete turbine change out was required. A team of personnel from Naval Engineering Support Unit Honolulu, under the direction of a master technician from MLCPAC (vr-9), was tasked with the job. The project was successfully completed during a regular maintenance period in the cutter's homeport of Honolulu. Several lessons were learned during the project that could be useful to future teams completing a turbine change out on another 378' WHEC (high endurance cutter).

WHEC Turbine Change Out

The Pratt and Whitney FT4A marine gas turbines on board RUSH are arranged as seen in Figure 1. Removal of the individual turbine sections is accomplished by complex chain fall operations that lift the components of the engine out of the ship through the inlet plenum. This procedure is spelled out in detail in the ship's technical publication (TP 3255).

Figure 1. Arrangement of WHEC 378' turbine sections.

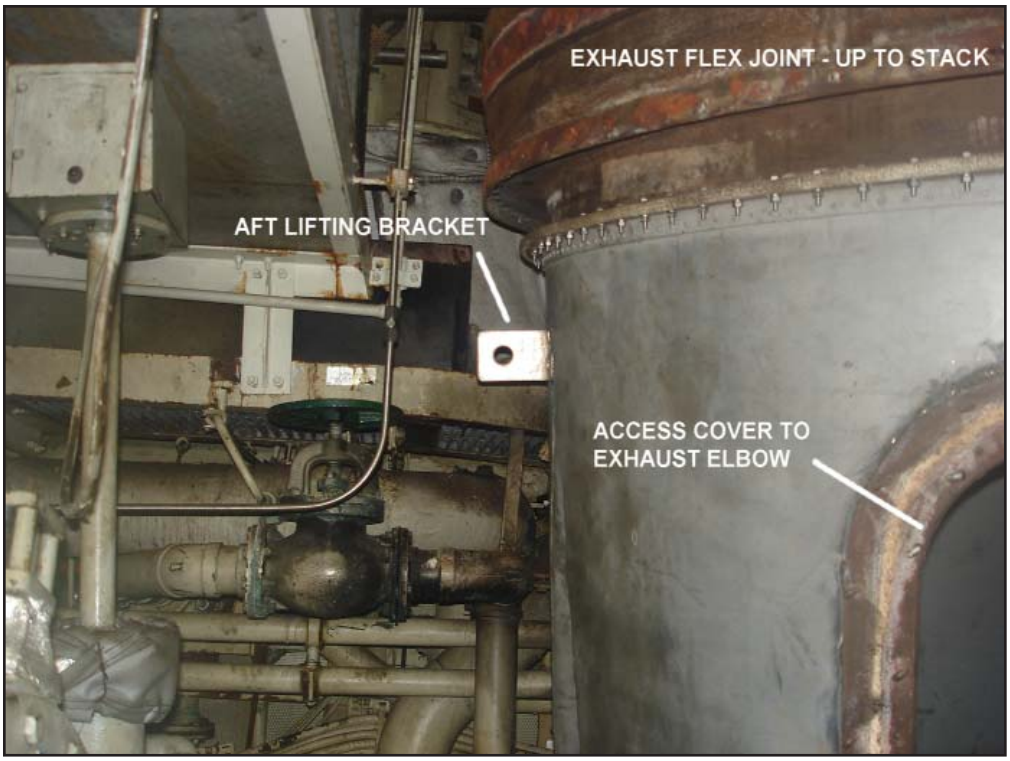


In a typical turbine change out, only the gas generator section and the free turbine section are removed and then replaced. However, in this case, the exhaust duct elbow was significantly damaged during the casualty, requiring it to be removed and replaced as well. This massive exhaust duct elbow is very large and cumbersome and does not have any pre-installed lifting points to facilitate removal. In addition, there is no documentation or corporate knowledge of one of these exhaust duct elbows ever being removed from a 378' WHEC during a turbine change out. This evolution involving the removal of one on the RUSH is believed to be the first ever of its kind, which required a plan for removing it to be developed and tested on scene.

The first step in the project was the removal of the damaged gas generator and free turbine sections per normal procedures. Then the unusual step of removing the free turbine output shaft (power shaft) was undertaken. Normally this shaft is simply supported in place during turbine change outs. However, in order to get the exhaust duct elbow out of the space, it had to be removed. This was accomplished by first disconnecting the inner duct that covers the power shaft and securing it to the overhead with a ½ ton chain fall. Then three chain falls were used to lift the power shaft; one at the aft end near the reduction gear, one in the center inside the exhaust duct elbow, and one at the forward part of the shaft in the turbine box. The seal and seal housing on the reduction gear side were removed allowing the shaft to be freely moved upward and forward with the three chain falls. Once the power shaft had been moved enough to clear the exhaust duct elbow it was removed from the turbine box and secured to the deck.

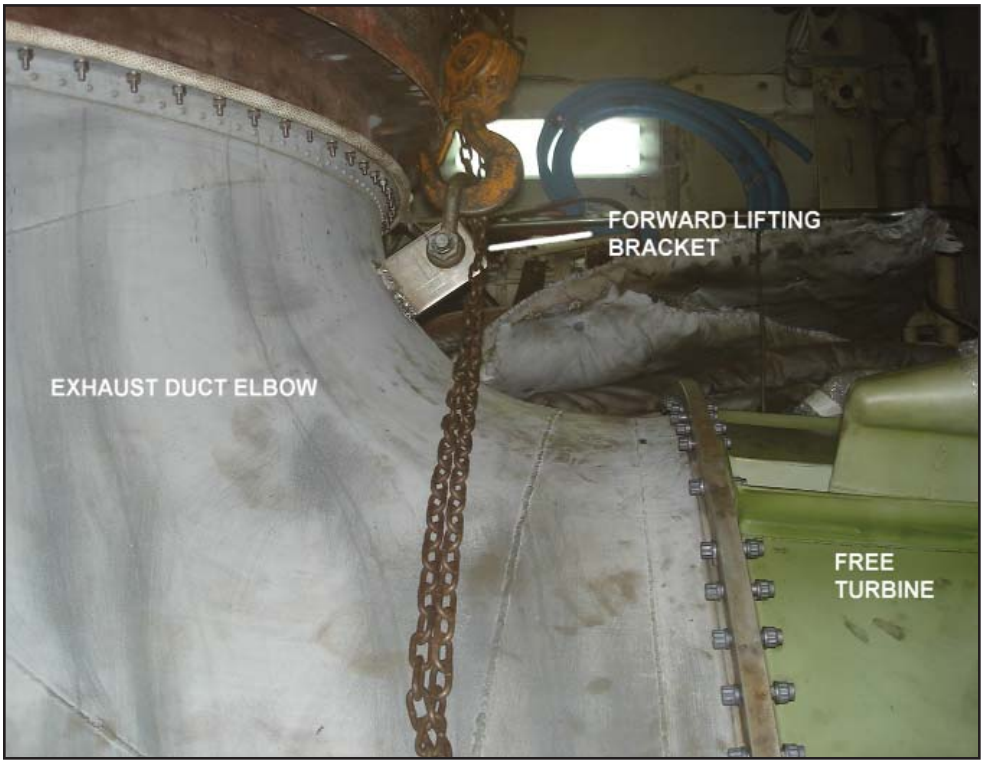
Once the turbine output shaft was safely out of the way, the removal and installation of the exhaust duct elbow itself could begin. Two lifting brackets were bolted onto the front of the elbow flange and a lifting strap was looped through the inside of the elbow. This method of support proved very cumbersome, especially during the transition from horizontal to vertical lifting of the duct at the bottom of the inlet plenum. Therefore, a different approach was used during the subsequent installation of the new exhaust duct elbow. For the new elbow, two lifting brackets were welded just below where the trunk meets the flex joint for the stack, replacing the strap arrangement used during the removal of the old duct. The images on the next page show placement of the brackets.

These two new lifting brackets placed fore and aft on the top opening of the duct allowed for better maneuverability in the plenum chamber than the lifting strap looped through the elbow and reduced the chance for damage during the process. Figure 2 (see page 28) shows the transition of the new duct at the bottom of the inlet plenum using the new brackets.



Aft Lifting Bracket on New Exhaust Duct Elbow.

Forward Lifting Bracket on New Exhaust Duct Elbow.



The new exhaust duct elbow was successfully maneuvered into place using this arrangement. Welding of the two additional brackets is highly recommended for future exhaust duct replacement evolutions.

The size of the elbow itself created a significant problem in that it was too large to be freely maneuvered in the turbine box. This required some piping brackets for the hydraulic start hoses to be cut off the deck to provide more space. In addition, the gas generator front mount lower half had to be removed completely vice being reclined per the tech pub. With these modifications, the exhaust elbow was removed from the turbine box but its size actually prohibited it from being freely hoisted out of the inlet plenum vertically without rubbing the lagging in several places on its way out. The elbow had to be slowly wedged through in places to minimize the lagging damage during both the removal of the old and installation of the new exhaust elbow. Lagging repairs were affected following the turbine installation.

In addition to the particular challenges associated with the exhaust duct elbow replacement, there were several lessons learned regarding the overall turbine change out that would be beneficial for future projects.

1. Taking pictures of all piping and wiring configurations before removal of the damaged turbine components is highly recommended. This provided visual documentation of all hose and wiring connections that was invaluable during installation of the new turbine.

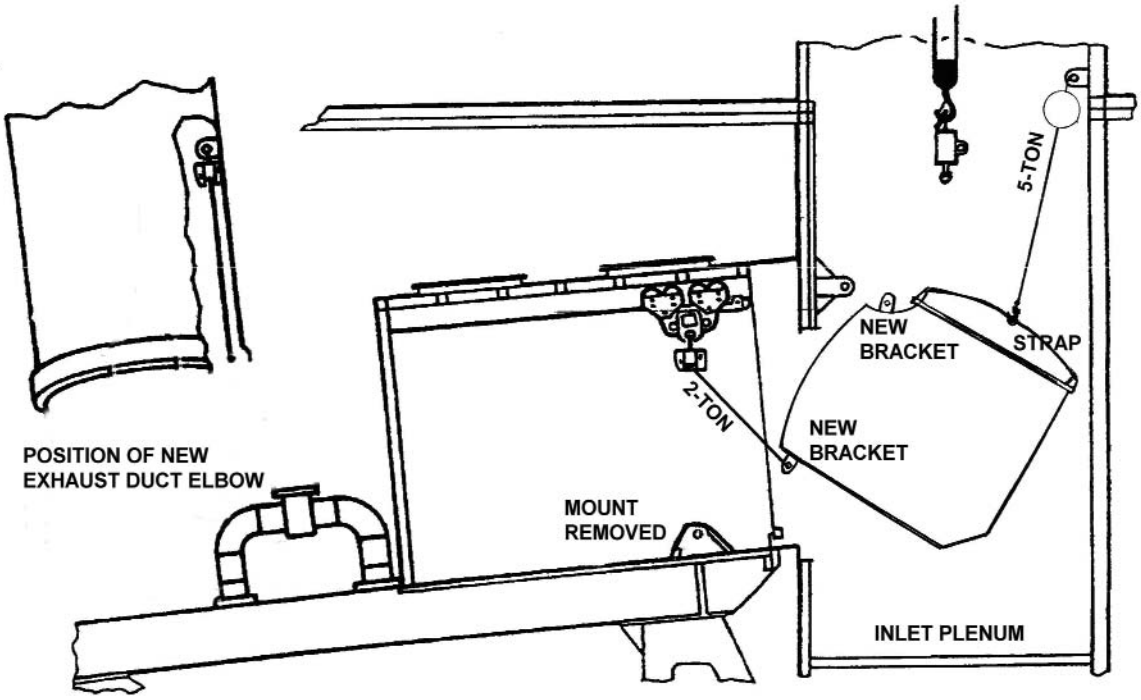


Figure 2. Installation of the new exhaust duct elbow.

2. The use of metal tags installed on all removed lines, tubes, and hoses were critical to avoiding confusion during the installation. The tech pub requires the use of tags but does not specify what type and in previous turbine change outs, tags were made with tape and paint markers. However, over time the chemicals in the oil and fuel would often wash the markings off of the tags. The use of metal tags avoided this problem and is recommended for future operations.

3. Having a second engine lifting bracket on scene in addition to the one typically used for a turbine change out is recommended. This allows the simultaneous use of one for removal of the damaged turbine and the other for installation of the new turbine. Having both engines rigged for lifting at the same time saves the 4-6 hours it takes unbolting one bracket and switching it over to the other engine. This time is critical after the new turbine is lowered on board and attention is shifted to getting the old turbine into a shipping crate and out of the weather. Minimizing delay in crating the old turbine also reduces valuable contracted crane service time. The most common lifting brackets used for 378' WHECs are part number 378 FRAM-W-234-023-63, while in some cases the -62 bracket is needed (including WAGBs). A quick measurement of the bolt pattern on the engines will determine which brackets are needed.

4. The damaged turbine was temporarily stored on scene following its removal until installation of the new turbine was complete. Having the old turbine remain on scene provided a ready source of supply for spare parts as they were needed during the installation, such as camlock fitting for gearboxes, piping elbows, and brackets for vibration sensors.

5. During the installation of the new gas generator, the cables between the lifting beam and the brackets on the front of the gas generator were not used. The lifting beam was shackled directly to the brackets allowing for more direct control of the engine's movement and reducing the complexity of the chain fall evolution. Removing these lengths of cable also reduced the tendency of the gas generator to sway during its vertical travel in the plenum chamber due to tidal surge and wakes in the harbor. It is important to note however, that these cables must be used below the lifting beam when moving the power turbine since it must be lifted with primary support from the bottom lifting brackets as shown in Figure 4.

In conclusion, the gas turbine change out on board CGC RUSH, including the replacement of the exhaust duct elbow, was a success. It was accomplished following standard procedures for the gas generator and free turbine installation and with a newly developed procedure for removing and replacing the exhaust duct elbow. Maintaining a core group of experienced technicians on the subject of gas turbine change outs is critical to meeting the Coast Guard's maintenance needs of the future. The lessons learned from this

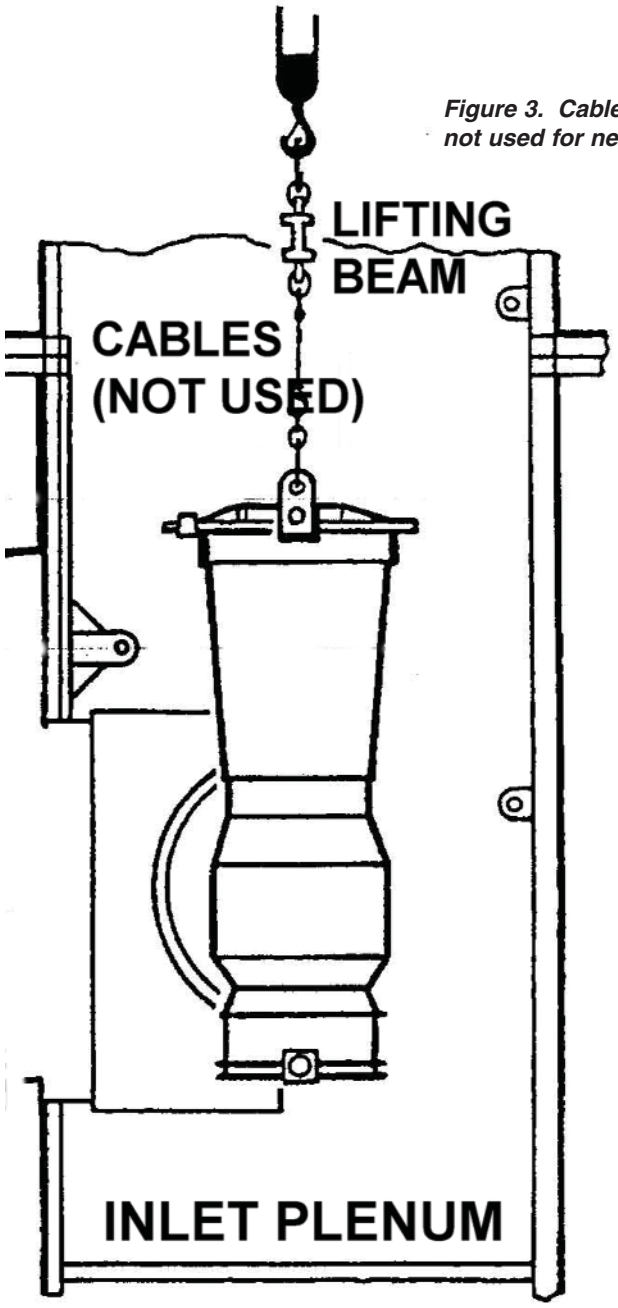


Figure 3. Cables below the lifting beam were not used for new gas generator installation.

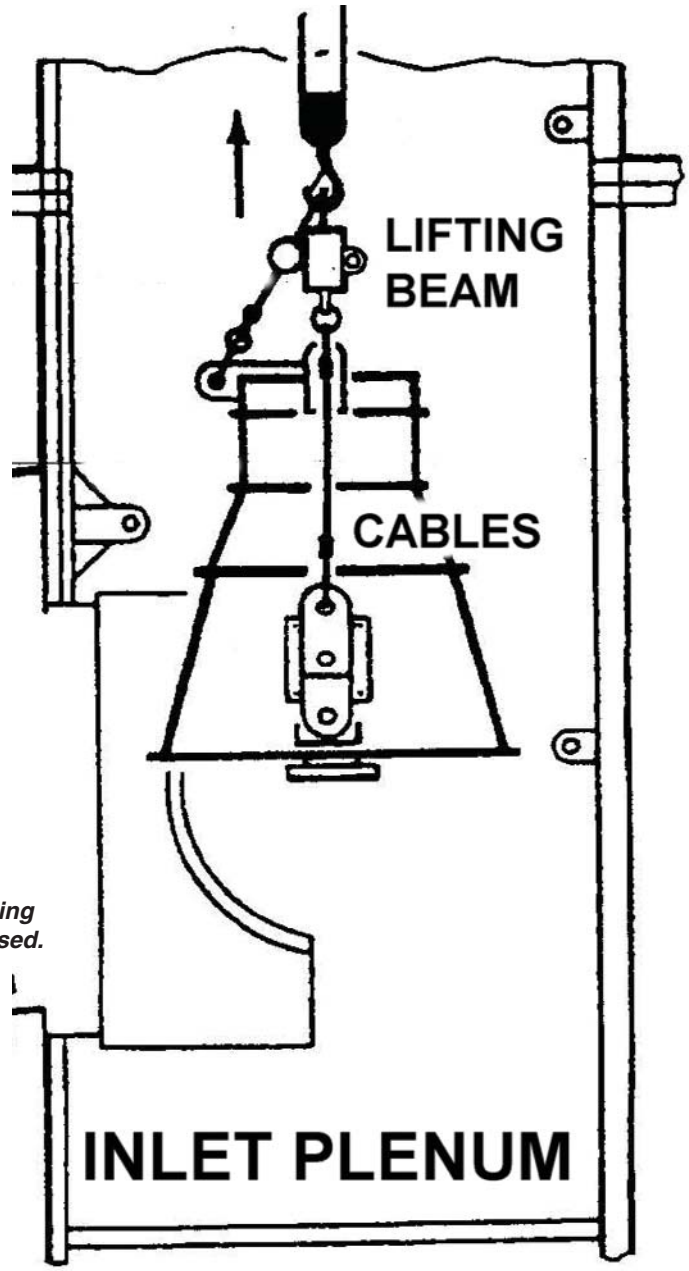


Figure 4. Cables between the lifting beam and free turbine must be used.

project are intended to enhance that corporate knowledge and to assist with future gas turbine change outs on 378' WHECs.

Civil Engineering:

A Key Player for Deepwater

by LCDR Nick DeLaura, USCG
Facilities Design and Construction Center Atlantic

Construction site preparation and foundation phases of work (Dec 2005).

The term "DEEPWATER," brings to mind images of new cutters, aircraft, and electronics to carry Coast Guard operations through the 21st Century. We envision the new National Security Cutter (NCS) operating with a new Unmanned Aerial Vehicle (UAV) at sea executing Homeland Security missions. But, new assets need piers, hangars, shore side shops, and offices. Fortunately, the Civil Engineering (CE) Program began partnering with DEEPWATER long before the DEEPWATER contract was awarded. We were tasked with identifying shore facility project scopes and budgets to be included in the contract documents and budget request. This planning effort is now paying dividends with facility construction underway as new assets come on line. Noteworthy is the recent completion of the Aviation Training Center (ATC) Mobile Consolidated Hangar.

Erection of pre-engineered steel frame hangar (Mar 2006).

Installation of hangar envelope (May 2006).

Completion of hangar envelope (to include doors) and pavement (July 2006).

This $25M Consolidated Hangar Project was completed by Facilities Design and Construction Center Atlantic (FDCCLANT) in support of DEEPWATER's newest and most advanced air asset, the Maritime Patrol Aircraft (MPA). The new hangar is an impressive 98,000 square feet: 48,000 square feet of hangar deck, capable of accommodating six airframes (3 MPAs and 3 HH-60s), and 50,000 square feet of dedicated support spaces (i.e., aviation shops, offices, admin, storage, etc.).

FDCCLANT awarded this project in July 2005 using Design/Build as the project delivery method. FDCCLANT became the CE Program leader in design/build after experiencing a 50% per-

Completed hangar - rear elevation (Nov 2006).

Completed hangar - front elevation (Nov 2006).

sonnel reduction in 2004. Design/build has allowed us to work smarter, delivering facilities to our customers and the Consolidate Hangar project scope lent itself nicely to the process.

In design/build a single contractor is awarded a contract to design and build a facility. Advantages of design/build include time and cost savings. The year (or more) invested in developing a complete design to put out for bid is eliminated. Because only one contract is awarded, the contractor can begin building foundation construction before the superstructure design is complete. Conflicts between designer and builder are handled by the prime contractor without Coast Guard involvement resulting in a dramatic decrease in claims and litigation.

Design/build also offers cost saving opportunities through value engineering, but we have had to learn how to structure our contracts to allow the contractor to value engineer. Too much specificity in the contract documents may limit opportunities for innovation, ideas, and value engineering. Too little specificity may result in delivery of a facility that does not adequately meet our operational customer's needs. For the Consolidated Hangar project, we think we found the correct balance.

