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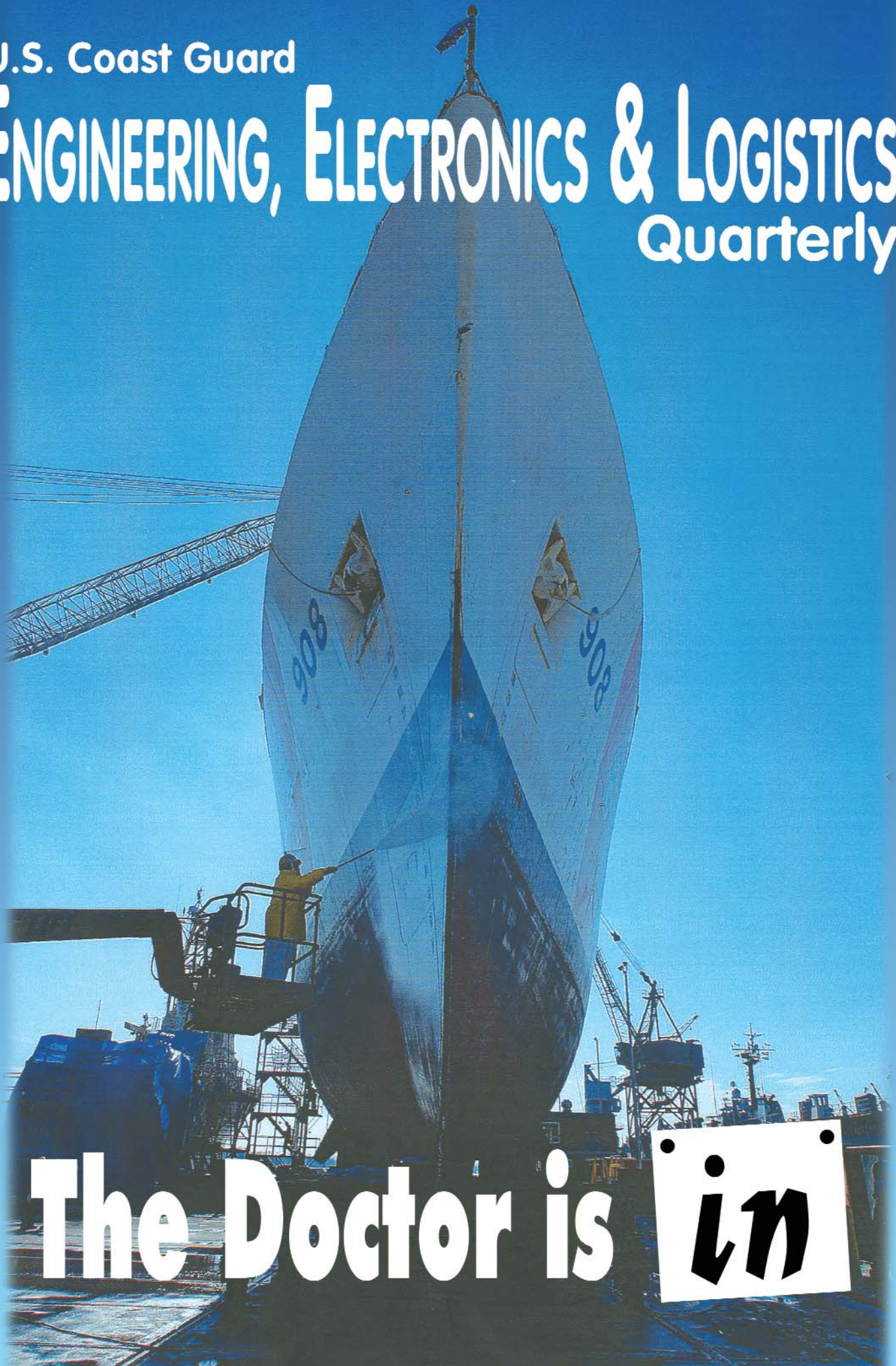
Spring 2006



The Doctor is in

Web site: www.uscg.mil/systems/EEL_QUARTERLY.htm

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Article and Photo Submissions:

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, UPS or DHL in hard copy and/or in Microsoft Word on a 3.5 disk, CD or e-mailed. 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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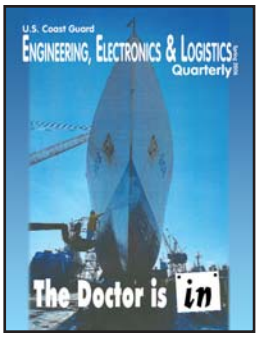

On the Cover: ***"Ship Repair IS Brain Surgery" -- Coast Guard Cutter TAHOMA in drydock at the Yard. Read more about this metaphor of the YARD as a ship's hospital on page 58 -- the Doctor is in!***

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Correction: In the Winter 2006 issue on page 40, second column RADM Gable should read RADM Gabel. We apologize for this misspelling.

On the Back: ***Petty Officer 1st Class Steven Huerta prepares to hoist two children into a Coast Guard rescue helicopter. The children were among many New Orleans citizens to be rescued from their rooftops due to flooding caused by Hurricane Katrina. U.S. Coast Guard Photo by Petty Officer 2nd Class Kyle Niemi***

From the Assistant Commandant

CG-4

Greetings and welcome to the Spring 2006 issue of the *Engineering, Electronics, and Logistics Quarterly* magazine. Since I last communicated with you, Coast Guard Engineers and Logisticians have been working overtime to ensure the Coast Guard remains mission ready. Whether repairing infrastructure ravaged by hurricanes or developing solutions to engineering problems at sea, ashore and in the air, our combined technical knowledge continues to play a critical role in Coast Guard mission success. It is this technical knowledge that is the basis for developing Technical Authority capabilities.

But what is Technical Authority? Technical Authority is a set of processes and policies to ensure that assets, both new and existing, are reliable, maintainable, safe, and ready to perform the missions required of them. The U.S. Navy has had a codified Technical Authority policy for several years; it is a new concept for the Coast Guard. Coast Guard Technical Authorities are responsible for implementing the processes and policies to deliver and maintain assets that meet the technical requirements needed to ensure operational readiness.

Who is the Coast Guard's Technical Authority? With so much going on in the development of new assets, systems, and logistics, it is often easy to forget that we already have engineers, technicians, and logisticians intimately familiar with Coast Guard missions, policies, and procedures. These same people are also well versed in the technical requirements needed to ensure that a sustainable, reliable, mission ready asset or system is available to the operational commander. Recognizing that we already have "technical authority" in place, we have embarked on the journey to codify the Coast Guard's Technical Authority program. The Technical Authority for engineering (air, surface, and shore) and

logistics is Commandant (CG-4). The Technical Authority for Command, Control, Communications, Computer and Information Technology (C4&IT) is Commandant (CG-6). Through our combined efforts, we will develop a Technical Authority policy to help ensure assets and systems are capable of meeting the operator's requirements in a safe and efficient manner through:

- **Technical Standards**: Technical Authorities establish, monitor, approve, and enforce technical standards, and policies for the assets and systems we procure and maintain.
- **Technical Expertise**: Technical Authorities are peers of industry, possessing the technical expertise and authority to convey exact standards and needs to industry partners with clarity.
- **Ensuring Safe and Reliable Operation**: Technical Authorities ensure safe and reliable operation through intelligent design, and through development and review of options, risk assessments, and certifications.
- **Judgment in Making Technical Decisions**: Technical Authorities are empowered to make authoritative technical decisions. We are the "go to" people when a decision is required, when design standards or practices are being deviated from, where safety of life at sea or in the air is at issue, or impact on mission effectiveness is of concern.
- **Stewardship of Engineering Capabilities**: Technical Authorities perpetuate the technical competencies of the Coast Guard by ensuring the right mix of talent, skills and infrastructure for the job.
- **Accountability and Technical Integrity**: Technical Authorities demonstrate integrity and exercise discipline to ensure the soundness of technical decisions.

While Technical Authorities are the "go to" people when a technical decision is required, we must remember that not all decisions are based solely on technical requirements. Cost, schedule, and mission impact play a vital role in decision making. Because of this, we must work as a team with our partners in the Acquisition and Response directorates. We must provide them with sound technical advice, determining which options are technically acceptable, and providing the risk and value assessments of those options so sound, informed decisions can be made.

In acquisitions of new assets and maintenance of current ones, it is essential that we maintain our position as a peer of industry. This position allows us to provide the inherently governmental function of oversight. From this oversight position, we have the capacity and ability to enforce technical standards ensuring assets are delivered and maintained with the inherent reliability and capability needed to perform our missions.

A necessary ingredient of technical authority is a sufficient number of trained and experienced staff to perform this inherently governmental function of oversight. Technical Warrant Holders are the personnel representing the Technical Authority who have responsibility over individual systems and/or equipment. These are the personnel in the field or at our engineering centers of excellence who have the knowledge and resources, and the delegated authority, to monitor, approve, and enforce technical standards and policies.

Technical Authority is integral to implementing the new centralized logistics model for the Coast Guard and the engineering core competencies. As we transition to a centralized model of logistics, each new product line will have personnel designated as Technical Warrant Holders. The assignment of a Technical Warrant will be based on the competencies, education, and experience of each individual. With each product line staffed with personnel holding Technical Warrants for their assigned areas of responsibilities, the product line will have the authority to establish and enforce technical standards.

Through the implementation of Technical Authority, we in the engineering and logistics communities will have the capabilities, competencies, and authorities to ensure compliance with technical standards.

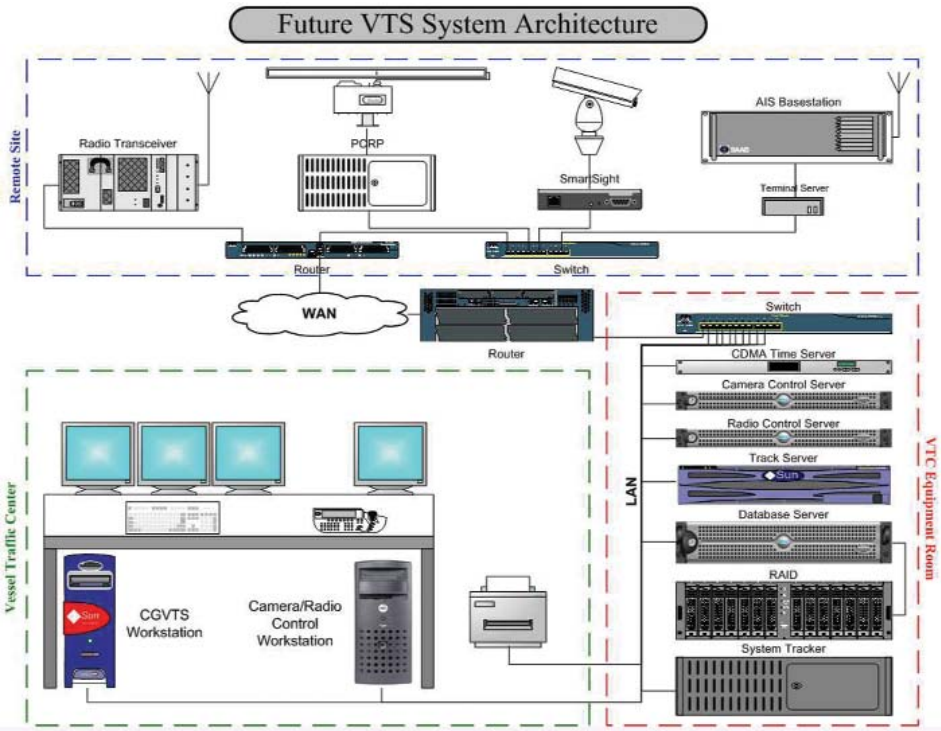
Although this policy is still being developed, it is important to understand that it is the knowledge, skills, and abilities of Coast Guard Engineers and Logisticians that will ensure our credibility within our organization and with our peers in industry. Thank you all for your service to the Coast Guard in this time of great change in the engineering and logistic communities. Through your efforts we will keep the Coast Guard "Semper Paratus."

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

Vessel Traffic Service Project
(C2CEN)

Last fall the Vessel Traffic Service (VTS) Integrated Project Team (IPT) hosted a week long Demonstration and Evaluation (D&E) of C2CEN's (Command and Control Engineering Center) internally developed Coast Guard VTS (CG-VTS) system version 4.6. The CG-VTS software application is built on top of the Department of Defense's (DoD) Common Operating Environment (COE), a software architecture shared by hundreds of CG and DoD applications from missile tracking programs to shipboard navigation systems. Several significant upgrades to the COE have occurred over the last 10 years since CG-VTS was first developed. As a result, a significant overhaul of the system is being undertaken to allow compatibility with the latest COE components.

The D&E is one of many steps being taken by C2CEN's engineers to engage our customer early and often during the software development cycle to ensure our product meets the requirements of the program manager and the end-users. Five representatives from VTS Puget Sound and San Francisco attended the D&E, including operators, watch supervisors and site administrators; each providing a unique perspective on how the CG-VTS system should be designed to meet their specific needs. These five individuals were joined by over 20 members of C2CEN's VTS integrated product team of engineers, software developers, support personnel and system testers for a two day presentation of the system. The presentation highlighted hardware and software architectures, database design and data flow within the new application. This was followed up by a two day hands-on evaluation of the system in the C2CEN VTS lab. Two separate systems were loaded and configured covering the San Francisco and Puget Sound areas, allowing the operators to feel right at home working in their own geographic environment. Simulated radar video and AIS tracks were injected to each system using newly acquired Buffalo Computer Graphics simulators, creating an extremely realistic test environment. By the end of the week over 100 comments and discrepancies were collected from the attendees and communicated to the software developers, affording our guests the opportunity to directly impact the end product. C2CEN greatly appreciates the support of Sector Seattle and San Francisco commands who allowed their talented personnel to participate in this event, which will greatly contribute to the successful fielding of CG-VTS 4.6 in 2006. POC: LT Dean Milne (757) 686-4237.



Sector Command Center, Terma Scanter 2001 Frequency Diversity Radar (C2CEN)

In response to the call for increased Maritime Domain Awareness (MDA) in American ports, the U.S. Coast Guard Command and Control Engineering Center (C2CEN) recently installed the first Terma Scanter 2001 Frequency Diversity (FD) Radar system in the United States. The radar is now operational and is part of the Sector Command Center sensor suite for the Joint Sector Command Center (SCC-J) at Hampton Roads, VA. The Terma FD, which is the state of the art in coastal surveillance technology, combines several advanced technologies to provide enhanced detection capability and improve the detection of small targets in severely cluttered environments.

First, the system employs a 21-foot, high-gain, circularly polarized array, this high-gain antenna provides improved resolution over smaller arrays to give a more accurate picture of the target environment. Circular polarization is used to reduce clutter from rain and sea spray.

In addition to the advanced array, the Terma FD system comes equipped with a highly sensitive receiver. The receiver uses Low Noise Front-end technology and has a high-dynamic range. This increased sensitivity can actually lead to better performance over higher power systems as it allows the Terma FD to pull small targets out of the noise floor.

Finally, the Terma FD uses the Frequency Diversity concept to provide enhanced capabilities. The Terma FD simultaneously transmits on two separate carrier frequencies which is the basis of the Frequency Diversity concept. All slotted waveguide antennas transmit their beam at different angles based on the carrier frequency. Thus, the two beams transmitted by the Terma FD are sent out in slightly different azimuth directions. Target detection is improved through careful processing of the return signals. For example, the time diversity provided by the FD concept removes sea clutter. Since the correlation time for sea-clutter sources is less than the time between successive scans by the two beams, the effect of these sources is reduced. Also, the FD radar can better compensate for target fluctuations.

C2CEN plans to test the FD radar's performance in various weather conditions against a variety of targets. Performance of the radar will be documented and provide a baseline against which other radar systems can be compared. The testing will use large targets of opportunity and smaller controlled targets. The radar output will be recorded and analyzed to determine detection performance. These results will be compared to computer models generated at C2CEN using the Computer Aided Radar Performance Evaluation Tool (CARPET) radar modeling software to see how well the real world system compares to the theoretical models. The goal of the testing is to provide data for a cost-benefit analysis to determine if the increased cost of fielding the Terma radar corresponds to significant enhancements in the Coast Guard's MDA. SCC Point of Contact: LT Rothberg (757) 686-4265.

Terma Scanter 2001 Frequency Diversity Radar installation in Virginia Beach, VA.

USCG and DHS Environmental Awards (CG-443)

The Department of Homeland Security (DHS) and the U.S. Coast Guard are assessing award nominations from field units describing original and positive environmental actions taken during the last year. Many criteria for the two award programs are similar, and highlight partnerships in education and outreach (both internally and public), innovative waste and energy reduction practices, and sustainable design practices for building construction and renovation that are also cost effective. This year there were 20 Coast Guard nominations submitted from units, teams and individuals, with categories ranging from recycling to minimizing petroleum use in transportation, to natural resource management and protection. The Coast Guard Environmental Award program has closed its call for nominations, and the Awards Panel met on January 4, 2006 to select USCG winners. The DHS Environmental Achievement Award was developed in 2004, and addresses waste/pollution prevention, recycling, green purchasing, sustainable design/green buildings, environmental management systems, minimizing petroleum use in transportation, natural resource protection and management, the National Environmental Policy Act (NEPA), and historic and cultural resource management. The DHS award nominating period closed in January, 2006. Both programs feed into the White House Closing the Circle Award, which recognizes outstanding federal efforts which result in significant contributions to, or have made a significant impact on promoting environmental stewardship. Criteria for the DHS and WHCTC award are available on www.ofee.gov. Point of Contact is Ken Malmberg at 202-267-6214.

Yard Celebrates 50th MK 75 Gun Repair (Yard)

Current, former and retired members of the Yard Ordnance Shop and the Engineering Logistics Center's Ordnance Program Management Branch recently gathered for a group photo to commemorate the 50th overhaul of the MK 75 76mm weapons system. The MK 75 gun repair program began at the Yard in 1989, and today is one of the major product lines of the Ordnance Shop.

The Yard is the sole source for major repair of naval weapons systems on the Coast Guard fleet and is the only active MK 75 gun overhaul facility in the United States.

The MK 75 is used on 378' high endurance cutters and 270' medium endurance cutters. Other shop projects include overhaul of the MK 38 machine guns on 378', 210' and 110' cutters as well as repair of the MK 92 companion radar to the MK 75 gun, used for detection and target lock-in.

Yard Completes 41' UTB Project Ahead of Schedule & Under Budget (Yard)

In a cooperative effort between the Yard, C2CEN, Maintenance & Logistics Command (MLC) Atlantic, MLC Pacific and the operational community, the 41' Utility Boat fleet's service life has been extended, in addition to providing enhanced operational functionality for the deck plate sailor. The project, known as SINS (Small Integrated Navigation System), replaced antiquated stand alone Radar, Global Positioning System, Depth Sounder and Differential Global

Positioning System equipment with a modern Integrated Navigation System. By integrating these systems into one package, SINS provides greater capability for boats to respond to maritime distress calls and coordinate response operations. Having new electronics equipment also benefits the maintenance community by eliminating the need to support obsolete and unsupportable equipment and has reduced the number of trouble calls. Improving equipment reliability and availability also translates into increased platform readiness.

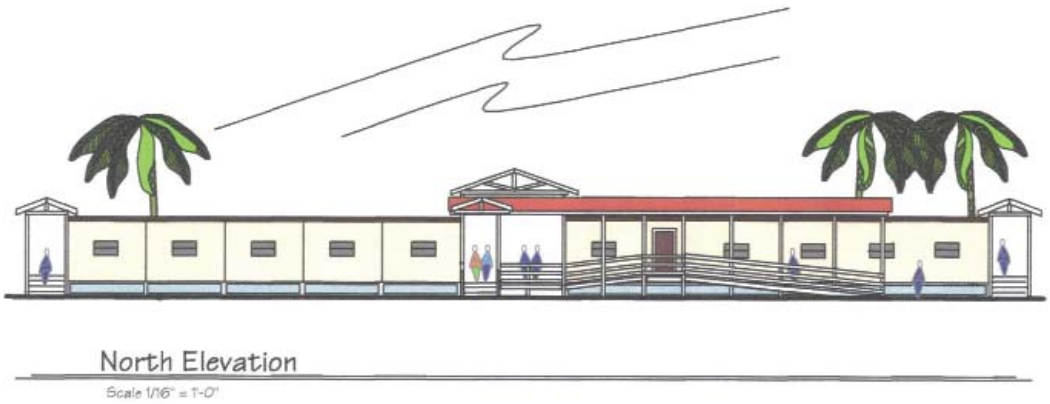
The project began in July 2002 with a target completion date of September 30, 2006. The Coast Guard tasked the Yard to develop an equipment design plan, engineering change requests, system operational verification tests and updated class drawings in addition to developing and executing an aggressive road-show travel plan.

The Yard completed SINS installations on 160 41' platforms. On October 24, 2005, the Yard outfitted 41313 in Hawaii, completing the project ahead of schedule and $600k under budget.

Members of the Yard installation team have been recognized by the First District's Meritorious Team Commendation for their accomplishments and contributions. The Yard is currently involved with SINS installations on 47' Motor Lifeboats, 55' Aids-To-Navigation Boats and the early version of the Over-the-Horizon boats to further enhance operational, maintenance and logistics Coast Guard needs. The high-technology features of SINS have one primary purpose -- improved response time to save lives.

Interim Facilities for Station Gulfport (CEU Miami)

Station Gulfport was completely destroyed by the 20 foot storm surge from Hurricane Katrina. Civil Engineering Unit (CEU) Miami was tasked with standing up temporary facilities so that operations could be restored to the Mississippi Coastline (see article page 30). Realizing the temporary facilities were not adequate for the two years it would take to rebuild the station, CEU Miami developed an interim facility plan utilizing modular buildings. The buildings were placed in the parking lot of the Gulfport Oceanarium, which was also destroyed by the hurricane, and all utility tie-ins were brought in from the local points of connection. The modular buildings had been used as a temporary facility for an oil drilling operation in Alberta Canada and brought down for complete renovation on site. Integrated Support Commands New Orleans and St Louis provided skilled labor to complete all the utility connections and interior renovations. Overall, executing this project using the used modular buildings saved five months and 25% over purchasing new facilities which were already in high demand from the 2004 hurricane season. The drawing is a rendering of the completed interim facilities.



An artist rendering of the interim modular facilities for Station Gulfport.

With Congress passing a portion of the hurricane supplemental funding in December 2005 enough funds were obtained to construct the new facility. Facilities and Design Construction Center Atlantic is charged with building the new facility with an estimated cost of $13.5M and construction duration of approximately two years.

Jeffery G. Orner, *CG-4's Deputy Assistant Commandant for Engineering and Logistics*

Mr. Orner has been a member of the Senior Executive Service since July 1999. He assumed responsibilities as Deputy Assistant Commandant for Engineering and Logistics in November 2005.

As the Deputy Assistant Commandant for Engineering and Logistics, Mr. Orner is responsible for all Logistics and Engineering (Naval, Civil, Aeronautical and Industrial) for the Coast Guard's $25 billion capital plant consisting of 23,000 facilities, 230 ships, 1,800 boats and 200 aircraft. He also leads more than 2000 personnel located at Coast Guard Headquarters and at three major Headquarters commands.

Mr. Orner was the Executive Director of the Naval Supply Systems Command (NAVSUP) from 2001 to 2005. As the Command's number two official, Mr. Orner led a worldwide work force of over 24,000 military and civilian personnel, engaged in supply chain management operations. He was also the leader of the Navy's logistics community.

From 1998 to 2001, he was the Assistant Deputy Commander, Fleet Logistic Support at the Naval Sea Systems Command. As NAVSEA's senior logistician, he led NAVSEA's efforts to improve the efficiency and effectiveness of Fleet support processes, programs and information technology. He established and led the team that developed the Distance Support program. The Naval Sea Logistics Center reported to him.