The contract to design and build the hangar was awarded to Butler Construction, a pre-engineered building manufacturer and builder on GSA schedule. Butler brought loads of technical and project management experience to the table making them the ideal candidate for the Hangar project. The Coast Guard enjoyed significant schedule and cost benefits as a result of some innovative value engineering by Butler Construction.

High Expansion Foam (HEF) commission test at 1 minute.

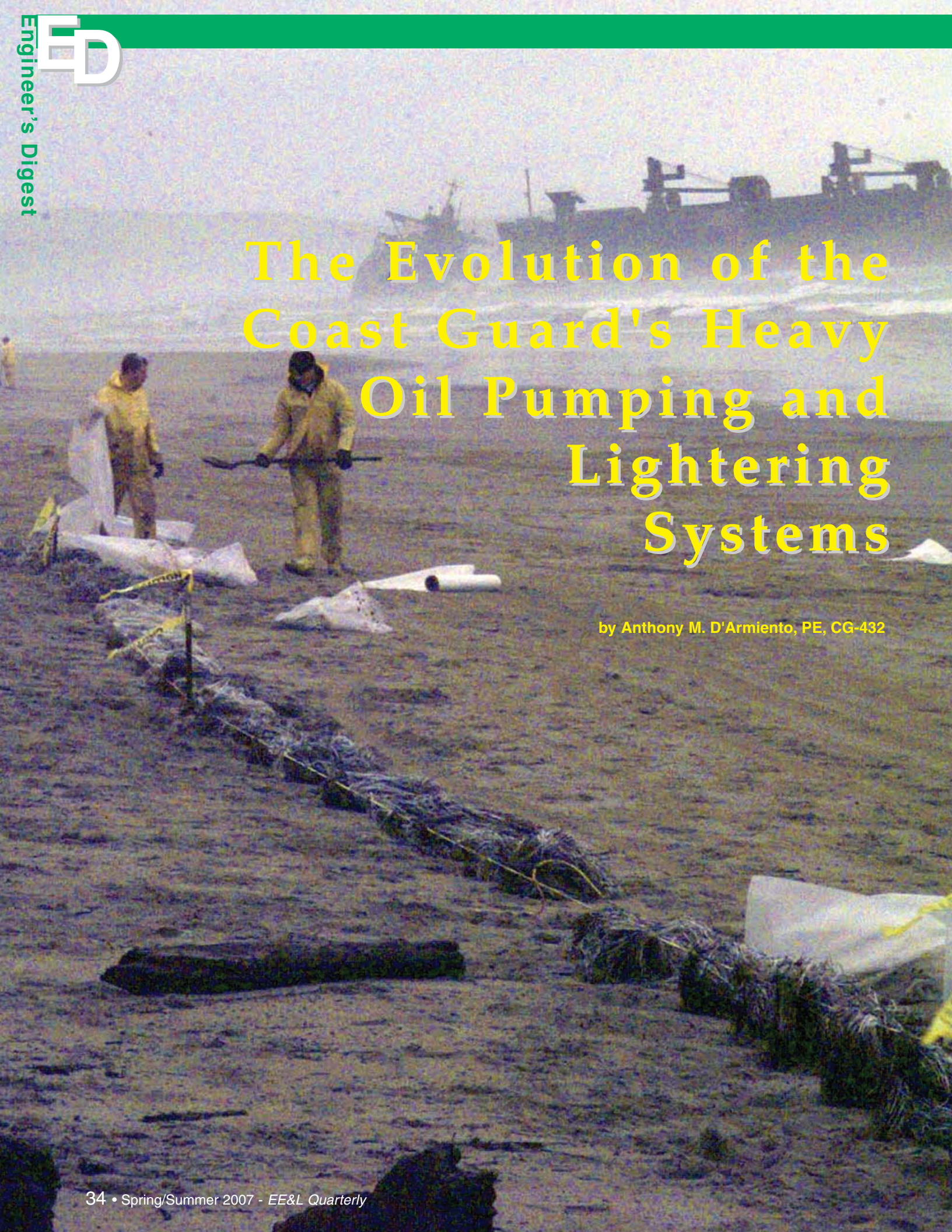
Following award, FDCCLANT and Butler Construction worked closely with all stakeholders to ensure proper design requirements were identified, discussed, and implemented. On-site customer design review meetings facilitated rapid review and response to design change requests and Butler recommended several impressive value engineering alternatives. Two of the most noteworthy were replacing the Aqueous Fire Fighting Foam (AFFF) fire suppression system with a High Expansion Foam system and installing a Geo-Thermal HVAC System instead of a conventional cooling tower system.

A High Expansion Foam (HEF) System replaced the AFFF system found in most Coast Guard hangars. Because Butler builds hangars often, they were well-versed in the new HEF system and its advantages over AFFF. AFFF is glycol based foam which is discharged via a deluge sprinkler system. AFFF can damage hangar and aircraft electronics and is a chore to clean-up. Clean-up includes capturing the spent water solution in hangar trench drains, holding it in holding tanks, and slowly discharging it into municipal sanitary systems over time to meet environmental code requirements. The holding tanks are big and expensive and the foam is a mess. HEF is a soap/surfactant solution that evaporates. Any residual foam/film left is easily washed down with water and does not damage electronics. It has no adverse environmental impact and does not require holding tanks. Fourteen HEF foam generators are hung high in the hangar overhead. By eliminating the AFFF solution, holding tank, piping, and discharge pumping systems, we saved $500K.

Geo-Thermal HVAC Systems are not typically used in Coast Guard facilities because most of our sites are not large enough to install a series of geo-thermal wells and our heating and air conditioning costs are not so great as to justify the increased system and installation cost. However, the Consolidated Hangar size and site lent itself nicely to the geo-thermal system recommended by Bulter. System installation required drilling more than one hundred wells (each 190 feet deep) around the hangar. The system selected is a closed loop water system. The encapsulated water is circulated through a flat plate heat exchanger to remove building heat and dissipate it back into the ground strata via radiation. Deep earth temperatures around the hangar remain a constant 55-60°F year-round providing excellent heat transfer. Inside the hangar, heat pump units condition the spaces. This geo-thermal system is expected to save hundreds of thousands of dollars in utility costs over the building's life cycle.

Design/build has proven to be an invaluable contracting tool for FDCCLANT in executing Acquisition, Construction, and Improvements (AC&I) shore facility projects. Under the "old" AC&I execution timeline, 4-5 years were typically required to plan, design, bid, and build. With design/build, FDCCLANT has cut that timeline to 2-3 years and benefited from innovative value engineering alternatives saving the Coast Guard millions of dollars.

The construction of the Consolidated Hangar at ATC Mobile is just one DEEPWATER shore project. The Civil Engineering Program is continuing to work with DEEPWATER to ensure the right facilities for our new assets. Remember, DEEPWATER is more than just the acquisition of new vessels and aircraft -- it is also the construction of critical shore infrastructure to support new assets and missions.



The Evolution of the Coast Guard's Heavy Oil Pumping and Lightering Systems

by Anthony M. D'Armiento, PE, CG-432

Background

One of the Coast Guard's major areas of responsibility is the protection of America's natural resources and the environment. The Ocean Engineering Division, COMDT (CG-432), of the Engineering and Logistics Directorate, COMDT (CG-4), is the support manager for configuration control and engineering policy for the Coast Guard pollution response systems. CG-432 works closely with the three National Strike Force (NSF) teams, the Atlantic Strike Force, Gulf Strike Force and the Pacific Strike Force, as well as to each District Response Advisory Team (DRAT). Since the early 1970's, CG-432 has been collaborating with the NSF's program manager, COMDT (CG-3RPP), and the National Strike Force Coordination Center (NSFCC) by continuously improving response capabilities to meet current and future threats. One major environmental threat is the grounding of a large motor vessel with large amounts of fuel oil on board. The Coast Guard's lightering system would be used to offload the oil or liquid cargo from the motor vessel in order to permit its free movement to sheltered waters.

Until the 1990's, the Coast Guard NSF deployed an "early generation" lightering system referred to as the Air Deployable Anti-Pollution Transfer System (ADAPTS). It was developed by the Coast Guard to facilitate a major need when a loaded tanker runs aground. ADAPTS consisted of a small centrifugal pump capable of being carried by helicopter and lowered through a standard 14-inch tank hatch. It also comes with a diesel engine for power and a fuel bladder. The ADAPTS pumps the liquid product to a barge or temporary storage device (i.e., fuel bladder) alongside the grounded ship. Without such a system, many oil cargoes might be spilled in the ocean and cause significant natural resource impacts, especially if the oil reaches the shoreline.

Though the ADAPTS was a readily deployable asset, its single most critical limitation was that its centrifugal pump was not well suited to pumping heavy fluids with viscosities of approximately 15,000 centistokes (cSt) or greater. Hence, it was not suitable for pumping Number 6 oil, Bunker C, asphalt, coal tar, and other heavy liquid products. Since most large commercial vessels such as container ships, tankers and bulk freighters use heavy oil like Number 6, there was a gap in the Coast Guard's response capability. This was evident with the inadequate response to the grounded *M/V New Carissa* off the coast of Oregon in February 1999.

As described in detail in the Coast Guard's *Systems Times* Summer 2000 article "Improving the Coast Guard's Viscous Oil Pumping and Lightering Capability" various options were ruled out by the Incident Commander responsible for removing the remaining 140,000 gallons of No. 6 oil from the *M/V New Carissa* incident. The Coast Guard's NSF team struggled to remove the oil before the winter storms reached the area. The first option of burning the oil on board was considered infeasible. Secondly, because the oil had cooled to the ambient temperature of 35 degrees Fahrenheit, the viscosity of the oil was approximately 200,000 cSt and well beyond the viscosity limitation of the ADAPTS.

Fortunately, hydraulically powered screw pumps were provided to facilitate pumping 110,000 gallons of a mixture of oil and water approximately 600 feet from the grounded vessel to shore. Despite at least 30,000 gallons of very heavy oil remaining on board, the *M/V New Carissa* was lightered enough for it to be successfully pulled off the beach and towed to a safe place.

The Federal On-Scene Coordinator's report (Volume I, Section 4) emphasized the need to improve the U.S. salvage and lightering capability. There were only two salvage vessels on the Pacific Coast capable of re-floating a large deep draft vessel and neither was readily available until several days after the grounding. This crisis may have been mitigated if an "adequate and timely salvage capability" had existed. In response to the lessons learned and the concerns addressed by the Federal On-Scene Coordinator, the Coast Guard started a partnership with the U.S. Navy Supervisor of Salvage (NAVSUP-SALV), the Canadian Coast Guard (CGC), and the salvage industry to collaborate on current state of lightering technology and recommendations to improve this technology. The partnership agreed to develop a lightering system that relied heavily on Commercial-Off-The-Shelf (COTS) technology, and could pump oil at a viscosity of 200,000 cSt over a distance of up to 1,500 ft. A series of workshops were conducted by this partnership to conduct tests of existing lightering systems. Each workshop involved major incremental improvements to the lightering systems.

The most recent workshop in December 2003 resulting in the U.S. Coast Guard achieving the goal of pumping heavy oil at 200,000 cSt approximately 1,500 ft. A comprehensive report documented the findings of the December 2003 workshop. The report's recommendations were incorporated by CG-432 into a contract for improving the Coast Guard's existing lightering system. The recommendations formally identified the components for a new lightering system called the Viscous Oil Pumping System (VOPS). In June 2004, CG-432 award-

ed the contract via a Military Interdepartmental Purchase Request (MIPR) to NAVSUPSALV. At this article's writing, the development of the first VOPS has been completed with scheduled delivery to the Atlantic Strike Team in February 2007. CG-432 anticipates that the Gulf Strike team will receive the second VOPS in the fall of 2007, and the Pacific Strike team will receive the third VOPS in the spring of 2008.

Technical Description

Given the technical background of most of this publication's readers, the primary intent of this article is to provide a detailed explanation of the VOPS configuration and provide a discussion on how integrated logistics elements are addressed in the system's design. Key elements such as utilizing COTS equipment will be highlighted. Also, since the National Strike Force will be part of the newly created Deployable Operation Group (DOG), this article will elaborate on the transportability of the VOPS.

System Configuration Overview

Figure 1 is a schematic of the Viscous Oil Pumping System. The center of the system is the Desmi DOP-250

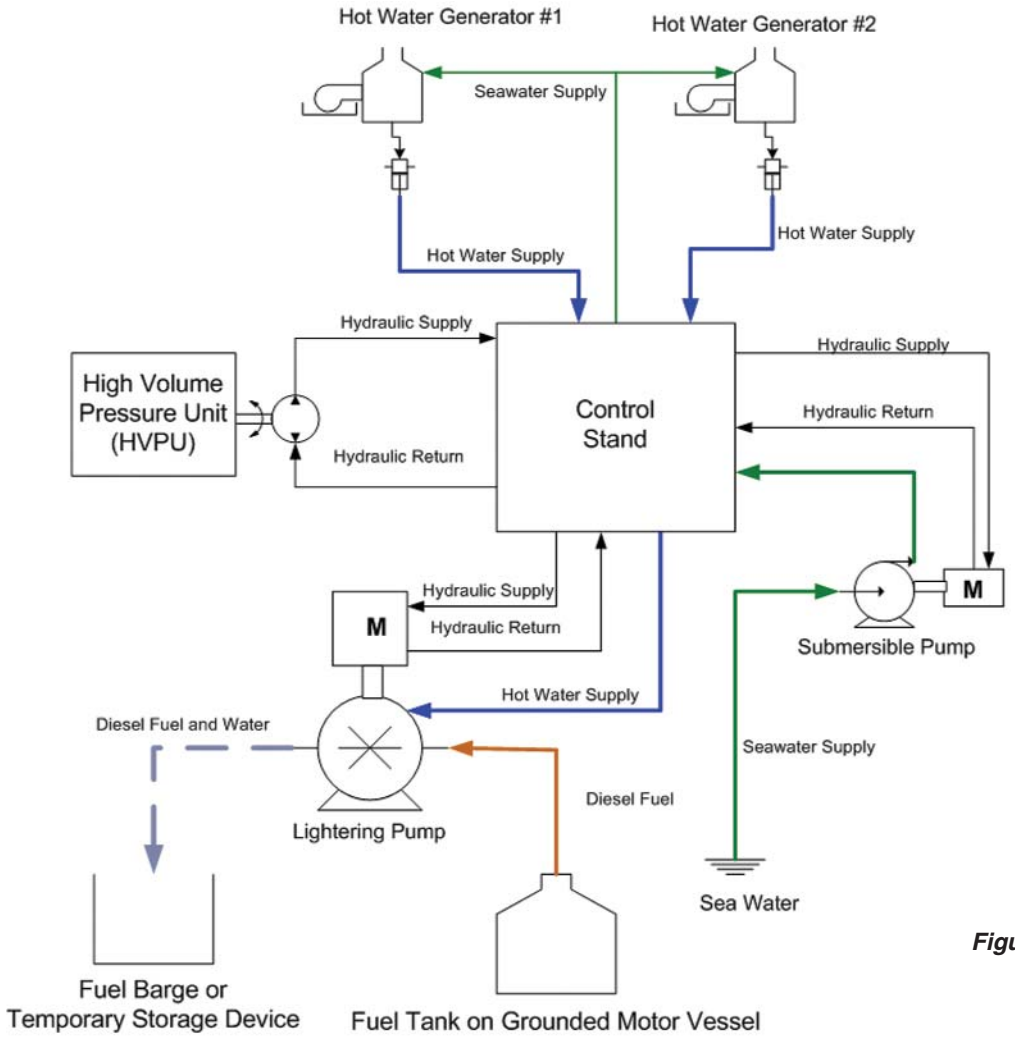


Figure 1 VOPS schematic.

Major Equipment List				
Number	Displayed Text	Manufacturer	Model	Description
1	Lightering Pump	Desmi USA	DOP 250	Screw Pump with 250 GPM output
2	Hot Water Generator	Landa Systems	SLX10-25824E	Diesel-fired, 10 GPM output at 200 Fahrenheit, weigts 2100 lbs
3	High Volume Pressure Unit (HVPU)	Highstar	Series 40-8.7 LT	71 GPM output at 4000 psi, weighs 3950 lbs
4	Submersible Pump	Hydra-Tech	S3 CML	Centrifugal Pump with 25 GPM output at 90 feet head
5	Control Stand	NAVSUPSALV	-	Aluminum frame, weighs 150 lbs

Figure 2. DOP-250 with high torque plus inlet flange.

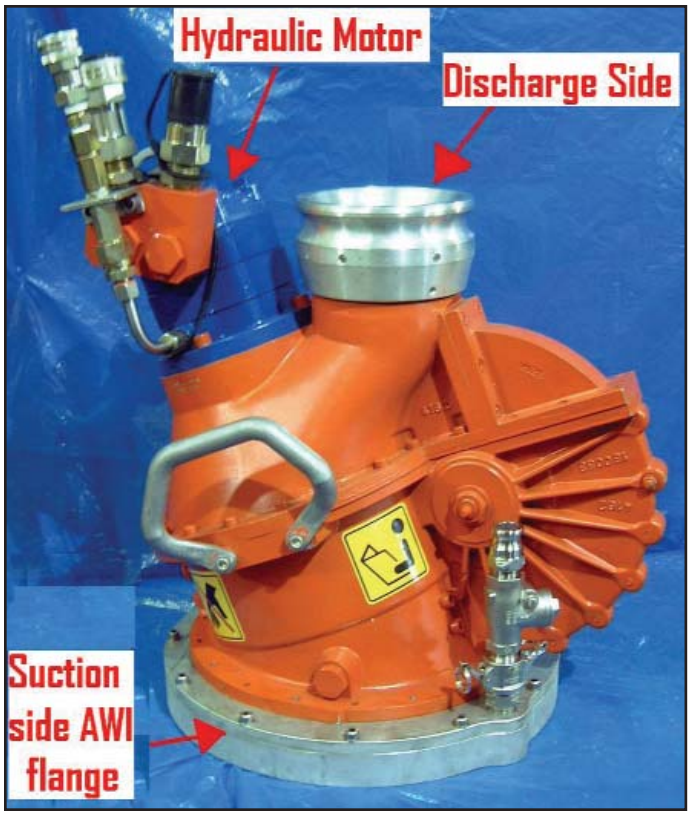


Figure 3. Water lubrication pump.

positive displacement screw pump. A smaller version of this pump, called the DOP-160, is used when dictated by the size of tank openings. The DOP-250 and DOP-160 pumps are fitted with Desmi Annular Water Injection (AWI) flanges on the inlet and outlet sides. Each pump's standard hydraulic motor will be upgraded to a higher-torque version to allow pumping a heavier oil product. Figure 2 is a photo of the DOP-250 pump with a suction-side AWI flange and the high-torque motor.

Seawater is pumped by a Hydra-Tech submersible water pump (see Figure 3) to the control stand which regulates the flow and directs it to the two hot water generators. Figure 4 shows the control stand. Each hot water generator heats the seawater to 200 degrees Fahrenheit and discharges it at 10 Gallons Per Minute (GPM) to the control stand. Figure 5 (see next page) is a photo of the hot water generator. The control stand regulates the hot water pressure and transmits the hot water to the screw pump's AWI flanges.

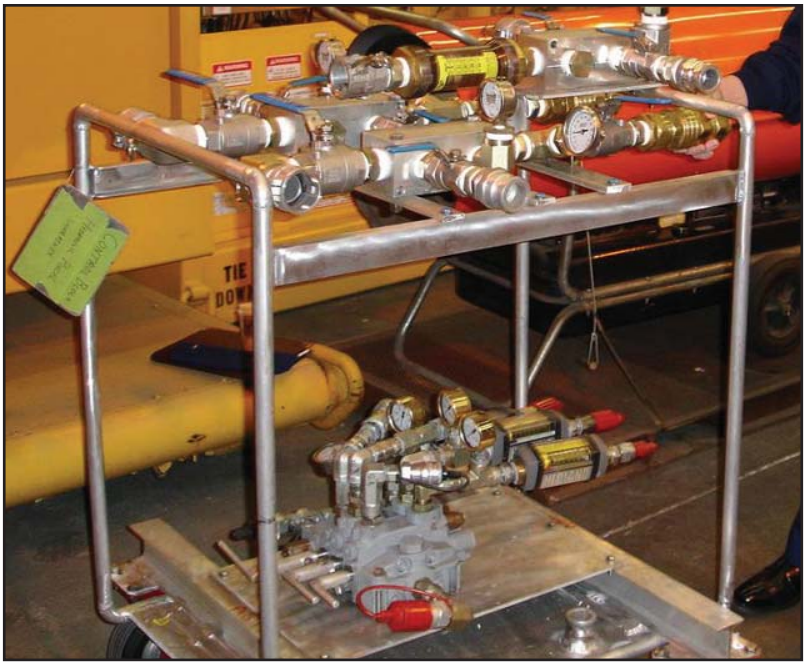


Figure 4. Control stand.

Figure 5. Hot water generator.

The screw pump and the submersible pump are powered by hydraulic power from the Highstar High Volume Pressure Unit (HVPU) via the control stand's hydraulic circuit. The HVPU is a self-contained, portable, skid-mounted prime mover designed to provide hydraulic fluid up to 71 GPM at 4000 psi. It is powered by a Detroit Diesel in-line 4 cycle engine.

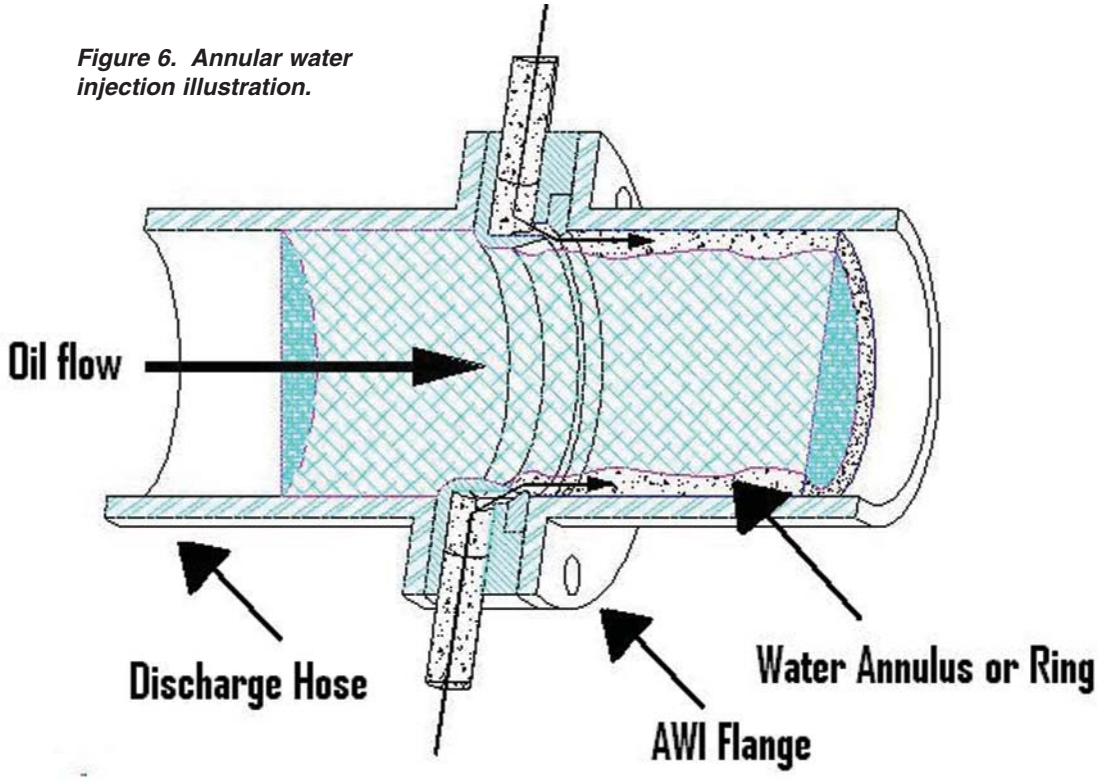
As the pressurized hot water is injected by flanges, a water ring (or annulus) is formed around the viscous oil, which is at a lower pressure than the water. As seen in Figure 6, the water mixes minimally with the oil and the ring is maintained through the pump and the entire 1500 feet of discharge hoses. Essentially the water is in contact with the pump's cavity and screw as well as the hoses. Therefore, the frictional loses are much lower than if the VOPS pumped oil without the water ring.

Test data in the VOPS workshops showed a 14 to 1 pressure drop results when just cold water lubrication is used. Without water lubrication the pressure settings of the pumping system would be quickly exceeded. The Hydra-Search connections of the discharge hoses rated at 150 psi would fail and the screw pump's pressure limit may be reached.

Hot water is required in order to draw the very viscous product through the pump's suction side. This heating effect is called "local bulk heating"; without it the heavy oil would not be able to be lifted by the screw of the pump due to the high frictional forces of the fluid. Once flow is established for several minutes, cold water can be gradually introduced to the AWI flanges and eventually replace the hot water. Switching to cold water will allow the shutdown of the hot water generators. For 1500 feet of 6-inch discharge hose, it will take at least 15 minutes until cold water flow can be started.

The hot water generators should be on standby in case hot water is needed based on monitoring the discharge pressure of the screw pump. If the discharge pressure starts to creep past 75 psi, then hot water should be quickly reintroduced to the AWI to ensure a continuous flow of 250 GPM (which includes the water) through the

Figure 6. Annular water injection illustration.



screw pump. In very cold temperature environments, it may be necessary to constantly provide hot water to prevent the "freezing" of the product flow through the lengths of discharge hoses.

Pressurized hot water is also required to restart the flow after a prolonged shutdown. The screw pump should be throttled to operate near 150 psi of discharge pressure. The combination of the screw pump discharge force and the pressurized hot water will work to clear a hose that may be clogged with "frozen" or gelled product.

If unable to clear the hose by multiple throttling attempts, there are two options. One is to disconnect the hoses at the mid-point of the discharge hose sub-system; meaning, disconnect at the 750 foot mark if using 1500 feet of discharge hose. Then try to clear the 750-foot hose connected to the pump. Reconnect and try to clear the other 750 feet of hose. Another option is to operate the NAVSUPSALV "hose pigging system," which is basically a large "sponge-like" device that is driven through the hose sections by a high-pressure compressed air system. Based on an established Memo of Agreement (MOA) between NAVSUPSALV and the U.S. Coast Guard, the Navy pigging system will accompany the VOPS to any frigid temperature sites such as Arctic regions.

Logistics

To address operational challenges beforehand, the following logistics elements were incorporated into the VOPS design to ensure its success:

- Maintenance Planning
- Manpower and Personnel
- Computer Resources
- Supply Support
- Technical Documentation
- Reliability and Maintainability
- Facilities
- Training
- Support and Test Equipment
- Packaging and Transportability

The staging area for a response operation is that location where equipment from all sources is assembled and held pending deployment to the field. During prolonged operations, equipment maintenance and repair can be accomplished in these areas. Regional or area contingency plans must include provisions for setting up staging areas. Some key provisions to consider are:

- For marine incidents, ready access to piers capable of accommodating support vessels is important. Pier size, capacity, strength to support equipment, limited draft, and access to the site must be considered.
- The staging area must be readily accessible by Material Handling Equipment (MHE) such as cranes and forklifts for off-loading/on-loading trucks and vessels on short notice.

The VOPS is packaged for transportation on a flat bed trailer as shown in Figure 7. The principal components shown in the photo:

- Two ISU 90-containers: a four-way forkliftable internal airlift/helicopter slingable, 90" high container unit
- One Highstar HVPU
- One diesel fuel tank

One ISU-90 container will store a hot water generator on one side and the control stand and various VOPS accessories on the other (see Figures 8 and 9 found on the next page). The other ISU-90 container will store the other hot water generator on one side and the pumps, hydraulic, water, and discharge hoses on the other side. Preliminary storage configurations of the VOPS showed that only up to 700 feet of 6-inch discharge hose can be stored within the second ISU-90 container. As a result, the remaining 800 feet of hose will need to be transported as it is regularly transported by the strike teams, on a C-130 aircraft pallet. Additionally, since more room will be needed for the pallet of hoses, each NSF team's 48-foot flat bed trailer will be utilized to transport the VOPS. Since each component is skid mounted, they can be removed from the trailer by a forklift.

Figure 7. 42-foot flat bed trailer.

Figure 8. ISU 90 container one side.

Figure 9. ISU 90 container opposite side.

So far this article has focused on transporting the gear from a NSF team by tractor trailer or by C-130 from a nearby airfield. Another major transportation challenge is to deploy the gear on board a freighter via helicopter. Consider that not all lightering events will be conducted alongside a pier with the assistance of shore side crane or alongside a work barge with its own crane. For example, a ship may be aground ¼ mile from shore and in strong seas. As mentioned above, the major components like the hot water generator and HVPU are skid-mounted; hence, a harness could be rigged to allow ease with transporting the component by helicopter to the grounded vessel. Another option is to place the components on a C-130 pallet, which has lifting rings each rated for 7500 pounds. One pallet can be loaded with the heaviest of components, the 3950 pound Highstar HVPU. Another pallet can be assigned the 2100 pound hot water generator, the control stand, and VOPS accessories. Hoses can be airlifted by cargo net. To finalize the packaging, slings can be connected to the pallet lifting rings and the pallet can be transported by Coast Guard HH-60, which is rated with a cargo sling load capacity of 6000 pounds.

Reliability and maintainability is paramount to facilitate the continuous operation of the VOPS, especially when kept in storage for prolonged periods. It may take three to four days of continuously operating the VOPS to lighter a one-million gallon oil tanker. Hence, the selection of VOPS components was predicated upon proven, COTS equipment. The Desmi screw pump has at least 20 years of a strong track record in the petroleum and process engineering industry. Rigorous testing of the Desmi pumps in the workshops confirmed the manufacturer's reliability claims. Because the gear is available through common commercial sources, most of the replacement parts are readily available.

Another effort to verify the reliability of the system was a day-long salt water test of the second-generation VOPS in August 2005. The screw and submersible pumps were set up to pump salt water. Though the hot water generator was not advertised to run on salt water, the original equipment manufacturer Landa North America projected the unit would be able to run continuously on salt water without any difficulty. Testing observations and data confirmed the manufacturer's projections.

According to Landa North America, salt water can be used by the unit as long as the unit is flushed with fresh water after its usage. A prolonged operation using salt water will degrade the system and shorten the life expectancy of the unit by as much as 40%. The unit is expected to be operational for at most three major lightering deployments if it runs on salt water only. Fortunately, the vendor has a proven equipment track record and has provided various hot water and pressure washer type systems to the Federal Government since 1969. Hence, supply support and

replacement hot water generator units should be readily available from the vendor. One important criterion for selection of a replacement is that it is compact, portable as well as can operate on diesel fuel, the same fuel to run the Highstar HVPU. Diesel fuel should be available from the service tanks of the grounded vessel, therefore the risk of running out of fuel for the VOPS is eliminated.

Another reliability and maintainability characteristic of the VOPS is the ability to utilize other NSF gear as a backup. Component commonality such as use of the same hydraulic hose connections allow for the use of the Deutz Hydraulic Power Unit (HPU), which is available at each NSF team as well as at each of the 20 prepositioned Vessel of Opportunity Skimming System (VOSS) sites located throughout the United State and its territories. The screw pump and water lubrication pump require 42 GPM and 10 GPM respectively of hydraulic fluid at or near 3000 psi. The Deutz HPU can provide the 52 GPM of hydraulic power at 3000 psi.

Computer resources include placing all key logistics artifacts and documents on CG Central's Ocean Engineering community page. CG Central will serve as a repository for VOPS information, as it is already for other gear in the NSF inventory. For example, the hot water generator unit's 43 page maintenance manual has been electronically scanned and placed in CG Central. The VOPS maintenance and operation manual currently under development by CG-432 and NAVSUPSALV is to be placed in the Ocean Engineering community page as well.

The change in the VOPS footprint is essentially only the addition of one ISU-90 container. The NSF teams have sufficient warehouse space to accommodate this requirement. The ISU-90 containers are weatherproof and can be stored outside. However, this should be done on a short term basis only.

The O&M Manual will meet the technical documentation requirements. The manual will include an illustrated step by step guide on how to setup, operate, disassemble, and restore the VOPS. It will also include troubleshooting recommendations for common system failures.

After delivery, a two-day training session will be provided onsite to each team. Classroom instruction on the first day will include such topics as an introduction to lightering, the principles of pumping a heavy product via a positive displacement pump, and annular water injection concepts. The second day will focus on hands-on instruction of the VOPS.

A two-hour training video is being developed for the VOPS. The video will demonstrate the step by step instructions in the O&M manual as well as provide an explanation of how the VOPS will be used in various scenarios from an Incident Command System (ICS) perspective. The video will be released by October 2007.

Maintenance support is the responsibility of the NSFCC's equipment support branch and executed through the NSF national maintenance contract. Casualty repair costing over $2000 is funded by CG-432. Maintenance procedures cards for the VOPS will be developed. Another maintenance strategy is to be included in the Engineering Logistics Center's equipment condition monitoring contract. Plans are in place to perform equipment health testing at the Atlantic Strike Team in Fort Dix, NJ. This will ascertain the projected service life of the Highstar HVPU and Deutz HPU which average about 10 and 13 years, respectively.

Conclusion

As a result of a partnership with salvage industry and government stakeholders since 1999, the U.S. Coast Guard's lightering capabilities have increased dramatically. This new technology will significantly enhance the Coast Guard's pollution response capability to salvage the environment from incidents such as the M/V New Carissa grounding.

Acknowledgements

Along with all the stakeholders involved in the various VOPS workshops, the following individuals are specifically thanked for their outstanding contributions to the Coast Guard VOPS enhancement efforts:

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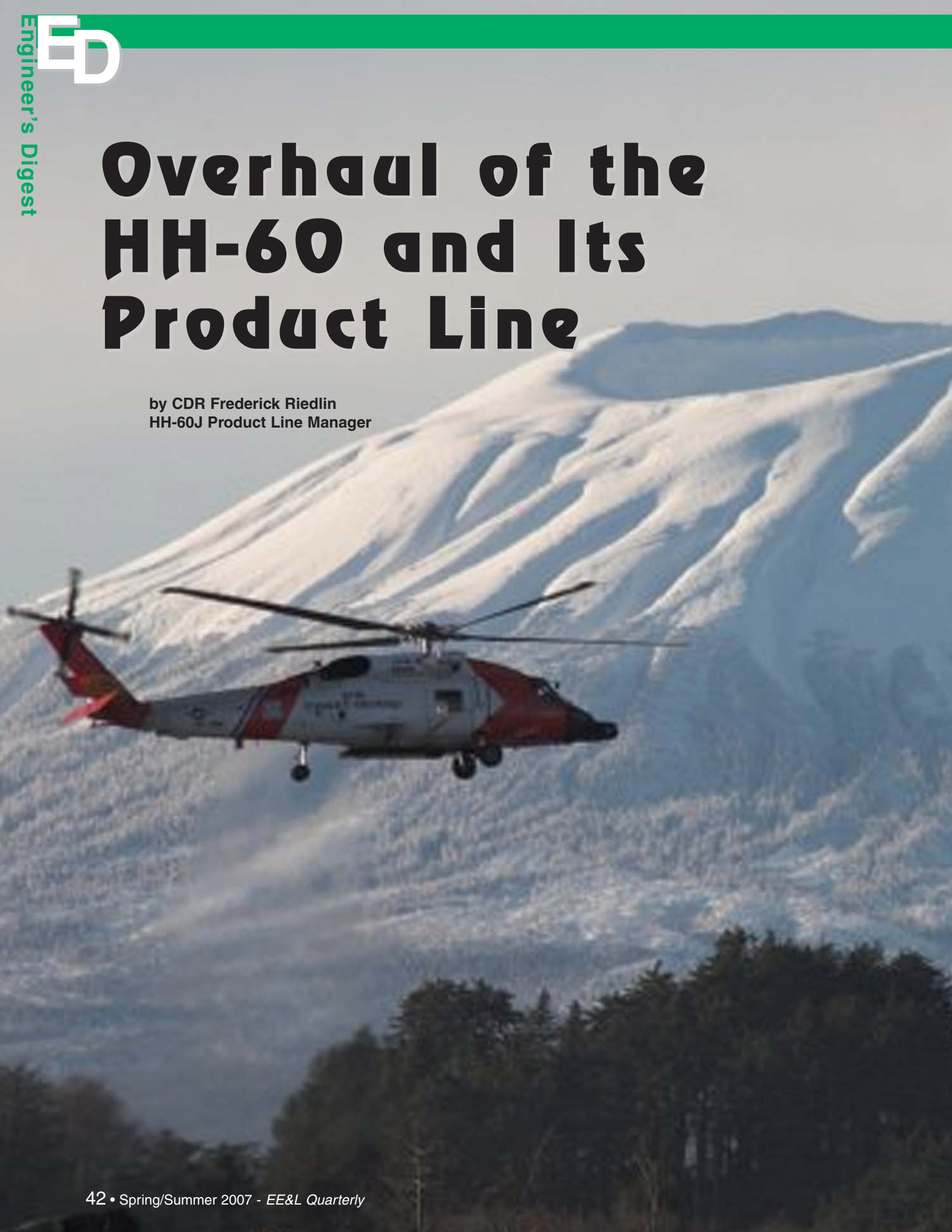
Robert Loesch, LCDR, USCG retired

Overhaul of the HH-60 and Its Product Line

by CDR Frederick Riedlin
HH-60J Product Line Manager



When Hurricane Katrina slammed into the Gulf Coast, Coast Guard Aviation rushed to the rescue. Aviation units from around the country contributed aircraft and/or personnel to the cause, launching a massive rescue effort unprecedented in the history of manned flight. A critical part to the fight was the HH-60J helicopter. As the Coast Guard's MRR helicopter, the HH-60J proved to be an essential component of the rescue effort employing its tremendous strength and endurance to rescue thousands of stranded denizens of the Gulf Coast. In all, 18 HH-60J aircraft converged in Mobile, Alabama, to help with the rescue efforts. This represented 53% of the Coast Guard's entire operation HH-60J fleet. While these aircraft were flying day and night, the men and women at the operational HH-60J units from around the country ensured that Search and Rescue (SAR) aircraft were always available at their home units.

Now fast forward to hurricane season 2007 and assume this is the season that Katrina unleashed its furry. This time, the Coast Guard's MRR response is slow. Aviation Training Center (ATC) Mobile, having no Bravo aircraft, is unable to launch an HH-60J. The remaining units, beleaguered by growing requirements and a reduced fleet size, are only able to respond with nine HH-60J aircraft, all of which arrive 1-2 days following the storm surge. The aftermath is tragic, countless lives are lost. So, what happened? This is a story about a failing production process.

Although the HH-60J helicopter is an extremely capable and powerful aircraft, it has a depot level Achilles heal -- a complex riveted structure made from 7075 aluminum alloy. Although this alloy is extremely strong and lightweight, it is very susceptible to corrosion and the fatigue failures caused by corrosion. As the HH-60J aged, the level of effort to complete depot overhauls increased. Aircraft coming to depot overhaul were requiring more structural repairs. This in turned slowed the production process and reduced output, ultimately causing aircraft to remain in the field longer. The longer aircraft remained in the field, the more extensive the corrosion damage, and the longer it took to overhaul. Cycle time to complete an overhaul exponentially increased with no foreseeable end in sight.

This vicious cycle placed the HH-60J's future at risk. Production throughput rates had been trending down since Fiscal Year 1999 (FY99) from nine aircraft per year to a low of five aircraft delivered in FY05. Starting in March of 2007 aircraft passing the do not exceed (DNE) for overhaul were going to be grounded due to risk of extensive structural damage. In all, nine aircraft would meet this fate effectively reducing the operational fleet by 26%. This staggering loss would most likely force the Coast Guard to retrench its remaining fleet to cover only urgent operational requirements. In order to get healthy and avoid grounding aircraft, the Product Line would have to achieve the impossible; build nine aircraft per year despite the fact that the labor hours to complete a PDM had nearly doubled.

In 2004 members of Aircraft Repair and Supply Center (ARSC) staff enrolled at the National Graduate School first revealed the impending problem. LEAN manufacturing was the first initiative introduced to attempt to turn around the growing production problem. Crews from all areas of production received initial training and dissected several work processes, actively exposing production steps that did not contribute value to the final product. These steps, or waste, were then subdivided into unnecessary (required in the current process to achieve the final outcome; however, does not add value to the process) and necessary categories. All unnecessary waste was designed out of the process, while necessary waste was examined for possible alternatives that would eliminate the need for these non-value added steps.

LEAN produced excellent results in improving processes and cleaning up work spaces; however, production problems prevailed. Critical to the success of a LEAN manufacturing system is the development of the level production system where processes are regulated on a strict TAKT (or cycle time) and the ability to pull inventory into the system. The pull of inventory, in our case aircraft, into the production system when the process was ready (not driven by delivering an aircraft), causes operational gaps and creates an unacceptable impact on the operational commander's ability to perform his/her mission in the field. Our production system was a push system in which an aircraft must be delivered before an aircraft can be brought into the process. This could not be changed without having additional aircraft in the Coast Guard inventory. Clearly LEAN, alone would not be enough to stem the tide.

In 2005 the HH-60J Product Line completed a detailed statistical analysis of the dependent processes required to overhaul an HH-60J. The flow chart (Figure 1)

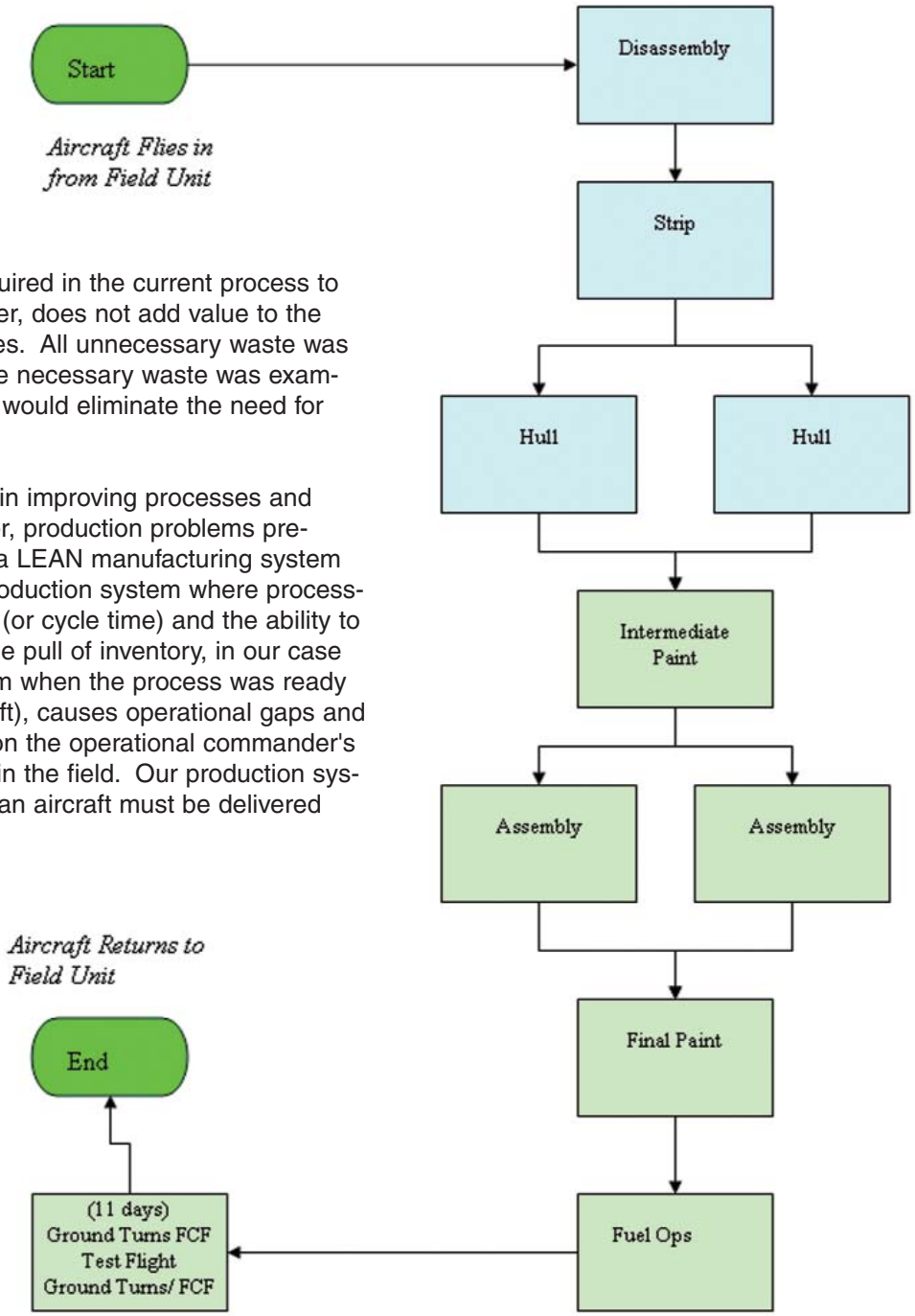
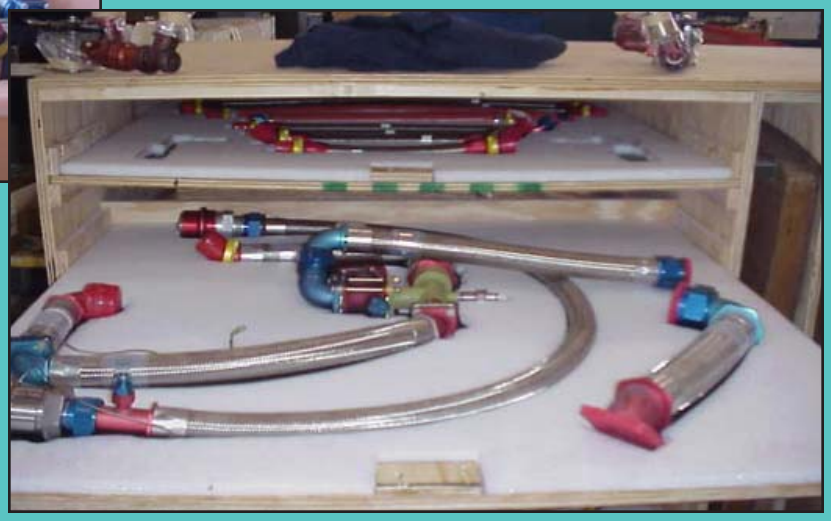


Figure 1.