From 1993 to 1998, he was an Assistant Program Executive Officer for Mine Warfare, where he led a nationwide team, working on life-cycle cost reduction initiatives, logistic support matters, major

fleet readiness improvement efforts, and the establishment of disciplined configuration management processes for 25 system and ship acquisition programs and over 70 in-service systems.

He was the Configuration Management and Logistic Support Branch Head in the NAVSEA Surface Combatant Program Office from 1988 to 1993. There he led a team that managed the readiness, configuration management, maintenance and support of all non-AEGIS surface combatant ships in all life cycle phases, including shipbuilding, major modernization and in-service support.

The Department of the Navy hired Mr. Orner in 1982 as a graduate cooperative education student. When he graduated from that program, NAVSEA selected him into a position in their Fleet Logistic Support Directorate, where he worked on business process improvement efforts, including configuration management and the Fleet Modernization Program and related educational efforts.

A native of Ebensburg, PA, Mr. Orner holds a Bachelor of Arts Degree from Wittenberg University in Springfield, Ohio, and a Master of Science Degree from The American University in Washington, D.C. He is a member of the Acquisition Professional Corps, certified in Program Management and in Life Cycle Logistics.

Mr. Orner has received both the Navy Meritorious Civilian Service Medal and the Navy Superior Civilian Service Medal. Mr. Orner was the first winner of the Admiral Stan Arthur Award for Logistics Excellence (CNO Logistician of the Year Award) and the NAVSEA Logistician of the Year Award. In April 2004, the NAVSUP civilian and military team was awarded a Meritorious Unit Commendation, in recognition of the Command's business transformation, and its superior mission performance. Mr. Orner was awarded the Presidential Rank Award of Meritorious Executive by the President of the United States in 2005.

President Signs Homeland Security Spending Bill

Deepwater

Deepwater Funding Sustains Program Momentum

by Capt. Gordon I. Peterson, USN (Ret.)

Joined by legislators, cabinet members and law enforcement officials, President Bush signed the Homeland Security Appropriations Act for fiscal year 2006 during a White House ceremony on October 18 [2005]. The bill provides for $933.1 million in funding for the Integrated Deepwater System as part of the Coast Guard's overall appropriation of $7.8 billion. This level represents a 29 percent increase over last year's Deepwater funding of $724 million to modernize and recapitalize the Coast Guard's inventory of cutters, aircraft and supporting systems.

"This bill will help us identify terrorists seeking to enter our country, safeguard our cities against weapons of mass destruction, and better prepare the federal government to respond to catastrophic events," Bush said.

ADM Thomas H. Collins, commandant of the Coast Guard, expressed his gratitude to the House and Senate for their strong support in providing needed funding for the year ahead, particularly for the Deepwater Program. "This funding will allow us to modernize our ships and aircraft in accordance with a recently revised implementation plan," he said. "Most importantly, it will ensure that, for now and into the future, our Coast Guard men and women will have the tools needed to provide the safety and security the American public deserves and expects."

Deepwater

President George W. Bush is joined by legislators, cabinet members and law enforcement officials last October in the East Room of the White House as he signs the Homeland Security Appropriations Act for fiscal year 2006. The appropriation's $933.1 million in Deepwater funding will sustain the program's momentum in modernizing and recapitalizing the Coast Guard's aging legacy assets. White House photo by Paul Morse.

According to Deepwater Program officials, increased asset funding will yield essential system-wide capability for the Coast Guard's maritime homeland security missions and sustain operational effectiveness in all of the service's multiple military and maritime responsibilities -- contributing to the top budget priorities to recapitalize the Coast Guard, implement the Maritime Strategy for Homeland Security and enhance mission performance.

"Our budget for fiscal year 2006 is a critical first installment in executing the revised post-9/11 Deepwater implementation plan approved in 2005," said RADM Patrick M. Stillman, Deepwater's program executive officer. "This funding will sustain the momentum we have developed over the past year. Like the Commandant, I am very appreciative of the support provided by the Department of Homeland Security, the administration, and Congress."

The Deepwater Program's revised post-911 plan provides for progressive modernization, conversion and recapitalization of the Coast Guard's aging legacy fleet. Its requirements for improved operational capabilities are fundamental to the Coast Guard's ability to deliver required levels of operational excellence. "The Deepwater Program is very much about reducing risk in the maritime domain," Stillman said. "Continued risk reduction is contingent upon improving the Coast Guard's capability, capacity, and readiness."

"A Critical First Installment" for Deepwater's Post-9/11 Plan

The Fiscal Year 2006 appropriation of $933.1 million for the Integrated Deepwater System (IDS) will enable each program domain to advance in important ways -- a "critical first installment" on the program's revised post-911 implementation plan according to RADM Patrick M. Stillman, IDS program executive officer.

The fiscal year 2006 appropriation will provide for:

- Procurement of long-lead material for and production of the third National Security Cutter;
- Continuation of design work for the first Offshore Patrol Cutter, five years ahead of the original schedule;
- Completing the design and acquiring long-lead materials for the first Fast Response Cutter, now scheduled for delivery in 2008, 10 years ahead of its original schedule;
- The next phase of the Eagle Eye Tiltrotor Vertical-Takeoff-and-Landing Unmanned Aerial Vehicle (VUAV), including mission sensor packages and ground control technology;
- Accelerated re-engining of operational HH-65 helicopters ahead of the original schedule using two production lines;
- Service-life extension and conversion of HH-60 helicopters and HC-130H long-range search aircraft into Deepwater end-state aircraft and continued missionization of the Coast Guard's six HC-130J aircraft;
- Service-life extension and electronics upgrades for legacy medium endurance cutters; and
- Continued development of Deepwater's interoperable network-centric system for command, control, surveillance, reconnaissance and intelligence sharing to improve maritime domain awareness and provide a common operational picture.

Stillman also sees the Deepwater Program as a key enabler in the Coast Guard's implementation of the new National Strategy for Maritime Security signed by President Bush in September [2005]. "Without the basic building blocks that Deepwater delivers, successful implementation of maritime security strategies would not be sustainable," he said.

HC-130J Missionization

The Deepwater Program also recorded important milestones in its aviation and surface domains during the final months of the last fiscal year.

In September, a $117.5 million contract was awarded to Integrated Coast Guard Systems (ICGS, a joint venture between Lockheed Martin and Northrop Grumman) to missionize six HC-130J long-range search aircraft. The contract will fund system modifications that will lead to more-capable aircraft needed for the Coast Guard's full range of post-9/11 missions.

"The missionized HC-130J will add an important dimension to the Coast Guard's inventory of aviation assets," said Stillman. "Its performance, improved sensors, modern communications systems, and full interoperability with other platforms will pack more punch than our older legacy assets -- an important consideration given the Coast Guard's expanding mission requirements for maritime homeland security."

Current plans call for the first HC-130J to begin the modification process in January 2007, following final system design and engineering, with delivery projected nine months later. The final aircraft is slated to be missionized by July 2008.

Modifications to the HC-130J will result in approximately 90 percent commonality in C4ISR (command, control, communications, computers, intelligence, surveillance and reconnaissance) systems planned for the Coast Guard's CASA CN235-300M maritime patrol aircraft. Sensors shared by both aircraft will include the electro-optical/infrared-FLIR Systems Star Safire III, DF-430 UHF/VHF Direction Finder System, and SAAB Transponder Tech AB R4A Airborne Automatic Identification System (AIS). The HC-130J's radar systems will feature the proven multimode EDO EL/M 2022A(V)3 maritime surface search radar, mounted beneath the plane's fuselage, and a nose-mounted APN-241 weather radar.

Deepwater program officials say that the Coast Guard's contract award for HC-130J missionization reflects concerted public-private collaboration between multiple

Construction of the first hull in the Coast Guard's new class of National Security Cutters, shown here at Northrop Grumman Ship Systems yard in Pascagoula, Miss., was approximately 30 percent completed as 2005 drew to a close. NGSS Photo

offices at Coast Guard Headquarters, the Aviation Repair and Supply Center (ARSC, Elizabeth City, NC), and industry.

The Coast Guard will missionize six HC-130J aircraft to deliver more capable fixed-wing platforms to meet post-9/11 missions. The aircraft will provide improved surveillance capabilities and organic heavy air transport for the Coast Guard's Maritime Safety and Security Teams, Port Security Units and the National Strike Force. Photo by U.S.Coast Guard.

"We worked hard with multiple partners to define a solution to missionize these six aircraft in a way that leverages the existing design of our maritime patrol aircraft, as well as industry's past work with the U.S. Air Force's C-130H program," said CAPT Matthew J. Sisson, the Deepwater Program's air domain program manager. "It truly was an all-hands effort. By obtaining high levels of commonality in each aircraft's systems for sensors and communications, we have paved the way to reduce overall program cost, increase capability, and decrease schedule risk," he said.

Deepwater program officials credit the role of ICGS as a systems integrator in moving the HC-130J modernization forward with minimum delay. "We requested ICGS to deliver, install, and test the necessary mission equipment for our HC-130Js so that they can meet the performance requirements identified in the Coast Guard's Aviation Asset Performance Specification," Sisson said. "As part of the Deepwater Program, this process will ensure integration and interoperability with all new and existing aviation assets, including our legacy fleet of HC-130H aircraft."

With 27 HC-130H and six HC-130J aircraft in service, the U.S. Coast Guard is one of the largest operators of the surveillance/patrol version of the venerable C-130 Hercules transport aircraft. While equipped for long-range surveillance, the HC-130 also can be converted quickly for cargo and personnel transport, including the handling of oversized equipment.

In response to declining readiness and availability rates in the Coast Guard's aging HC-130H fleet, Congress provided funding in the fiscal year 2001 military construction appropriations bill to acquire six HC-130J aircraft. In addition to its more-capable systems, the missionized HC-130J also will provide improved mission capability with improved fuel efficiency, higher availability, and greater range and endurance.

The primary role of the Coast Guard's long-range search aircraft is to meet the long-range maritime patrol requirements in the vast Pacific Ocean areas that cannot be accomplished by the medium-range CASA surveillance aircraft. Additionally, the HC-130H/J will provide organic heavy air transport for the Coast Guard's Maritime Safety and Security Teams, Port Security Units and the National Strike Force.

Fast Response Cutter's Design Moves Forward

The Deepwater Program's Fast Response Cutter (FRC), the smallest of three classes of new cutters planned to recapitalize the Coast Guard's legacy surface fleet, also moved a step closer to early production with the success-

Fast Response Cutter

Length: 140 ft.
Displacement: 325 LT
Maximum Speed: 30-plus knots
Endurance: 5-day threshold, 7-day objective
Range: 4,230 nautical miles
Propulsion: (4) 3,650 BHP Diesel Engines
Aircraft: None
Boats: (1) Short Range Prosecutor
Armament: 25 mm gun, .50-caliber machine gun mounts

ful completion of its preliminary design review in mid-September.

"This successful milestone keeps the Deepwater Program on track to advance the design and construction of the FRC by 10 years to deliver an early replacement for our aging patrol boats -- a modern cutter well-suited for the Coast Guard's post-9/11 missions," Stillman said.

Current plans call for ICGS to begin construction of the first-of-class ship next summer or fall for delivery in early 2008. This first cutter will undergo extensive testing and evaluation before follow-on hulls are constructed. The 140-foot composite-hull craft will be manufactured in Gulfport, Miss., at Northrop Grumman Ship Systems' Composites Center of Excellence. The company's Gulfport facility re-opened in late September after three weeks of clean-up and recovery operations following Hurricane Katrina.

"ICGS and Northrop Grumman brought us a world-class design for the FRC," said CAPT Michael Anderson, Deepwater's program manager for surface platforms. "The cutter's glass-reinforced, plastic-laminate composite hull will be well-suited for the Coast Guard's demanding operating environments, especially in temperate zones characterized by warmer water conditions -- contributing to reduced maintenance and higher availability." Anderson lauded the joint ICGS/NGSS/Lockheed Martin/Coast Guard FRC team for its exceptional preparation and perseverance to overcome unexpected obstacles posed by Hurricane Katrina to conduct a very successful preliminary design review.

Deepwater Program officials say the maturing design has the FRC firmly on track to operate at speeds greater than 30 knots with exceptional sea keeping and performance characteristics. The cutter will be able to deploy independently to conduct the Coast Guard's full range of multiple missions, including fishery patrols, law enforcement, maritime security, search and rescue, and national-defense operations. The FRC will carry one 25-foot "Short Range Prosecutor" (SRP) small boat capable of stern launch and recovery.

"The FRC is being designed to provide the Coast Guard with a state-of-the-art patrol craft that is capable of conducting simultaneous missions," said Mike Duthu, FRC program manager for ICGS. "We understand the resulting increased op-tempo and complexity of operations that will be required of the crew, and the cutter has been designed for enhanced quality of life, specifically with regard to berthing, sea keeping and speed in a seaway. The design also includes additional volume for mission planning and execution and crew training."

The FRC will have a 35-year hull life and was conceived from the keel up to be interoperable across existing and future Coast Guard assets. Its command-and-control system, for example, is a derivative of the larger system planned for the Deepwater Program's National Security Cutter (NSC) -- also being designed and built by Northrop Grumman Ship Systems at its facility in Pascagoula, Miss. The first hull in this class of large NSC cutters was nearly 30 percent complete by late September according to ICGS.

The FRC's design review allowed ICGS to present the Coast Guard with the ship's formal design concept and to confirm that its requirements are sufficiently developed. This entailed detailed review of hull, mechanical and electrical (HM&E) design, C4ISR (command, control, communications, computers, intelligence, surveillance and reconnaissance) capability and logistics support.

The cutter's critical design review, its next program milestone in the ship-design cycle, is projected for late this year [2005] or early in 2006.

"I am very proud of this team and the work they have accomplished to continue development of this program in service to the U.S. Coast Guard," said Phil Teel, ICGS chairman and president of Northrop Grumman Ship Systems. "When we see what the Coast Guard accomplishes every day, and particularly in times of need, we are passionate about pressing onward, working to bring the superior capabilities of this vessel to the fleet to put to use as soon as possible."

Capt. Peterson, a senior technical director with the Anteon Corporation's Center for Security Strategies and Operations, is assigned to the Integrated Deepwater System's program office.

RADM Patrick M. Stillman, program executive officer for the Deepwater Program, right, presents an award to Mr. Royce Winbush, Northrop Grumman's general ship superintendent for the first National Security Cutter, during a brief ceremony in Pascagoula, Miss., Nov. 17, 2005. The award honored the shipbuilding team's performance recovering from Hurricane Katrina's damage.

Tow Tank Testing Guides Cutter Design Effort

by Capt. Gordon I. Peterson, USN (Ret.)

Navies around the world have tested accurately scaled ship models in large tow tanks and basins for more than 100 years. Experiments using tethered and radio-controlled free-sailing models allow naval architects to determine a hull design's performance in calm water and waves as well as to measure hydrodynamic impact loads and other forces critical to a ship's performance, sea keeping and safety.

The Deepwater Program's Fast Response Cutter (FRC), which successfully completed its preliminary design review in mid-September [2005], is undergoing a year-long series of tow tank tests to accumulate more-detailed data and information. The cutter's design for a stern ramp for small boat launch-and-recovery operations is an area of special interest.

Despite the introduction of modern tools like computer-aided design, computational fluid dynamics modeling and tow tank experimentation continues to play an important role in the design and construction of naval and commercial ships.

New Breed of Cutter

"When you're developing something from several good ideas, you want to validate the overall characteristics early on to obtain good sample data," said Diane Burton, a naval architect and engineer assigned to the Deepwater Program as its surface technical director. Although the FRC's composite-hull benefits from the successful designs of comparably sized ships around the world, it will be a new breed of cutter.

"It's a new design," Burton said, "which is one reason our model test series is so rigorous." Burton brings more than 25 years of experience to the process, including past assignments as a naval architect and systems-engineering manager with the Naval Sea Systems Command.

The cutter's first phase of tow tank testing involving a 1:7.5-scale model began last July with water resistance and flow tests. They progressed in subsequent months to cover launching and recovery of a scale model of a Rigid Hull Inflatable Boat (RHIB), sea keeping and maneuvering. In February, tests were conducted on the design of the FRC's propeller to measure its cavitation characteristics.

"Later," said Burton, "we can enter more detailed data into our model for seas around the world to refine our design."

According to Burton, the use of composite materials instead of steel during construction of the first FRC will have no bearing on the current series of model testing.

PHOTO ABOVE: Scale models of the Fast Response Cutter (FRC) and its Rigid Hull Inflatable Boat (RHIB) are tested in the tow tank at the Maritime Research Institute Netherlands (MARIN). Data recorders for the test are located to the left of the towing carriage. The free-sailing FRC model is steered by autopilot. The free-sailing, radio-controlled RHIB model, shown here entering the FRC model's stern ramp, is steered by a trained operator. Photo Courtesy of Northrop Grumman/MARIN.

"Our ship models are accurately scaled to the FRC's lines," she said. "In fact, because a composite hull is molded, we are able to build our models to more accurate dimensions."

Model testing and computational studies of the FRC are being performed at the Maritime Research Institute of the Netherlands (MARIN). According to Dr. John Hackett, director of advanced ship design, hydrodynamics and signatures for Northrop Grumman Ship Systems, one of the Deepwater Program's industrial partners under contract to design and build the FRC, Northrop Grumman has relied on MARIN's services for the last 20 years. An internationally recognized authority on hydrodynamics founded in 1929, MARIN's world-class facilities and staff of research scientists specializing in hydrodynamics are making important contributions to the development of the highly capable small cutter. Delivery of the first hull in the class is projected for 2008.

The first round of the FRC's boat-recovery model tests concentrated on global design features. Experiments covered such issues as the desired speed for RHIB recovery operations, the effectiveness of the design's water-management system and various types of doors for the stern ramp. The FRC's "boat pocket geometry" of ramp and flare, angled bulkheads, batter boards and bunks also were confirmed. Subsequent tests entailing launching and recovery of the radio-controlled RHIB allowed design refinements.

The FRC's design builds on earlier testing and analysis of the Bertholf class of National Security Cutters -- at 418 feet the largest of Deepwater's three classes of modern cutters. The FRC's design also will benefit from the study and observations of other navies and coast guards around the world, especially those in northern Europe.

"Because northern European navies generally operate in much higher sea states and extreme conditions," Burton said, "we have learned a great deal from studying their ships and operations."

Early Results Positive

According to Burton, the FRC's tow tank tests are proceeding on schedule, and preliminary results are positive from several perspectives. "This vessel acts more like a larger combatant in the seaway," she said. "It seems to be more stable, and we have no major issues or challenges at this time. We have tested every combination of headings, speed, and wave height to try to simulate a broach, and we never saw one."

Phase three testing in August [2005] demonstrated the FRC was a very stable platform in sea states three to five. Recovery of the RHIB was judged effective.

Still, Burton interjects a note of caution in her assessment. "Everything we have seen so far is based on observations," she said. "We need to see the results of our detailed data analysis and compare it against our requirements and other factors. This assessment will allow us to continue to validate and refine the FRC's design." Following delivery of the first-in-class, 140-foot FRC in 2008, current plans call for it to undergo extensive operational testing and evaluation before follow-on composite hulls are constructed.

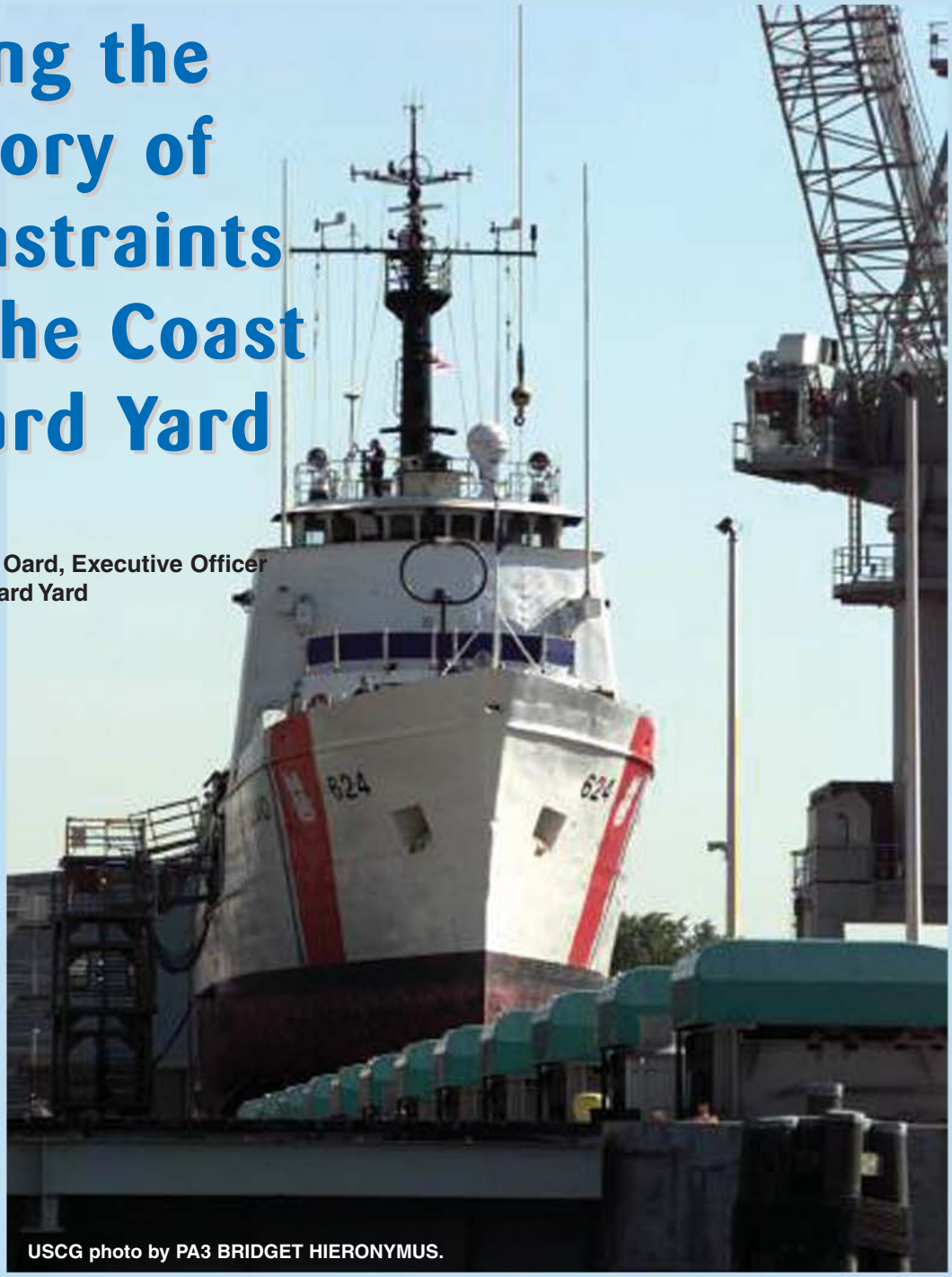
Future model tests in the tow tank also will evaluate improvements to other hulls, such as the Offshore Patrol Cutter's stern launch-and-recovery system, including procedures for capturing larger 11-meter RHIBs. Final validations, however, will come from full-scale trials.

Capt. Peterson, a senior technical director with the Anteon Corporation's Center for Security Strategies and Operations, supports the Deepwater Program at Coast Guard Headquarters.

The Fast Response Cutter's design for a stern ramp for small boat launch-and-recovery operations is an area of special interest during tow tank testing. Here, a radio-controlled scale model of a Rigid Hull Inflatable Boat enters the cutter's stern ramp during a test sequence. Realistic model testing in varied wave conditions will lead to continued refinements in the ramp's design. Photo courtesy of Northrop Grumman/MARIN.

Using the Theory of Constraints at the Coast Guard Yard

by CDR Marty Oard, Executive Officer
U.S. Coast Guard Yard



USCG photo by PA3 BRIDGET HIERONYMUS.

Coast Guard Naval Engineers, the Atlantic Area (LANTAREA) (Aof) staff and cutter crews that have visited the Yard since the summer of 2004 have probably heard of the Theory of Constraints (TOC), but may not understand many of the concepts that make up this theory. If you do not work in any of these programs or places, you may have never heard of TOC. The TOCs was best known in D. Eli Goldratt's 1984 book, *The Goal*. The TOCs can be applied to any process (supply chain, manufacturing, project management, …). As an aside, Goldratt's book should be mandatory reading for all managers, and is one of the most enjoyable books you will ever read. This book is mandatory reading in many MBA programs at universities throughout the United States. D. Eli Goldratt also published a book titled *Critical Chain* in 1998, another very good read. This book fleshes out his application of the TOCs in the field of project management using a novel (story) format. To learn more about this specific application of the TOCs, read my article titled, "Implementation of Critical Chain Project Management (CCPM) at the Yard" (found on page 22).

As is often the case, innovation or the need to change is born in the face of adversity. In 2003, the Coast Guard Yard's performance for on time delivery was deficient. On average, each cutter was delivered 28 days late, as measured from the initial expected date of delivery. Yes,

there were many rationale reasons (significant growth work, the rainiest summer in almost 100 years and a hurricane) for these late deliveries. However, from the operational commander's perspective, the situation needed to improve. The operational pain was just too great. From the maintenance perspective, the fleet was (still is) in poor shape (lots of structural deterioration; frequent and significant Casualty Reports (CASREPS)). What was needed was a way to complete more repairs in the given time frame with manageable risk. This was the Yard's goal, and this is where the TOCs helped meet the Yard's needs.

Important TOC Definitions

Throughput: The rate at which the system generates money through sales. This is considered to be the same as Contribution Margin (selling price -- cost of raw materials). Labor costs are considered to be part of Operating Expense rather than throughput.

Inventory: All the money the system invests in things it intends to (or could) sell. This is the total system investment, which includes not only conventional inventory, but also buildings, land, vehicles, plant and equipment. It does not include the value of labor added to Work-In-Process inventory.

Operating Expense: All the money the system spends in turning Inventory into Throughput. This includes all of the money constantly poured into a system to keep it operating, such as heat, light, scrap materials, depreciation, etc. (Sytsma, 1997, p. 2).

The five steps for applying the Theory of Constraints

1. **Identify system constraints.** Additionally, all identified constraints should be prioritized. This will ensure the greatest attention is focused where it is needed most.

2. **Decide how to exploit the system constraints.** This is a two part process. First, plans need to be made for resolving the constraints identified in step 1. Second, all parts of a system or process that are not constraints should be managed such that their throughput is only enough to match the output of the constrained resources. This will result in reduced costs and freeing up resources that can be better utilized elsewhere. NEVER let non-constrained portions of a system over produce! Over production never moves an organization closer to its goal.

3. **Subordinate everything else to the above decision in Step 2.** Since the constraints keep an organization from achieving its goal, all available resources should be utilized to help break them down. Constraints are not acts of God. In practically all cases, their limiting impact can be reduced or eliminated.

4. **Elevate the system constraints.** As resources are focused on breaking a constraint (also called elevating a constraint) at some point the constraint will no longer be a constraint. The constraint will be broken.

5. **If the constraint is broken, return to Step 1.** Once the existing limiting factor (constraint) is resolved another constraint, somewhere else in the system, will become the new limiting factor (highest priority constraint). (Sytsma, 1997, p. 1).

Finally, the TOCs use the following measures as a method of tracking progress toward an organization's goal.

Net Profit = Throughput - Operating Expense
Return on Investment (ROI) = (Throughput - Operating Expense) / Inventory
Productivity = Throughput / Operating Expense
Turnover = Throughput / Inventory
(Sytsma, 1997, p. 2).

Using the Theory of Constraints at the Yard

In the fall of 2003, the five general steps of the TOCs were used to analyze the Yards woes with the following results.

Goal: The Coast Guard Yard's goal is to accomplish all requested vessel repairs within a specified time period.

Throughput: The Coast Guard Yard's throughput is measured by the number of cutter days it saves or loses the Coast Guard.

Inventory: This includes the cost of all materials (steel, cable, paint, welding rods, wire, etc.) and the hours of labor available to accomplish vessel repairs.

Operating Expense: The Coast Guard Yard's operating expenses include all costs necessary to repair the ship. Most of these costs vary with each vessel repair availability, since the work done on each vessel is unique. However, each vessel repair generally includes the following cost categories: temporary services (water, electricity, steam, sewage, berthing); labor (welders, riggers, machinists, pipefitters, electricians, dockmasters, painters, sheetmetal workers, etc.); and overhead expenses (amortized cost of equipment; training costs;

cost of accountants, safety and quality staffs, and other office workers).

Yard Constraints:

1. Repair specification deficiencies: If the specification is poor several things can result:

(a) Valuable time is wasted determining the actual scope of work before that work can be started.

(b) The late discovery of essential repair work. The primary cause of extra work was the discovery of severe structure deterioration, usually in bilge areas.

(c) Materials that are needed to complete repairs are not identified in a timely manner. As a result, these materials were not arriving on time and were delaying vessel departures.

(d) The amount of work requested was greater than can be sequenced in the given period of time, or greater than the workforce that the Yard had available to accomplish it.

2. Often, materials were identified on time, but were not ready when needed for assembly. This occurred because purchases were not accomplished in a timely manner, incorrect materials were ordered or materials arrive damaged or otherwise unusable. Note: The Maintenance and Logistics Command (MLC) is responsible for ordering long, lead-time materials and the Coast Guard Yard is responsible for inspecting these materials when they arrive. The Yard is also responsible for ordering all short lead time materials.

3. Workload exceeds the capacity of the facility or workforce at the Yard in one shop or another. One of the biggest components to this problem was the fact the Yards planning and scheduling staffs were not breaking down and sequencing the work so that accurate workforce forecasting could be accomplished. Two additionally problems were limits on the number of billets at the Yard and the time that it traditionally takes to hire new personnel. It was taking the Yard at least two to four weeks to hire new personnel, which is fast by federal hiring standards, but too slow to meet workload demands.

4. Taking on additions or changes to vessel repair work at the vessel or operational commander's request, in the name of meeting the customer's needs without properly assessing the impact on the cutter's repair schedule.

5. Poor quality Yard repair estimate: If the Yard does not create a quality estimate of the work to be accomplished, it cannot properly plan the required work. It is important to note that a quality estimate cannot be accomplished without a quality repair specification. Additionally, a quality estimate can identify whether or not a repair specification is of poor quality.

Exploitation of Yard Constraints:

1. The Yard needed to engage earlier in the specification development phase of preparation for the vessel repair. Yard personnel needed to focus on the following: ensuring that the scope of work on each item is well defined; ensuring that the length of time for each availability is adequate for the work requested (check sequencing and workforce loading); ensuring that all materials are properly identified so that long lead time items are ordered early enough.

2. The Yard needed to track long lead time items, as well as short lead time items. If a long lead time item has not yet arrived, the Yard could then question whether or not the associated work item should be cancelled. Additionally, when long lead time items arrived, they could immediately be checked for quality.

3. The Yard needed to develop more accurate estimates and scheduling tools to define when its workload was peaking in each shop. Better estimates and scheduling tools would enable the Yard to more effectively assign and distribute workers to and within projects.

4. All changes to the vessels repair availability needed to be estimated accurately for both cost and schedule. Cost and schedule impacts needed to be brought to the attention of both the MLC and the LANTAREA Commander's staff for approval.

5. Same as 3 above.

Subordinate Everything Else to Yard Constraint Exploitation:

1. Develop procedures for the Yard Quality Management System to ensure early engagement in MLC specification development. The Yard Planning, Estimating and Scheduling staff developed the procedures and are engaging with the Acquisition Team (A-team) earlier and more frequently.

2. Expand the Yard procurement staff to add tracking and inspection of long and short lead-time materials for repair availabilities. Procedures were developed for the Yard Quality Management System to ensure all materials arrive and are inspected in time for installation.

3. Develop procedures for the Yard Quality Management System to ensure timely and accurate estimates and job sequences for repair availabilities. Additional full time resources and a few contract resources were added for an interim period to improve scheduling and estimating.

4. Same as 3. Additionally, the Yard has become more disciplined regarding putting MLC and LANTAREA on notice through the change order process when delivery of a ship is in jeopardy because of unforeseen or additional work.

5. Same as 3.

Elevate Yard System Constraints:

The Yard now religiously tracks the number of lost or saved cutter days for all vessel repair events. Measures were developed, if they did not already exist, to ensure the visibility of all actions being taken to exploit all constraints (1-5). Contracts for marine trade labor were put in place to meet surge workload needs in constraints 3 and 5. Add contract personnel to organization to ensure measures for 1, 2 and 4 are met. As excess capacity is identified, this capacity should be made available to Coast Guard customers to accomplish work that will improve vessel readiness.

Breaking Previous Yard Constraints: By monitoring the reasons why specific projects tasks do not complete on time, we can actually identify what constraints are prohibiting us from meeting our goal. This is crucial to insuring that we continue to improve, because as each constraint is resolved another will take its place.

For those of you familiar with ship repair in the Coast Guard, there are no real epiphanies in this analysis with respect to the actual problems that were plaguing the Yard. However, this analysis did provide us with important insights on how to address these problems in a more systematic way.

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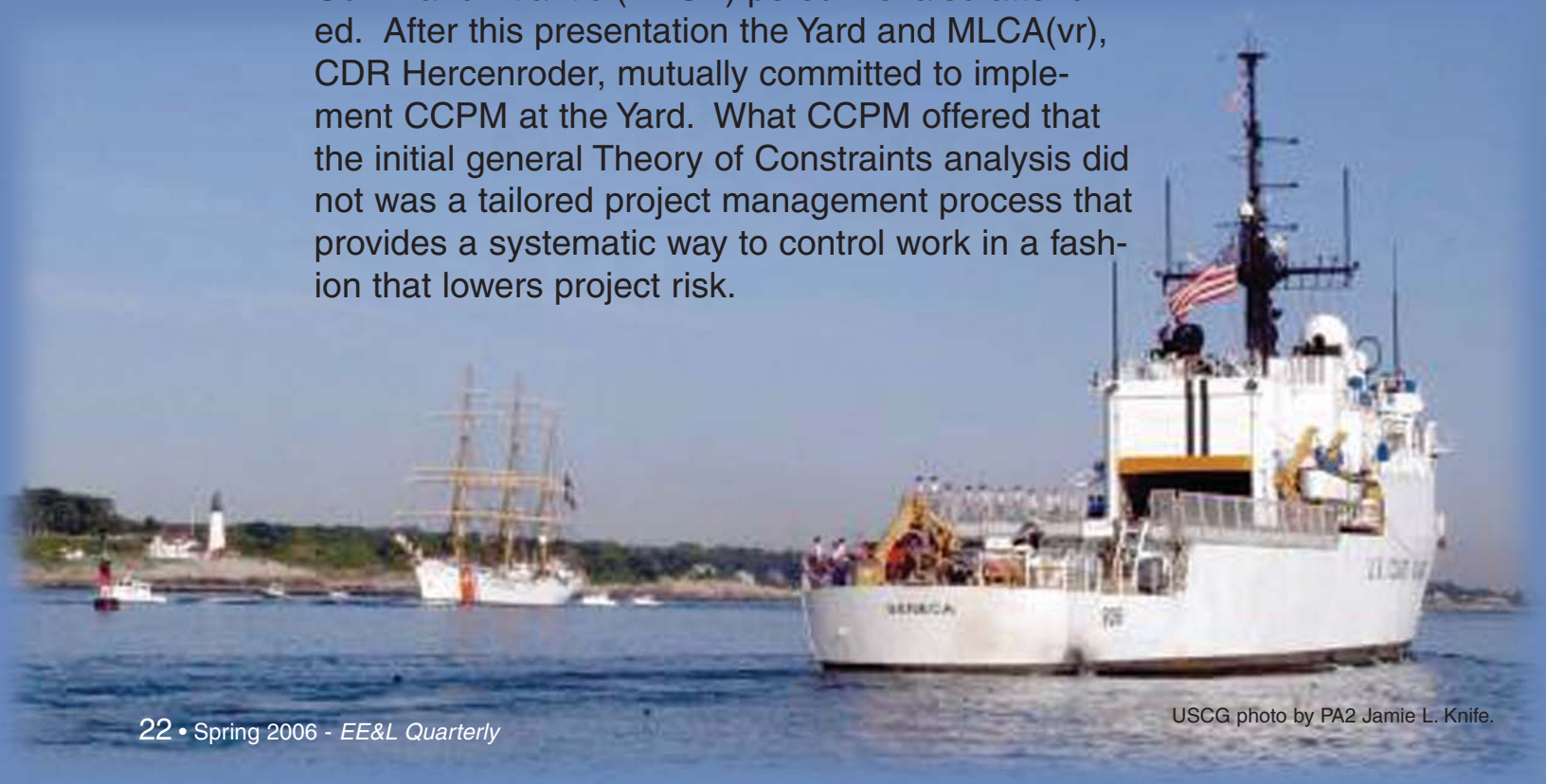
Implementation of Critical Chain Project Management at the Yard

by CDR Marty Oard, Executive Officer
U.S. Coast Guard Yard

Critical Chain Project Management is a systems approach to managing projects and is based on D. Eli Goldratt's Theory of Constraints (TOCs). In January of 2004, the Yard's Industrial Staff Chief at the time, CDR Eric Linton, learned about Critical Chain Project Management (CCPM) from a professional acquaintance at an American Society of Naval Engineers (ASNE) conference. Naval Sea (NAVSEA) was in the process of implementing CCPM at its shipyards, and was kind enough to lend a contract member of their staff to the Yard for a presentation, at which Maintenance and Logistics Command Atlantic (MLCA) personnel also attended. After this presentation the Yard and MLCA(vr), CDR Hercenroder, mutually committed to implement CCPM at the Yard. What CCPM offered that the initial general Theory of Constraints analysis did not was a tailored project management process that provides a systematic way to control work in a fashion that lowers project risk.



USCG photo by PA2 Jamie L. Knife.

To properly prepare for the implementation of CCPM, several key issues or tasks had to be addressed.

1. Existing repair availability work needed to be broken down in enough detail to facilitate accurate sequencing of it in Primivera, the Yard's project management software.

2. Detailed task sequences needed to be built for standard repair availability work items for all cutters.

3. A specific cutter availability had to be selected for prototype implementation.

4. Yard senior and middle management, the Navel Engineering Support Unit (NESU), MLCA and cutter personnel had to be educated and trained on CCPM concepts and processes.

5. Yard Industrial, senior and middle management, needed to develop new work processes for CCPM. This was done in conjunction with the Yard Quality Staff and contracted CCPM experts.

Because of the time and effort it takes to create detailed task sequences for the project management software, a 270' MEC (Medium Endurance Cutter) availability in the spring of 2004 with the installation of a Welin-Lambie davit was selected. This enabled us to target Coast Guard Cutter SENECA as the primary availability for implementing CCPM with Coast Guard Cutter CAMPBELL as a fall back. Additionally, a detailed breakdown and sequencing of work tasks had already been completed for TAHOMA, who had arrived in January 2004. This was particularly critical, since Coast Guard Cutter SENACA was only two months from arrival when the final decision to prototype CCPM was made.

The five tasks (listed above) for CCPM implementation were completed by the end of February 2004. These preparations included a meeting with all Yard Foreman (middle managers), senior managers and the Commanding Officer, Captain Rábago, to discuss the Yard's endeavor into CCPM and urging them to give it their full support.

How does CCPM work? As demonstrated in Figure 1 below, CCPM has human and process improvement elements.

Human Elements

1. Estimating - People that are experienced at making job estimates will typically make their estimate at a 90 percent success rate. It is important to understand that this is not done consciously, but sub-consciously. In other words, they are sub-consciously ensuring that they are on time the majority of the time.

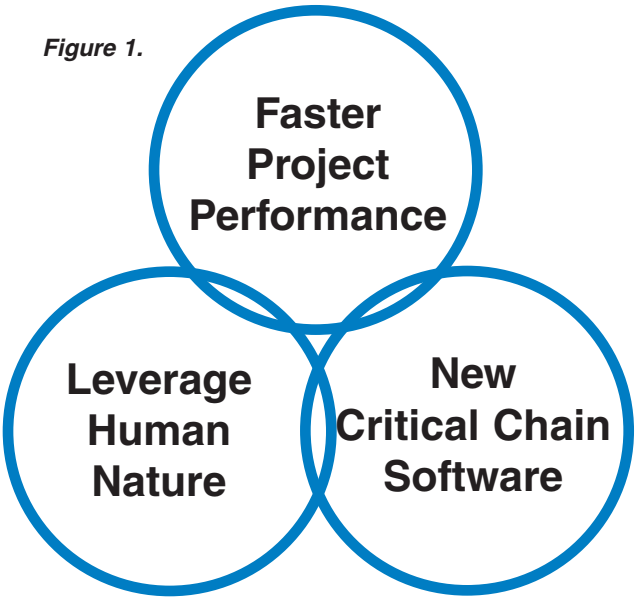
2. "Student Syndrome" - This is simply the tendency of people to procrastinate. For example, a worker is given three days to complete an assignment that takes four hours. Most workers will wait until the middle or late in the morning of the day that project is due before they even start the task. As you might guess, if any crisis occurs the deliver of this project will be late. This is why the workers initial 90 percent estimate works most of the time (Sciforma Corportation, 2004, p. 2).

3. Parkinson's Law - Work tends to expand until the actual project length fits that estimated project length.

4. Multi-tasking - In a multi-project environment, resources often are applied to the area of greatest pain. Additionally, this area of greatest pain is typically defined only by a combination of the crisis of the day and strength of personalities of different customers and project managers. In other words the problem of the day, whether it is determined by who ever screams the loudest for resources or it is truly the most important problem requiring resolution, will get the resources. This results in critical resources being moved from one crisis to the next, often before each task presently being worked on is completed (Sciforma Corportation, 2004).

The end result of these four human factors is that projects rarely finish ahead of schedule. In fact, all it takes is one minor problem to result in a project finishing late. When a project is complex, like ship repair, it is easy for one part of the project to be problematic, which then results in the ship being returned to the operational commander late.

Figure 1.



(Sciforma Corporation, 2004, p.1).

Process Elements

1. Multi-tasking - A second multi-tasking problem relates to scheduling of work and is best explained through the following example. If a facility needs 32 work hours to unload cargo from a vessel, it can either unload one vessel per day or four vessels in four days. In this case, the implementing organization will realize greater operational efficiencies if they can schedule vessels to come in one at a time.

2. Resource Level Loading - The Critical Path Methodology (CPM) that project managers and engineers have been taught in college or professional training seminars has a serious flaw. Once a CPM chart is complete it is rarely resource level loaded. Level loading takes into account that a project manager has only one electrician and there may be times throughout a project when the electrician is assigned multiple tasks simultaneously. Since electricians are not gods (I have been stationed with a few folks who may dispute this assertion) and therefore cannot be in more than one place at a time, one or more of these tasks will finish late and delay the project. Many sophisticated project management programs (software) have resource level loading functions in them, but the resulting final delivery date or project length date is unacceptable to the project stakeholders so this step is often eliminated. Even when a project manager level loads a project and finds additional subcontractors to increase the resources available to ensure the job completes on time, the difficulty of choreographing the many different trades and organizations results in the late completion of tasks. Poor coordination and late task completion inevitably results in project time and cost overruns.

3. Project Prioritization Process - Project management organizations, as discussed in the human element, respond to subjective inputs as a mode for prioritizing tasks. Lack of a disciplined, objective process for prioritizing work will result in less critical tasks receiving resources first or the shifting of resources before a task is complete.

Critical Chain Project Management (CCPM) at the Yard

All the human and process elements listed above existed at the Yard, as they do in the vast majority of project oriented organizations, and required resolution. The following CCMP based process improvements, which were implemented initially for Coast Guard Cutter (Coast Guard Cutter) SENECA's availability, have greatly improved the Yard's schedule and cost performance.

1. Scheduling Backwards - Project managers and customers need to make a mental shift and determine the desired completion date of a project. The project work sequencing network can then be built backward from this point.

2. Schedule tasks as late as possible - This requirement sounds counter intuitive given that the goal is to complete work ahead of schedule. However, the advantage of scheduling tasks as late as possible has several benefits. First, it prevents the project manager from expending resources early in the project life that will not contribute to early project completion, and facilitates focusing on what is important. Second, it lowers costs by preventing the unnecessary early expenditure of resources. Third, as a project progresses, the project members gain experience and get more efficient. Therefore, scheduling as late as possible will lower costs and save time.

3. Task Estimating - Yard project orders are broken down into tasks with lengths of five days or less. All tasks should be estimated with a 50 percent probability of completion (down from the normal 90 percent). At the Yard this was accomplished by simply cutting the time estimate in half and then giving the new estimate a subjective reality check. Changing from 90 to 50 percent probability of completion task does represent removal of a built in time or scheduling safety factor. The loss of this safety factor is address below in "Inserting Buffers."

4. Resolving Resource Conflicts - If two developers are needed during a two week period (Fig. 2), but only one is available, then the length of time necessary to complete four weeks worth of work will be four weeks (Fig. 3) not two weeks, unless an additional developer is hired. Primivera will automatically adjust (level load) resources and stretch the project plan as necessary to reflect resource limitations. The Yard had not used this tool in the past because the project plan with 90 percent probability of completion estimates for tasks and resource level loaded almost always produced an unacceptably long (unrealistic) project duration. When 50 percent probability of completion estimates were used in conjunction with resource level loading, the resulting project length was much more reasonable.

5. Identifying the Critical Chain - It is only after both task and resource relationships have been determined that the critical chain can be identified. The sequence of project plans provides a simple demonstration of task relationships, resource level loading and identification of the critical chain in a project (Fig. 4).

6. Inserting Buffers - A portion of the safety cushion in each task, which was removed in Task Estimating above, is now pooled into project and feeder buffers. The pooling of schedule safety in buffers is similar in concept to how USAA pools risks when they underwrite insurance policies. The project buffer is the safety cushion for the critical chain. The feeding buffers are the cushions for

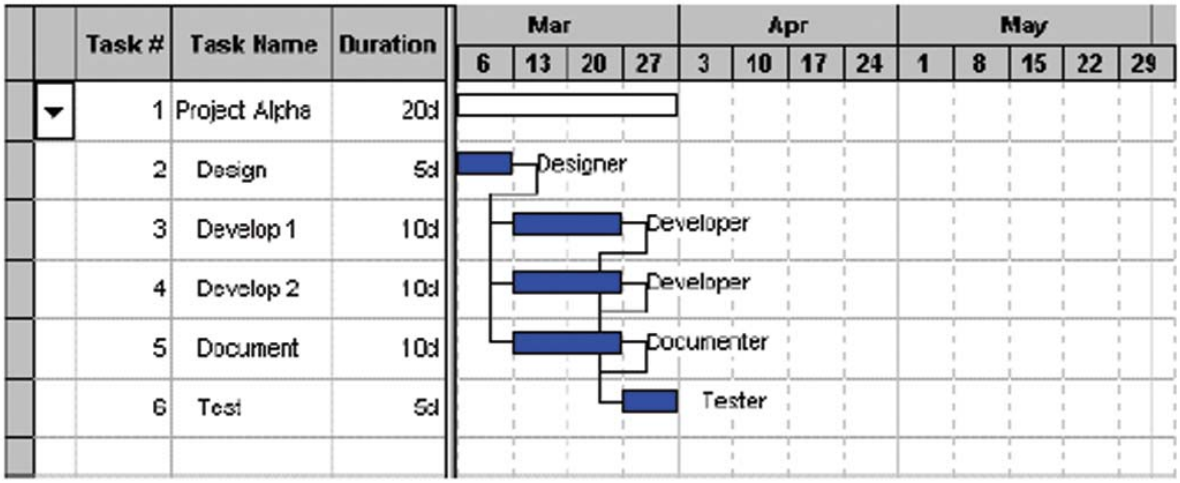


Figure. 2. Task relationships (Sciforma Corportation, 2004, p.8).