Fuel System LEAN

Before Kaizen

After Kaizen



Hull Rework - Standardization of Work LEAN

Before Kaizen

After Kaizen

depicts the phases of aircraft production. A total of six aircraft, work-in-process (WIP), were allowed inflow on the Product Line. Essentially, an aircraft could not be inducted until an aircraft was delivered. Total build time often took 200+ days to complete an aircraft and was only getting worse. The analysis confirmed two bottleneck processes and massive statistical variance in all phases. Hull, the core of the PDM process in which all structural repairs were completed, was the primary bottleneck and dictated total production capacity. Cycle time in Hull was rapidly deteriorating. It was getting so bad, that the 6004's Hull phase took a shocking 128 days. Assembly phase, where aircraft are put back together, also proved to be a bottleneck to throughput. Both of these bottlenecks dictated the entire plants throughput. Process variation further reduced output compounding flow problems throughout the line. The Product Line's predicament was a classic case of the Theory of Constraints.

Use of discrete event computer modeling allowed the Product Line to explore options without investing in capital and costly plant layout changes. Options explored included the addition of industrial capacity, addition of aircraft inputted into the process, reduction of cycle time in key phases of construction, and the reduction of variation. The addition of capacity or aircraft into process would come at a significant cost to the Coast Guard in both terms of dollars and operational capability. Adding capacity would also require time to put in place. With only 1½ years before aircraft groundings began, the Product Line embarked on an all out effort to reduce cycle time and variation in the Hull and Assembly phase.

Improvements on the Line:

The key to the success of the Product Line would be found in its most precious resource, skilled artisans, and the proper timing of work performed. In essences, we needed to know the ability of our current capacity once it was being best utilized. The focus for improvement was made in key bottleneck areas (Hull and Assembly). Primary focus was given to the Hull since it was the greatest growth area in work required. Two important past restructuring events would present an excellent foundation for the needed changes in this critical area and would ultimately lay set the stage for our recovery: Redesign and LEAN.

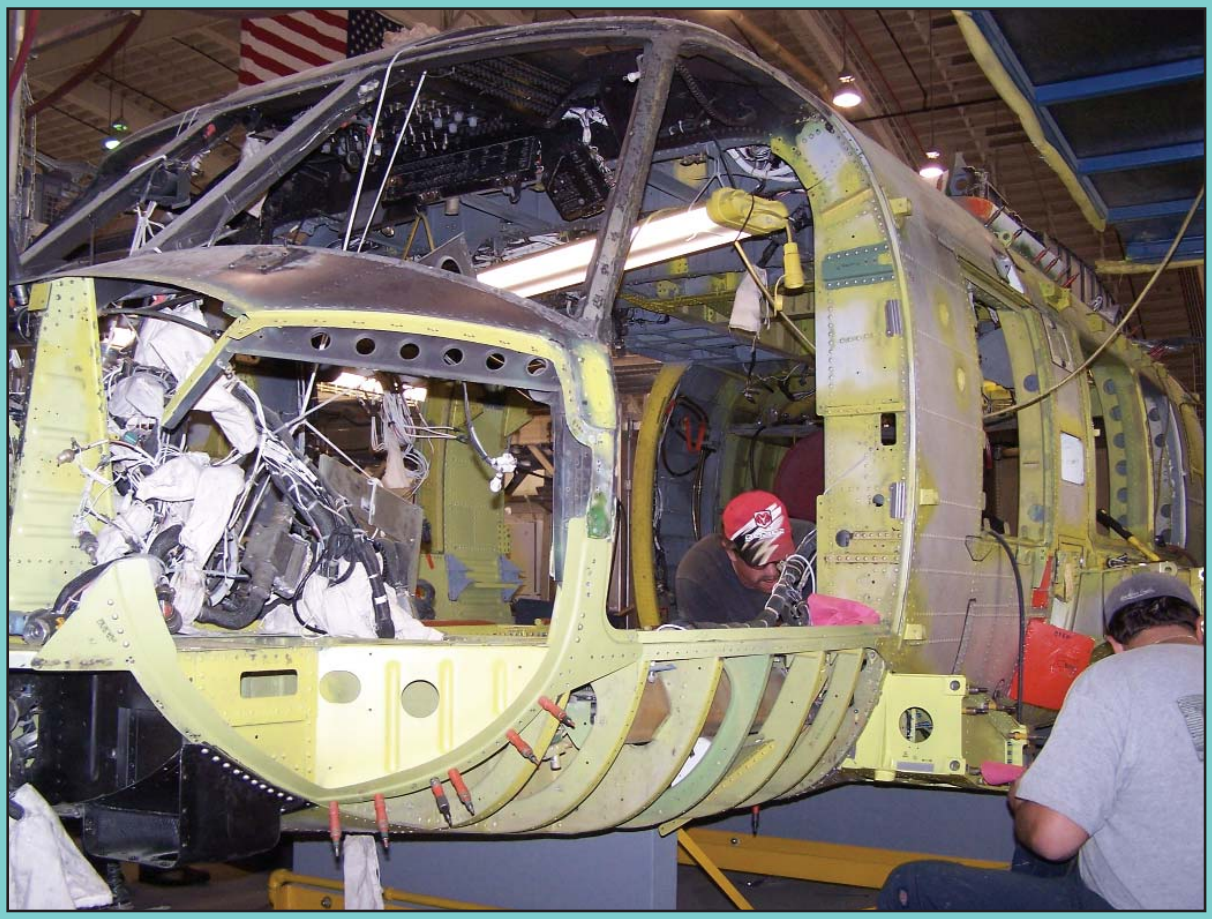
HULL

Over the years as production requirements increase, there was a creep in the number of technicians on the line. This growth was not accompanied by a change in resource management. By 2005, Hull was populated by 34 skilled metal smiths managed in a single pooled-resource method lead by one cell leader and one work leader. Specific jobs were assigned to individuals, and often, technicians were given multiple jobs across more than one aircraft, requiring the technician to determine the most efficient order to complete the work assigned. Project management tools were in place; however, efficiencies were never reached because workers completed tasks out of the optimum sequence and they were not regimented on a tightly controlled schedule. Aircraft that were falling behind received priority handling and siphoned valuable labor from aircraft that were on time, only in turn making those aircraft late.

The third PDM cycle brought additional requirements with the development of E-PDM that would add more requirements to the Hull process and increase the cycle time of our bottleneck. E-PDM was a much more extensive structural inspection that included disassembly/inspection of the cock and nose, major fitting groups, and introduction of new bushing technology. It was developed to eliminate the 10,000 hour designed service life of the HH-60J aircraft. The implementation of this extensive inspection was both good and bad. By lifting the 10,000 life limit on the Hull, the aircraft was recertified as indefinite, as long as PDM intervals were maintained. With an average airframe age of 8,500 hours and several aircraft fast approaching the 10,000 mark, getting PDM under control from a manufacturing sense was paramount to our ability to significantly increasing the service life of this venerable national asset.

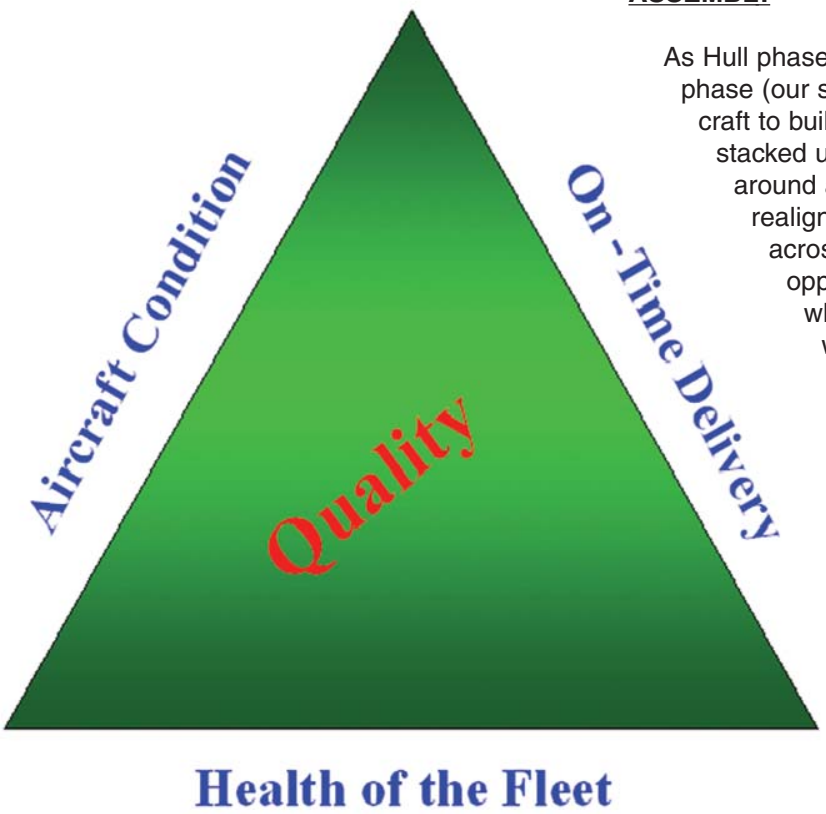
To cure the troubled Hull phase, we reached back to our redesign roots (in 1995 ARSC redesigned the overhaul process into Product Lines which in turn were broken down into functional cells). We expanded the cellular concept from the redesign era into the Hull process and developed a cellular manufacturing layout. Two cells would be formed from the existing workforce, each containing 12 members. Teams would be responsible for the nose-to-tail structural work for a single aircraft. Detailed project management planning using resource leveling was employed, and to attack variability, a custom net concept was adopted (time to complete based on work required and resource available).

HH-60 Product Line



To test the concept, a pilot team was assembled. Artisans would be assigned work areas with specific deadlines which were assigned in calendar date as apposed to our previous method, number of work days. The entire project was mapped out allowing the team members to know their world of work throughout the completion of the entire hull. In turn, they would be left alone to complete their assigned areas (no moving technicians to other jobs), and the Supply and Engineering Cells would ensure their resources were vigorously applied to minimize work stoppages. To reduce rework, the quality process was pushed upstream through the use of daily "buddy checks" and intermediate Quality Assurance (QA) inspections. This quality effort significantly reduced errors and nearly eliminated the discovery of extensive rework often found during final QA inspections. The results were spectacular. The first hull, the 6003, was completed in a remarkable 45 days. This was the fastest E-PDM ever performed and an unprecedented 50% reduction in cycle time. The experiment was so successful that the pilot team stated that they would quit if we went back to our old way of doing business. We struck gold by finding a faster way to perform the work that was also a more satisfying work environment for our technicians. Within weeks all of Hull phase was structured into cells. We quickly discovered that working in a well defined cell allowed workers to focus without distraction, created ownership, and reduced setup times (artisans worked an area to completion, eliminating the need to research another's work). All of which significantly improved productivity.

A fundamental shift in quality had occurred. The preconception on the line was that quality and speed of manufacturing were mutually exclusive. Quality of the aircraft produced was always important; however, a disjointed work schedule and workers moving from aircraft to aircraft often caused mistakes to migrate and did not lead to self correcting behavior and learning. By forming into a well defined team that was responsible for the total condition of the aircraft before it was moved to the next phase, rework was reduced rapidly and improper repairs stopped migrating. Schedules tightened and for the first time speed to manufacture and quality were synonymous. Tightening schedule requirements ensured that the right resources were brought to bear early in the process, nearly eliminating surprise delays. Quality shifted from a single focus on aircraft to a quality triangle that looked holistically at the health of the entire fleet and owning it. The health of the fleet could only be improved by increasing production and reducing the PDM interval.

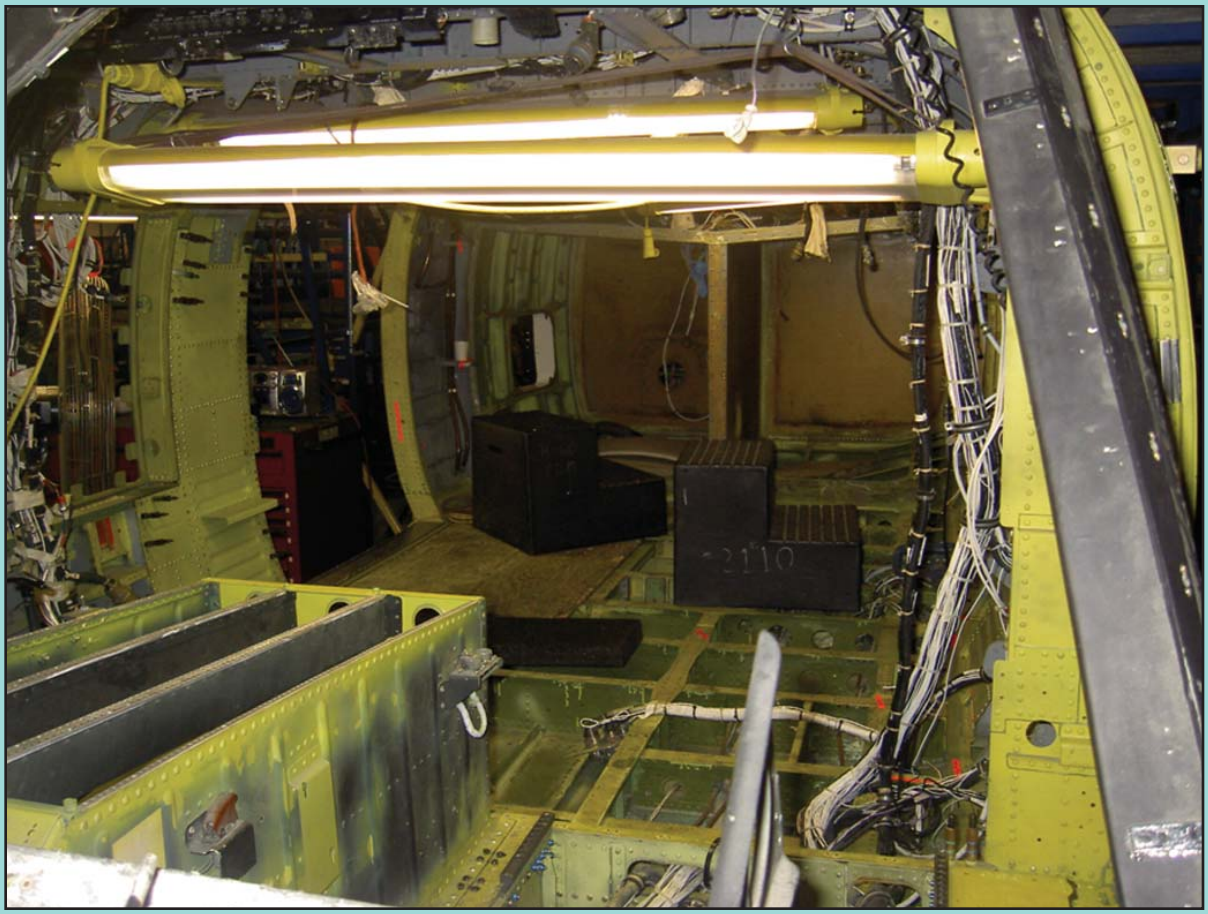


ASSEMBLY

As Hull phase accelerated, the mechanics in the Assembly phase (our second bottleneck) would be inundated with aircraft to build and throughput would slow as aircraft stacked up waiting to be worked on. Already designed around a team concept, the Assembly workforce realigned their process, coordinated the team effort across multiple shifts, and worked targeted overtime opportunities. Detailed project management tools where implemented and work was performed within schedule. The extraordinary effort from the Assembly crews can not be understated. Cycle time quickly dropped from 59 days to a remarkable 33 days, with the fasted build time coming in at 24 days. In an effort to level the production flow, the Product Line adopted a schedule of 40 days for aircraft being sent to east coast units and 33 days for aircraft heading west. This would allow an additional seven days for aircraft transfers and would ultimately enable the Product Line to develop an aircraft delivery/induction schedule of one aircraft every 5½ weeks.

Within a year the HH-60J Product Line changed its destiny by producing nine

HH-60 Product Line



aircraft. Remarkably, in the same year the members of the Product Line returned the HH-60J fleet to fully operational in an astonishing six week period when critical fatigue cracks were discovered on the hoist fitting of 26 field aircraft and a six week strike at Sikorsky Aircraft Corporation decimated the supply pipeline of critical dynamic components. The 80% increase in production was possible without adding any additional workers or outsourcing. In fact the turnaround was so fast that an outsourcing initiative with Sikorsky Aircraft Corporation to perform structural work was cancelled before contract finalization, saving the Coast Guard $5M annually and freeing these funds for other vital programs. The statistics behind the turn around were staggering. Despite the fact that the overall direct labor hours to build an aircraft had increased, overhaul cycle time dropped from over 200 + days to a remarkable 135-145 days. We were using our resources more effectively to complete the work required. The Product Line's accomplishment reduced the Coast Guards PDM deferred maintenance for the HH-60J (a measure of aircraft flying in the PDM extension interval), from $23M to $6M. This reduced the Coast Guards overall PDM deferred maintenance by 50%. Hull achieved the most spectacular results: cycle times dropped from a high of 128 days to 41-45 days despite the high number of structural repairs required (including beam replacements), quality improved dramatically, and the technicians became a high performing team.

The HH-60J Product Line employed management science to optimize the work flow and produce steady state results, but in the end, it was the floor level mechanic that turned the tide for the HH-60J program. Their ingenuity, determination, enthusiastic participation, and creativity were the cornerstones of our transformation and helped secure the HH-60J's future. By slashing the time to build an aircraft, the technicians on the line further created the time that will be required to build the MH-60T aircraft (massive avionics upgrade and rewire effort) when they go into production next year. It truly was their resolute determination to find the right solutions to our production problems that guaranteed that the men and women flying the HH-60J had an aircraft they could rely on when they were alone in the darkness, pitting their training and faith in the machine in a selfless effort to save lives.

HH-60 Product Line

Keeps ‘em Flying

Training at an Engineering Command

by Robert C. Daniels, C2CEN
with assistance from Bettina M. McDougal and Robert D. Cimbalist

The Command and Control Engineering Center (C2CEN) is well known for a wide variety of fielded command, control (C2) and electronic navigation (eNav) systems. However, less known are the C-Schools that are offered at C2CEN's Systems Training Branch.

Beginning in 1986, C2CEN began offering various C2 and eNav "C" school courses, teaching the operation and maintenance of equipment and systems designed, developed, and fielded by C2CEN. Since that time training opportunities have grown from a single classroom instructing the Command, Display and Control Operator course to 13 "C" schools instructed in four state-of-the-art classrooms with high-tech combination simulator-labs. On average approximately 350 "C" school students are trained on site every year. Like most "C" schools, training quotas are centrally managed by the Training Quota Management Center (TQC).

C2CEN also offers five distinct post-installation, just-in-time, exportable training courses. Approximately 500 students per annum are trained in the field by one of the five exportable courses. C2CEN's exportable courses are designed as follow-on training to installation of new versions

of C2 or eNav systems, teaching the "deltas" between the legacy version and the new advanced versions to personnel who are already experienced operators and/or maintenance personnel. Exportable training courses range from one-day, over-the-shoulder instruction to five-day sessions followed by a two-to-three-day underway training. They are designed and funded as one-time, per unit training evolutions as new or upgraded systems are installed.

WLM engineering control center console mock-up. Photo by Mr. Robert Cimbalist

In 1998 the Systems Training Branch staff consisted of a single instructor, who single-handedly designed, developed, and instructed the course, as well as managed student administration. Today, the Training Branch is headed by a Lieutenant Commander and is supported by 12 military members, two civilian (GS) employees, and six contractors. The instructional staff, lead by three senior chiefs, teach courses in the operation and maintenance and management of the Shipboard Command and Control System (SCCS); the Command, Display and Control-Integrated Navigation System (COMDAC-INS); the Integrated Ship Control System (ISCS); and the Machinery Plant Control and Monitoring System (MPCMS); as well as a course in Optical Surveillance System (OSS) maintenance and an exportable Sector Command Center Core C2 Software operator course. The courses are professionally developed and maintained by the Branch's Course Development Section. Included in this three person team's abilities are the capability of conducting training analyses (Diagnostic and New Performance Planning Front End Analyses), as well as the development of Computer Based Training and Job Aids. All student affairs, including greeting the students and issuing command student security badges, and assisting the students with berthing, order modifications, and transportation needs, as well as supporting the instructional staff in preparing course material for their courses, is conducted by the Training Program Facilitator.