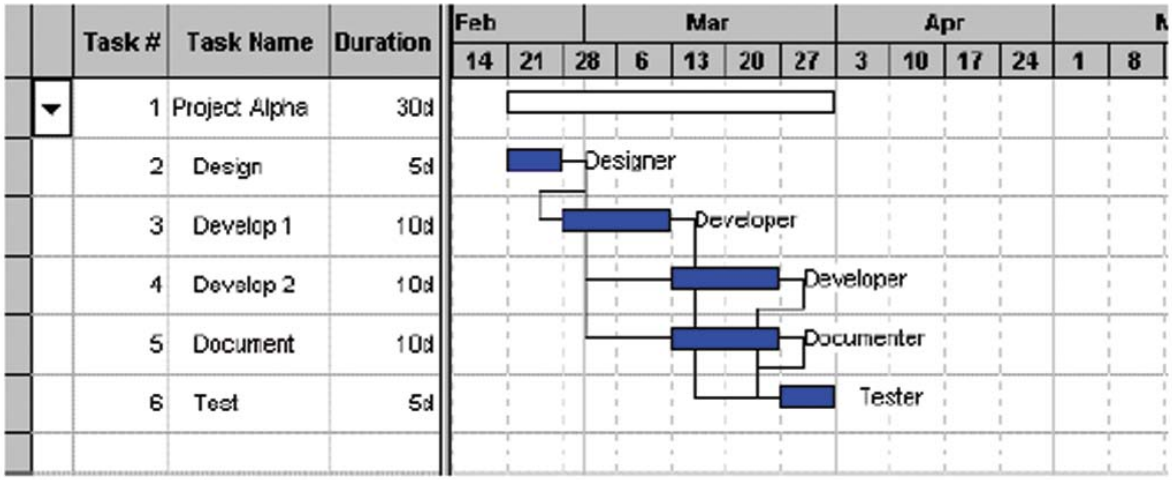


Figure 3. Resource level loading effect [only one developer available] (Sciforma Corportation, 2004, p.9).

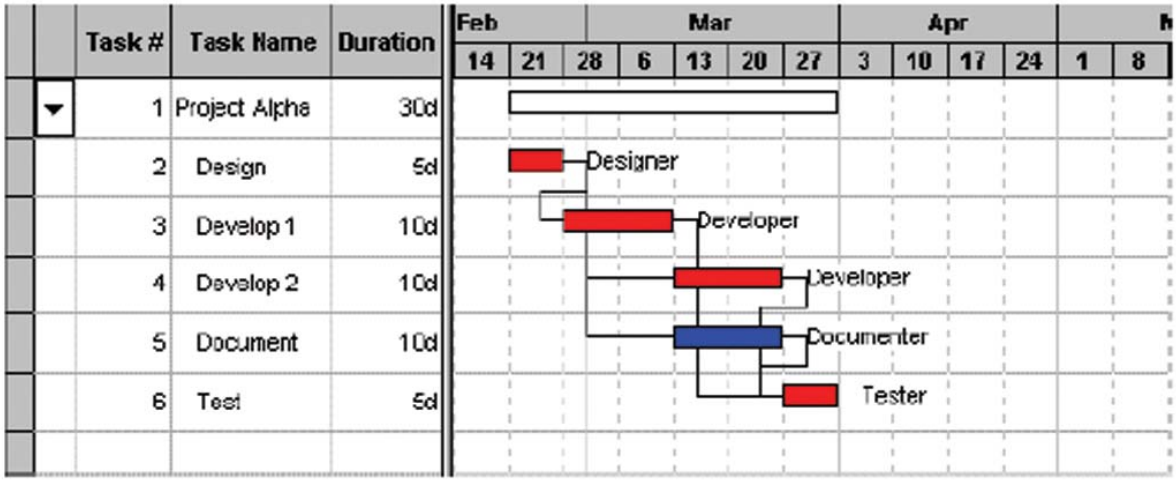


Figure 4. Critical Chain [identified in red] (Sciforma Corportation, 2004, p.9).

each non-critical chain that feeds into the critical chain. If these feeding chains are not properly attended too, they will become the critical chain. The details of this issue are explained below in the "Buffer Management" section. See Figure 5, next page, for a visual example of how buffers become a part of a project plan. These buffers are sized by taking two-thirds of the 90 percent probability of completion estimate that was initially removed from each task and adding them together. For example, If the 90 percent probability of completion estimates for all of the critical chain tasks equals 180 days, then the 50 percent probability of completion estimate for the critical chain would be half the time or 90 days. Therefore, the project buffer would be 60 days or two-thirds of the 90 days that were removed from the 90 percent probability of completion estimate. Feeder buffers are calculated a little differ-

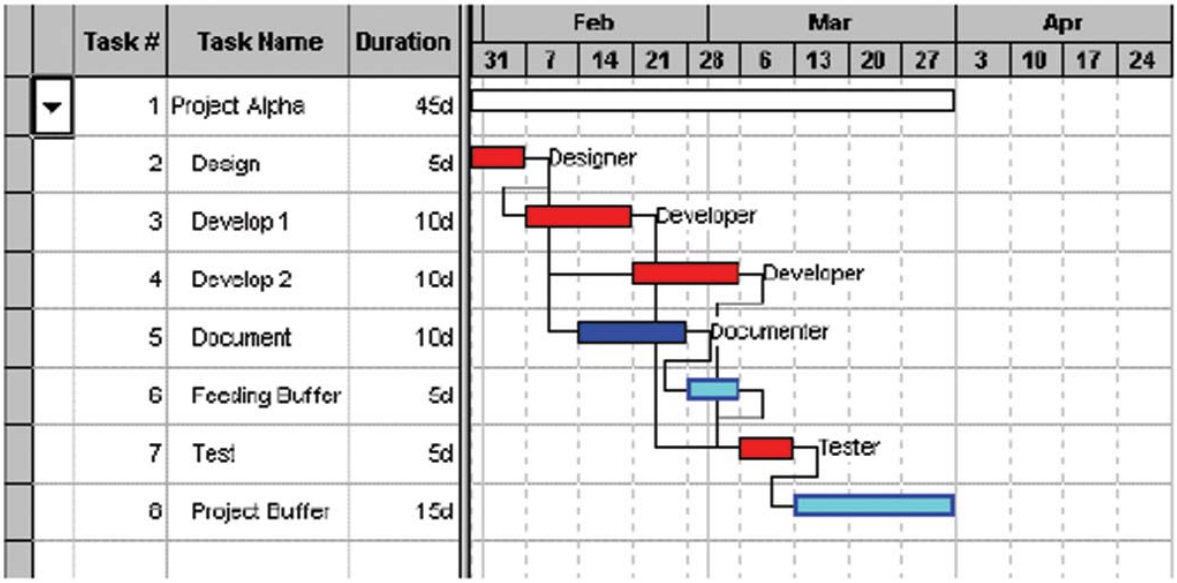


Figure 5. Insertion of project and feeding buffers (Sciforma Corportation, 2004, p.10).

ently. If the 90 percent probability of completion estimate for all tasks in a feeder chain is 30 days, then take half of the task length and add it to the end of the task as the feeder buffer. Therefore, the feeder buffer would be 15 days.

7. Relay Race Approach - Many of you with project experience are familiar with the term "percent complete." Historically, regardless of whether a vessel was at the Yard or a commercial facility, the ship's inspectors would estimate how far along each task was and report "percent complete" at a particular level (0-100%). The purpose of this exercise was two fold. First, a contractor is often paid based on how much work (what percent complete) they had completed. Second, "percent complete" was compared to the percentage of time that had past and was used to determine (approximately) whether the contractor was likely to finish on time or not. Unfortunately, "percent complete" is a poor indicator of how long it will take to complete a task or project. For example, a task could be 99 percent complete, but the one inexpensive and simple to install part that is missing may be six weeks from delivery.

The relay race approach is all about knowing when each task will be complete and ensuring the next task is ready to start, just like handing the baton from one sprinter to the next in a 400 meter relay race. This is accomplished through a three step process.

First, trade supervisors and leaders are asked to periodically (periodicity will be discussed in the "Schedule Updating" section) update when will each task be complete. Any task that is not going to be complete on time gets closer scrutiny to determine if the delay is being caused by issues that are controllable (parts delays or poor coordination between trades) or uncontrollable (numerous seized bolts or unexpected contamination of equipment components requiring additional cleaning).

The second step is to have work assignment and coordination meetings between the work supervisors, leaders, ship superintendent and senior ship personnel. These meetings help ensure that the right workers are available to take over when the previous task is complete.

Finally, once a task is started it should, with few exceptions, be worked continuously until it is complete. Bouncing the workforce from one task to another before they are completed is highly inefficient.

8. Schedule Updating - The frequency of updating the schedule is driven by the size and complexity of the work. If a project is larger and more complex, the project schedule should be updated more frequently. For Navy projects in the 10s or 100s of millions of dollars, the schedule is typically being updated twice a day. The Yard currently meets daily for the first and last 25 percent (based on time) of an availability, and only every other day during the middle 50 percent of the availability.

9. Buffer Management - All buffers are divided into three equally sized parts which are color coded green, yellow and red. Penetration of the first third of the buffer, green portion, indicates that project delivery is expected to be on time or early, and that the project manager should stay the present course. Penetration of the second third of the buffer, yellow portion, indicates that project delivery schedule is at risk; and that the project manager should make plans to slow or reverse the loss of buffer time.

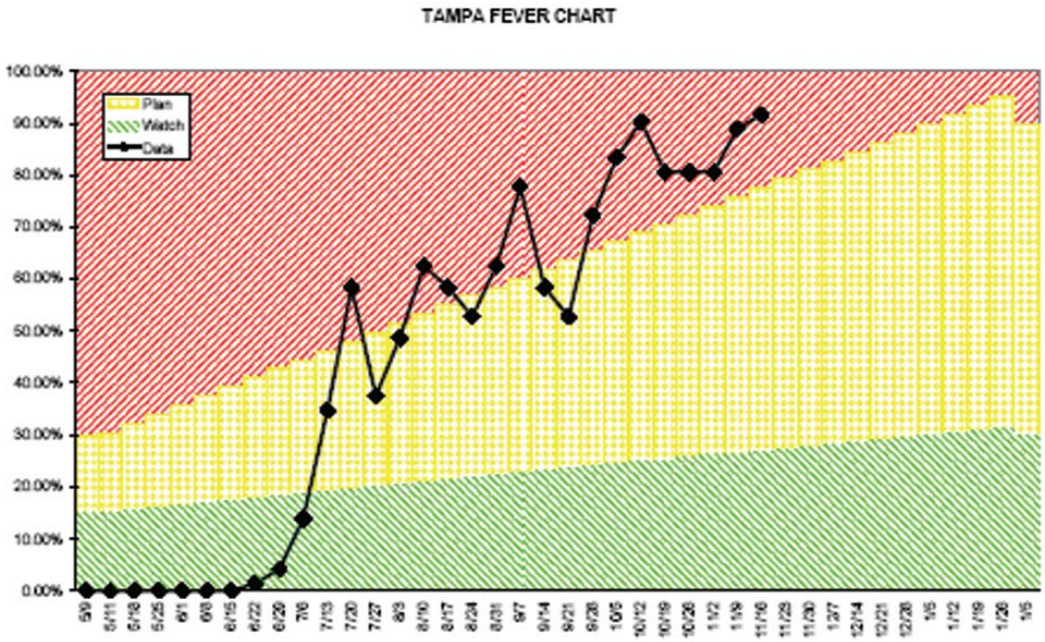


Figure 6. Coast Guard Cutter TAMPA MEP availability Fever Chart demonstrating buffer management.

Plans may include the addition of resources to a project by either shifting them away from other projects, by contracting additional resources, or accelerating delivery of a part by funding overnight shipping. Penetration of the final third of the buffer, red portion, indicates that the project delivery schedule will not be met unless the plans formulated during the yellow buffer penetration are implemented. Obviously, if there is a persistent problem in the yellow or green portions, it may make sense to create and implement corrective measures before the red portion of the buffer is penetrated. Figure 6 demonstrates buffer management on the Coast Guard Cutter TAMPA MEP availability.

10. Multi-Project Management - The Yard presently manages each project individually with CCPM. Unfortunately, we cannot level load resources across all projects without a cost prohibitive amount of labor. Additionally, all "what-if" scenarios take hours to determine and can only be assessed for a single project. Fortunately, there is light at the end of the tunnel on these issues. The Yard is presently in the process of getting approval to load software that will make CCPM assessments across multiple projects just a few clicks away. This new tool will greatly increase the Yard's ability to see and take action to resolve resource conflicts between projects. It will also enable the Yard to easily determine the Yard-wide impact of changing project priorities, changes in project start dates or adding new work. These new capabilities should further enable the Yard to both deliver early and reduce repair costs through more efficient use of labor.

Summary

The use of CCPM at the Yard has already had the following impacts.

- The Yard can accomplish more work within a given period of time. Coast Guard Cutter SENECA was delivered with no increase in the length of the availability despite a 20 percent increase in the scope of work.
- The Yard had been able to give cutter days back to the operational commanders that would have been lost in the past as a result of late deliveries. Additionally, the greater confidence in delivery time makes scheduling work with the operational commander easier.
- The morale of Yard management and workers has risen as their work is better organized and more effective.
- Senior operational and maintenance managers are making better decisions because they have a higher level of confidence in Yard project management.

Implementing CCPM is not a simple task, it requires significant changes to organizational culture in both processes and human behavioral areas. However, if your organization operates in a project environment, CCPM is a commitment well worth making. It is not just Yard measures telling this positive story. The positive feedback from the cutters, MLCA and operational commanders are further validation that we are on the right track with regard to meeting the needs of our customers.

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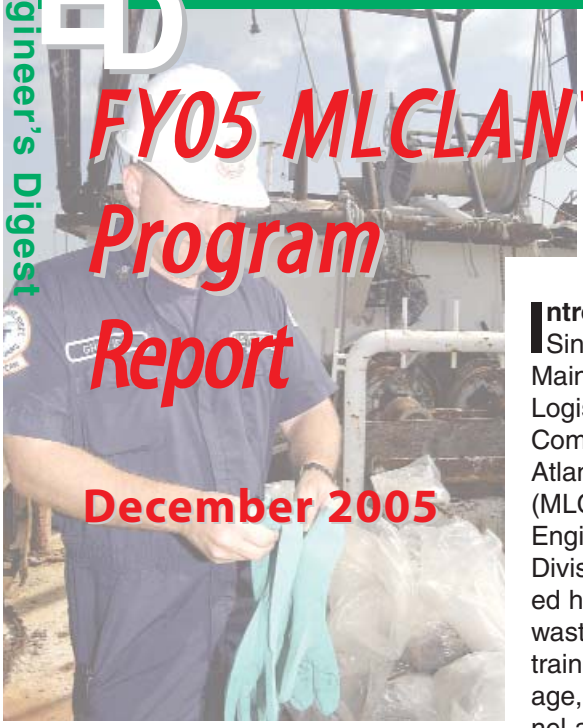
Sciforma Corportation (2004). Critical chain concepts. Retrieved 25 February 2005 from http://www.sciforma.com/Products/PS_Suite/critical_chain_concepts.pdf.



FY05 MLCLANT Hazardous Waste Training Program Report

December 2005

by Sheri L. Imel, MLCLANT
Civil Engineering Division

Introduction - Since 1988 Maintenance and Logistics Command Atlantic's (MLCLANT) Civil Engineering Division has provided hazardous waste management training, on average, to 200 personnel a year throughout the Atlantic Area. Periodic training for hazardous waste coordinators is required under the Resource Conservation and Recovery Act, Hazardous Materials Transportation Uniform Safety Act, and Occupational Safety and Health Act. MLCLANT offers a basic course for newly designated hazardous waste coordinators and an annual refresher course for returning students.

Unlike commercial hazardous waste management training, MLCLANT's course is Coast Guard oriented. Trainees are provided with and instructed in the use of applicable CFR's and other source material. The goal of this program is to acquaint trainees with the tools needed to perform their jobs and to resolve compliance problems at their units. It has been designed to cover the spectrum of need from those who generate small quantities of regulated or hazardous waste to industrial facilities that are large quantity generators. Course topics include:

- ❑ Laws and Regulations
- ❑ Chemistry and Toxicology
- ❑ Hazardous Waste Identification
- ❑ Generator Requirements
- ❑ Hazardous Waste Storage and Incompatible Chemicals
- ❑ DOT Transportation Requirements
- ❑ Hazardous Waste Manifest Requirements
- ❑ OSHA Emergency Response Awareness Level
- ❑ Preparedness, Prevention and Contingency Plans

In FY04 (Fiscal Year 2004) MLCLANT made a significant change to its training program by premiering a web-based version of its 12 hour refresher training program. By converting the classroom refresher course to an online course, MLCLANT cut its annual AFC 30T fund expenditure from $250,000 to $100,000. Full scale implementation occurred during FY05 wherein Atlantic

Table 1.

Unit Type	Number of Students		Unit Type	Number of Students
Activity	2		Integrated Support Detachment	2
Air Station	12		LORAN Station	7
Aids to Navigation Team	8		Maritime Safety and Security Team	1
Vessels	25		Marine Safety Office	2
Communications Station	1		Naval Engineering Support Detachment	1
Electronic Support Detachment	1		Sector	11
Group	13		WLR Support Detachment	7
HITRON	1		Station	86
Integrated Support Command	5		Training Center	25
			Total	**210**

and Pacific area personnel were trained on hazardous waste management procedures.

MLCLANT conducted two, 28 hour basic hazardous waste management courses for newly assigned hazardous waste coordinators from stations, groups, industrial support commands, sectors and independently moored vessels. The basic course covers laws and regulations, management of hazardous waste, health and safety, and preparation of hazardous waste for shipment. This course was not offered to shore and vessel tenant commands because of their limited compliance responsibilities. Instead, tenant command coordinators took the web-based training. The online system also served as a refresher course for those who received hazardous waste management training in the past. Online training provides a review of the regulatory requirements and updates to laws, regulations and Coast Guard policy. Seven sessions were conducted with the assistance of a contract instructor.

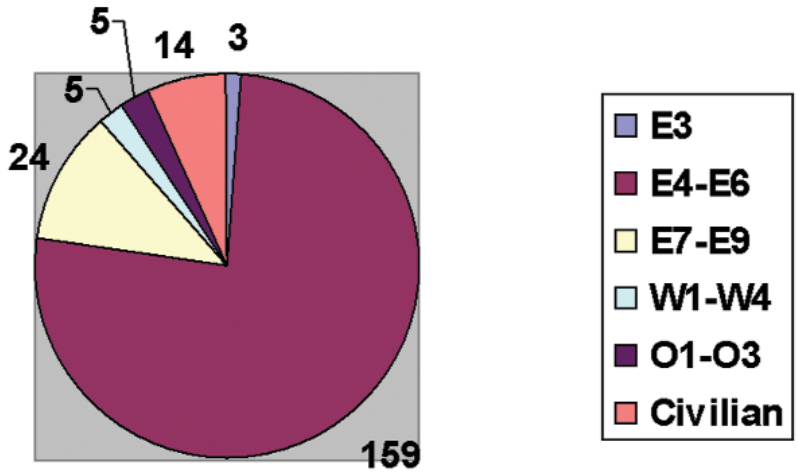


Figure 1. Student Population.

Course Statistics - MLCLANT offered training to 210 personnel in FY05, including over 30 Pacific Area unit coordinators. Sixty hazardous waste coordinators attended the 28 hour course and 150 coordinators took web based training. See Table 1 for distribution of students by unit type.

Quotas were given out on a first come, first serve basis. Small units, such as stations, were allowed one student for the basic course and one student for the online course. Larger units, such as ISCs (Integrated Support Commands) were permitted to have two students for each class type. Of all unit types, stations received most of the quotas. This can most likely be attributed to the fact that there are more stations than other types of CG facilities. While there are numerous aids to navigation teams, many of them are tenant commands and do not have full compliance responsibilities.

Figure 1 depicts the breakdown of the student population based on CG status. Out of 210 students 159 were E4 - E6, not surprising since most hazardous waste coordinators are petty officers. Large units assign hazardous waste coordinators at the E7 - E9, W1 - W4, O1 - O3, and civilian levels as well. Some units appoint E3s as assistant coordinators.

Training Measurements - Successful classroom hazardous waste management training is gauged by student performance on the end of course exam. The end of course exam tests students on their knowledge of hazardous waste management regulations and their ability to perform as hazardous waste coordinators. All attendees earned a passing grade of at least 75% in FY05.

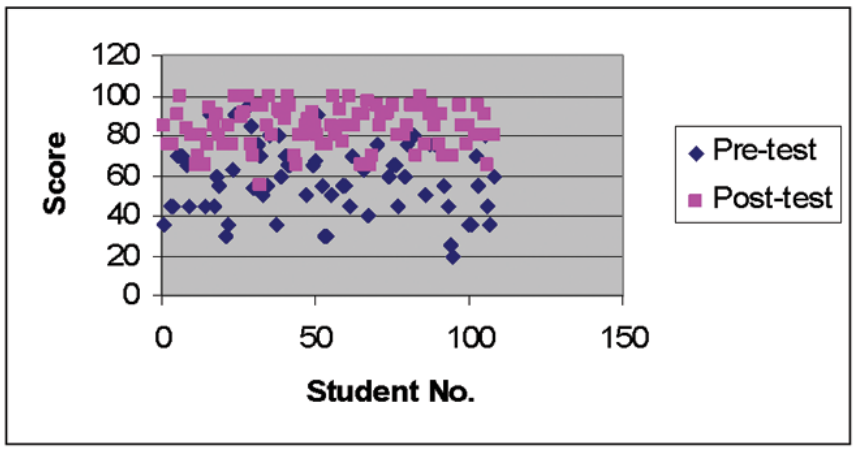
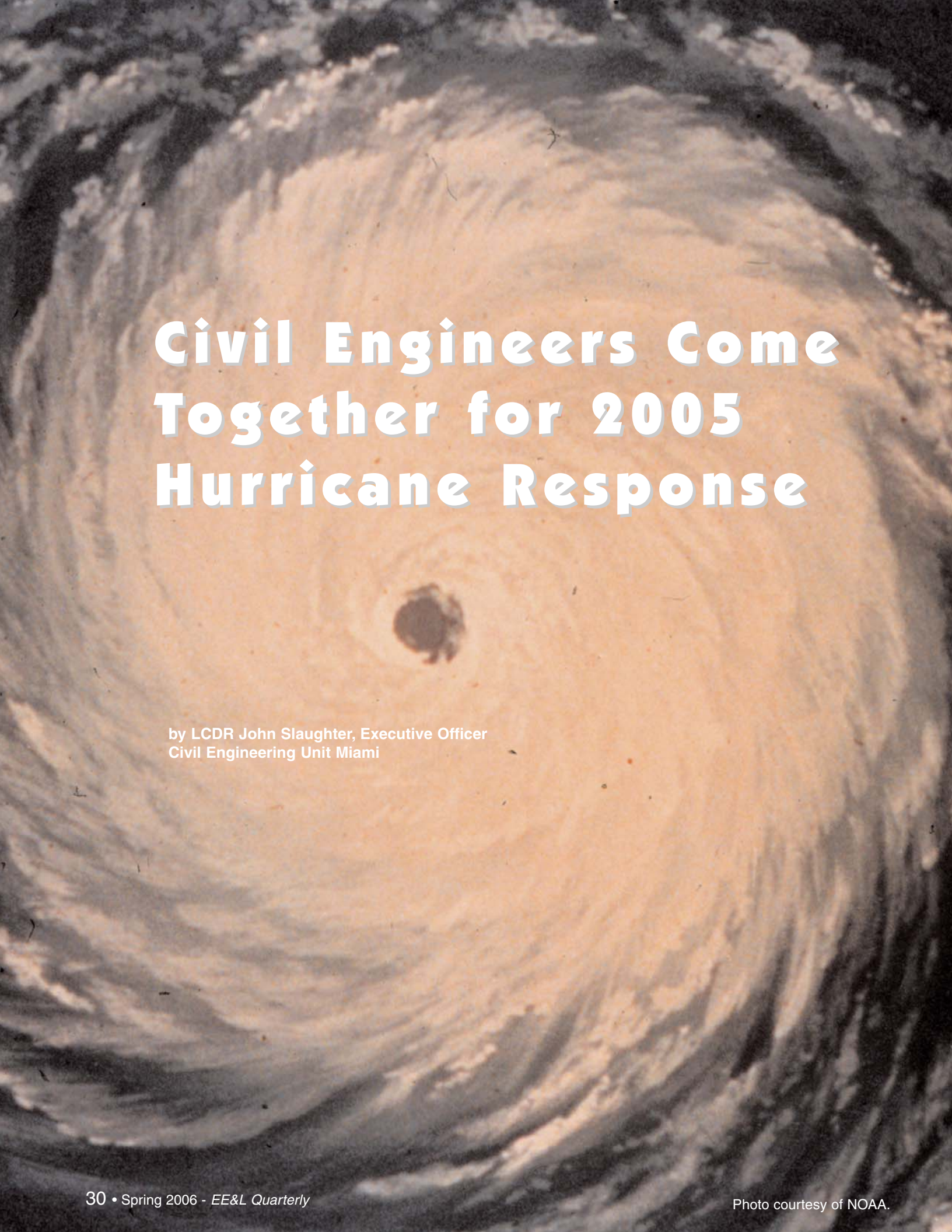


Figure 2. Pre-test and post-test score comparison.

Performance of the online training system was measured using a pre- and post-test. Students who took the pre-test scored an average of 66.8 points. In contrast, those who completed the post-test scored an average of 83.9 points (see Figure 2). The average test score change is +23 points.

These data indicate that MLCLANT's hazardous waste management training program meet its goal to provide hazardous waste coordinators with the information and tools needed to perform their job. MLCLANT continuously improves the basic and online courses to match expanding regulatory burdens. Future web-based training modules will include information on state specific requirements, the Clean Water Act, and the Emergency Planning and Community Right-to-Know Act.



Civil Engineers Come Together for 2005 Hurricane Response

by LCDR John Slaughter, Executive Officer
Civil Engineering Unit Miami

Photo courtesy of NOAA.

The 2005 Hurricane season has been widely publicized for its record breaking statistics and the indelible mark left on the Gulf Coast of the United States. The long forgotten 2004 season, where four hurricanes slammed into Florida in a six week span of time, turned out to be training ground for the personnel of Civil Engineering Unit (CEU) Miami in responding to the 2005 season. Just as CEU Miami was finishing up $17M in repairs from the 2004 hurricanes, the 2005 season rolled in like a lion and out like one as well. Through all of this, CEU Miami led the Civil Engineering program through one of its most challenging episodes ever.

The 2005 season started out with forgettable storms like Arlene and Dennis which threatened the very areas pummeled last year by Hurricane Ivan. Luckily the damage to Coast Guard (CG) units was extremely light considering the strength of Dennis. Everyone's luck ran out with Hurricane Katrina, who made her first visit right over CEU Miami in South Florida before becoming a monster in the Gulf of Mexico. As we pulled up wet carpet and tried to dry out from 20+ inches of rain in an eight hour period, CEU Miami's staff realized that Katrina was turning into our worse nightmare and would impact the critical mass of CG units in both Miami and New Orleans. Damage Assessment Teams (DAT) from CEU Miami and CEU Cleveland pre-deployed to safe areas outside the projected path of the storm to wait for passing before going in to assess damage. DAT personnel coordinated with deploying Emergency Response Teams (ERT) from Integrated Support Commands Portsmouth and Miami who would begin the process of rebuilding after the storm passed. Back at the office we used our experience from the 2004 storms and realized that all the essential equipment required to restore facilities (office trailers, generators, shower and bathroom trailers, fuel tanks, etc.) would be in high demand, so we actually secured contracts for the items used in Katrina about two days before the storm even hit the Louisiana/Mississippi coast. For about two days we waited, confident our preparation and experience from 2004 would enable us to quickly restore facilities to support operations at the affected locations.

Debris field and damage at Station Grand Isle. USCG photo.

New Challenges

As the reality of Katrina began to unfold for everyone, CEU Miami quickly realized this was not going to be a typical hurricane response. We eagerly accepted the offer from CEU Cleveland and CEU Providence for personnel support to complement our DAT personnel and from Facilities Design and Construction Team Atlantic to assist with repairs. The massive widespread damage shifted our normal comprehensive assessments to quick snapshots to determine whether operations could be maintained from that facility and then move on to the next one. Normally DAT personnel expect a three to five day deployment to assess damage, coordinate temporary repairs with ERT personnel and return to develop the contracts for permanent repairs. After Katrina, DAT personnel were left on site for two week rotations assessing the massive damage and assisting with set up and caretaking of temporary facilities. Although our initial focus for temporary facilities was swing space during reconstruction, the local commanders used them for the most pressing need, berthing and shelter for the massive amounts of search and rescue crews that descended into the New Orleans (NOLA) area. The civil unrest in New Orleans also required DAT personnel to maintain a checkpoint alongside Interstate 10 to coordinate armed escorts for equipment delivery. Normally the ERTs are focused on repairs to CG facilities, however, they quickly shifted gears and became professional RV hook up crews and essentially built villages of temporary facilities at Air Station New Orleans, Sector New Orleans, Station Sabine, Grand Isle, Gulfport and other locations. The civil engineering program quickly responded by providing over $8.9M of equipment and supplies, much of it arriving on scene just days after Katrina made land fall:

- 30,000 square feet of temporary facilities
- 80 travel trailers with berthing for 300+ personnel
- 56 generators with output in excess of 8.4 Megawatts of electricity
- 32 fuel tanks and pumps for storing 32,000 gallons of fuel
- 22 shower and bathroom trailers
- 50,000 gallon aviation fuel bladder and pumping system for JP-5
- Laundry service for the New Orleans personnel
- Galley facilities and services at Air Station NOLA, Sector NOLA and MCRB Gulfport

As Katrina response continued and the number of temporary facilities kept growing and growing, the civil engineering program sent personnel to St Louis to help coordinate major facility issues with the evacuated District Eight Staff -- CEU Oakland provided personnel to augment the Incident Command Post at Alexandria, LA to assist in helping track where all of the equipment was needed and where it actually ended up. As if the Katrina response were not enough, Hurricane Rita was brewing in the Western Caribbean and forecast to impact South Florida. With such heavy involvement with Katrina recovery there was no way CEU Miami could go "dark" for a few days of hurricane preparation and recovery, so personnel were deployed to ISC St Louis to continue Katrina response. A separate group of personnel were deployed to Station Fort Pierce and commandeered their training room to deal with the impacts of Rita in the Seventh District.

Damage Assessment

The damage to Coast Guard facilities as a result of this year's storms, particularly Katrina, is staggering. Station Gulfport was completely destroyed by the storm surge, Integrated Support Command New Orleans was destroyed by the flooding from the failed levee walls and Stations Venice, Grand Isle, Sabine, Pascagoula and Aids to Navigation Team (ANT) Dulac were heavily damaged as well. In total, the estimate to repair all of this damage stands at $200M, considering the annual (AFC-43) budget for the entire civil engineering program is only $160M the Coast Guard is depending on substantial supplemental funding from Congress to get back on our feet. In addition to the damaged shore facilities, Aids to Navigation (ATON) throughout the Gulf of Mexico and Florida Keys took substantial damage as well. Working closely with CEU Cleveland for ATON hardware, CEU Miami executed a $3M project to have all the critical aids at the mouth of the Mississippi River rebuilt in 60 days (normally a six month timeline) to allow unlimited safe vessel traffic through this critical area. Coast Guard owned facilities damaged by the Big Three 2005 Hurricanes:

Katrina
Station Pensacola
Sector Mobile
ATC Mobile
Station Dauphin Island
Station Pascagoula
Station Gulfport
Station Venice
Sector New Orleans
Station Grand Isle
Air Station New Orleans
ISC New Orleans
COMMSTA New Orleans
Sector Key West
Station Fort Lauderdale
ISC Miami
Air Station Miami
COMMSTA Miami
MSST Miami

Rita
Group Galveston

Flooding at Industrial Canal in New Orleans -- note Integrated Support Command (ISC) NOLA is at bottom left corner. USCG photo.

Air Station New Orleans. Note large amount of travel trailers and other temporary facilities. Also note corner of hangar roof torn off by Hurricane Katrina. USCG photo.

Station Sabine
MSO Port Arthur
ANT Dulac
Sector Key West

Wilma
Station Port Canaveral
Station Fort Pierce
Station Lake Worth Inlet
Loran Station Jupiter
Station Fort Lauderdale
Air Station Miami
ISC Miami
Station Islamorada
Station Marathon
Sector Key West
Station Fort Myers

Mississippi Coastal Recovery Base Gulfport

There are countless stories of civil engineering program success following this year's hurricanes but perhaps none is more compelling as our part in establishing a Federal presence back in Gulfport, MS after Katrina. Station Gulfport was completely destroyed by the huge storm surge and most of the Mississippi coastline was heavily damaged with little law enforcement present. Operational Commanders directed priority given to establishing something back in Gulfport, less than two weeks after Katrina passed temporary facilities were established for the Coast Guard and our federal and local law enforcement partners. Just one week after that CEU Miami established the messing contract and was feeding, at times, almost 300 people a day involved in recovery efforts along the Mississippi coast. This was truly a multi-team effort with personnel from CEU Miami, Providence, ISC Portsmouth, Maintenance and Logistics Command (MLCA) (t) and Electronic Support Unit (ESU) NOLA contributing to re-establish Station Gulfport and provide basic means for our operational partners.

Lessons Learned

As in any event of this magnitude there were successes, challenges and outright failures. Fortunately the civil engineering program had more successes than anything else, but there are always areas to improve. Here are the top five lessons learned from CEU Miami's perspective.

1. Integrate with the Operators - The institutional separation between operations and logistics elements was at times a substantial obstacle in our efforts to assist. It was not until we physically integrated into the District 8 (D8) Incident Management Team (IMT) that we fully understood the operational priorities and

Station Gulfport following Hurricane Katrina. USCG photo.

Flooding at Station Marathon during Hurricane Wilma. USCG photo.

The Eye Wall. Photo courtesy of NOAA.

purposes behind them. We are working with D8 and D7 to develop a plan where CEU Miami personnel will serve actual positions within their IMT for future hurricane evolutions.

2. Have a Plan - CEU Miami was lucky that Hurricane Rita and Wilma did not score direct hits and knock our building and people off-line for long. We are developing a contingency plan for next hurricane season to keep CEU Miami on-line and responsive while facing a potential direct hit ourselves.

3. Connectivity is Key - Our temporary facilities were certainly appreciated but until data and land lines were established they were merely shelters from the sun and rain. Working with MLCA(t) and our ESU partners is essentially to truly get units back on-line.

4. Know the Operators Language - The renewed effort to get the Coast Guard trained in the Incident Command System (ICS) is an excellent decision. The Operators seem to be way out in front of the support side when it comes to practical knowledge and use of the ICS, which again made it difficult to support at times. All CEU Miami personnel, civilian and military, will be trained in ISC 100, 200 and NIMS 800 ensuring we all have a working knowledge of the system -- members with additional response requirements will be trained to the ISC 300, 400 and 450 levels as appropriate.

5. Establish Industry Liaison - The commercial industry responds very well when they are familiar with our expectations and understand our priorities. CEU Miami was able to mobilize contractors quickly in Miami and even New Orleans where we have established relationships with construction contractors over the years. It was not quite so easy to get work going in Texas after Rita where we did not have these same relationships. As a result, CEU Miami is looking to expand our industry partnerships to all geographic areas where there is a large concentration of CG units.

The Future

Unfortunately recovery from natural disasters such as this is not easy or quick. The local economy has been devastated in some areas; labor and materials are simply non-existent or very hard to find. Regardless, the civil engineering program has developed an aggressive plan to try and repair all facilities prior to the 2006 hurricane season and we're well on our way to accomplishing this. In addition, we are partnering with local commanders to modify building designs during reconstruction to better accommodate quick evacuations and find ways to mitigate future damage. The complete reconstruction of Station Gulfport and ISC New Orleans will take longer but both units are being accommodated in some enhanced temporary facilities until their new buildings are ready. Some hurricane repairs have been handed off to other civil engineering commands in addition to projects in D7's and D8's Area of Responsibility that were already scheduled for this year. Overall, our goal as a civil engineering program is to meet the challenge of reconstructing the facilities damaged by the hurricanes and continue to meet prior commitments. Working as one program with one goal we will make it happen, demonstrating the true value we provide to our operational partners.

Hopefully the lessons learned during the 2005 hurricane season will never be tested to the extreme as they were following Katrina. Unfortunately, weather forecasters indicate we are entering a period of heightened hurricane activity where we can expect to see more storms and even more intense storms. If this does come to fruition, the Civil Engineering program and CEU Miami remain ready to prepare and respond, keeping Coast Guard operations going wherever the impacts may be.

Units involved or provided assistance to shore facility recovery efforts:

Maintenance and Logistics Command Atlantic
Civil Engineering Unit Miami
Civil Engineering Unit Cleveland
Civil Engineering Unit Providence
Civil Engineering Unit Oakland
Facilities Design and Construction Center Atlantic
Integrated Support Command Miami
Integrated Support Command Portsmouth
Integrated Support Command New Orleans
Integrated Support Command St Louis
Integrated Support Command Boston
Support Center Elizabeth City
Air Station Cape Cod
Training Center Yorktown

Station Sabine following Hurricane Rita. USCG photo.

Emergency Response Team Portsmouth

by LT Wes Hout, Team Leader

GULFPORT, Miss. (Sept, 6, 2005) Coast Guard Station Gulfport Mississippi destroyed by Hurricane Katrina. USCG photo by LTJG Earl Lingerfelt

Emergency Response Team (ERT) Portsmouth, staffed by the Integrated Support Command and tenant commands, respond to emergencies and natural disasters that directly impact Coast Guard (CG) units. ERTs are dispatched by Maintenance and Logistics Command Atlantic (MLCLANT) and directed by the Civil Engineering Unit Disaster Assessment Team coordinator. Additional ERTs respond from Integrated Support Command (ISC) Boston, ISC St. Louis, SUPCEN Elizabeth City, ISC New Orleans and ISC Miami. Dispersed throughout MLCLANT, ERTs are staffed with highly motivated personnel with a variety of skills to primarily restore CG operations. While on-scene, ERTs also protect CG assets, prevent further damage and remove debris.

ERT Portsmouth entered the 2005 hurricane season with an innovative personnel approach. Seeking to reduce travel costs and overhead, ERT personnel were divided into two, six person teams. Both the core team and supplemental team have a corpsman, carpenter/plumber, mechanic, two electricians and a purchasing agent. Experience has affirmed this small team has the necessary required skills for a successful emergency response. When dispatched by MLCLANT, the core team immediately responds with a 53-foot semi trailer filled with generators, tools and construction materials. Reducing ERT size greatly improves response times and provides berthing flexibility in the heavily damaged hurricane zone; where food, shelter and water are scarce. Once on-scene and damage is assessed, the core team restores CG operations and completes repairs. If needed, the ERT can request specific equipment from the supplemental team standing by at ISC Portsmouth outside the disaster zone. ERT Portsmouth's core and supplemental teams responded as planned to Hurricane Katrina with a quick and economical initial response, followed by a second wave of personnel, heavy equipment and site specific materials not available in the hurricane zone.

ERT Portsmouth deployed for Hurricanes Katrina and Rita responding to damage at Base Mobile, Station Pascagoula, Aviation Training Center Mobile, Station Gulfport and Station Sabine. While damage varied greatly, CG missions were severely impacted. While in Mobile, ERT Portsmouth quickly became experts in ripping out water-damaged interiors from flood waters and wind driven rain. Station Pascagoula required extensive electrical work to restore temporary power and repair damaged roofing. Station Gulfport challenged ERT Portsmouth with a new mission. Due to the catastrophic damage, temporary facilities were delivered to the site and ERT Portsmouth connected utilities for offices, galley, showers, toilets and RVs. The team also worked together with Navy Seabees to erect tents for food service and storage. Station Sabine sustained substantial damage and also required temporary facilities with utility connections. Station Sabine's temporary facilities were greatly valued and provided services to the local fire department, emergency medical crews and local officials. In responding to minor and major damage during the 2005 hurricane season, ERT Portsmouth was well tested and has gained a firm knowledge to effectively respond to future emergencies.

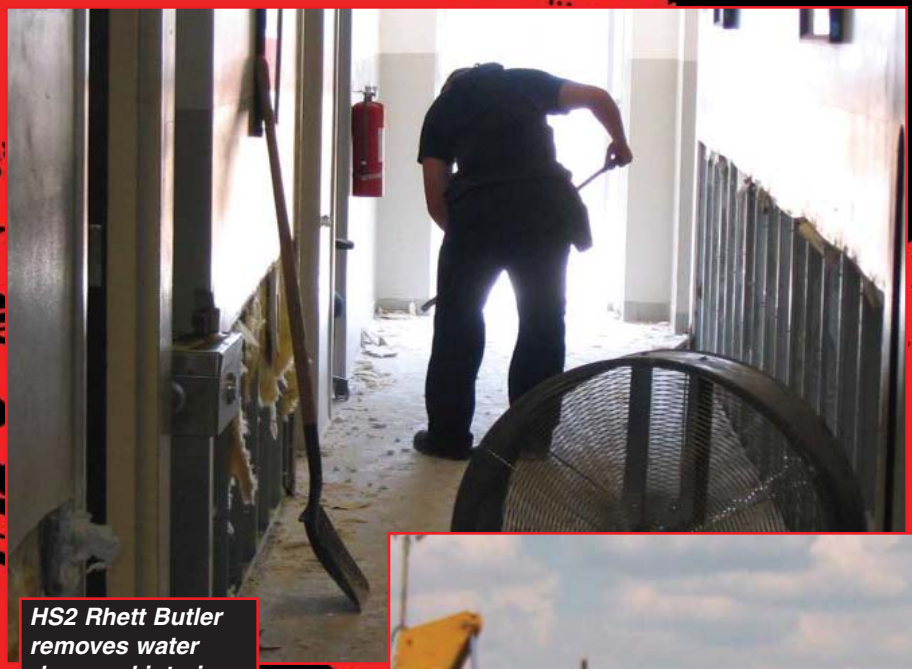
When a storm is bearing down on CG units, ERT Portsmouth responds! Meeting CG units in their greatest hour of need, ERT Portsmouth provides the skills, materials and motivation to restore operations and complete repairs. ERT Portsmouth is restocking and making preparations for the 2006 hurricane season, when the team will undoubtedly deploy to another hurricane zone.

ERT Portsmouth's semi departs with a generous gesture from Station Sabine's crew.

ERT Portsmouth at Station Sabine (L-R): OSCS Ken Curry, HS2 Chris Cisneros, EM1 Santonio Logan, DC2 Richard Moore, Mr. Robert Ward, SK2 Mike Reynolds, EM2 Keith Littrell, MK1 Mike Hardy, and LT Wes Hout.

ERT Portsmouth's Core and Supplemental Teams at Station Gulfport (L-R): SK2 Mike Reynolds, Mr. Robert Ward, LT Wes Hout, FN Tony Ponce, Mr. Chris Dunn, LTJG Amanda Henderson, MK1 Mike Hardy, EM2 Paul Greggs, LCDR Brenda Kerr, HS3 Rhett Butler, OSCS Ken Curry, HS3 James Angeles, EM2 Keith Littrell, EM2 Manuel Pangelinan and CWO Chris Evans.

Meeting CG units in their greatest hour of need ... ERT Portsmouth



HS2 Rhett Butler removes water damaged interiors at Base Mobile.

Mr. Chris Dunn lifts an exhaust fan on to the galley trailer while ERT Miami crew members sweep away debris from the site at Station Gulfport.

EM2 Paul Greggs, Mr. Robert Ward and FN Tony Ponce remove water damaged interior finishes at ATC Mobile.

EM2 Keith Littrell and EM1 Santonio Logan fabricate RV electrical panels at Station Sabine.

DC2 Richard Moore connects gray water lines to the shower trailer at Station Sabine.

ERTs Portsmouth and Miami complete roof repairs at Station Sabine.

When a storm is bearing down on CG units, ERT Portsmouth responds!

Mr. Robert Ward clears debris from the Multipurpose Building at Station Sabine.

MK1 Mike Hardy connects the fresh water tank to supply water to the shower trailers at Station Sabine.

ISC Kodiak to Execute $10M in Facility Improvements Through Energy Savings Performance Contracts

by ISC Kodiak

In the ever shrinking budget climate of the Coast Guard's shore program, the Department of Energy's (DOE) Energy Savings Performance Contract program (ESPC) stands out as one of the few remaining opportunities to reduce operating costs without a large capital investment. Although not widely used in the Coast Guard, Integrated Support Command (ISC) Kodiak has had great success in leveraging energy savings with facility upgrades and maintenance, all at no cost to the AFC-43 program.

Unfamiliar? The program was conceptualized as a mechanism to help government agencies meet the goals and requirements of the Energy Policy Act of 1992 and other Executive Orders that mandate energy conservation. The implementation process is simple. A DOE contractor will identify infrastructure changes that can produce energy savings and execute the projects at no cost to the Coast Guard. The contractor receives compensation for the project from the initial energy savings and the process may free up AFC-43 money for use on other projects.

To good to be true? Well, it almost is. It takes considerable time and effort to move a project of this nature through the process, but the ends certainly justify the means. Most of the savings come in project volume, so the garden variety delivery order is in the $5M to $10M range. The process, although well established, can take nearly a year from initial scoping to a finished package ready to "go to contracting."

What types of projects can you get through an ESPC? There are no limitations or restrictions on project scope, provided there is an energy savings component to provide the "savings" stream. If the project is something that is already on your backlog, you free up that AFC-43 money to accomplish other projects. ISC Kodiak has already completed two ESPC projects, totaling nearly $5M, that are at or near the end of the payback periods with anticipated annual operating cost savings of $864K.

Kodiak currently has several other large scale infrastructure improvements and maintenance projects targeted. The majority of them were programmed for execution within the next few years through the AFC-43 program. These same projects were identified by the ESPC contractor as having enough energy savings to warrant execution through their contract, thereby freeing up AFC-43 funds to apply to other local projects through traditional methods. Some examples of projects that ISC Kodiak will be executing through the ESPC contract are: 1) installation of major steam and condensate lines to eight existing industrial and office buildings; 2) installation of high efficiency System 2000 boiler units in some 200 government owned housing units; and 3) design and installation of wind generation turbines.

The ESPC concept may not work for every facility, but if you are interested in a clever way to get at infrastructure improvements while leaving your AFC-43 program unaffected and meeting some of the Government mandates for energy conservation, look into an ESPC.

Jack Doyle (Mechanical Engineering Tech at ISCK) during the installation of a prototype high efficiency stand alone boiler in one of Kodiak's 424 housing units. The system's impact was nearly a 35% reduction in fuel consumption.