A logical question frequently asked by many, "Why teach "C" schools at an engineering center?" requires a response. With rapidly changing technology and opera-

WLM secondary conning station mock-up. Photo by Mr. Robert Cimbalist

WMEC 270' CIC console mock-up.
Photo by Mr. Robert Cimbalist

tional requirements, systems designed, developed, and fielded by C2CEN must quickly evolve to meet the Coast Guard's needs. Thus, many "C" school courses require frequent, if not perpetual, upgrading. The first major advantage of conducting training at C2CEN is linked to the daily interaction between system developers and the training staff. In many instances, instructors and course developers are active members of the various C2 and eNav Integrated Product Teams (IPTs); this environment allows for rapid information exchange and product development. Close collaboration between system engineers and the training staff facilitates C2CEN's ability to quickly and accurately update course content. This ensures field technicians and operators receive the most up-to-date instruction on fielded systems. The second major advantage of collocation relates to overhead expenses. The same multi-million dollar suites of equipment and simulators that are used to train students are also used by system developers and engineers to troubleshoot casualties in the field -- think of it as a two for one deal. Having "C" C2 and eNav schools for systems solely developed and maintained by the Coast Guard at separate training facilities would essentially double the hardware overhead at considerable expense. By collocating engineering and training resources, system development times are reduced, students receive training that reflect systems encountered in the field, and overall system support costs are reduced.

Since each "C" school offered at C2CEN is centrally managed, units desiring training should contact TQC to obtain a seat in one of these courses. Since the post-installation, exportable courses are designed as one-time only training events, those course offerings are scheduled directly between the receiving unit and C2CEN's Integrated Product Team in conjunction with a new installation. Units receiving upgrades to C2CEN produced products will be automatically scheduled post-installation training when applicable.

WLB main ship control console mock-up.
Photo by Mr. Robert Cimbalist

For further information concerning C2CEN's training program, contact LCDR Steven Whitehead at (757) 686-4123 or visit the Systems Training section of C2CEN's web pages: Intranet: http://cgweb.lant.uscg.mil/c2cen/; Internet: http://www.uscg.mil/hq/c2cen/.

List of C2CEN instructed courses:

C2CEN's "C" school courses include:

- Shipboard Command and Control System (SCCS) Operator
- SCCS COMDAC-INS Operator
- WMEC 210' SCCS Maintenance & Management
- WMEC 270' SCCS Maintenance & Management
- WHEC 378' SCCS Maintenance & Management
- WPB 110' SCCS Maintenance & Management
- WLM Integrated Ship Control System (ISCS) Operations & Navigation
- WLM ISCS Maintenance & Management
- WLM Machinery Plant Control & Monitoring Sys (MPCMS) Operator
- WLB ISCS Operations & Navigation
- WLB ISCS Maintenance & Management
- WLB MPCMS Operator
- Optical Surveillance System (OSS) Maintenance

C2CEN's post-installation, just-in-time, exportable courses include:

- SSR-73 Operator Post-installation training
- BME Surface Search Radar (SSR) Operator Post-installation training
- Electronic Chart Precise Integrated Navigation System Operator (ECPINS) Post-installation training
- Sector Command Center Core C2 (SCC) Software Operator Post-installation training
- SCCS Command, Display and Control-Integrated Navigation System (COMDAC-INS) Operator Post-installation training (Deepwater)

WLM/WLB ISCS Operator Classroom. Photo by Mr. Robert Cimbalist

Course/Students Statistics Chart

	Amount of CLCVNs			Amount of Students Instructed		
Course	**FY05**	**FY06**	**FY07***	**FY05**	**FY06**	**FY07***
SCCS Operator	6	5	5	64	58	58
SCCS COMDAC-INS Operator	9	10	10	61	109	117
WPB 110' SCCS M&M	1	2	1	2	3	4
WMEC 210' SCCS M&M	3	3	2	15	18	7
WMEC 270' SCCS M&M	3	3	3	14	9	13
WHEC 378' SCCS M&M	3	3	3	14	9	17
OSS Maintenance	3	3	2	12	14	10
WLM ISCS Ops & Nav	3	2	2	27	23	25
WLM ISCS M&M	2	2	1	16	10	7
WLM MPCMS	4	4	4	18	18	20
WLB ISCS Ops & Nav	5	5	5	50	52	63
WLB ISCS M&M	2	2	2	17	13	12
WLB MPCMS	4	6	4	15	18	20
Totals	48	50	44	157	354	373

*Scheduled

Care and Feeding of the Uninterruptible Power Supply

by ETC Aaron Dahlen, CGC HEALY

We are all familiar with the ever present Uninterruptible Power Supply (UPS). They serve to protect our critical data systems, communications systems, navigation equipment, and machinery control. UPS technology is reliable and will perform the intended purpose when called upon. Unfortunately, UPSs are often neglected and fail when they are needed most.

This article was born out of work performed on CGC HEALY (WAGB-20). As many of you already know, HEALY is the Coast Guard's newest heavy icebreaker. Her primary mission is Arctic research. She has accommodations for 50 scientists and large lab spaces for their equipment. Included in those accommodations is power for the various scientific experiments including UPS support for the inevitable power anomaly and accidental power outage.

U.S. Coast Guard Photo

HEALY is a unique ship from an electrical perspective. She has an integrated plant where the propulsion and hotel service (fans, pumps, lights, etc.) are powered from the same generator. In fact, a single Main Diesel Engine can propel the ship at speeds exceeding six knots while powering all other electrical loads. This setup results in a simple efficient plant, but leaves something to be desired from a clean power perspective. Actions such as changing throttle position or energizing a fire pump can cause electrical noise, spikes, and sags.

To compensate for the potential electrical problems, HEALY has 82 medium sized (1400 - 3000VA) UPSs. She also has one large UPS with auxiliary generator for operation of the Machinery Plant Control and Monitoring System (MPCMS) equipment that will not be covered in this article.

What follows is an overview of UPS technology with a bias towards shipboard applications. The UPS topologies are reviewed along with the electrical specifications. A unit level PMS system is proposed. Finally, suggestions for selecting a UPS based on application are presented.

UPS Definition

An Uninterruptible Power Supply is designed to provide an alternate source of power during a power outage of moderate duration. The basic UPS is also designed to protect against power anomalies such as sags, power surges (spike), under-voltage, over-voltage, and frequency variations. The amount of protection varies between manufactures and models. Some UPSs have additional Power Conditioning circuitry to filter out line noise, harmonic distortion, and to provide power factor correction. The actual functions / protection levels of a UPS depends on the manufacturer and to a greater extent, cost.

Safety

A UPS is an inherently dangerous device. The greatest danger is associated with batteries. A typical medium power UPS contains two to six lead acid batteries. These batteries are capable of delivering hundreds of Amperes of current if accidentally shorted. This current is capable of welding or even melting tools or jewelry that accidentally become part of the circuit. The battery pack in certain UPSs presents a shock hazard. Voltages between 72 to 96VDC are common. An additional source of danger is the DC to AC inverter. This inverter converts the battery voltage to a 120VAC 60Hz signal. Technicians must ensure that both the battery pack and main AC input is secured before servicing the UPS.

The following safety rules must be followed while servicing a UPS:

- ✔ Removal of all jewelry;
- ✔ Lock out / Tag out of AC input power to the UPS; and
- ✔ Removal of the UPS battery before maintenance or inspection of the UPS -- use extreme caution when working with UPSs manufactured by Clary. The batteries are internal and not easily removed.

The following safety rules should be followed while working with sealed lead acid batteries:

- ✔ Read and understand the battery MSDS;
- ✔ Read and follow the manufactures safety instructions;
- ✔ Read and follow Chapter 4 (Safety) of the COMDTINST M1055025A;
- ✔ Don PPE appropriate to the type of battery being handled, at a minimum chemical goggles are required;
- ✔ Obtain Commanding Officers permission to work on high voltage series connected battery strings;
- ✔ Use insulated hand tool; and
- ✔ Properly dispose of batteries in accordance with local, state, and federal regulations.

UPS Types

There are two general categories of UPS. The Standby UPS is the most common. The On-Line UPS, a.k.a. dual conversion, is preferred from a performance standpoint but is several times more expensive than the Standby UPS.

Standby UPS

The Standby UPS is a familiar site to most technicians. Units such as the one pictured in Figure 1 (see next page) are used to power CGSWIII servers, Private Branch Exchange telephone systems, and even the 73 radar on some platforms. Figure 1 is a Commercial-Off-The-Shelf unit that has been modified for shipboard use. For APC models only, look for "x93" in the model number to verify the shipboard modification.

Figure 1. The APC model SUA1500r2x93 is a Commercial-Off-The-Shelf Standby UPS modified to operate with shipboard power. This model has a reliable track record on board CGC HEALY. The unit has a front panel accessible battery tray for ease of service and technician safety.

The block diagram of a standby UPS is presented in Figure 2. Observe that there are two independent paths capable of providing power to the load. The primary path is a direct connection from the raw input power. A typical standby UPS will provide limited filtering (not shown on the block diagram). The secondary path is from the battery pack via the DC/AC inverter. A transfer relay connects the load to the appropriate path.

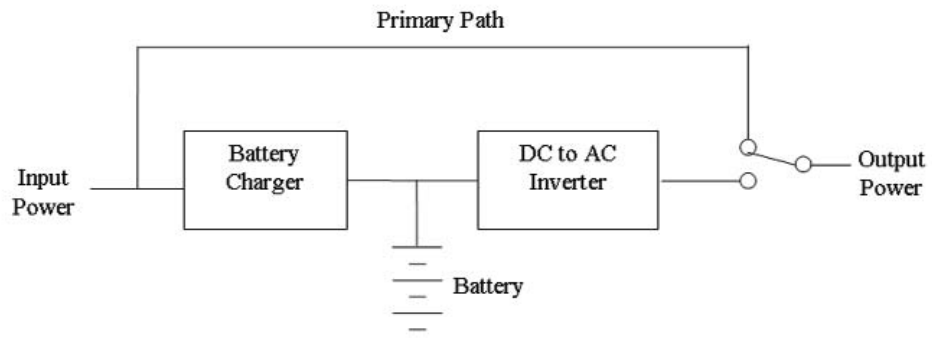


Figure 2. Block diagram of a Standby UPS. The normal power path bypasses the inverter.

In normal operation, the inverter is disabled and the load is connected directly to the raw input power. The microprocessor (not shown) is monitoring the input power for anomalies. The transfer relay will immediately switch the load to the inverter if any faults are detected. The battery is being charged as long as the input power is present. The battery charger is sized to charge the batteries, not the attached load. For example, if a Built In Self Test (BIT) is initiated, the battery will supply the load with an insignificant amount of help from the battery charger.

There are several points to notice about the standby UPS. First, this type of UPS is reactionary. Since the output is directly connected to the input, any anomaly on the input will be passed to the output. Secondly, there will always be a brief period of time when the load is not powered. This is due to the time required for the transfer relay to toggle. Finally, the inverter is sized for intermittent operation. It will only run until the batteries are exhausted, a period usually less than 10 minutes at full rated load, longer at partial load.

On-Line UPS

The On-Line UPS is another familiar item. The Clary Corporation UPS1-1.25K-1G-SRN is common UPS on board ships (ref: ELC SUPPLY ADVISORY 02/07).

The On-Line UPS is similar to the Standby UPS except that its power flow takes the opposite path. Under normal operation, the load is powered from the inverter. The AC to DC power supply performs double duty by charging the batteries and powering in the inverter. The alternate mode of operation bypasses the inverter and AC to DC power supply. This bypass mechanism is only used in emergency situations such as a failure of the AC to DC power supply or failure of the DC to AC inverter.

The On-Line UPS is often described as a double conversion UPS. The first power conversion is from AC to DC. The second conversion is from DC to AC. This double conversion process provides a cleaner output with less electrical

noise. The relatively high DC voltage provided to the battery pack (72 to 96 volts) is highly filtered, further reducing electrical noise. As a rule, higher voltages are easier to filter using capacitors. Also, the battery itself functions as a filter. Observe that the path of power does not change when power anomalies occur. The AC to DC power supply is simply shut down effectively disconnecting the input stage from the output.

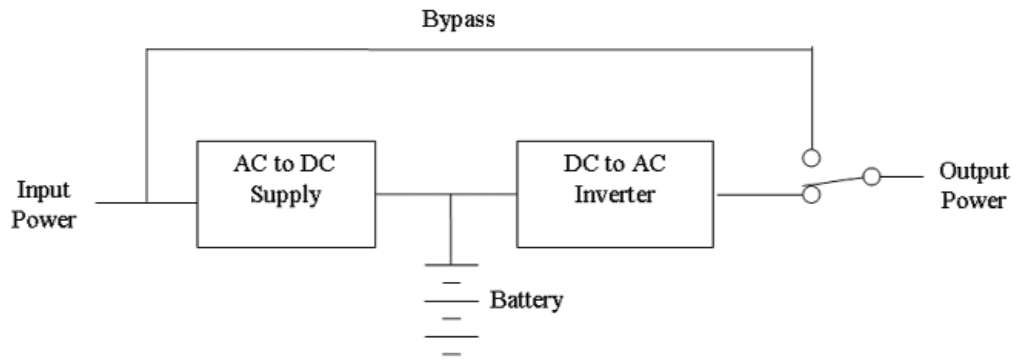


Figure 3. Block diagram of an On-Line UPS. The battery acts as a filter providing additional protection from input surges and spikes. The resulting clean power is preferred for all computer equipment.

Figure 4. The UPSI model MS2000 is an On-Line Mil Spec UPS designed to operate with shipboard power. This model has a reliable track record on board CGC HEALY. This unit has a front panel accessible battery tray.

The On-Line UPS will cost more than an equivalently sized Standby UPS. The additional expense is necessary because the AC to DC power supply is much larger than the battery charger found in the Standby UPS. The AC to DC converter is sized to provide the entire power output of the UPS plus charge batteries whereas the equivalent stage in the Standby UPS charges only the batteries. Also, the inverter found in an On-Line UPS is always running. Consequently, it will have larger silicon switches in its output stage, larger heat sinks, and additional cooling mechanisms. An On-Line UPS will often have additional electrical functions that add to the total cost. For example, the UPSI 2000MS UPS (Figure 4) has an input isolation transformer, power factor correction circuitry, and additional surge suppression / EMI filtering stages.

UPS Ratings

There are two general ratings to consider when selecting a UPS. The first is battery capacity. Battery size directly relates to run time. The second is inverter size.

UPS Battery Capacity

People often state that they need a larger UPS because the UPS did not power their load as long as they desired. This is partially true. What they usually need is more battery capacity. To understand why consider the UPSI 2000MS UPS.

The 2000MS contains six each series connected NPH5-12FR sealed lead acid batteries (Figure 5). These batteries are misleadingly advertised as 5 Amp-Hour (Ah). Recall that Ah readings are typically given assuming a 20 hour discharge

Figure 5. The UPSI battery pack consists of six each NPH5-12FR batteries yielding approximately 160 Watt Hours of energy.

rate. In reality, the 2000MS UPS taxes its batteries considerably higher. When fully loaded, the 2000MS will draw close to 20 Amperes. This is two orders of magnitude higher than the advertised 0.25A 20Ah battery rating! With this high current the rating of the battery plummets to approximately 2.2Ah. Given that the 2000MS UPS has six batteries at 2.2Ah each at 12VDC, the energy stored in the battery pack is approximately 160 Watt hours (Wh) or 160 Volt - Amp - hours. Therefore the 2000MS UPS can run at half power (700W) for about 10 minutes after factoring in the losses from the DC to AC inverter.

A larger UPS isn't always the solution for longer run times. Adding additional batteries is the answer. For example, assume a run time of 1 hour is desired for a 700W load using the UPSI 2000MS UPS. This load represents a small modern multiprocessor server or several PCs with LCD monitors. Since each 2000MS battery pack contains approximately 160Wh of energy, it would take five battery packs such as that shown in Figure 5 to power the load. This equates to about 150 pounds of battery and 9U of rack space. Most manufactures provide external battery packs for their UPSs -- there is a limit to the number of batteries that may be added, contact the manufacturer. An unfortunate exception to the external battery pack options is the common APC model shown in Figure 1. For this type of unit, it is preferable to purchase additional UPSs.

UPS Inverter Rating

UPS inverters are usually rated in terms of Apparent Power (VA). For example, a typical UPS (Figure 1) is rated at 1500VA. This can be misleading and is often misunderstood. A short review of AC circuit theory is appropriate to prevent misinterpretation of the UPS ratings.

Recall that AC circuits contain reactive components such as capacitors or inductors. These components cause the current and voltage to be out of phase with each other. A textbook example is shown in Figure 6. This classic phase shift can be shown graphically using the "power triangle" of Figure 7.

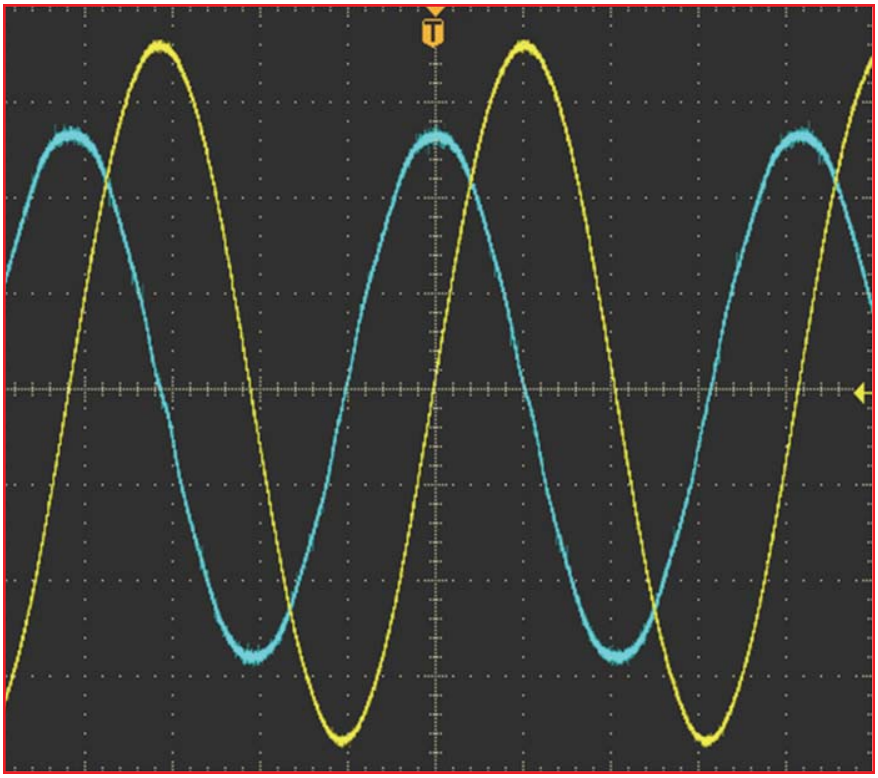


Figure 6. Phase angle relationship between voltage and current showing a 45° phase shift.

The **Apparent Power (VA)** is the product of Voltage and Amperes without considering the phase difference between them. It is calculated by multiplying the readings taken by a voltmeter and ammeter. VA is always the hypotenuse of the power triangle.

The base of the triangle represents **Real Power** and is expressed in **Watts**. This is a measure of the actual work being performed.

Volt Amperes Reactive (VAR) is a measure of the power flowing in the circuit's reactive components (capacitors and inductors). Reactive power doesn't perform any work; however, it cannot be discounted because the current is very real. The extra current flowing in the circuit leads to I^2R losses and can overheat generators and transformers.

The angle formed by the triangle is the amount of phase shift between voltage and current. For example, in Figure 6 we see a 45° phase shift between voltage and current.

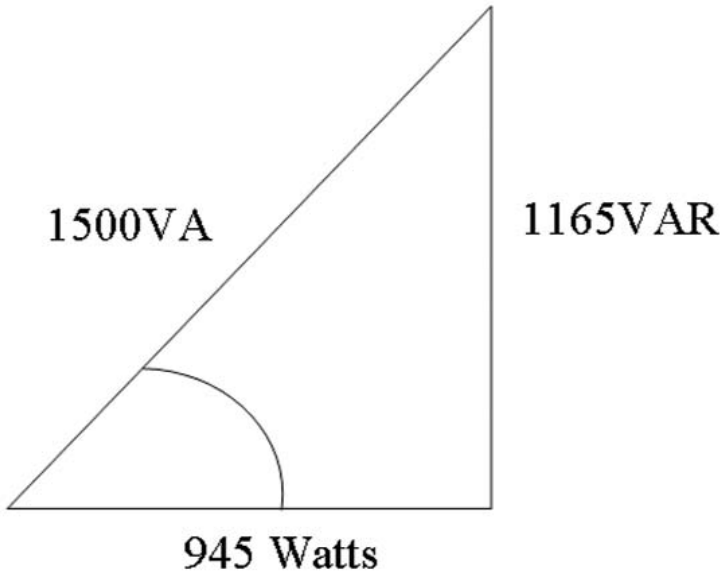


Figure 7. Power triangle for a typical 1500VA UPS showing the relationship between Apparent Power (VA) and true power (Watts).

The **Power Factor (P.F.)** is another way to express the phase shift. One way of calculating P.F. is to take the Cosine of angle. Recall that the Cosine of any angle will fall between 0 and 1. As a rule, a power factor of 1 (unity) is preferred. If P.F. is equal to 1 then there is no reactive component (VAR) in the circuit.

As is so often the case, real world equipment does not nicely follow the clean textbook examples. This makes power calculations for computer equipment more complex. A typical computer power supply is a non-linear load. The current is drawn on the peaks of the incoming AC waveform as illustrated in Figure 8. This highly distorted current waveform is caused by the simple diode fed capacitor input stage. The capacitor will charge (draw current) when the AC voltage is near its crest.

Confounding the UPS selection problem is the lack of data from computer manufactures. A typical computer power supply is specified in watts. Rarely is power factor data given unless power factor is unity.

The complete mathematical answer for calculating power based on highly distorted current consumption is beyond the scope of this article.[1] However, the technician and engineer still need to consider these effects when selecting equipment.