Polar Icebreaker Propeller Hub Leaks and Capscrew Torque

by LT Douglas Petrusa
Naval Engineering Support Unit Seattle

Over the past four years, the Polar CPP hubs have experienced hydraulic leaks while in the icy waters of the Antarctic during Deep Freeze Missions. Polar divers have isolated the leaks' source to the seam between the hub body and the cylinder cap. The cylinder to hub body joint is made with a set of twenty-four (24), 2-5/8" diameter socket head capscrews, shown in Figure 3 (see next page), which are secured into position with welded round-stock (lockwire). The seal is provided by a nitrile o-ring, as illustrated in Figure 2 (see next page).

The initial observations following oil leak detection from Polar divers noted some broken and twisted capscrew lockwire. Also, several capscrews were able to be turned by hand a ¼ turn. Twice in the past four years underwater salvage teams have been flown down to McMurdo Station at great expense to grind away the lockwire and re-torque these capscrews in an effort to mitigate the leaking hydraulic fluid. In both instances, the leaking was not completely stopped, however, it was minor enough to allow for approved operations. Figure 1 shows the broken lockwire visible in the foreground; beyond this is the hub body to cylinder cap seam lined with small beads of escaping oil.

Naval Engineering Support Unit (NESU) Seattle Port Engineers, along with members of Maintenance and Logistics Command Pacific (MLCP) (vs) have been evaluating the source of the leak

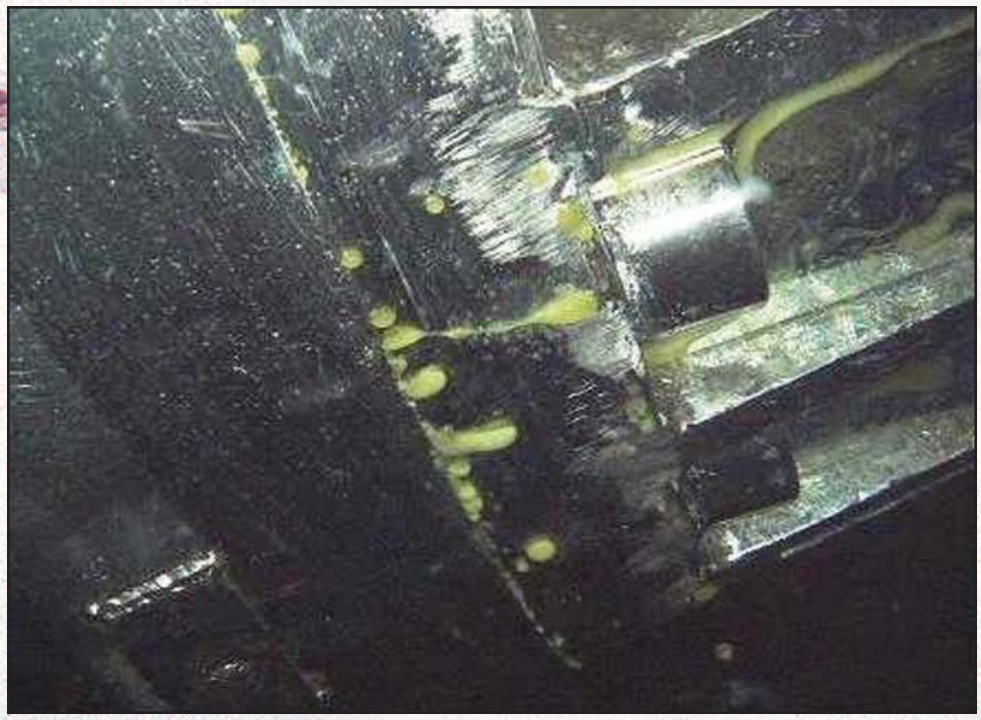


Figure 1. Capscrews in cylinder cap, beads of oil flow out along seam circumference.

and working toward a solution. A team consisting of Escher Wyss (Original Equipment Manufacturer (OEM)), Oregon Iron Works (hub repair contractor) and an outside technical consultant, have devoted considerable attention to identifying a long term solution.

Because the hubs had been hydrostatically tested successfully to 600 PSI following their overhaul at Oregon Iron Works (OIW), identifying the source of the leakage required a little bit more effort than simply looking at the blueprints. A conference was held at OIW in January of 2005 with members from NESU Seattle, MLCP(vr1) and (vs), and OEM tech reps. During this visit, the team evaluated three hubs that were being overhauled and brainstormed some repair solutions.

Analysis focused on two key areas of the major joint between the hub body and the cylinder cap: the joint fasteners (capscrews) and the seal (o-ring).

The Seal

The o-ring seal used is located on a spigot between the hub body and cylinder cap, and provides the joint's only sealing medium without any additional seals or gaskets. This mating surface of the hub body and cylinder, along with the spigot and o-ring, is pictured Figure 2 (not to scale). Oil pressure exists beneath the o-ring.

As shown, it became clear that previous attempts at tightening the capscrews to eliminate leaks were fruitless since the o-ring seal was not affected.

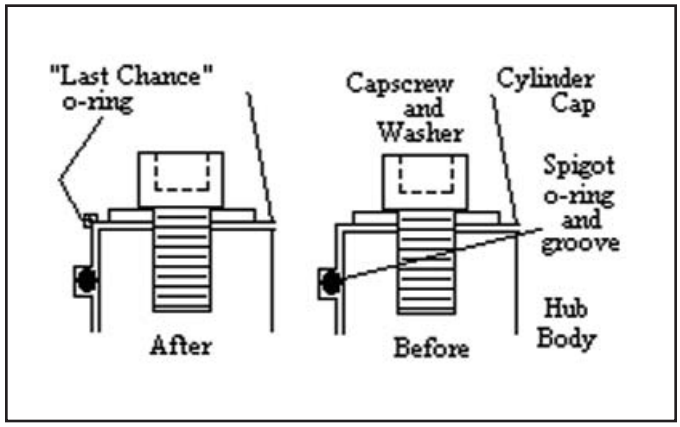


Figure 2. CPP hub joint.

Under closer inspection, it was apparent that there were compound problems with the sealing joint: the sealing surface of the hub body and the cylinder cap had been compromised over the past 30 years. Small pits of crevice corrosion were widespread around the circumference and in general, there was a bit of slop. In other words, the mating surfaces were not true circles any more.

It was the team's opinion that the root source of the leaks was individual paths of low resistance between the o-ring, its groove and the hub body. The fact that these leaks were undetected until the ship was in the ice was likely due to the high impact loads and stresses placed upon the propeller blades causing the entire cylinder cap to shift on the hub body. Although the slop described may be measured in microns, it was evident and certainly would serve as a short-circuit past the o-ring to the sea. The looseness of the capscrews was still an important issue, but not deemed the root cause of the leakage.

To combat these leaks the o-ring groove was redesigned to improve the crush of the seal to approximately 20 percent (each hub's dimensions are slightly different). The calculated crush of the existing seals was roughly 12 percent. The o-ring was enlarged and all of the mating surfaces were machined to eliminate all of the pits and restore concentricity. Also, an additional small "last chance" o-ring was inserted at the corner of the register, above the first o-ring. A small radius was machined to accommodate this additional o-ring. This "last chance" o-ring gets crushed when the capscrews are torqued into position, see Figures 2 and 3.

The Joint Fasteners

Even though the team was convinced that the leaky joint had been redesigned adequately, they still needed to understand why the capscrews were coming loose. *Machinery's Handbook* lists several reasons for "Torque Relaxation," some of which include thermal cycling, impact loading and vibrations, all of which are daily events aboard Polar Icebreakers. NDT studies indicate galling and fretting of the capscrew threads which are also sources of torque relaxation. It was recommended that the material of the capscrews be changed from the 304 stainless steel to a less elastic material to reduce the galling -- 304 grade material has a relatively high tendency to gall in comparison with other steels. The need for a material that is stainless, has high strength and a very low ductile to brittle transition temperature is a tall order. The fact that these fasteners do operate in cold environments with very high impact loading reduces the eligible materials. Also, the fact that for nearly 30 years the ships operated without capscrews backing out was reason enough to continue to use the 304 stainless steel.

The next step during the joint analysis was to make certain that the capscrews were sufficiently tight. Due to the fact that this isn't a simple nut and bolt configuration the amount of stretch can't be easily determined by taking external measurements. The capscrews are threaded into blind holes with a hydraulic (HyTorc) wrench and torqued to a prescribed value. How could we be certain that they were adequately tightened? The OEM design of the newest manufactured hub (U-18) included a

Figure 3. Capscrews, removed from service.

tapered shank capscrew which stretches (elongates) more easily due to its geometry. Relying on good old fashioned engineering practices, Shigley and Mischke's *Mechanical Engineering Design* was the reference of choice. We calculated the required amount of elongation the capscrews and discovered a range of acceptable torque values which would stretch the capscrews to the designed amount. The key factor in these equations was the thread lubricant coefficient of friction. The OEM recommends the usage of DEPAC, which is a metal free synthetic, anti-galling, anti-seize compound used for hub assembly. The coefficient of friction for DEPAC is unknown. At this point, we needed to conduct a physical experiment to determine whether or not the capscrews were stretching as designed when torque was being applied.

A control group of test capscrews was developed on a single hub and torqued into place using several different methods, see Figure 4. Using an ultrasonic transducer, the length of a fastener can be "pinged" accurately to a ten-thousandth of an inch. After the application of torque, the capscrews can be "pinged" again to determine the delta, or change in length. These ultrasonic measurements are most commonly used to secure bridge fasteners.

A second method of stretch determination was used. Several capscrews were center-bored so that a depth micrometer could be used to measure the length. In addition, we used several of the tapered shank bolts to see if there was any difference (these tapered shank capscrews must stretch farther to carry an equivalent load). In each and every fastener we discovered that the prescribed torque was not stretching the capscrews to the desired amount. As part of the testing, the application of additional torque on the capscrews continued until the desired elongation was achieved in an effort to ascertain a new torque value. More and more torque was applied and we still had marginal success. In fact, concern arose that the yield strength of the shouldered heads of the fasteners would be exceeded.

Out of curiosity (partly due to frustration), the decision was made to clean and coat the capscrew threads with a standard C-5A copper based anti-seize. We recognized instantly that there was a significant difference in this lubricant since the capscrews could be threaded into the holes by hand whereas normally this could only be accomplished using a wrench. Using the hydraulic (HyTorc) wrench, it worked like magic: the capscrews were stretching the correct amounts and the torque required to do so was just slightly less than the standard design specification. In fact, the torque used with the C5-A anti-seize compound matched the calculated values.

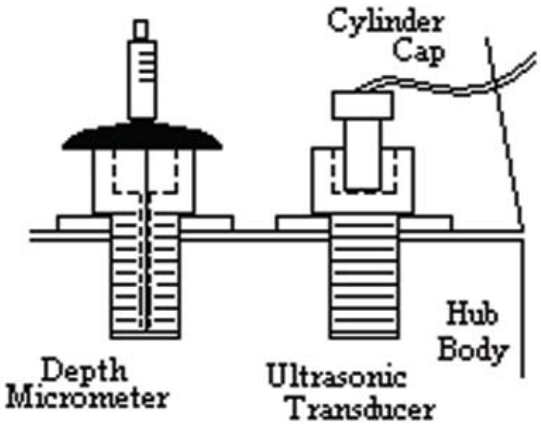


Figure 4. Capscrew Elongation Testing.

As a result of this experiment, the procedure for hub reassembly was changed: C5-A anti-seize compound will now be used for capscrew threads, and the Quality Assurance (QA) checks were amended to reflect this and the modified o-ring size.

In summary, although it seems that there is still a great deal that needs to be learned about the design of CPP icebreaking hubs, it is the engineer's mission to prevent further leakage of hydraulic oil during the Operation Deep Freeze mission. These CPP hubs, unique in Escher Wyss design and built for severe impact service, provided an opportunity for a group of talented engineers from the Coast Guard and industry to engage in collaborative re-engineering. For this effort, the group included: Mr. James Happe (MLCP(vs)), Mr. Dan Miller and Mr. Steve Hatfield (Oregon Iron Works), Mr. David Schumacher (CDI), Mr. Greg Young (International Bolting Technologies), Mr. Josef Boeni and Mr. Dieter Przygoda (NW Propeller), LCDR Gregory Stanclik (MLCP(vr1)) and LT Glenn West (NESU Seattle).

CENTER WING BOX RECAPITALIZATION

by LCDR Ed Sheppard
C-130 Product Line Engineer, ARSC and
Chris Andre
Retired Aviation Maintenance Technician (AMT) Chief and current member of the C-130 Product Line's Structures Element

Introduction

The U.S. Coast Guard (USCG) has a distinguished history of "doing more with less." However, even during our recent transition to the Department of Homeland Security (DHS), we must continue to remain innovative in reusing potential resources. The C130 Product Line has aggressively recycled usable components from recently retired airframes.

USCG photo by PA2 Veronica Bancdowski

1600 Series Aircraft Retirement

In 1999, the U.S. Coast Guard decided to retire the 1600 series C130 aircraft shown in Figure 1. Two airframes were flown to AMARC (Aerospace Maintenance and Regeneration Center) collocated with Davis-Monthan Air Force Base in Tuscon, Arizona. The remaining airframe, the 1603 remained in Elizabeth City, North Carolina, with future plans ranging from an avionics training device to a flight simulator. Even after decommissioning these 1600 Series HC-130H "Hercules" aircraft, they continue to play a crucial role in supporting USCG missions and future engineering projects. Over the last few years, the Aircraft Repair and Supply Center (ARSC) has visited AMARC (commonly called "The Boneyard") several times and removed millions of dollars of usable parts from those airframes and many of those parts are in service today. In addition many of the usable components from the 1603 have been sequenced back into the supply system.

Figure 1. 1601, 1602 and 1603 on the flight line at Coast Guard Air Station Barbers Point in 1984.

C130 Center Wing Issues

In June 2002, a U.S. Forestry Service C130A experienced an in-flight break-up and a subsequent fatal mishap as shown in Figure 2.

In March 2005, a Service Bulletin (SB) from the Original Equipment Manufacturer (OEM) confirmed that C130 operators worldwide were now faced with the reality of fatigue cracking in the center wings that could have catastrophic results. This mishap caused a renewed focus of center wing safety resulting in the application of flight restrictions on some operational aircraft and groundings on older airframes due to the potential for Widespread Fatigue Damage (WFD), a condition resulting when many small microscopic cracks may collectively reduce the overall strength of the structure to an unsafe level. During an excessive loading condition, those cracks may result in a catastrophic event.

Figure 2. U.S. Forestry Service mishap.

Center Wing Issues and Their Impact to Future Plans for the HC-130H

In response to the center wing issues on the C130 and potential for WFD, the USCG has issued flight restrictions for

Figure 3. 1603's fuselage prepared for the center wing harvest.

Figure 4. Separating the center wing section from the fuselage.

our five (5) older airframes, conducted aircraft Non-Destructive Inspections (NDI), funded an operational usage assessment to validate airframe usage, and funded a Damage Tolerance Assessment (DTA) study. These efforts are designed to validate structural durability and optimize our surveillance inspection program known as the Aircraft Structural Integrity Program (ASIP). To date, all evidence and inspection results have shown that USCG's C130s are deemed safe for continued flight and they do not have WFD. The impact of the center wing issues has resulted in our realization that the center wings do have a finite service life though.

Center Wing Harvest

As we prepare for the possibility of discovering an aircraft with an unusable center wing, we have researched the possibilities of refurbishing or even replacing the center wing structure and returning the aircraft to service as viable options instead of permanently retiring the aircraft. In either case having a center wing box structure available as a ready spare would be crucial. Therefore, the C130 Product Line contracted a vendor to perform the harvesting of the center wing from, the 1603 airframe in Elizabeth City, see Figures 3 and 4.

After months of coordination and discussion and seven days on-site by the contractor, the center wing structure was removed from the aircraft at ARSC and the disassembly was completed on December 15, 2005. The primary objective of this project involved preserving the center wing structure for future use. The center wing was preserved, transported and placed in long-term storage. Maximizing the resource was obtained by satisfying the following secondary objectives:

- **New Surface Search Radar Installation Mock-Up**
  The forward nose section of the aircraft (including the flight station) was also preserved and has been transported to Pegasus International in Kiln, Mississippi (as

shown in Figures 5 and 6) for use in developing the airframe integration of the new HC-130H Seaspray Radar manufactured by Selex. The new radar is scheduled to fly in April 2006.

- **Fire / Crash / Rescue Training**
  Members of the USCG Fire Department were afforded the opportunity to conduct trial extrication evolutions on various parts of the aircraft that included the ability to practice using hand and powered rescue tools. Valuable lessons were learned by the Fire Department that included aircraft structure familiarization, cutting techniques and personnel limitations. These experiences may one day save a life.

- **Preservation of structural components for mechanic training**
  More than 1700 pounds of structural components were loaned to the USCG's contracted Advanced Structural Repair Training vendor to assist Aviation Mechanics in learning their trade using actual aircraft parts and components.

Figure 5. Packaging G1603 for ground transportation.

Figure 6. CG1603 at Pegasus International.

Summary

Although the 1603 airframe will never fly again, many parts of it will. The C130 Product Line successfully leveraged the carcass of this retired airframe to obtain a center wing for future use on a USCG C130 or a Department of Defense (DoD) asset, a radar installation mock-up, a training device for the Fire Department and Structural Mechanics. The 1603's center wing alone is valued at over $4 Million. Combined with the millions of dollars of components reused from all three 1600 series airframe components, we have proven good stewards of our former airframe. Apparently, the Coast Guard can still do “more with less.”

H-60 Hoist Support Arm Structural Cracks - How it happened and what we learned

by LCDR Mark Ward
H60 Engineering Technical Services
Aircraft Repair and Supply Center

In early July, 2005, the H-60 Engineering Technical Services Office at the Coast Guard Aircraft Repair and Supply Center (ARSC) was notified of the presence of hoist support arm cracking in one of its operational aircraft (see Figure 1). The aircraft was the 6022 located in Astoria, OR. The airframe had a life history of 8,192 flight hours and was undergoing a routine six-month hoist support arm inspection. This inspection involves dye penetrant application followed by a visual inspection (modified Type I, method C, solvent removable dye with a 45, vice 30 minute dwell time). During this inspection AMT1 Adam Hoke discovered what looked to be a surface scratch on the interior of the bore that supports the hoist arm. After the dye penetrant inspection showed negative results, PO Hoke decided to use his skill as a level II certified eddy current inspector. PO Hoke discovered a crack in the fitting and forwarded the information up

USCG photo by Luke Pinneo.

his engineering chain of command. Astoria's engineering department quickly contacted ARSC H-60 Tech Services with this information. A crack of this type had never been discovered on any variant of the H-60 being flown in the world today (approximately 2.3 *million* flight hours worth of history); a crack of this nature was considered to be highly unlikely. This unlikelihood combined with the lack of evidence generated from the dye penetrant inspection required Tech Services to question the presence of cracking. To confirm the cracking, Tech Services sent Mr. Rusty Waldrop, the Coast Guard's Non-Destructive Inspection (NDI) Program Manager, to Astoria.

After hearing of the Astoria discovery, Air Station San Diego elected to perform an eddy current inspection on the 6025's hoist attachment fitting -- the results also came back positive for cracks. In the midst of these discoveries, Tech Services decided to perform an eddy current inspection on every fitting on the ARSC production floor. The results were unsettling. Approximately 30% of the airframes inspected had flaw indications and in each case they were visually undetectable. Because this anomaly was apparently so widespread, a theory was developed that fitting geometry and/or material variances may have been confusing the results. We decided to apply ultrasonic NDI to confirm our findings -- to provide a corroborating witness. To our dismay, it did. As an additional part of this discovery phase, we provided LCDR Joe McGilley, the branch Chief of ARSC's Aging Aircraft Branch, with two fittings for further analysis. Through his network of DoD and civilian materials analysis laboratories, LCDR McGilley was able to get the fitting analyzed at the Air Force Research Laboratory, Material Integrity Branch at Wright-Patterson Air Force Base. Their findings indicated that these were indeed cracked and furthermore, the dye penetrant inspection technique we had traditionally been using was ineffective.

During the installation process, the interior bore sleeve of the hoist fitting is coated with MIL-PRF-81309, a common Corrosion Preventative Compound (CPC). The use of this coating is critical to fill voids and prevent capillary action that would otherwise trap moisture in the bore. The problem, Wright-Patterson discovered, was that the 81309 was finding its way into the cracks as they developed, essentially sealing them off. Dye penetrant is a sensitive method of NDI, but it is also dependent on surface condition and cleanliness. Scanning Electron Microscopy revealed that the CPCs were very efficient in filling the crack void and sealing off the crack opening. No manner of cleaning would have removed the CPC. It was becoming clear that each and every hoist support fitting was going to need a thorough inspection using eddy current.

On November 14th, Tech Services did two things. First, we ordered the replacement of the 6022 and the 6025's hoist support fitting and second, we developed and issued a Time Compliance Technical Order (TCTO) ordering the inspection of each fitting via the eddy current method developed by Mr. Rusty Waldrop and Air Station Astoria. The time for compliance was set for 10 days so that units with aircraft away from station could be scheduled for inspection. Tech Services' plan was to use the 10 days to develop a schedule for fleet wide replacement. Each fitting repair would require approximately 19 work days to complete. This work schedule included time to prepare the aircraft by removing the engines, main and accessory gearboxes, cabin interior and a major wiring harness that runs transversely through this fitting. Removal and replacement of all these components also generates a lengthy post assembly test flight.

The plan was to complete the TCTO period and perform a triage to determine the fleet-wide impact. All aircraft with hoist arm support fitting cracks exceeding predetermined criteria, as set by the Original Equipment Manufacturer (OEM), Sikorsky, would be considered grounded for all hoisting operations (flyable for training and logistics, but not Search and Rescue (SAR) ready). With complete knowledge of aircraft hoist availability, assets could be moved and staged to provide cover until all repairs could be made.

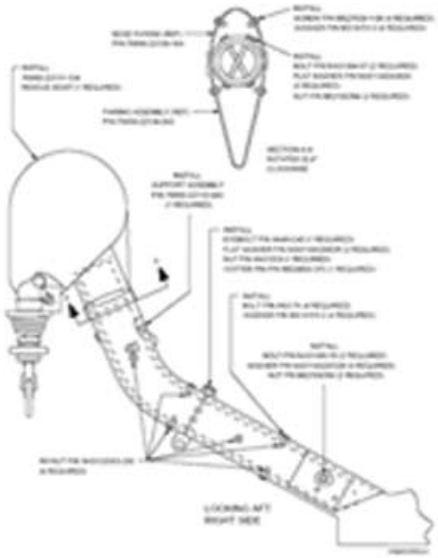
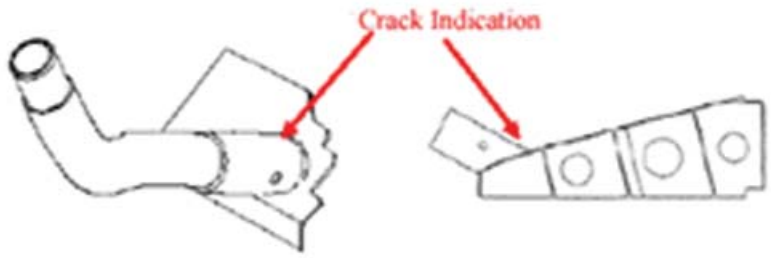


Figure 1.



By day two of the TCTO, working closely with CG-41 (Office of Aeronautical Engineering) and G-RCA, Tech Services determined that there needed to be a provision to classify aircraft as they were being inspected. The initial plan was modified to make allowances for those fittings that could be "blended-out." The majority of cracks being detected were less than ½ inch in length and estimated (by eddy current) to be less than 20-40 thousandths of an inch deep. These low-grade cracks could be slowly blended out of the parent material using a variety of methods outlined in the *Common Airframe Structural Repair Manual*. Once blended out, these fittings were deemed fit for all operational purposes.

USCG photo by PA2 Sarah Foster-Snell.