In the near future we can expect computer and UPS equipment to be built to European project IEC 555-2 specification.[1] This specification will effectively require manufactures to build equipment with unity power factor. A working knowledge of the AC Power Triangle will still be necessary when technicians and engineers connect the new devices to UPSs rated in VA. A serious overload will result if 1500 watts of unity power factor equipment is connected to a 1500VA UPS!

Figure 8. The current (blue) is non-sinusoidal and is drawn only on the peaks of the voltage waveform (yellow) – half wave rectification shown.

APC has a useful calculator to determining Watts and VA for computer equipment at http://www.apc.com/tools/ups_selector/index.cfm.

Failure Mechanisms

UPSs are often taken for granted. They are purchased, installed, and forgotten about. Then, when they are needed most, they fail to provide the needed backup power. Failures and performance degradation may be classified as:

Battery Pack - failures affect all types of UPSs. Battery problems are subtle. Rarely does the battery fail in a detectable way. Instead, the battery looses its capacity to provide the required power over a period of several

years. Most UPSs have built in self tests but they often don't load the battery to full capacity or test for extended periods of time. They therefore fail to detect battery deficiencies.

Failure of the **Surge Suppression** mechanisms is another sneaky failure. As you recall, one of the purposes of a UPS is to protect the attached equipment from damaging voltage spikes and surges. Often, this function is performed by multiple paralleled Metal Oxide Varistors (MOVs) installed on the power line input as seen in Figure 9. Repetitive voltage spikes can damage the MOV with no visible damage. Note that the UPSI MS2000 UPS is not prone to this type of failure. It uses an isolation transformer to prevent spikes from reaching the load.

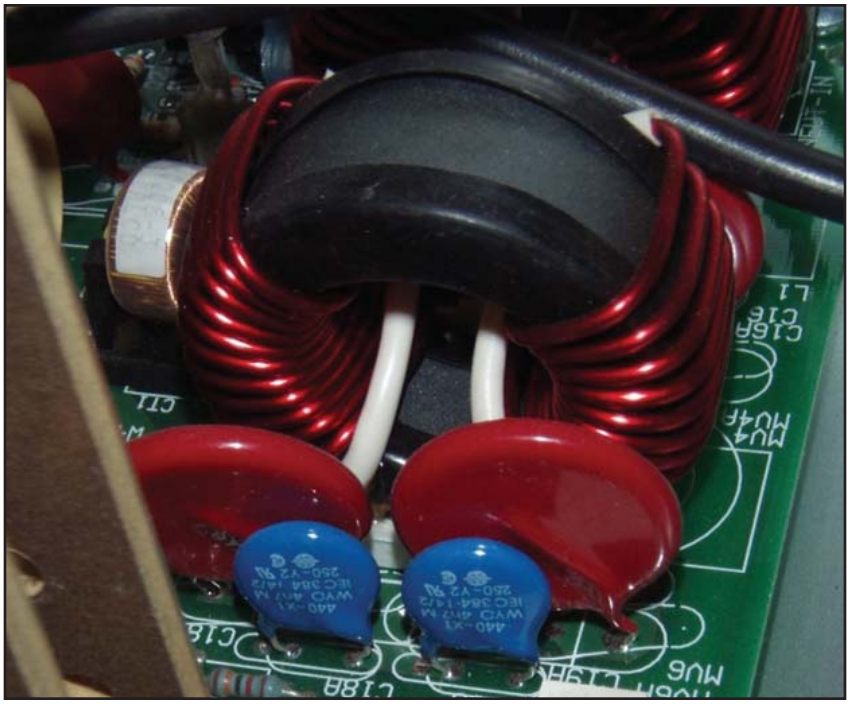


Figure 9. Input filter stage for an APC Standby UPS. The MOVs are the red and blue devices in the foreground.

Inverter failure - are obvious in the On-Line UPS but will often go undetected in the Standby UPS. The On-Line UPS is normally providing power through its inverter. When it fails, it will enter bypass mode and connect the load directly to the raw AC input. An alarm will sound notifying the user that the UPS has faulted. In contrast, a typical off-line UPS failure will go unnoticed until it is called to function as a UPS, i.e., the UPS is needed because the raw input power is unavailable.

Cooling Fan - This failure mechanism is seen more often in the On-Line UPS. Recall that the On-Line inverter is always running. Consequently it requires a constantly running cooling fan. Whereas the Standby UPS uses its cooling fan intermittently. The manufactures of most On-Line UPSs recommend that the cooling fan be replaced every three years, along with the UPS battery back.

Dirt Intrusion is a problem normally associated with the On-Line UPS. The constant running cooling fan draws a considerable amount of air into the unit. If filters are not maintained, the inside will be coated with potentially conductive dirt leading to failures -- especially in a wet marine environment.

Vibration induced failures are often encountered in the shipboard environment. Icebreakers are particularly susceptible to these failures as ice breaking operations and ice milling produces significant medium frequency vibration. Mechanical connectors often work themselves loose. Larger electrical components such as electrolytic capacitors and heat sinks can break solder connection and literally fall off circuit cards.

Control Circuitry failure can occur in either type of UPS. This failure is relatively rare.

Preventative Maintenance

A Preventative Maintenance Schedule (PMS) is required to eliminate the above mentioned failures. The basic principles of UPS maintenance are familiar to the experienced technician. The PMS starts with a cleaning and thorough visual inspection of the UPS and its internal circuitry. An electrical test is performed to verify the UPS is operating as designed. High failure items (batteries and cooling fans) are replaced in accordance with manufacture recommendations. Finally, records are kept to track failures.

A physical inspection of the UPS is necessary to discover any mechanical components/electrical connection that may have become loose. Overheated or damaged batteries will be readily apparent. The cleaning will remove potentially conductive dirt that has accumulated inside the unit. Finally, a close inspection of the circuitry will reveal overheated or damaged electrical components on the circuit board and components that are mechanically loose requiring resoldering.

The electrical test is required to verify the UPS is operating correctly. The test consists of two parts. The first is to verify that the transfer relay and inverter operate correctly -- applicable to the Standby UPS only. The second part of the test verifies that the battery pack has the capacity to sustain the UPS at rated power for a specific period of time.

The ideal battery test is to measure the specific gravity of the electrolyte. Unfortunately, this is not possible with the sealed lead acid batteries. The only viable test method for medium powered UPSs is to load the UPS with a suitable dummy load and verifying the run time. A small space heater (750W / 1400W @120VAC) makes a good dummy load. An alternative is to use 120VAC light bulbs. Be vigilant when selecting a dummy load so as not to overload the UPS. From the previous discussion, a 1500VA UPS will not power a 1500W load!

All lead acid batteries have a service life. The manufactures of lead acid batteries suggest a useful life of three to five years with a floating charge under ideal conditions. It is imperative that units budget to replace batteries on a rotating schedule. If this is not done your UPS may not operate correctly when it is needed.

HEALY has developed an in house PMS procedure. Feel free to contact the author for a copy of the procedure and supporting history card.

History Records

A history should be kept for each medium powered UPS. This history will allow future technicians to monitor the performance of the installed UPSs and make corrections should a failure occur on a regular basis.

A UPS history card should include the following items:

- ✔ Date battery replaced
- ✔ Date last tested -- results of test
- ✔ Type of equipment being powered
- ✔ % load
- ✔ Comments for unusual conditions

The format of the history cards was given careful consideration. HEALY considered an electronic data base but rejected the idea due to the complexity and overhead required to develop and maintain. Instead, the tried and true paper log was implemented.

Logistics

The lead acid batteries in a UPS require special logistical procedures. The most important thing to realize is that the lead acid battery must be immediately installed into a UPS where it will receive the proper charge. A battery left on the shelf will quickly self discharge rendering it useless. Along the same lines, do not store UPSs unless the battery has been removed or the UPS is plugged in and turned on. This will insure that the battery receives a proper charge.

All batteries are considered HAZMAT. Most contain heavy metals that are harmful to the environment. Dispose of all batteries in accordance with local, state, and federal regulations. As a rule, you can return your batteries to the company / distributor they were purchased from. The battery MSDS often contains information for battery disposal and recycling.

UPS Selection

In selecting a UPS it's helpful to first categorize by function. To that end, HEALY's UPS loads have been grouped into six categories. The following table lists the categories and the desired run time for each type of load (see next page).

Note that a run time over 15 minutes will require a grossly oversized UPS or an external battery pack. As a rule, the On-Line UPS will have the option of using an external battery pack. Commercial-Off-The-Shelf Standby units such as the one shown in Figure 1 do not have external battery packs.

Run Time	Type of load
2 Hours	Critical - This category includes all equipment essential for damage control. HEALY with her minimum manned crew is dependent on these systems. Specific equipment includes: the ICOM VHF radio system (WIFCOM), 1MC, and telephone PBX. HEALY is unique in that she does not have an Internal Communications switchboard with a battery backup. Instead she has separate UPSs installed for each equipment.
½ Hour	Mission Essential - This category includes the navigation equipment, radio equipment and MPCMS.
½ Hour	Science Network - CGC HEALY has an extensive data network. There are 10 UPSs used to support of science servers and network.
Mission dependent	Science Equipment - including portable experiments, precision data measurement instruments, and data recording devices.
Auto Shutdown	CG Network - TISCOM selected server and UPS.
Varies by Application	Other - Any system that does not fall into the previous categories.

A cost vs. benefits decision must be made to determine if an On-Line UPS is warranted. Ideally, only the On-Line UPSs would be used because of its superior ability to provide clean power. However, the cost must be considered as shown in the following table.

Standby UPS:

MFG:	Model number:	NSN:	Cost:
APC	SUA1500r2x93 (rackmount)	6130-01-436-9358	$1172
APC	SUA1500X93 (tower)	7021-01-406-4502	$1528

On-Line UPS:

MFG:	Model number:	NSN:	Cost:
UPSI	2000MS	N/A	~$6000
Clary	UPS1-1.5k-1G-SRND	6130-01-470-3290	$5349

This table is for cost comparison purposes of similar sized UPSs. It is not a comprehensive list of UPSs, nor does it serve as an endorsement for a particular manufacturer.

A UPS can be selected when the topology, run time, and expected loads are known. There are additional things to consider such as:

- ✔ Future expansion;
- ✔ Supportability and repair -- contact TISCOM for more information;
- ✔ Standardization across platforms -- contact TISCOM for more information; and
- ✔ Compatibility of auto shutdown software with attached computer loads.

Acknowledgments

Thank you to the Petty Officers at ESU Seattle's HEALY MAT and the HEALY ET shop for your help in developing this article. Your efforts in collecting the data presented in this article and performing the initial testing and repair to HEALY's numerous installed UPSs are greatly appreciated.

Disclaimer

The purpose of this paper is to present initiatives and propose new ideas for exploration. It is not intended to reflect USCG direction or policy. Use of company names, trademarks, or copywrited material is not an endorsement of any product or service.

CGC HEALY is a unique ship -- by definition she is a class of one. For example, she has a radar and navigation suite unlike any other vessel in the Coast Guard. These unique systems are typically supported via contracts not TISCOM as is common for a WHEC.... As such, Ships Force often find themselves in a position to perform engineering type work by drafting and reviewing contract specifications. This article is but one example of ET work performed on HEALY.

Contact Information

ETC Aaron Dahlen has been the Coast Guard for 15 years. His background includes OMEGA, several LORAN stations, Petaluma "C" school instructor, ACET, and Polar Ice Breakers. He is currently serving aboard CGC HEALY home ported in Seattle, WA. You may reach him at ADahlen@HEALY.USCG.mil

References:

[1] Wuidart, L. Understanding Power Factor. 29 Nov. 2006 <http://www.st.com/stonline/books/pdf/docs/4042.pdf>.

The following 'net links provide useful UPS information:

apc.com

bb-battery.com

clary.com

enersysreservepower.com

novaelectric.com

upsi.com

NORTH POLE (Dec. 20, 2002) -- The Coast Guard Cutter HEALY's crew poses in front of the cutter after reaching the North Pole Sept. 6. The HEALY became only the second U.S. surface ship to reach the North Pole. U.S. COAST GUARD PHOTO

U.S. Coast Guard photo by PAC Tom Sperduto

Rescue 21

by LCDR David Savatgy, PE, PMP (G-AND) and
LTJG Travis Gracewski (G-AND)

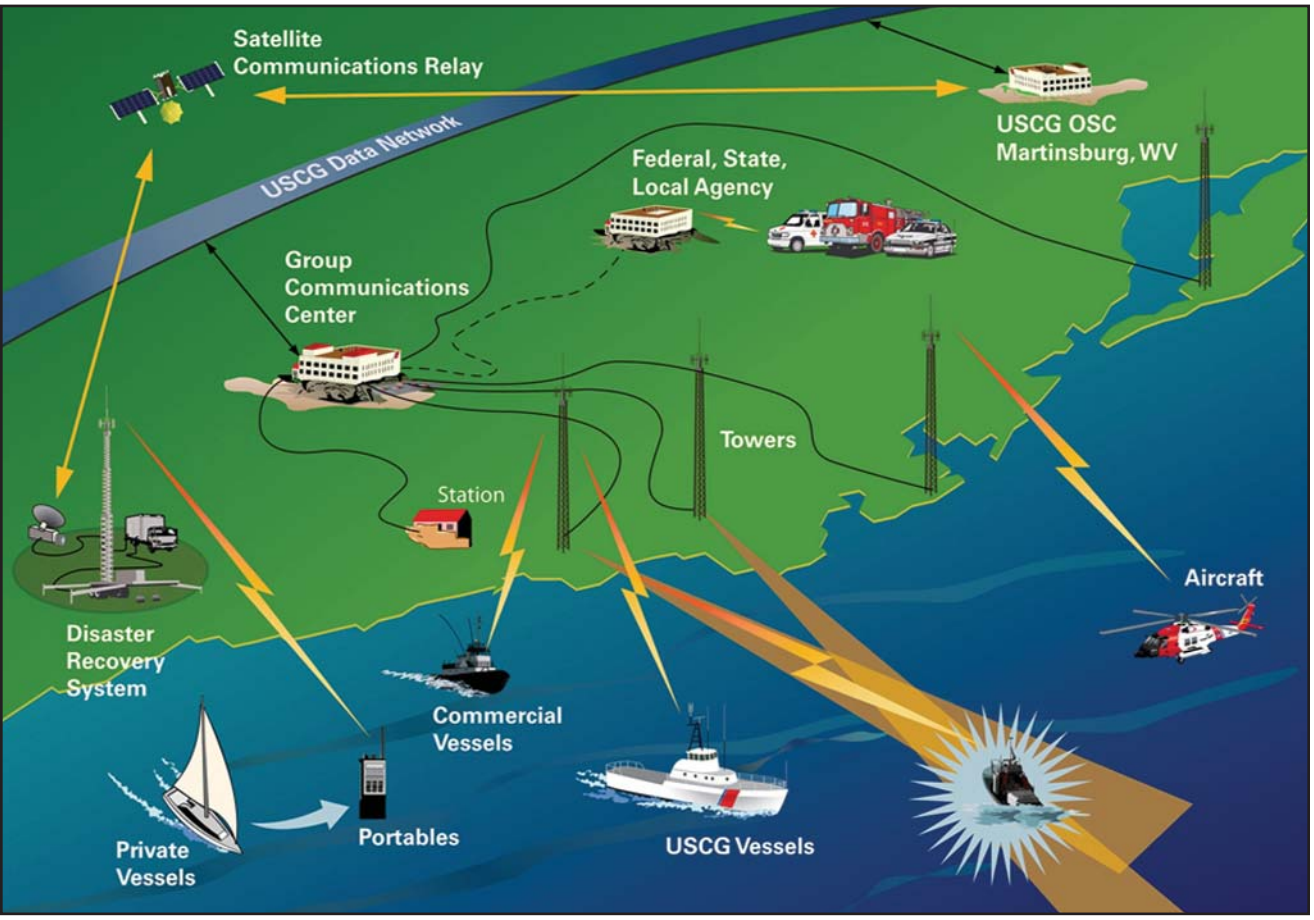
Introduction: Rescue 21 is the Coast Guard's second largest Acquisition, chartered to design and deploy a highly reliable nationwide command and control "maritime 911" communications system. Once fully deployed, the system will dramatically improve communications coverage filling 88 known gaps, increasing interoperability with local responders, and provide reliable direction-finding capability tied to geographic displays at all Coast Guard Sector Commands and Stations. Rescue 21 allows the Coast Guard to monitor Digital Selective Calling (DSC) emergency communications. Currently, Rescue 21 is operating in five Coast Guard Sectors covering 2000 miles of coastline, and has been saving lives and operational dollars due to identification of hoax callers and more efficient response to Search and Rescue operations.

Coast Guard Rescue 21: Major System Acquisition Cost Control

Rear Admiral Currier had been the Assistant Commandant for Coast Guard Acquisitions for only a few weeks in mid-2005, looking across the table at his senior staff, he put it bluntly, "When I look at the Rescue 21 project, it's like a helicopter with its tail rotor on fire heading for the water in a dead spin. We need to take decisive action to turn this program around. The Nation absolutely needs this program to succeed. Failure is not an option." A quick look at the project metrics reinforced his point. Rescue 21 was over budget, behind schedule, and delivering most, but not all of the improvements originally envisioned. What had started as a $611M project to be completed in 2006 was currently forecast to cost more than $800M and be completed in 2011. Recently, the Government Accountability Office and Congressional Committees had put Rescue 21 front and center on their radar, being equally blunt in testimony, stating, "The House Appropriations Committee has little confidence in the Coast Guard's contract management capability and their plans to aggressively oversee cost, schedule, and risk for the remaining development and deployment of Rescue 21."

Captain Abel assumed the duties of project manager of Rescue 21 in late 2005, and found himself swamped with the project's shortcomings. Even with a staff of 25 government personnel and a team of support contractors, spiraling technical development costs were pushing the schedule further and further to the right. With the Initial Operational Capability (IOC) regions just coming online, the project was at the verge of success, or failure. The threat of project cancellation weighed heavily on all, and would have cost the Coast Guard five years of delay in the deployment of a new, and much needed, communications system.

Multiple factors had led to the current state of affairs for the Rescue 21 project. A strained relationship had developed between General Dynamics, the prime contractor, and the Coast Guard, born primarily from a fixed price development effort that had left General Dynamics with an estimated $30M cost overrun. Rescue 21 had been awarded as a "Performance Based Contract," and the Coast Guard had been reticent to take firm management actions early in the acquisition. Instead, the Coast Guard had adopted a contractual approach of allowing General Dynamics to meet the



This image illustrates the components of Rescue 21. Image courtesy of General Dynamics.

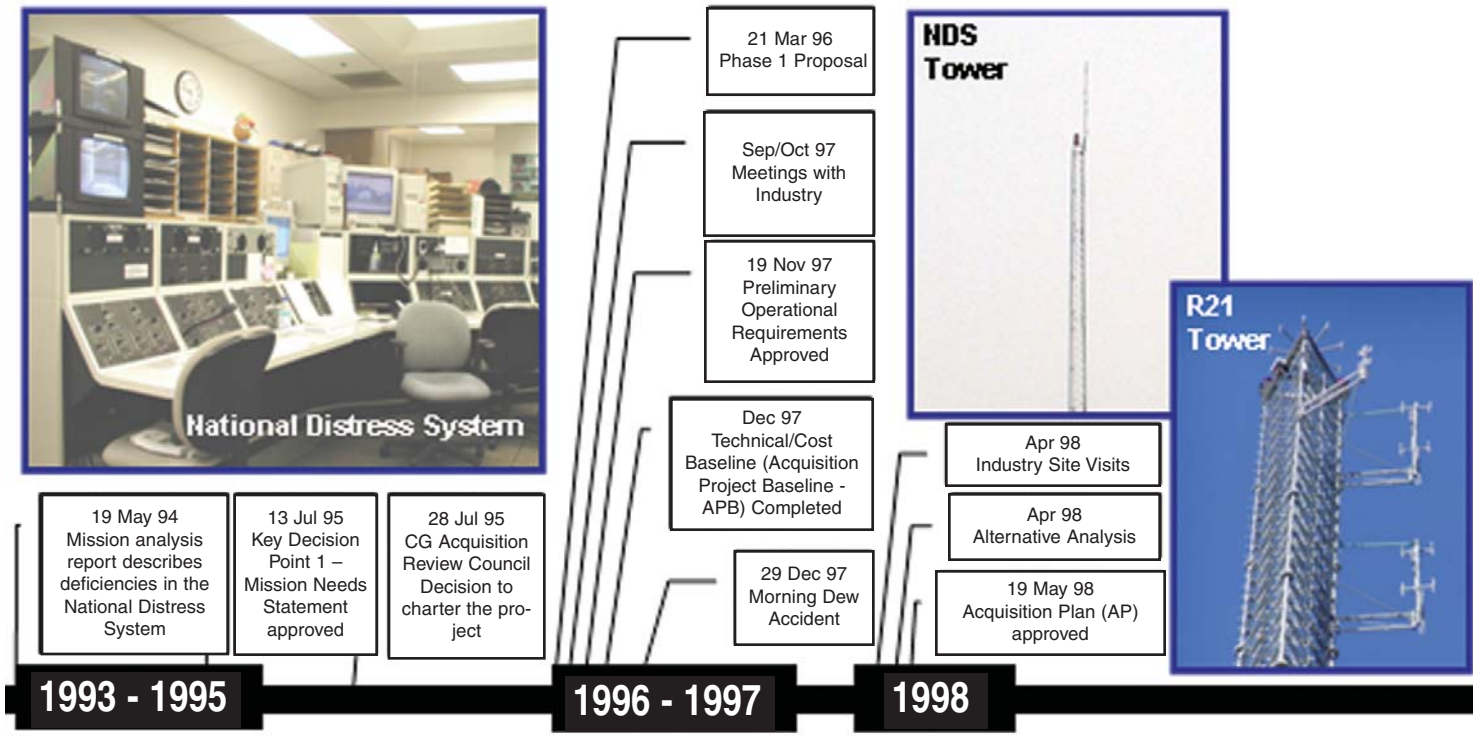
performance requirements signed up for with limited contractual intervention. This is an approach often adopted in contract management for fear that "you touch it, you own it," since additional contractual direction often places more ownership and risk on the government. The common thought among the Coast Guard staff was that "General Dynamics signed up to a performance standard -- the contractor has to perform. If General Dynamics does not meet all requirements, we will seek consideration." Unfortunately, this approach was doomed to fail because the structure of the contract allowed General Dynamics to place additional cost burden on the government as portions of the contract expired due to schedule delays and had to be re-priced.