Hoists fittings containing cracks that could not be blended out or that exceeded the OEM specified dimensions where then separated into two groups. Those that were within initial OEM dimensions but could not be successfully blended out were deemed "for SAR use only." Those exceeding the OEM specified dimensions were classified as "NO SAR."

Days 3-10 passed as Air Station maintenance personnel adjusted their maintenance plan to execute the TCTO. The results trickled in. In the end, the total number of cracked fittings remained very close to the initial failure-rate estimate of 33%. The number of fittings found flawed and their status is summarized in Table 1.

Once the full scope of the problem was realized, the H-60 Product Line Manager, LCDR Carl Riedlin, worked closely with CG-41 and G-RCA to deploy repair teams to Air Stations Kodiak, Cape Cod, San Diego and Clearwater. As of this writing, all fittings are either replaced or have a scheduled replacement date. Total evolution is estimated to be less than 90 days upon verification of the crack.

Lessons Learned:

Several lessons were learned from this evolution. From a fleet engineering management standpoint, these lessons can be applied across any Coast Guard system.

Lesson One: Work from a Conservative Base

The existence of cracks in helicopter hoist fittings might sound innocuous to just about any helicopter operator in the world (the aircraft can still fly -- right?). Not so in the Coast Guard; at the end of the day SAR is still our job-one.

Not only did this problem touch upon our ability to perform a fundamental mission, it also carried the potential for major injury should the fitting fail. To top-off the list of operational risk management items, during the TCTO performance period, we had significant weather bearing down on one Air Station that had several of its aircraft affected by fitting cracks. In short, Operations (OPS) needed to have these helicopters capable of hoisting and Engineering needed the hoists grounded until all available information could be gathered. A middle ground was initially challenging to find.

To manage this situation, Tech Services elected to work from a very conservative baseline. All fittings would be classified as either BRAVO or CHARLIE. In order for this strategy to work in the real world, there needed to be a well-reasoned plan in place to expand conservative limitations before they were imposed. To accomplish this, Tech Services worked closely with Sikorsky Engineering to develop "interim" classifications for each fitting as they were inspected. This allowed for the development of a third classification. All fittings could be classified as BRAVO, BRAVO (after minor repairs) or CHARLIE (non-

Table 1.

	Cracks
Blended	12
Requiring Repair/Replace	14
Total Number of Cracks	26
Fleet Size	41
Percent of Fleet with found flaws	
	63% had cracks
	34% required repair

repairable, requiring complete replacement). As luck would have it, this allowed all Air Stations to remain B-ZERO without any losses in coverage.

Lesson Learned: It is safer to go from conservative engineering tolerances to liberal than it is the other way around; but be sure to have a well thought out plan on how to get there.

Lesson Two: Information Management

Any event that encompasses an entire fleet requires a large information data-pipe. Decision makers require a continuous flow of information. Working the problem in a vacuum is a very easy trap to fall into. This has two crucial negative consequences. First, the big picture gets lost very quickly. Secondly, a headquarters "data-call" is going to happen, it is just a matter of when.

H-60 Tech Services made the choice in the very early stages to keep as many decision makers in-the-loop as possible; email was very useful in this capacity. The down-side to this strategy is the potential to pass wrong information, a major reason why critical information flow sometimes becomes stagnant. The best way to mitigate this is to simply publish an errata when "reality changes." While the accuracy of all information needs to be verified, information is best delivered hot off the press whenever possible in these instances.

Two information flow techniques were employed that were found useful and are suggested here. First, make a small PowerPoint suitable for a "drive-by" briefing. No more than five slides, use lots of pictures and highlight the salient points. Include all available risk factors and mitigation strategies. Do not wait to be asked for this brief; it **will** be needed, so get it out early and keep it updated often. The information passed in this PowerPoint should be easily translated into brief and unambiguous "sound bites" that will help speed information flow at all levels.

The second technique was to collect as much data as possible and put it in a central place such as a shared Intranet folder. Tech Services used a shared Excel spreadsheet placed in a public folder. Continuous improvements were made to keep the sheet simple and well formatted. Centralization is key in that it allows multiple inputs and maintains the most current version by default. Our spreadsheet became very useful in providing regular status briefs; but it also became vital for another important reason.

Lesson Learned: Feed the information beast early and feed it often. Collecting and continuously organizing data helps you keep the bubble and see the big picture.

Lesson Three: Consider All the Information

As the results from the TCTO came in, they seemed in disagreement with popular speculation as to the cause. The timing of this evolution was right after the tremendous effort the H-60 community put into Hurricane Katrina relief in New Orleans. Expectations were high that this problem was a manifestation of these operations. Also there was speculation that this problem was being caused by newly developed fast roping tactics that utilized the hoist hook as an attachment point. But the aircraft involved in these types of operations did not seem to correlate to the aircraft manifesting cracks. At one point we added a column to the spreadsheet that

showed replacement history on the hoist attachment fitting. This particular fitting has a replacement history due to a completely unrelated issue. H-60 Tech Services first looked to the Significant Component History Report (SCHR) for a replacement history on this fitting and found that the data was somewhat sparse. We then looked to the H-60 Supply Cell for a procurement history of the fitting by aircraft tail number. The results were impressive. We discovered that out of the 26 aircraft that had some form of flaw, 25 had **no replacement history**. Meaning, all the fittings that had flaws were original fittings (it turned out that the 26th fitting was replaced in 2003 and had only a minor flaw).

The act of organizing and collecting all the data in one place allowed Tech Services to easily spot this trend. Also, having more than one person involved in the data capture allowed for many eyes (each with their own view points and bias) to watch its progression and theorize on potential causes.

Lesson Learned: Resist the temptation to hunt Zebras when you see hoof prints when pressure exists to provide an answer to causal factors. Consider possibilities only after all reasonable data is collected and processed. Also, and perhaps most difficult, learn to say "I don't know."

Lesson Four: Coordination and Cooperation

The cracking problem affected all but one H-60 Air Station, some stations had multiple hits. Although the airframe was still flyable, the Air Station's operational capabilities were compromised. As the impact of the problem unfolded ARSC, CG-41 and G-RCA had to continually update their contingency plans should an Air Station go no B-ZERO. Aircraft would have to be temporarily relocated, people would have to be moved, maintenance would have to continue unaffected and deployments of repair teams would have to be scheduled.

While most of these plans turned out as just exercises in "what-if," they still had to be detailed out for contingency purposes. Due to the nature of this problem this planning crossed Operations and Engineering boundaries at many levels. Air Station engineers had aircraft that were technically flyable, but unable to perform SAR. Air Station Ops Officers had an extra layer of operational risk assessment in the deployment of their assets. CG-41 and G-RCA were faced with the potential to relocate major resources and all the planning that goes with it. All of these issues required very close coordination between these two functional areas.

Lesson Learned: (More of an observation) Our organization is capable of extraordinary cooperation.

Conclusion

The strong correlation we observed in the hoist fitting removal data gave us a good idea how the problem arose. We know that the original hoist fittings saw anywhere from 4,200 to 8,500 hoist evolutions over their lifetimes. They were getting inspected on six month regular intervals using a technique that was fundamentally flawed. This allowed slow but steady crack growth. The key to controlling crack growth is early detection and mitigation via replacement or other techniques such as cold-working, stop drilling, or in this case, blending.

USCG photo by PA3 Adam Eggers.

What we still do not know is *why*. What was the exact mechanism by which these flaws were introduced? In our research we discovered that this problem has never occurred on any variant of the H-60. Was it due to the sheer numbers of hoists we conduct? Was it the extended hoist arm that potentially introduced more force and moment to the fitting? Vibration? Material and/or design flaws?

The answers to these questions are highly desirable but a safe and reliable mitigation strategy is not necessarily contingent upon their answers. While Tech Services con-

tinues to research the reasons for failure, the mitigation strategy we developed circumvents the problem through improvement to our inspection techniques and the periodic replacement of the hoist attachment fitting during Programmed Depot Maintenance. This strategy is safe, economical and will limit crack growth through proper detection and timely repair.

In the end, this evolution was a strong testament to the strength of our Aviation Program. If not for the care, attention to detail and persistence of one dedicated Coast Guard Petty Officer in Astoria, Oregon, this problem would have persisted, potentially to the point of catastrophic failure or loss of life. Open lines of communication from the field level to ARSC Tech Services ensured that the words *something was wrong* was heard loud and clear. ARSC's Aging Aircraft Program provided pivotal assistance in determining the scope of our issue as well as providing maintainers with a strong NDI training program. The H-60 Product Line deployed teams of government civilians to seven of our eight Air Stations. Initially, staffing of these teams was seen as a major hurdle so close to the holiday season. What we found was sheetmetal artisans and aircraft electricians jumping at the chance to get to the field to ensure our aircraft were returned to service as fast as possible. Finally, we saw operators and maintainers working the problem together to ensure a safe and efficient solution to a difficult problem. All these events prove yet again that Coast Guard Aviation as a whole is far greater than the sum of its parts.

Ship Repair Is Brain Surgery

"Doctors Duca and Kaplan" (CAPT Stephen Duca, Yard Commanding Officer (left) and CAPT John Kaplan, Yard Industrial Manager (right)) study x-rays (blueprints) to determine the "diagnosis" of the patient (cutter).

by CAPT Steve Duca
Commanding Officer
Coast Guard Yard

The Doctor is in

Everyone has heard the adage about some seemingly simple and straightforward task, "Well, it's NOT brain surgery!"

After two years as the Industrial Manager and now as Commanding Officer (CO) of the CG YARD, I find myself frequently using medical, and especially surgical, analogies to explain the challenges of ship repair to our customers, support partners, practically everyone. The metaphor of a hospital with numerous surgical specialties is particularly appropriate to the YARD's role as a ship repairer.

I've decided to share some of these challenges with the shipyard as a medical facility, the cutters as patients, the processes as medical procedures, etc., etc. The format is as follows: The **medical terminology** will be in **bold**, followed by the (*YARD/ship repair process terminology*) in (*parenthetical italics*).

ENJOY … and if this gives you a headache, **take two aspirin** (*reply to the Change Request*) and call me in the morning.

THE FACILITY

The Curtis Bay Medical Complex (*YARD, particularly the Industrial Waterfront*) is a somewhat modern facility with six **emergency room beds** (*Shiplift, 4 land-based docking positions, OAK RIDGE*) and numerous **outpatient rooms** (*piers and wharf spaces*). The **Curtis Bay Medical Complex** (*YARD*) also houses a **major medical supply distribution business** (*ELC -- for CG-unique spares*), which doubles as the **medical standards authority** for the corporation (*ELC in its Naval Engineering policy role*).

THE STAFF

The President and Chief Executive Officer (*YARD CO*) reports to the **Board of Directors and Chairman of the Board** (*CG-45 (Office of Naval Engineering) and CG-4 (Assistant Commandant for Engineering and Logistics)*). He/she usually has experience as the **Hospital Administrator** (**see below**).

The **Hospital Administrator** (*YARD Industrial Manager*) manages the overall medical business and administrative functions.

The **hospital Chief of Staff** (*Production Manager*) runs the day-to-day operations of the medical complex. He/she manages the emergency and outpatient rooms, the **Attending Physicians** (*Project Managers, Ship Superintendents)*, the rest of the **Medical Staff** (*Engineering, Planner Estimators*) and the rest of the **hospital staff** (*waterfront production craftsmen*), and also advises the Hospital Administrator in the unique and specific complexities of the **patient** (*cutter*) population.

The **Department Heads** (*General Foremen*) and their **direct reports** (*Foremen*) run their respective medical specialties. These specialties include:

Sensory functions	Electronics
Neurology	Electrical
Plastic Surgery	Sheet Metal/Joiner
Dermatology	Paint Shop
Orthopedic	Structural
Various circulatory function specialists (blood, digestive, lymph, etc)	Piping
Reconstructive surgeons	Machine Shops

Central Appointments (*the Scheduling Branch*) coordinates all the medical and surgical procedures, routine and emergency, to be ready not only for the next day's appointments, but for appointments well into the future.

The **Curtis Bay Medical Complex** (*YARD*) has over a century of experience and, armed with this unmatched expertise, functions as a **"teaching hospital"** (*Core logistics facility*).

THE CLIENTELE

The **average patient** (*cutter*) is hard to describe. Many are past retirement age and beyond, in fact should have retired years ago (*378s, 210s, 110s*). Most are suffering from **repetitive stress injuries and overwork** (*high OPTEMPO*). Much of the physical damage is **degenerative in nature** (*corrosive effects of the salt water environment*).

Some are **approaching middle age** (*270s*) and in need of a **comprehensive physical** (*270 Mission Effectiveness Program (MEP)*) with **several organ transplants** (*system recapitalization by Engineering Changes*) anticipated. Some have already had the **comprehensive physical** (*210 MMA*) and are in for their SECOND **comprehensive physical** (*210 MEP*). Finally, like their brethren immediately above, some have exceeded all life expectancy projections (110s).

Other patients are relatively young (*225s, 175s, 87s*).

All of the patients seem to think they are in better physical shape than they are actually in. For most, it has been four years since their **last routine physical** (*drydocking*) and they have had few **lab tests, X-rays or other preventive medicine** (*engineering diagnostics, non-destructive testing*) in the interim. They often have had a less extensive **Doctor's visit** (*dockside availability between drydockings*).

Many patients, upon hearing of the need for more medical treatment or further testing to pinpoint their malady, focus inwardly and discount the remaining patients and their needs. Each of these patients expects no wait to be seen and views the entire medical complex as available to them exclusively.

The **anxious family in the waiting room** (*Operational Commander*) paces nervously for the **bad surgical news** (*Open and Inspect "items of discovery"*) as the patient is diagnosed.

An interesting family dynamic occurs when one patient, on the waiting list for a **critical organ donation** (*GFE*), is preempted by another family member with a more urgent need for a transplant. In fact, **organ donation** (*loaning of parts from cutters under repair to operational cutters*) is a steady business line, although not very profitable, that can wreak havoc on the hospital's schedule.

Another funny family dynamic: despite living all across the country (*different cutter homeports*), all patients have the **same family tree** (*traced to OPCON*). When the **head of the family** (*OPCON, usually AREA*) steps in and gives one sibling **"favored son" status** (*operational prioritization of existing and emerging workload*) this makes for interesting "family talk." As physicians, we must listen to these individual woes sympathetically.

The *Maintenance Managers* (*MLC (Maintenance and Logistics Command) and NESU (Naval Engineering Support Unit)*) are the **family physicians, HMO and the insurance company**, all in one! They have a day-to-day patient/doctor relationship with the patient. They strive to know the overall **wellness** (*maintenance*) condition of their patients. Despite the best of **wellness** (*maintenance*) programs, **patients** (*cutters*) don't always know that ailments exist or, if known to them, don't always tell their physicians what their ailments are!

"Doc Robinson" (Kevin Robinson, Outside Machine Shop) uses a stethoscope to "examine" a 210' tail shaft (during re-machining of the sleeves).

THE PLOT

The **Preventive Medicine** (*maintenance*) Program starts with the screening visit with the **family physician** (*Work Definition Conference*). It is known that upcoming **routine physical** (*quadriennial drydock*) or **Doctor's visit** (*dockside availability between drydockings*) is due; so the **patient** (*cutter*) develops a **list of aches and pains** (*Recurring Work Items and CSMPs*) that, in a perfect world [unlimited finances], would all be addressed.

The **screening visit** (*Work Definition Conference*) may include some **x-rays** (*UT shots*) and some **biopsies** (*destructive testing*). As the **medical workups** (*A-Team process*) progress, the **"chief complaints"** (*Definite Work Items*) are decided upon. Almost always, the **patient** (*cutter*) receives a **routine physical** (*quadriennial drydock*) or **Doctor's visit** (*dockside availability between drydockings*) package which is less that they initially requested after the **HMO** (*MLC*) determines the **"authorized" procedures** (*final Worklist*) based on their **formulary** (*Cutter Class Maintenance Plan*).

The **patient** (*cutter*) arrives at the **Curtis Bay Medical Complex** (*YARD*), checks into their **room** (*waterfront berth*) and almost immediately goes onto **life support** (*temporary services like electricity and sewage*).

Despite the best medical work-ups, a certain amount of **exploratory surgery** (*"Open and Inspect" work*) is required to determine the **exact nature and extent of the various medical problems** (*Critical Inspection Reports*). Often what starts as **surface skin blemishes** (*bilge inspection and preservation*) grows into significant **skin cancer** (*which has metastasized*) and **which requires excision and grafting** (*significant structural growth and rework*).

After all the medical problems are suitably determined (*Critical Inspection Reports completed and submitted*), the **HMO** (*MLC*) again determines **"authorized" procedures** (*approved Change Requests*) based on their **formulary** (*Cutter Class Maintenance Plan*). At this point, the **HMO's ability to pay** (*contract budget*) and, significantly, the **patient's post-surgical plans** (*cutter's OPSKED*) determine what medical procedures will actually be accomplished.

As you might imagine, every **medical Department Head** (*General Foreman*) tries to convince the **hospital Chief of Staff** (*Production Manager*) that their surgical procedure is the top priority. The **hospital Chief of Staff** (*Production Manager*) must de-conflict the **medical**

Department Heads (*General Foremen*) on a daily basis, keeping the **overall health of the patient** (*overall cost/schedule/quality requirements*) in mind.

Surgical repair, especially trauma repair, is a significant value of the **Curtis Bay Medical Complex** (*YARD*). Often, the **anxious family in the waiting room** (*Operational Commander*) doesn't have time for a **complete medical work-up** (*A-Team process leading to the award of a commercial contract*). The patient complains of some medical ailment, is transported to our **Emergency Department** (*waterfront*), gets **treatment** (*repaired*), and departs, leaving the **hospital** (*YARD*) and the **Insurance Company** (*MLC*) to sort through the actual bills. Many a patient would have been **"laid up" sick** (*significant loss of operational days*) if the Curtis Bay Medical Complex had not taken them in immediately for medical treatment.

After surgery, the patient undergoes a period of **physical therapy and rehabilitation** (*system lite-offs, Dock Trials and Sea Trials*) before they are able to leave the hospital on their own (*cutter departure*). Despite the best efforts of the medical staff throughout the surgical procedures, the **risk of infection** (*accumulation of general shipyard dirt over time*) is always a concern. Fortunately, the **janitorial staff** (*contract compartment cleaners*) does its utmost to send the patient out the door clean.

"Doc Byrd" (Bob Byrd, Inside Machine Shop Foreman) uses a defibrillator to "jumpstart" a newly overhauled Paxman engine.

One of the unique benefits of care giving at the **Curtis Bay Medical Complex** (*YARD*) is the aftercare program. We really do treat patients like one of the family! Once you become a patient of ours, we forge a life-long relationship. We encourage phone calls and emails to the medical staff to **diagnose medical problems** (*troubleshoot CASREPs*) whether we performed the initial procedure or not. And generally at no charge.

We also make **house calls** (*Road Trips*), especially in the **Sensory** (*Electronics*) specialty. In fact, some of our **traveling surgeons** (*especially Electricians, Electronics, Ordnance*) are away from home for approaching 300 days annually.

It takes a lot of teamwork and coordination to run a Medical Complex. Like any business, there are critical support services and overhead functions: there must be lights, and HVAC; the staff has to be able to eat somewhere (*Galley, Drydock Club, Waterfront Café*); someone must pay the bills (*Fiscal Department*); **medical admin** (*YARD Servicing Personnel Office*); external certification requirements (*ISO 9001 Quality and ISO 14001 Environmental Management Systems*) a Chapel for pastoral care; a gym to support wellness efforts; a place for the overnight staff to sleep (*barracks*), a **gift shop** (*Exchange*), even a **Ronald McDonald House** (*Guest Housing, Berry Hall*). We offer these services to our staff, the patients, the patients' families and the other **major medical supplier co-located with us** (*ELC*), at prices well below the going commercial rate.

CLOSING

In summary, the YARD works hard every day to deliver the best **VALUE** we can to the operational Coast Guard fleet and the taxpayer. Working safely to maximize the "health" (capability and readiness) of the cutter and boat fleet and its sailors, at the lowest cost, and in the shortest duration is our goal.

Editor's Note: CAPT DUCA is NOT licensed to practice medicine in any state!

Acknowledgements: I want to thank the **head of the East Coast HMO** (*CAPT Dennis Blackall, MLCA(v)*) and the **immediate past CEO** (*CAPT Ron Rábago, YARD Industrial Manager 2001-3 and YARD CO 2003-5 and my boss while I was Industrial Manager*) for their review and comments.

LTPIO

What Does Logistics Transformation Mean for the Coast Guard?

Logistics encompasses all the activities associated with developing, acquiring, sustaining, and eventually retiring the components of capability including people, information, and systems.
(COMDTINST 4000.5A)

Logistics Transformation Program Integration Office (LTPIO)

Introduction The Coast Guard has a storied and unmatched history of success. Our legacy of success is largely built on our proclivity for action and innovation. To continue our legacy is to continue to reevaluate our position and to challenge all of our assumptions. Several studies and a thorough business analysis suggested that by embracing new logistics practices we can:

- ✔ Improve asset availability
- ✔ Lower total ownership costs
- ✔ Become a data driven logistics organization, which drives continual improvements
- ✔ Establish a culture of preventive and corrective vice casualty response
- ✔ Link logistics efforts to operational performance and financial savings
- ✔ Meet all statutory compliance requirements (GPRA, CFO Act, etc.)

What will Logistics look like after the transformation?

- ✔ The objective is to implement a common way of doing business across all the Coast Guard Logistics communities of Naval, Air, C4ISR and Facilities. The model is based on industry best practices which stress centralized process planning with distributed execution through closely monitored management controls.

How will the transformation be accomplished?

- ✔ The Coast Guard's Aviation Logistics business model represents industry best practice, and is the result of a similar transformation.
- ✔ Aviation logistics processes are clearly understood and very well documented. We will leverage the lessons learned from their transformation to lower project risk and accelerate the transformation of logistics throughout the Coast Guard.
- ✔ RADM Gabel, Assistant Commandant for Engineering and Logistics, will lead the effort. A Logistics Transformation Program Integration Office (LTPIO) has been chartered under RADM Gabel and charged with carrying out the task.
- ✔ The Commandant directed thru an ALCOAST that all Coast Guard commands support RADM Gabel in this effort.

What are near term efforts?

- ✔ CFO OM&S Remediation Initiative - The focus of this effort is to eliminate excess/obsolete materials at field units to significantly reduce the Coast Guard's inventory burden, improving the opportunity for a successful FY2007 CFO OM&S audit.
- ✔ RB-S Transformation Pilot - The focus of this effort is to apply the Aviation business model, industry's best practice, within the Response Boat-Small (RB-S) community with the goals of validating the model and developing a transition plan for the rest of the Coast Guard.
- ✔ Technical Information Management System (TIMS) - The focus of this effort is to leverage an existing COTS solution within the CG to consolidate A-TIMS, NE-TIMS, CE-TIMS and CGPMS into a single application. This will require the consolidation of business processes across all communities.

‘snapshots

CFO OM&S Remediation Project

Introduction

- ✔ The CFO OM&S Remediation Project is one aspect of a comprehensive plan to transform our logistics business procedures.

Why is the project important?

- ✔ The Coast Guard is not in compliance with key requirements of the CFO Act.
- ✔ Specifically, we are unable to fully comply with requirements to:
  - Accurately account for all of our inventory in terms of quantity,
  - Accurately value all of our inventory, and
  - Accurately classify our entire inventory in terms of its intended use.
- ✔ Compliance is not optional; good stewardship of taxpayer's dollars demands immediate changes. Failure will result in increased scrutiny from Congress and ultimately reduced funding support.

How will we achieve compliance?