The project had also been a victim of what has been referred to as the "Conspiracy of Hope," which "occurs when industry is encouraged to propose unrealistic cost and optimistic performance and understate technical risk estimates during the acquisition solicitation process, and the Department is encouraged to accept these proposals as the foundation for program baselines."[1] Some members of the Rescue 21 staff have commented that the project started off on the wrong foot when all three project management areas were constrained (cost and schedule were bounded by Congressional mandate, and technical functionality was mandated by the Coast Guard). A complex acquisition must have an iterative process to balance program costs with benefits in order to remain viable. At least one corner of this three-part triangle must be adjustable during the course of the project, especially for projects spanning a decade, or longer.

In retrospect, completing the design and nationwide deployment of a complex system such as Rescue 21 in a congressionally mandated four years, including over 300 remote fixed facility towers and equipment installations at over 75 Coast Guard units, was unrealistic at best. Schedule durations necessary to hold public review meetings in compliance with the National Environmental Policy Act, site surveys, designs, deployment, and testing of each region of the country, and the amount of software development to integrate Commercial-Off-The-Shelf (COTS) equipment are but a few of the factors contributing to a longer project lifespan. Many of these factors were underestimated by both the Coast Guard and the Contractor during the proposal phase. COTS integration proved a monumental task and contributed to at least six - eight months of schedule delay.

Several cost control measures were taken when it became clear that the project was over budget:

- 2004/2005 - Over an 18 month period, the Coast Guard painstakingly documented the observed poor performance of a General Dynamics major subcontractor responsible for the majority of infrastructure preparations at remote



tower sites. These efforts ultimately resulted in the removal of the existing subcontractor and the development of a more effective relationship between General Dynamics C4 Systems and General Dynamics Network Services for remote tower site work.

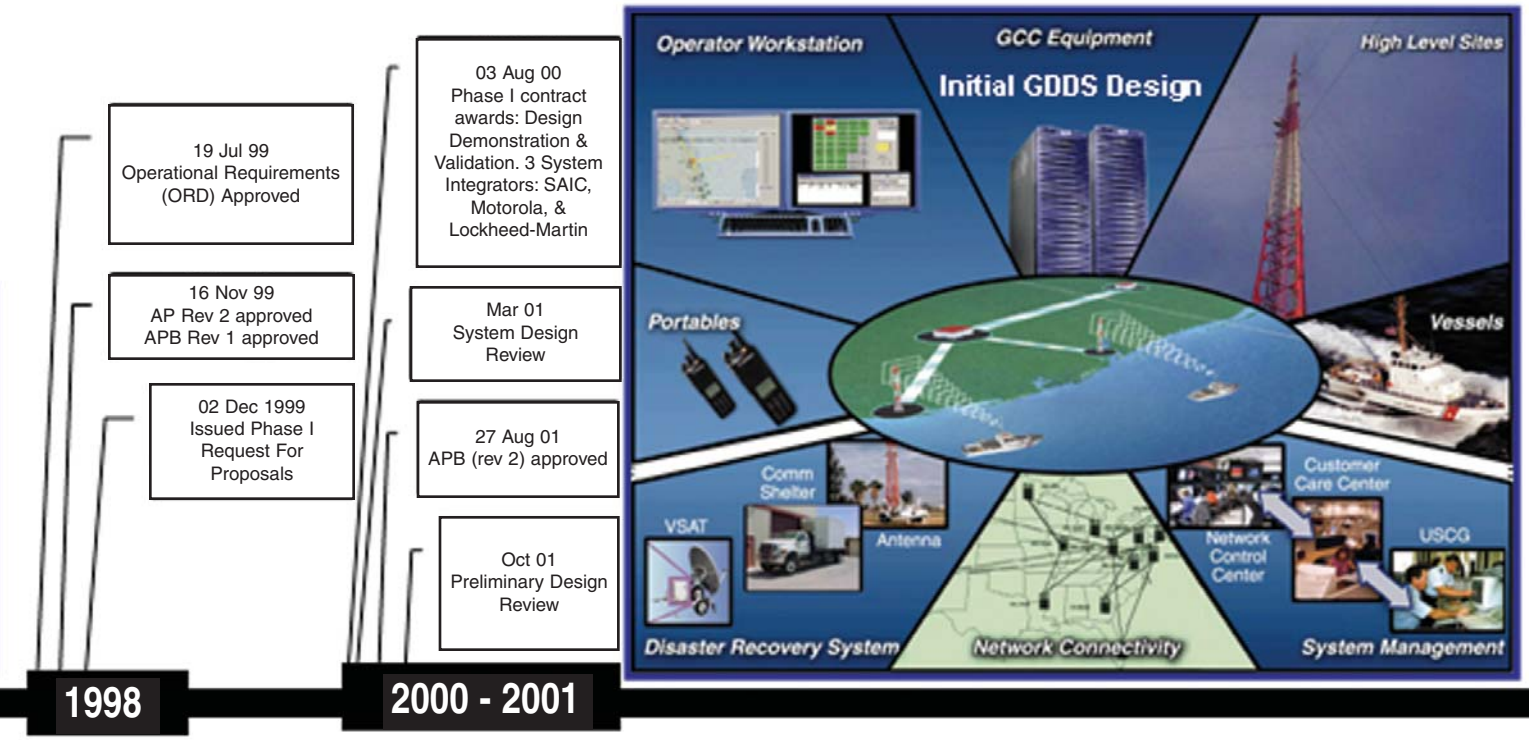
- Nov 05 - The Coast Guard established a Project Resident Office at the prime contractor's facility, initially consisting of eight military members in 2005 and increasing to 18 members in 2007. The command cadre was hand selected with a Commanding Officer having experience in leadership and telecommunications and the Executive Officer being a Professional Civil Engineer with experience as a Contracting Officer's Technical Representative. These key leadership positions, paired with face-to-face real-time interaction with the contractor, have already prevented additional project delays and fostered a significant improvement in the Coast Guard's relationship with the Contractor.

- Mar 06 - As a preliminary cost saving strategy, the Vessel Subsystem was removed from the General Dynamics contract, and will be accomplished using in-house Coast Guard resources. Coast Guard engineers will design and implement radio installations for the many vessels covered by the Rescue 21 contract. The asset tracking requirements are being achieved by leveraging vessel installations already planned by the Nationwide Automatic Identification System (NAIS) project, avoiding duplication of work by Rescue 21.

- Mar 06 - The Western Rivers consists of 46 legacy tower sites which were always envisioned to be upgraded with Rescue 21 on a one-for-one basis. As a further cost savings initiative, these sites are being investigated for a recapitalization effort (new radios and infrastructure) as opposed to a full rescue 21 suite. Given that Coast Guard operations on the Western Rivers are different than operations at Sea, Direction Finding technology and six radio channels may not be needed along the rivers.

- May 06 - The project sponsored a General Dynamics trade study to eliminate the use of expensive metal communications shelters and transition to concrete shelters, which are an industry standard, being both more economical and maintainable. The use of dual air conditioning (AC) units at remote sites is also being pursued, which lowers the project's operation and maintenance costs by eliminating a single point of failure and the need for immediate AC 24-hour emergency response.

These management actions were a step in the right direction, but still more was needed. The decisive action Rear Admiral Currier and Captain Abel set in motion took the project even further towards recovery by chartering a "Blue Ribbon" panel from the Defense Acquisition University in May 2006. To find areas for improvement, the panel dissected the Rescue 21 contract and all aspects of program management on both the government and industry sides. The team was led by Mr. Paul Schneider, a former Deputy Assistant Secretary of the Navy for Research and Development, and



also consisted of a retired Admiral, as well as several team members who had managed multi-billion dollar projects over the course of remarkable careers. Throughout five weeks, this world class team conducted extensive research and detailed interviews of Coast Guard and General Dynamics personnel, becoming familiar with every aspect of Rescue 21. At one point, Mr. Schneider visited local marinas and West Marine stores in the Baltimore area while researching commercial VHF radios and their typical use among the boating public. The credentials and past experience of the team proved vital towards building credibility with General Dynamics and every member of the acquisition team. The team recommended significant improvements on both the government and contractor sides, reporting that without corrective actions, the project was headed for a further cost breach of an additional $130M, and would likely take longer than 2011 to complete. Mr. Schneider noted that in the Department of Defense (DoD), this syndrome is known as the double buy in; the typical DoD Major Acquisition generally costs over twice the initial budget and rarely finishes on schedule. However, the news was not all bad. Mr. Schneider added, "The good news is that the performance of the Rescue 21 system appears to be favorable; your operators comment that they like Rescue 21, and it helps them do their jobs better. Often times on these complex major acquisitions, cost, schedule, and performance are all red and they've spent all of their money. There isn't much we can do to help in that situation."

Working with the DAU Team, Rear Admiral Currier and Captain Abel met with General Dynamics and collaborated on a viable way ahead. The way ahead includes a revised contract structure which eliminates redundant testing and eases administrative burdens while maintaining cost control and effective management oversight. An iterative requirements management process is also being instituted, whereby operational requirements are balanced against program cost impacts in order to maximize system functionality within established funding levels. In some cases, this amounts to an approach where an entire new antenna tower is not built in order to meet the goal of 98% coverage; instead, an existing tower may be reused in order to achieve the threshold of greater than 90% coverage at a significantly reduced cost while still meeting Coast Guard operational requirements. Each of these cost benefit trades is vetted through the operational sponsor and local Coast Guard commands to ensure that Rescue 21 coverage aligns with key operational areas, and that no unacceptable gaps of degraded coverage are provided.

Recently, this new approach was successfully tested during Full Rate Production (FRP) negotiations for equipment installations at 11 Sectors, 47 Coast Guard Stations, and 72 remote tower sites covering one-fourth of the CONUS coastline. Initially, the work scope was proposed at $94M as a firm fixed price contract. As a result of judicious cost-benefit analysis and gained efficiencies by combining several smaller contracts into a larger contract, this work scope was negotiated down to $74M, a 21% reduction in cost, and constrained the project within its $730M acquisition program baseline (APB). There are no complete gaps in radio coverage areas anticipated, only some areas of marginally

29 Jan 02
Key Decision Point 2

Feb 02
IOC and LRIP Site Surveys completed

8 Apr 2002
Received Phase II Proposals

20 Sep 02
General Dynamics Decision Systems (GDDS) Awarded Rescue 21 Contract (GDDS bought Motorola). GDDS is now General Dynamics C4 Systems

18 Mar 03
GRU Eastern Shore Groundbreaking Ceremony

Jul 03
Began installation and test at IOC Remote Fixed Facilities (RFFs) and Disaster Recovery assets.

27 Jan 04
Formal Qualification Test

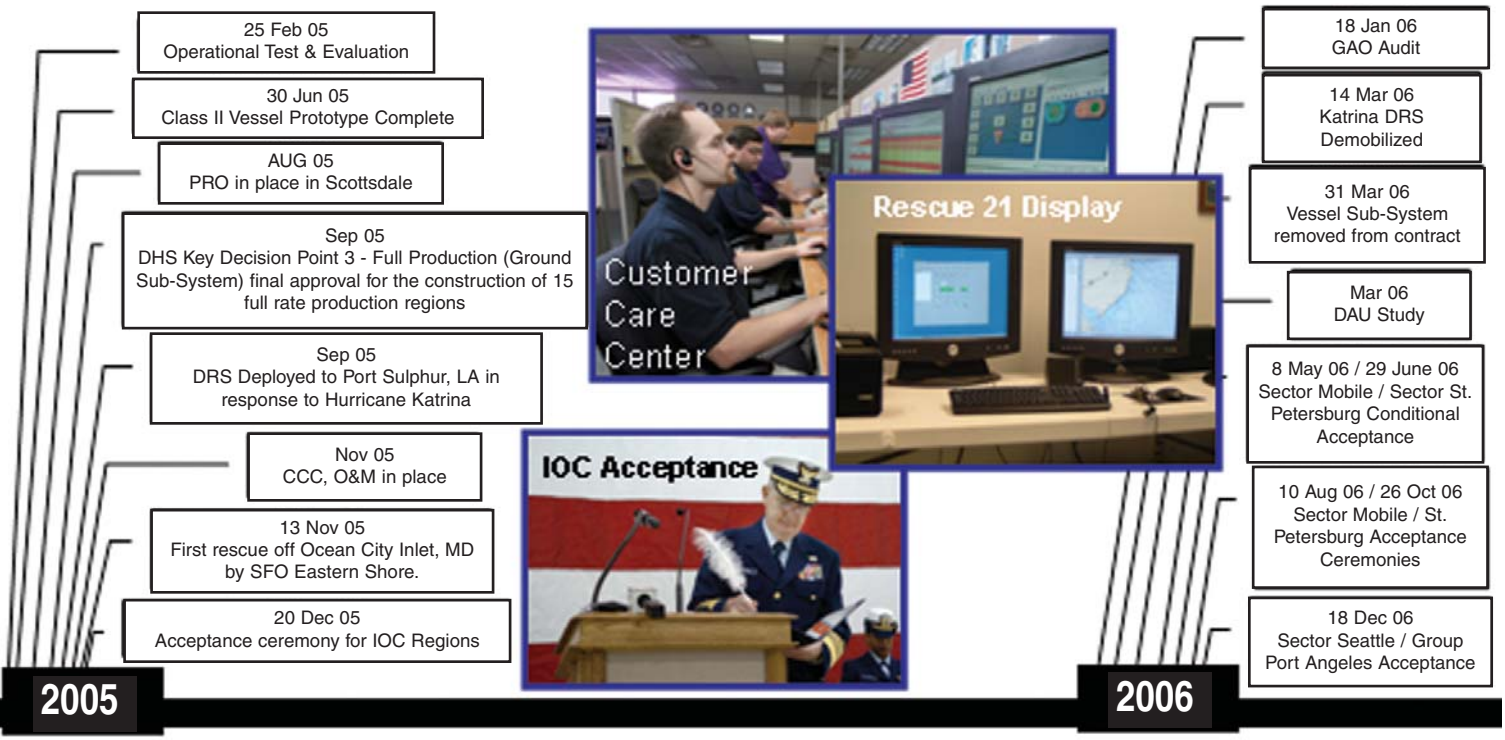
2002 - 2004

decreased audio quality (all above commercial cell phone quality). Several inland river towers will be built without direction-finding capability, which decreases both the build and maintain costs over the next 20 years. These trades were deemed operationally acceptable in order to keep the program within budget and on schedule.

This image indicates the tower sites and communications coverage for Rescue 21 in Sectors Mobile and St. Petersburg (left), and Atlantic City and Eastern Shore (right). Image courtesy of General Dynamics

Today, with the success of the Rescue 21 IOC regions and the follow-on Low Rate Initial Production (LRIP) regions, the project has proven that it has developed a working operational system that General Dynamics can effectively deploy throughout the nation. Rescue 21 now covers Coast Guard communications for 2,000 nautical miles of coastline, and is fully into FRP, building out 14 additional Sectors. The commencement of the FRP Sectors is a testament to the program's sound management practices under Rear Admiral Currier and Captain Abel, as well as the hard work and dedication of the project staff. As the FRP Sectors come on-line, the monumental task of acquiring "best value" operations and long-term maintenance support remains. While the project's cost control efforts initially focused on deployment, operations and maintenance represent one of the next challenges. If appropriated in 2008, a Rescue 21 life-cycle maintenance office will help augment the maintenance staff to analyze these important issues. Operations and maintenance are a considerable expense, and the project must meet Coast Guard operational requirements while minimizing life-cycle costs.

[1] A Report by the Assessment Panel of the Defense Acquisition Performance Assessment Project for the Deputy Secretary of Defense. (Defense Acquisition Performance Assessment Report, January 2006), p. 45



MLCA WEB DEVELOPMENT AND HOSTING SERVICES

A Customer's Perspective

by LCDR Frank W. Klucznik
Atlantic Area (Amr)

INTRODUCTION This article is designed to highlight the gap between data capture requirements and data collection in Coast Guard Information Technology (IT) systems, and recognize Maintenance and Logistics Command Atlantic's (MLCA's) proactive approach to mitigate the problem through their web development and hosting services. The material was written by an MLCA customer and presents the views and experiences of the author. As such, it is not intended to convey or express the views or positions of the LANTAREA Commander or MLCA.

CHALLENGE The Coast Guard's shift in mission focus after 9/11 dramatically changed the data required to manage programs and resources. As a result, the shift created a gap between the data needed by program and resource managers, and the data captured by current IT support systems. Specific examples include:

1. Response needs the ability to compare actual against planned resource hour consumption rates to support the Operational Planning Process.
2. Prevention requires data on man-hour usage for all "P" missions to better manage human capital and identify resource shortfalls.
3. Prevention also needs the ability to track and monitor vehicle resources at all units.
4. The Commercial Fishing Vessel Safety program requires data on Coast Guard (CG) Auxiliary activities to better manage their program.

These are just a few of a growing list of new data requirements that are not being met. This problem is exacerbated by three major factors: (1) senior Coast Guard leadership and external elements such as Office of Management and Budget (OMB) and Government Accountability Office (GAO) are demanding data driven management practices; (2) implementing new requirements in large existing enterprise IT systems such as MISLE, AOPS, and ALMIS can take years to accomplish; and (3) many of our processes are so immature they cannot produce a stable set of requirements enterprise mangers could use to develop new functionality.

MLCA RESPONSE MLCA recognized the change in data requirements several years ago, and developed the capability and support infrastructure necessary to create and host small web-based data collection and reporting tools.

These tools provide functionality critical to effective day-to-day management of Coast Guard resources and operations by:

1. Establishing a standard process for gathering, storing, and displaying data from operational units within LANTAREA (Atlantic Area) that are not currently collected in other Coast Guard IT systems;

2. Storing data in central repositories for trend analysis, resource and budget management, and data sharing among organizational elements;

3. Supporting the development of business processes by shifting existing process from spreadsheets and into a modern web-based database environment; and

4. Generating stable, tested requirements Headquarters system managers can use to incorporate functionality into enterprise wide systems.

The hardware and software configuration provided by MLCA is maintained by a staff of contracted personnel, and meets the very latest Department of Homeland Security and Coast Guard security requirements. They also provide daily back-up services, disaster recovery, and are currently developing a Continuity of Operation Plan utilizing data clustering, network load balancing, and automatic failover to a remote site.

EXAMPLES The success of the Operation Neptune Shield Scorecard (ONSS) web-based scorecard serves as a recent example of how MLCA services have helped bridge the gap between program management needs and existing data collection at an affordable cost. The ONSS project went from "just an idea" to becoming an IT system approved by CG-6 (Command, Control, Communications, Computers and IT Directorate) for Coast Guard wide deployment in only 24-months, at a cost of under $300k. The system supports the Ports, Waterways, Coastal Security (PWCS) program by reporting Maritime Security (MARSEC) level attainment in Military and Economically Strategic ports throughout the U.S., capturing reasons why units are not able to achieve 100% attainment, and recording the impact of PWCS activities on other Coast Guard missions. In doing so, ONSS directly supports several Headquarters divisions, both Areas, nine Districts, 32 Sectors, and more than a 20 field units in the management of the Coast Guard's Homeland Security Mission. The project also generated a stable set of tested requirements G-PRI and G-RCC are actively using to incorporate scorecard functionality into Marine Information for Safety and Law Enforcement (MISLE) and Abstract of Operations System (AOPS). The process of incorporation is expected to take 12-18 months, during which time ONSS will continue to provide critical support and cost savings benefits throughout the Coast Guard. The primary benefits of ONSS include: the establishment of a central data repository, standardized data collection and validation process, workload reduction by eight FTE annually, and cost savings of more than $246k yearly. Meanwhile the training, operation, maintenance, and support costs for the system are only $50K a year. As a result of its great success, this project has received praise and strong support from VADM Crea and RADM Hewitt. Additional information on the ONSS project is available in a four-part series titled Chronicles of ONSS published in the Fall 2005, Winter 2006, Spring 2006, and Fall 2006 / Winter 2007 editions of the *Engineering, Electronics and Logistics Quarterly*.

A second example involves the LANTAREA Shore-Based Working Group (SBWG) study that took place between January and September 2006. The SBWG utilized MLCA's web development services on an "as available" basis to develop a web-based data collection and report generation tool. The tool was developed and deployed in only six weeks using agile development methods, and supported the collection, validation, and analysis of more than 29,000 data points from 170 shore-based boat units within LANTAREA. The study produced a 1600+ page report containing a one-of-a-kind mission and capability profile for every unit, sector, and district involved. The SBWG study was hailed by VADM Peterman as a landmark event at the last LANTFLAG's conference, and described as one which has changed the way the Coast Guard will view and manages small boat resources in the future. The overwhelming accomplishments of the LANTAREA SBWG study is directly tied to the IT support received from the MLCA Web Development Team, because of the large amount of data the study was able to collect and analyze.

CUSTOMER PERSPECTIVE From a customer perspective, the MLCA web development and hosting services provide a vital role in bridging the gap between program management and existing data collection systems. They build bridges using Information Technology to automate existing processes embedded in spreadsheets, support custom data collection needs for LANTARA studies, and help document data requirements for enterprise system managers. Their services are unique, and reduce the administrative workload associated with collecting data and conducting program studies, eliminate errors induced by manipulating data in spreadsheets, and allow managers to focus on processes and analysis rather than managing data in spreadsheets and PowerPoint presentations. Their contribution is noteworthy, and is helping to shape the future of the Coast Guard.

A One-on-One with Mr. Jeffery Orner

Deputy Assistant Commandant for Engineering and Logistics

The LTPIO staff sat down with Mr. Orner in March of 2007, and asked about his career, duties as the Deputy Assistant Commandant for Engineering, and logistics and what the Coast Guard's logistics future looks like.

Question 1: **How would you characterize the role of the Deputy Assistant Commandant for Engineering and Logistics?**

Answer: The duties of the Deputy Assistant Commandant for Engineering and Logistics (CG-4D) encompass the entire scope of CG-4's responsibilities. This involves oversight over a wide variety of programs and policies including all engineering (Naval, Civil, Aeronautical and Industrial) and logistics for the Coast Guard's $25 billion capital plant consisting of 23,000 facilities, 230 ships, 1,800 boats and 200 aircraft. CG-4 executes an annual budget of $1 billion, and leads more than 2000 personnel located at Coast Guard Headquarters and at three major Headquarters commands. The CG-4 team is responsible to maintain affordable readiness for the Coast Guard through innovative and disciplined approaches to logistics, engineering and industrial processes.

I am also accountable to provide leadership and oversight of the workforce. It is important that we maintain a diverse workforce with the skills and support needed to meet new and challenging mission requirements.

As the Coast Guard attempts to resolve the issues associated with CFO compliance, I'm accountable to RADM Gabel and ADM Allen to achieve CFO audit compliance within the engineering and logistics communities. That includes ensuring that our Operating Material & Supplies, Plant Property & Equipment and Environmental Liabilities are accurately reflected in the Coast Guard's financial statements.

A significant role I'm playing as RADM Gabel's Deputy involves using my logistics experience to serve as technical advisor, program champion and subject matter expert on logistics issues. Applying my experience to further the transformation of Coast Guard logistics into a centralized system that provides efficient and effective support to the mission is my primary focus. The Commandant has issued his intent on the future of logistics and mission support functions. I'm playing a leadership role in executing this intent, known as CIAO 4. In support of RADM Gabel and the Coast Guard leadership, and in cooperation with representatives of the logistic

and operational community Coast Guard-wide, I'm developing plans to implement the CIAO 4 vision of a single Mission Support organization. This transformation to a Mission Support organization is a momentous task for the Coast Guard, and one that I'm proud to be helping to implement.

Question 2: **What are the most challenging issues facing the Coast Guard and specifically the Engineering and Logistics Directorate today?**

Answer: As a whole, the Coast Guard continues to accomplish its many and varied missions with skill and success. With a force about the same size as the NYPD, the Coast Guard manages to save lives, enforce laws and protect our Nation's waterways every day. Since 9/11 and the creation of the Department of Homeland Security, the CG's missions have expanded to include an enhanced homeland security focus that requires a greater degree of interoperability with federal and state agencies. While the missions and responsibilities for homeland security are growing throughout government, the Coast Guard's and most federal agencies budget dollars have flattened, or in some cases are shrinking. This will require us to develop relationships and partner with other federal, state and local agencies to provide services and reduce risk to the American public.

In the world of logistics, I see several significant challenges. First, of course, we have aging assets, including boats, cutters, airframes and physical plants that get more challenging to maintain as they age. Meeting those challenges is a day to day focus of the CG-4 team and of many others across the Coast Guard. In addition, we have a significant opportunity to recapitalize many of our assets through the Deepwater program. That program is delivering complex new assets that require disciplined logistics and configuration management planning and systems to ensure that we get the best value out of those impressive new assets. The CG-4 team is working closely with their Deepwater counterparts to ensure the assets delivered are adequately supported and meet the operators' needs. We are integrated with the Deepwater Program to provide comprehensive engineering and logistics, for both interim and long term support. There will be one common set of Coast Guard logistics processes, though some assets will have a different mix of industry versus organic government support than others.

I was onboard BERTHOLF, the first National Security Cutter, a few weeks ago. She's a beautiful ship and we have a lot of work ongoing to ensure that her crew gets the support they need from the day she leaves the yard. It's going to be a busy spring and summer, but the crew won't be disappointed with their support.

As I mentioned earlier, the Commandant, ADM Allen, has a clear vision of the future and all of us in the Coast Guard leadership are deeply involved in planning to make that vision a reality. The 10 Commandant's Intent Action Orders are an excellent road map to that future and I'm delighted that I have the opportunity to help put such a sweeping and inspiring vision in place. Executing that vision while also putting mission execution first will require a dedicated and cooperative effort from the whole Coast Guard team. Working on the Mission Support reorganization, I've seen how each of the Commandant Intent Action Orders is interdependent and connected to others. As long we recognize and work within these interdependencies, I am confident that we can move to a more effective, responsive and better supported Coast Guard. We have an impressive team of military and civilian personnel, both at headquarters and in the field, who understand and take deep pride in their roles supporting the Coast Guard's mission, and I'm confident the people of the Coast Guard are up to the challenges we face.

Question 3: **You bring a lot of experience with you from the Navy, having been a Senior Executive Service member there for some years. Why did you make the move to the Coast Guard, and what specific jobs or projects have best prepared you for this position?**

Answer: I came here for a number of reasons. Most importantly, I believe in the mission of the Coast Guard and when I saw this senior leadership position open, I seized the opportunity to play a role in building the future of a dynamic and widely respected organization. I also believe that it is healthy, from time to time, to seek out new opportunities and challenges and to apply one's experiences in a new context in order to learn, grow and made a difference. Such career moves happen naturally for folks in uniform, but for civilians we generally must seek out such career opportunities on our own. I could not be happier to have joined the Coast Guard team and I expect to be here for the long term. I am so very impressed with the professionalism, attitude and dedication of the Coast Guard team from top to bottom. I am proud to be here and to have the opportunity to make a contribution.

I have 25 years in the logistics field and in acquisition, and I've been in a variety of different positions that have encompassed shipbuilding and system acquisition programs, modernization and support of older ships, research and development programs and associated policy/ process related positions. I'd have to say that it was no single job, but really the wide variety of experiences that prepared me best for this assignment. I think it's important, in preparing for a job like this, that you have broad technical and leadership experience that can really only be obtained by challenging yourself with new work and new organizations. As Executive Director of the Naval Supply Systems Command, I served as the number two official in a 24,000 person, $10 billion worldwide organization. I played a key leadership role in transitioning the organization to a more efficient and customer focused organization. Leading that complex transformation, which required major process and organizational realignments, while continuing to provide effective logistic support to the Navy, in a wartime tempo of operations, taught me a lot that I feel will be useful as we plan the Coast Guard's logistics transformation. In addition, when I am working to improve the life-cycle support, the affordable readiness of all Coast Guard assets, I draw more on my Naval Sea System Command experience, where we routinely faced similar challenges to those we face in Coast Guard acquisition and sustainment today.

Question 4: **Have you been involved with transformation efforts during your DOD career? If so, how would you compare them to the CG's effort? How do our chances for success compare to the DOD?**

Answer: Yes, I have been involved in transformation projects with the Navy and DOD over the course of my career as I alluded to earlier. The Navy is challenged by its size, just as DOD is. The sheer number of business stovepipes can be overwhelming. Add to that the level of autonomy enjoyed by many larger commands, and transformation is challenging, but is underway with some success nonetheless.

While we clearly don't have the resources that the other Services have, Coast Guard logistics has several things going for us: manageable size, can-do attitude, and the fact that we have chosen a proven internal business model as our new baseline (CG Aviation), rather than having to invent a new and unproven one. It's also significant that we have the explicit support and direct involvement of leadership at the highest level in our logistics transformation. With that clear guiding vision for the future, I believe our odds of success are quite high.

Question 5: **For those outside of HQ, it's probably confusing to understand the difference between the Commandant's Intent Action Order #4 - Logistics Reorganization, the Logistics Transformation Program and the Civil Engineering High Performing Organization (HPO) effort. Many in the Coast Guard probably aren't even aware of all of them. Can you discuss the relationship and explain how you see them fitting together?**

Answer: I'm sure the "alphabet soup" of these programs is confusing to many personnel inside and outside of HQ. In simple terms, LTPIO or the Logistics Transformation Program Integration Office is the effort to develop and implement processes to deliver more effective and efficient logistics support throughout the Coast Guard, in a single/common business process model. This involves standardization of the way we provide logistics support, transforming to a bi-level maintenance philosophy, disciplined and responsive engineering, configuration management and logistics processes, pushed support to operational units and central management of processes and resources supporting local execution. CIAO# 4 will provide the organizational structure to support and enable the LTPIO business processes. Finally, the HPO (high performing organization) is an effort within the Civil Engineering community to comply with A-76 requirements in an enterprise manner, and improve the efficiency of civil engineering support. The HPO, if approved, will, in effect be delivering the organizational segment of CIAO#4 for the civil engineering functional area.

Question 6: **In terms of the logistics transformation effort, in your opinion, what are the particular challenges that must be faced to be successful in this transition?**

Answer: Some of the challenges for this effort include: putting in place a new business model that involves some dramatic changes, while continuing to effectively support current readiness with no disruption; over-

coming resistance to change; building confidence in our new logistics practices; improving internal controls so that we can consistently achieve clean financial statements; improving configuration management discipline and putting in place standard maintenance practices; and improving acquisition practices to ensure that supportability considerations are built into up-front acquisition planning. Also, an important challenge is to overcome perceived notions that communities (i.e. cutters, aviation, civil engineering, etc.) require different logistics processes and different information technology systems. In addition, we have to balance the constant demands on our base resources with needs for such investments as new information technology, new maintenance procedures, and configuration baseline validations. All of these changes really involve not only process improvement, but also cultural change that must take root if we are going to sustain these new business processes and achieve the desired long-term results. That's going to take sustained leadership commitment at all levels of the Coast Guard. As I mentioned earlier, we have a great team of dedicated people from across the Coast Guard who are good at overcoming such challenges and who are working diligently to provide the support the mission requires and move this logistics transformation forward. I have been a member of the Coast Guard team for over a year now and I have been consistently impressed with the attitude, professionalism, expertise and persistence of Coast Guard people across the organization.

Question 7: **From a management perspective, what do you view as the key components and benefits of adopting CG-wide a single logistics business model following the best practices found in the aviation community?**

Answer: We are moving to a business model that is really quite simple from the perspective of the operational unit. Support will be driven by a set of operational requirements. We'll make decisions based on data. We'll have a bi-level maintenance philosophy. There will, of course, continue to be operational maintenance performed by the unit. All depot-level maintenance and support will be centrally funded and will be pushed to the unit. Each major asset type (i.e. National Security Cutters, HH-65 helos, etc.) will have a product line manager who is the single point of contact and accountable to provide units with the support they need. These product line managers will work in Logistics Centers structured much like the Aviation Repair and Supply Center (AR&SC) is today. Beyond these functions, there are a variety of key components of this single logistics business model for the entire Coast Guard. These include: disciplined configuration management and standardized maintenance procedures; a strong compliance program; a single set of business processes used by all support providers, and end users; centralized funding and inventory management; and ultimately, a single integrated logistics and finance IT system. Also, we are ensuring that all of our acquisition programs will plan for and deliver the products and services needed to provide life cycle support for our new assets.

The benefits of a single logistics model are numerous. From a HQ and management perspective, this model requires that decisions be made based on data and reliable information. Accurate information supports the ability to measure effectiveness, optimize costs, enable CFO Act compliance, and defend budgets. I'm also pleased to note that this system is based on accountability at all levels. Support personnel, at all levels, will be accountable to provide the processes, support and materials required to execute the mission, and know their role within this system.

The business processes being put in place by the Logistics Transformation Program Integration Office (LTPIO) are a foundation and key enabler of the CIAO #4 organizational alignment. We have a pilot implementation of the LTPIO business processes for standard boats beginning in the next few months. We expect to receive a wealth of useful information and ideas from this first pilot effort and we'll build on that.

Question 8: **I'm sure that a lot of people are wondering how this reorganization will affect their jobs. What can you tell us about that?**

Answer: First, we don't know the details yet -- we're in the early planning stages of this transformation and that's all still under development. As we move forward, we will be open and transparent, we'll involve the stakeholders and we'll ensure that all members of the support community know what is being planned and what has been decided.

Emerging Technologies

by LCDR Frank W. Klucznik
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Something to Think About

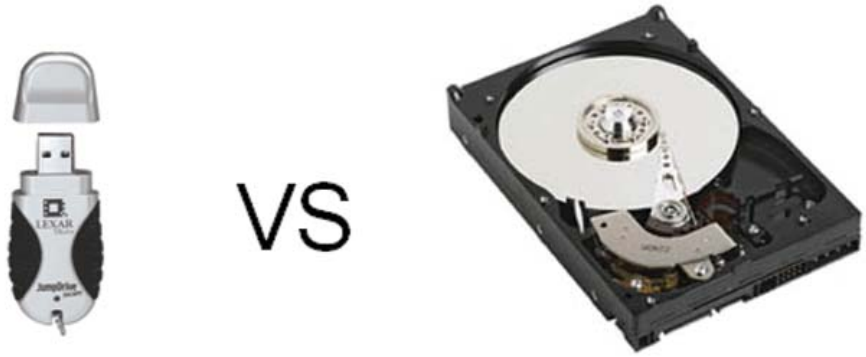
This quarter I want to try something a little different. Rather than cover a single topic in detail, the column contains a brief review and discussion on several emerging technologies and the potential they present to businesses and/or society in general. The technologies covered include RFID Passports, Flash Memory, Web Services, Benchmarking, and Mobile Communications.

RFID PASSPORTS -- The acronym "RFID" stands for Radio Frequency Identification and represents a class of transponders designed to automatically communicate information through a wireless radio transmission.[12] These transponders are commonly referred to as "RFID tags" and may be attached, embedded or incorporated into almost anything. RFID tags use radio signals to communicate information to a nearby receiver scanning the frequency of the tag.[12]

RFID tags are widely used today. For example, automobile owners use RFID technology to pay highway tolls by attaching a tag to their windshield that transmits a unique identification number to the receiver located in the booth. Highway authorities count the number of times each unique identification number passes through their tollbooth to calculate the appropriate charges against each user account. Veterinarians place small pill sized RFID tag into the neck of a family pet. These tags contain the name and address of the animal's owner, and were successfully used to reunite animals to their owners after devastating events such as hurricane Katrina, or after an animal was stolen or run away from home. Finally, Wal-Mart and other retails stores use RFID tags to track inventories and deter theft of highly pilferable items such as video games, music CDs, and DVD movies.

Governments in the United Kingdom (UK) recently began using RFID passports to identify individuals entering and departing the country.[4] This use of technology represents the next evolution of RFID tag usage, and has the potential to make significant improvements in the customs and immigration process. Using RFID tags in humans decreases the risk of individuals illegally entering a country using forged paper documents.[4] Although RFID technology is far from perfect, it is more reliable than traditional paper or smart card technologies. RFID passports have the potential to increase throughputs at customs checkpoints, reduce wait time for travelers, and decrease terrorist activity on public transportation systems such as airplanes and ships.

FLASH MEMORY -- Flash memory is an inexpensive computer chip designed to store data without requiring electricity or moving parts.[11] Flash memory also offers fast read access times and a higher shock resistance than most typical computer hard disks. Examples of flash memory applications include digital cameras, cellular telephones, MP3 Players, and USB jump drives.[11]



A discussion thread on techdirt.com in 2005 posed the question: "Can Flash Crash The Hard Drive Business"?[3] Critics of the idea offered a wealth of technical limitations of flash memory such as a maximum of 100,000 read/write cycles, read/write speeds are slower than some hard drive configurations, and a size limitation of 4GB for data storage to name a few.[3] On the other hand, proponents of flash memory tout its noiseless, requires a very small amount of power to write data, and is less expensive than standard hard drive storage.[3]

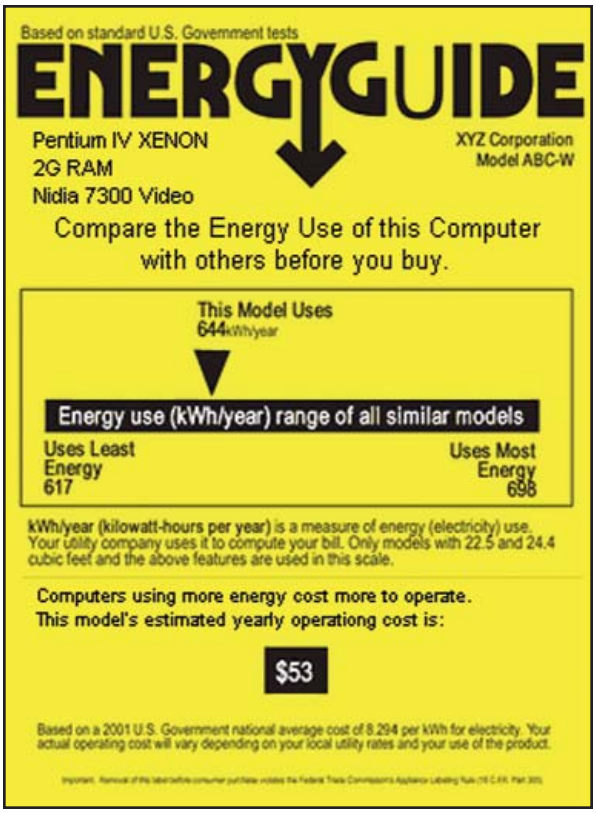
Flash memory represents the next generation in data storage. Although "Flash" technology has not quite matched the speed and storage capacity of traditional hard drives, the gap is closing. Hard drive storage is one of the principle high wear components in a computer system because it contains an electric motor, armatures, bearing, spinning platters, etc. All of these moving parts have a limited lifespan, and will at some point fail. In addition, hard drives generate noise, and heat requiring cooling fans, which are another high failure item. It is reasonable to expect engineers will some day focus on the high wear parts of a computer and redesign them just as they did in automobile industry. Automobiles once required tune-ups every 5,000 - 7,000 miles. Now most new cars manufacturers recommend tune-ups at 100,000 miles. If engineers continue to evolve flash memory, the future of hard drives, CD/DVD drives, and computers as we know them today may be in jeopardy.

WEB SERVICES -- The latest trend in software offerings involves providing software as an online service. The normal path to Information Technology (IT) bliss involves spending money on expensive software licenses, purchasing servers to host software products, building an Intranet infrastructure, and hiring an IT staff to maintain and manage it all. However, Microsoft, 37 Signals, Google, and other companies are now making software available through the Internet as a service.[1,7] Current offerings include word processing, spreadsheets, project management, group chat, information management, collaborative writing, and searchable to-do lists to name a few.[1,7]

This new business approach is designed to leverage economies of scale, and alleviate the need for companies to purchase expensive hardware and IT staff to maintain and manage software configurations.[7] Microsoft, in particular, is targeting small to medium sized businesses in their software service marketing models.[7]

The concept of receiving software functions as a service via the Internet is appealing and has merits; however, it does not come without pitfalls. The relatively low costs may tempt startup and other small companies with a need to reduce operating costs in order to maintain profit margins. However, employees without Internet connectivity will not be able to work while flying on airplanes or on other pubic modes of transportation, in countries with poor communication services, in a city park, traveling in an automobile, etc. These employees will still require standalone software packages. Data storage and privacy matters are also issues to consider for the new business model. Although software services are provided over the public Internet, companies will want to ensure some level of control and protection over their proprietary information. Online software service providers will have to offer assurances of data integrity in order to earn customer trust, and once service providers address these and other issues, time will be the true test for this new marketing scheme.

BENCHMARKING -- Benchmarking is used in the computer industry as a comparative measure of performance, and is the result of running a standard computer program or sets of programs on various computer configurations.[10] The term was originally introduced by the land surveying industry as a point of reference for measurements.[10] Since its introduction, the term has found relevance in the finance, geolocating, venture capital and computing segments.[10]



On September 25, 2006, the Business Applications Performance Corporation or BAPCo® announced a joint venture with Ecma International to develop a new benchmark examining "performance-qualified energy efficiency of personal computers."[2] Their new product is intended to measure the energy consumption of computers as they are used in real world applications.

This new application of benchmarking has the potential to revolutionize the way consumers and businesses evaluate computer technology purchases. Currently the Federal Trade Commission requires certain electrical appliances have an EnergyGuide label listing annual energy consumption and costs as a comparative metric between appliances.[8] The work initiated by BAPCo® and Ecma International will help create a similar measure for computers as an additional metric for comparing hardware configurations. In his keynote speech at the Intel Developer Forum in September, Senior Vice President Pat Gelsinger highlighted this new initiative, and announced the PG&E electric company of California would soon begin offering rebates to customers who purchase energy efficient computer systems.[5] This is evidence the new benchmark will change the way people purchase computers and lead to credits from electric providers for those who choose energy efficient computer systems.

MOBILE COMMUNICATIONS -- As cellular telephone technology continues to evolve, mobile communication services are offering more and more functionality and changing the way people communicate. For example, Verizon wireless services offer customers text messaging, music, video, games, mobile web, digital camera, and various other tools and applications through their mobile telephones.[9] All of the other mobile telephone providers offer similar services as well.

As a result of these enhanced functions, products such as mobile web technology, advertising, marketing analysis, and user tracking are becoming more popular. The Wireless Watch Japan community recently featured an interview discussing the popularity of new DoubleClick Japan's Mobile Analytics software, which analyzes trends and usage by mobile web users.[13] The interview was conducted with the marketing manager for the new product, who discussed the surge in mobile marketing and advertising services in detail.[13] Furthermore, an article in *Business Week Online* last year announced Qualcomm's intention to begin offering television services through cellular telephones.[6] Hollywood is even developing a TV series in one minute snipets specifically designed to target the mobile market.[6]

The examples described above are signs of things to come, and how mobile technology is changing society. As a foreshadowing, I recently saw a commercial for a national mobile provider that predicted the direction of things to come. In the commercial a businessman was traveling a great distance to give a presentation and was dressed in his suit. The producers of the media intentionally showcased him in scenes where individuals such as his wife, stewardess, bellhop, and others asked if he needed anything, and his response was "No thank you. He had everything he needed." He left home without a suitcase, sped through check-in at the airport because he had no luggage to check-in or bags to pass through x-ray machines. When he arrived at his hotel there were no bags for the bellhop to carry in, and when he finally arrived at the meeting location he informed his sponsor he had everything he required right in his pocket. As he entered the room filled with business people, he removed a Blackberry style device from his pocket and immediately begin wirelessly transmitting the presentation to a projector that projected it on a screen at the front of the room. The commercial conveyed an unmistakable message; all consumers will need in the future is a mobile communications device, because it will do everything.

CONCLUSION -- merging technologies are often described as something on the leading or bleeding edge. In my experience, the leading edge of technology is best depicted as a serrated knife because there is no single identifiable blade that makes up the leading edge of technology. Rather, the leading edge is comprised of countless emerging technologies across a broad spectrum of market segments, and each has their own distinct periphery. Consequently, the topics covered in this paper represent just a small part of the leading edge and I hope they inspired some discussions around the water cooler until next time….

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