- ✔ A thorough analysis will identify stagnant inventory, consumables with no-demand for three years and repairables with no-demand for seven years. These will be targeted for removal from field units. This represents more than $250-million in inventory (76% of total inventory items) tied up in parts that have not been used in several years.
- ✔ The repositioned inventory will be consolidated at our two major Inventory Control Points (ICPs), ELC and ARSC.
- ✔ The two ICPs will properly classify the inventory and then reutilized it if needed, or dispose of it if excess.
- ✔ A responsive, centrally managed process will be established to ensure that field units can get items returned from the ICPs in the unlikely event that they are needed. This process will be free to the field units.
- ✔ Field units will be given the opportunity to retain a limited number of parts which they deem critical.
- ✔ To ensure that these items do not creep back into our inventory, no allowance shortfall buys will be allowed for items on the removal lists.
- ✔ An extensive Pilot Program has been conducted to ensure that a well-defined process is in place to execute this project.
- ✔ Metrics will be put in place to monitor and report removal effort performance.

What are the benefits?

- ✔ The primary outcome will be the Coast Guard's compliance with the CFO Act OM&S requirements.
- ✔ Field level inventory management efforts each year are burdensome and greatly exacerbated by the number of parts which have no relationship to unit maintenance procedures. Removing these stagnant inventories will ease the inventory burden, make needed parts easier to locate, allow new capabilities to be added to the vessels as we'll no longer be weight restricted and free space for other uses.
- ✔ With or without this stagnant inventory removal effort all field units were tasked to perform wall-to-wall (W2W) inventories. These inventories will be more manageable because of the greatly reduced number of items.

THE CHRONICLES OF ONSS PART III

by LCDR Frank W. Klucznik
Atlantic Area Command

USCG photo by PA1 Scott Carr.

INTRODUCTION

This is part three of a multi part series chronicling an Information Technology (IT) pilot project from conception to disposition. The pilot was dubbed ONSS, pronounced "ONUS," after the Operation Neptune Shield Scorecard and involves automating a manual reporting process that captures Coast Guard Homeland Security activities. Part one was published in the Fall 2005 edition of the *Engineering, Electronics & Logistics Quarterly (EE&LQ*) and described the conception of the project through its first year of development. Part two was published in the Winter 2006 edition of the *EE&LQ*, and discussed the System Development Lifecycle (SDLC), and its impact on project development. This article will cover refinements in project management, vertical alignment and a best practices solution on organizing training / meetings through teleconferencing.

Nothing in this article is intended to criticize, malign or embarrass any individual or organizational entity. This series is designed as an informative journal describing events as they unfold and explaining some of the processes, lessons learned and best practices captured during system development.

REFINEMENT

Process improvements (i.e., refinements) are interjected into ONSS project development on a regular basis through the spiral development model. The model was originally proposed by Boehm in 1988 as an alternative method to the waterfall model for software development, and takes on the form of a spiral depicted in Figure 1. Each loop represents a phase or cycle of development as defined by the project team, and includes a review and risk analysis in every cycle. The spiral model supports iterative project development, which reduces the overall time to develop a project from conception to deployment.

ONSS software development is currently evolving in six month cycles, while the SDLC documentation was recently increased to a quarterly cycle. This dual timeline

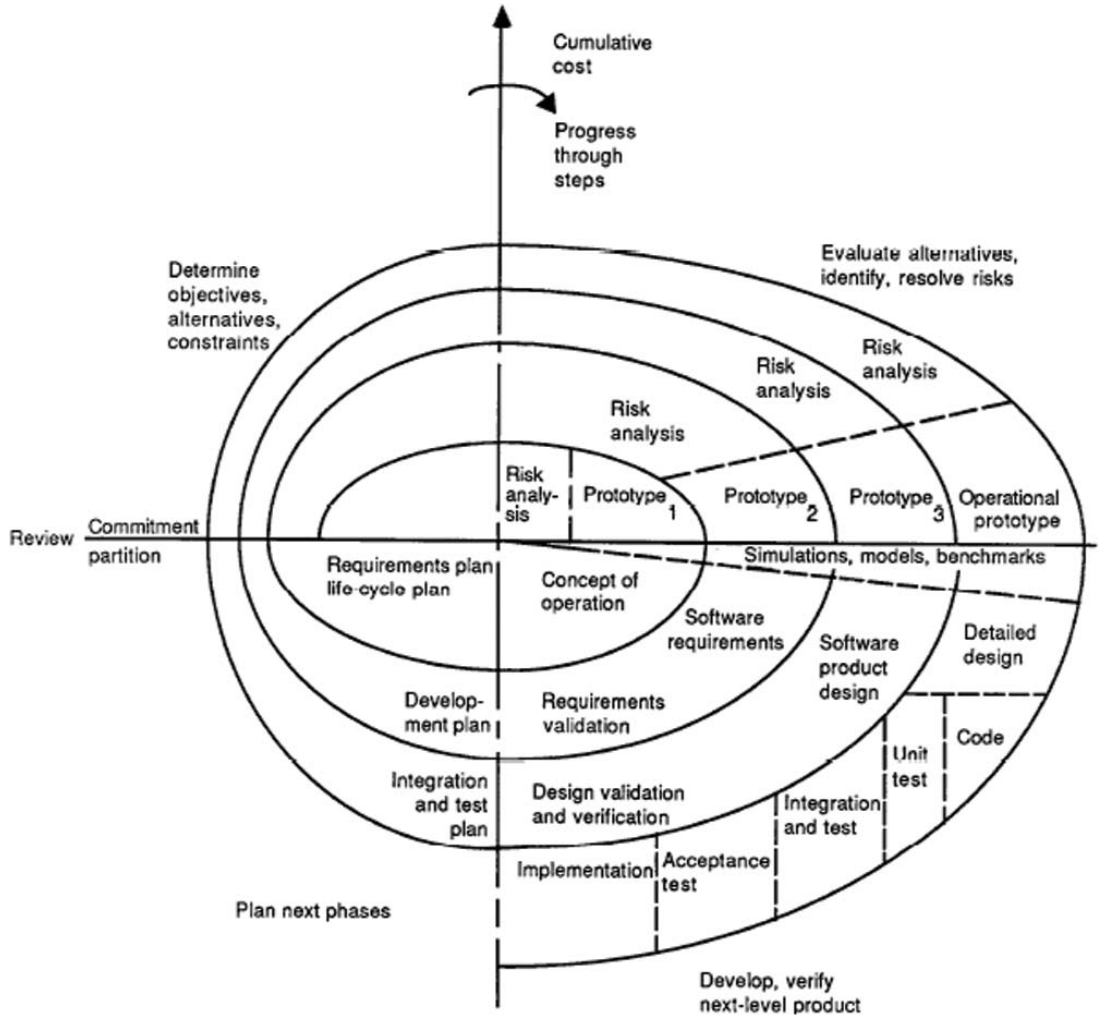


Figure 1.

was established to help get the system documentation caught up without hindering software development. Recall, the Winter "Chronicle of ONSS" explained the SDLC process was officially brought on-line when development on the first version of ONSS was 50% completed. Consequently, documentation lagged development from the very beginning, and the project development team had to redirect a significant amount of effort last year away from system development to generate system documentation. Unfortunately, we were never able to get the system documentation caught up with system development because a series of homeland security events and natural disasters took priority.

An analysis of the project showed the review and approval process possessed the single greatest potential for accelerating system deployment because it contributed to approximately 50% of the delays in project deployment. Twenty-five percent of the remaining delays were caused by project creep, while regulatory compliance made up the last 25%. The former was addressed during the development of ONSS V1.0.0, and the latter was resolved prior to operating the system in a limited capacity during the fall of 2005. Since neither of these two issues presented a hindrance to the project any longer, the review and approval process remained as the only significant challenge.

The review and approval of the ONSS system documentation was reduced by more than 40% through the adoption of a concurrent review schema in lieu of a traditional sequential process. This reduction is expected to catch the documentation up with system development within the first 90 days of Calender Year (CY) 2006. When the project was initially adopted by G-MP and G-OP, dual sponsorship sounded like a good thing. However, it quickly became an impediment to the review and approval process because it doubled the number of reviews required for approval. Figure 2 (see next page) is an excerpt from the project business case, and shows all of the major elements involved in the project before vertical alignment took place in Headquarters during January 2006. The phase one documentation received no less than six sequential reviews by the system

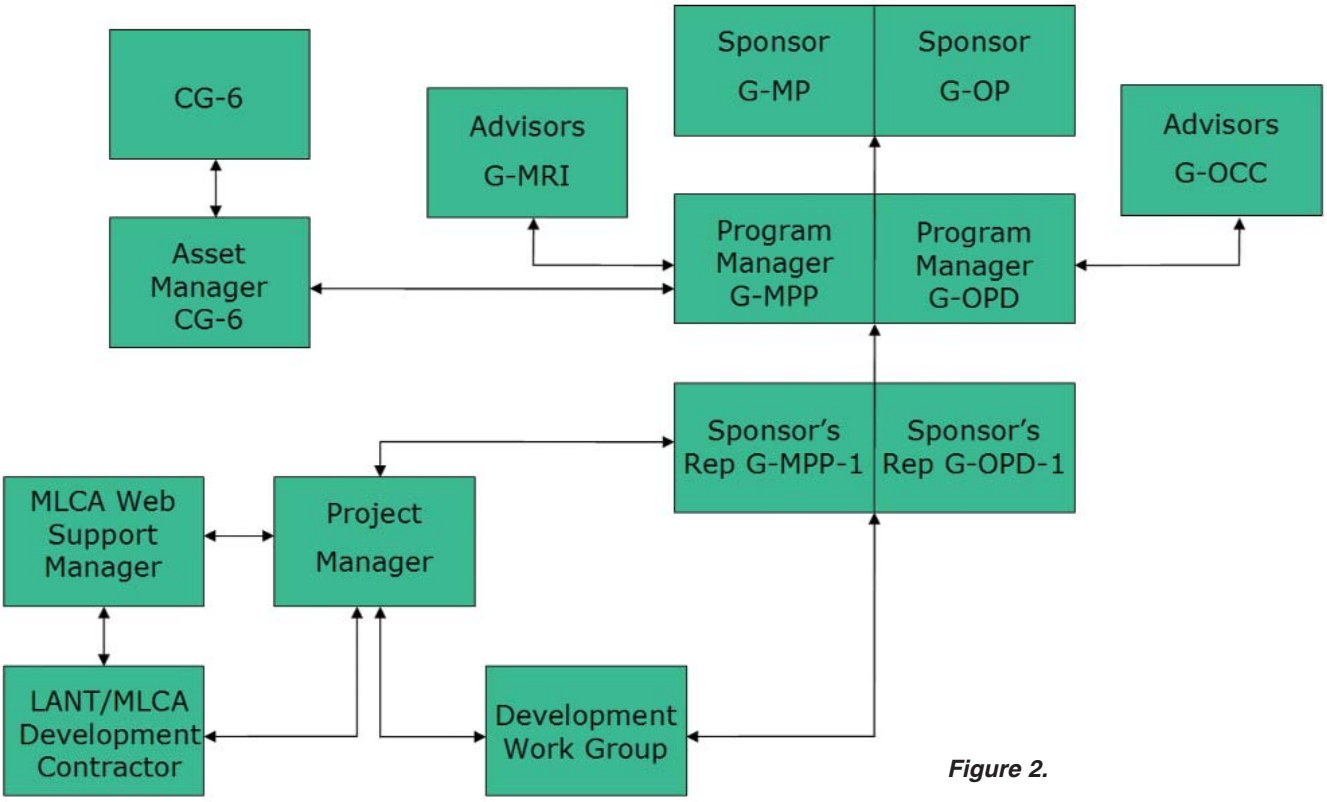


Figure 2.

Sponsors before being forwarded to CG-63 for approval, and the process took more than six months to complete. Figures 3 and 4 model how a concurrent review will dramatically improve review time by reducing the number of steps and feedback loops in the overall process.

The project development team helped to facilitate a concurrent review process by adding several system enhancements in V2.0.0 released in January 2006. For example, updated SDLC files are now posted on the ONSS homepage in lieu of routing them through email distribution. This action provides parallel access to system documentation for everyone involved in the process, ensures only those who need the information receive it, and reduces the amount of duplicate files stored on Coast Guard file servers. File management functionality was added to the system that allows the System Administrator to upload or delete files available to all users on the system's homepage, thereby reducing the development team's dependence on the project's Web Developer for this service. A standard naming convention was also implemented to help users identify and locate files of interest; the convention involves assigning a prefix to the file name such as "Brief_" for PowerPoint briefs, "Doc_" for SDLC documentation and "Train_" for training files. As a further enhancement to the naming convention, V2.0.0 introduced sort functionality in the documentation list. Now users interested in training can use a single mouse click to bring training documents to the top of the list, and when updated SDLC documents are uploaded, reviewers can sort the documents by date to retrieve the latest files from the top of the list.

Switching to a concurrent review process and adding several system enhancements such as parallel file sharing and standard naming conventions are expected to allow the system documentation to catch up with system development within the first 90 days of the new year. One of the greatest unknowns in our ability to move forward with documentation is the impact of Headquarters' vertical alignment. As of this writing, G-MPP was dissolved and its staff assigned to other Headquarters elements, and G-OPD, who was renamed G-RPD, is currently functioning as the project's primary sponsor. It remains to be seen whether the project will have one or two sponsors in the future, and all we can do is wait and see how things shake out at Headquarters.

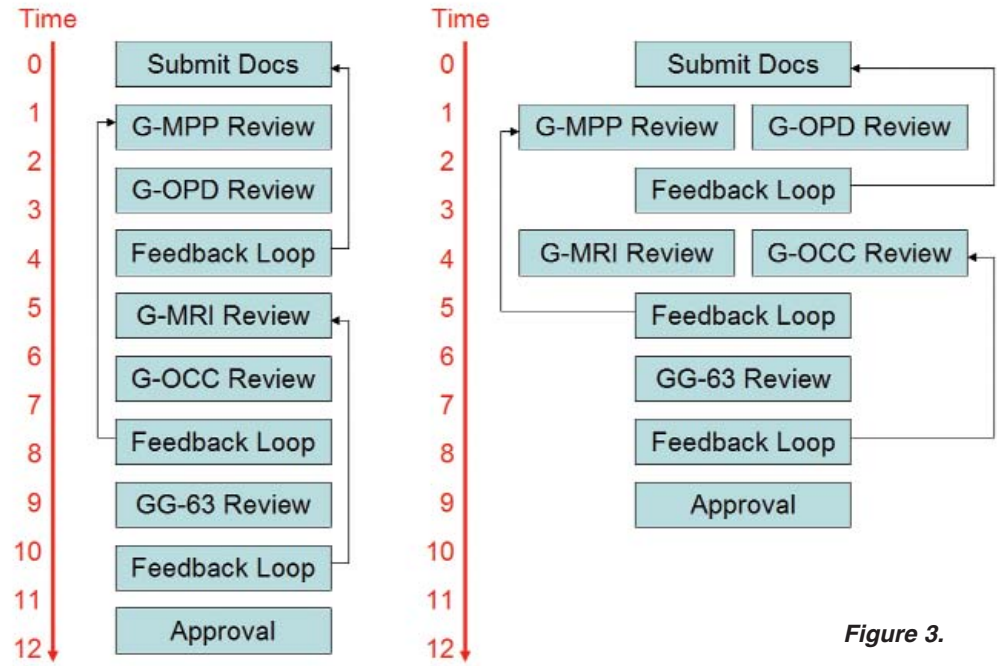


Figure 3.

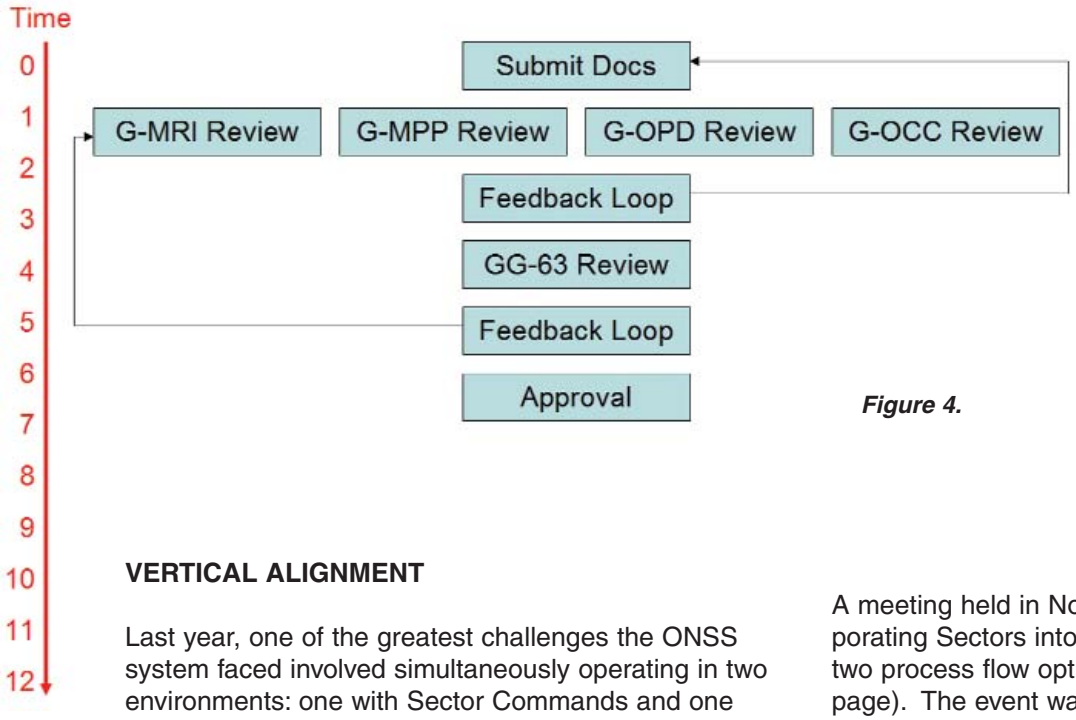


Figure 4.

Although this workaround was a little awkward for some, it was both functional and manageable for a period of time.

Even before Sectors were conceived, the Scorecard was somewhat challenging to manage because it measured nationwide activities at 55 distinct data points defined as Military and Economically Strategic (MES) ports. Coast Guard Captain of the Ports (COTPs) were assigned primary responsibility for tracking and reporting ONS activities through the Scorecard, and although most COTPs were assigned a single MES port, several were responsible for two ports. The introduction of Sector commands introduced another level of complexity to Scorecard reporting because it involved the merger of one or more COTP Zones. Of the 32 Sector commands 14 contain only one MES port, 14 Sectors have two ports, one Sector has three ports and three Sectors have four ports.

VERTICAL ALIGNMENT

Last year, one of the greatest challenges the ONSS system faced involved simultaneously operating in two environments: one with Sector Commands and one without. The system was designed before sectorization began taking place in the field. Consequently, there were no organizational maps or customer requirements for incorporating sectors into the process flow. However, when CG-63 granted permission to operate ONSS in 16 LANTAREA (Atlantic Area) ports in the fall 2005, over 50% of LANTAREA Sectors were effectively in place and functioning. A work around was developed that required field units and Sectors commands to share the responsibility of tracking daily activities and generating periodic Scorecard reports.

A meeting held in November, 2005, to discuss incorporating Sectors into the ONSS system, produced the two process flow options shown in Figure 5 (see next page). The event was attended by more than 60 members from various locations and levels throughout the organization, and attendees communicated a clear and unanimous message that all Sectors were not created equal. The development team anticipated the long process flow would be the popular solution because ONSS was originally configured with three actionable levels: Unit, District and Area. Adding a fourth layer between the Units and Districts appeared to represent an intuitive resolution. Headquarters staffs were not incorporated as an actionable element in the process because they are considered end-users

ONSS PROCESS / INFO FLOW OPTIONS

Actions	1	2
Reject / Final Review / Validate	Area	Area
Reject / Review / Validate	District	
Reject / Review / Validate	Sector	District
Report Generation	Unit	Sector

Process Flow

Figure 5.

of the data, and accordingly, are provided with read-only access to the system. During the discussions at the November meeting there were single port units who wanted to use the long process flow option, while a four port command insisted they needed the short process flow option. Although these two examples were counter intuitive, all participants agreed there was no single solution that would work for everyone.

Sectors were incorporated into ONSS as a dynamically configured element capable of evolving as the ONS program matures, and flexible enough to adapt to the latest Coast Guard organizational structural. This implementation method was chosen because it met customer needs, as well as any future changes in the organization's structure. The process flows in Figure 5 are a function of user roles, and the ONSS application automatically assigns the correct user functionality based on users assigned to each MES port. The presence or absence of unit users is the determinant factor for assigning system functionality and process flows. If a port has unit users, then the long process flow is assigned. Conversely, if a port has no unit users the short process flow is selected. The system possesses the ability to adapt and change as quickly as administrators can update user roles and does not impact the data stored within the central repository.

BEST PRACTICES

The development team was able to leverage teleconference technology in conjunction with PowerPoint presentations to engage our customers in over 200 hours of interaction during a three month period. This interaction involved four requirements meetings (63 participants) and eight training sessions (143 participants), utilized organic resources, and cost nothing beyond one hour of FTE per individual, per event. The total cost savings to the Coast Guard was approximately $210,000 in travel and per diem, an average of two days FTE per person, while the benefits to the project were priceless.

Anyone can leverage technology in a similar manner by: (1) acquire teleconferencing services to support the maximum number of participants; (2) create a presentation with a detailed agenda including timeline, presentation material and page numbers within a reasonable size constraint; (3) email participants ahead of time with meeting details, RSVP instructions, any meeting guidelines and send out a detailed reminder at least one day prior to the event; and (4) keep an open email program during the event to provide an alternate means for participants to communicate through.

SERVICES: The ONSS development team needed to stay in contact with an unusually large number of people, so we obtained approval to use a telephone bridge from Headquarters with the capacity to host 26 callers. Most teleconferences are not going to involve a group that large, and many standard telephone systems throughout the Coast Guard can only support conference telephone calls for small groups (i.e., 2-3 callers). Command centers often have the ability to host larger group conference calls. The exact capability and availability of services varies from location to location and should be researched for your local area.

PRESENTATION: PowerPoint presentations were made readily available for downloading from the ONSS homepage prior to the event. Each presentation contained a detailed agenda and time line, presentation material and page numbers, which are essential for keeping everyone in sync throughout the meeting. Although most Coast Guard IT systems don't offer document posting and downloading services, PowerPoint presentations contain-

ing 24 or more slides can easily be created under 1Meg in size and transmitted via email across the Coast Guard Intranet. The key to developing a small presentation with a lot of information is to minimize the use of background colors, slide transitions, sounds and graphics. The goal is to provide a well organized structure to manage a teleconference, and not to impress the audience with your PowerPoint skills. If the meeting requires a file too large for the CG email system, then a CG Central Microsite may offer an alternative means.

EMAIL PARTICIPANTS: The ONSS events used a standard email announcing the event two weeks ahead of time that provided at least two meeting times/dates, explained the purpose of the event, required an RSVP at least two days prior, and let potential participants know availability was limited and filled on a first come first serve basis. When participants RSVP'd, a second email is sent confirming the reservation and letting them know to expect another email at least one day prior to the event with detailed instructions.

One day prior to the event, a final email is sent to each participant reminding them of the meeting time and date, purpose, agenda and timeline, details for downloading the presentation (if necessary), and any meeting guidelines / protocols participants are required to follow (i.e., conference call phone number, password, etc.). These guidelines help to manage expectations on both ends, minimize questions and provide a very manageable event, even with larger groups of people.

OPEN EMAIL: Finally, we recommend the meeting facilitator keep an email program open and visible during the meeting. This provides an alternative means for participants to contribute to the event. It is particularly useful for individuals who are not comfortable speaking to a group of individuals they are not familiar with. Someone may be experiencing difficulty expressing their opinions or comments because of a high level of discussion by others, or participants may have questions that were not answered before the end of the meeting. Maintaining an open email account allows participants another opportunity to contribute to the event.

UPDATE

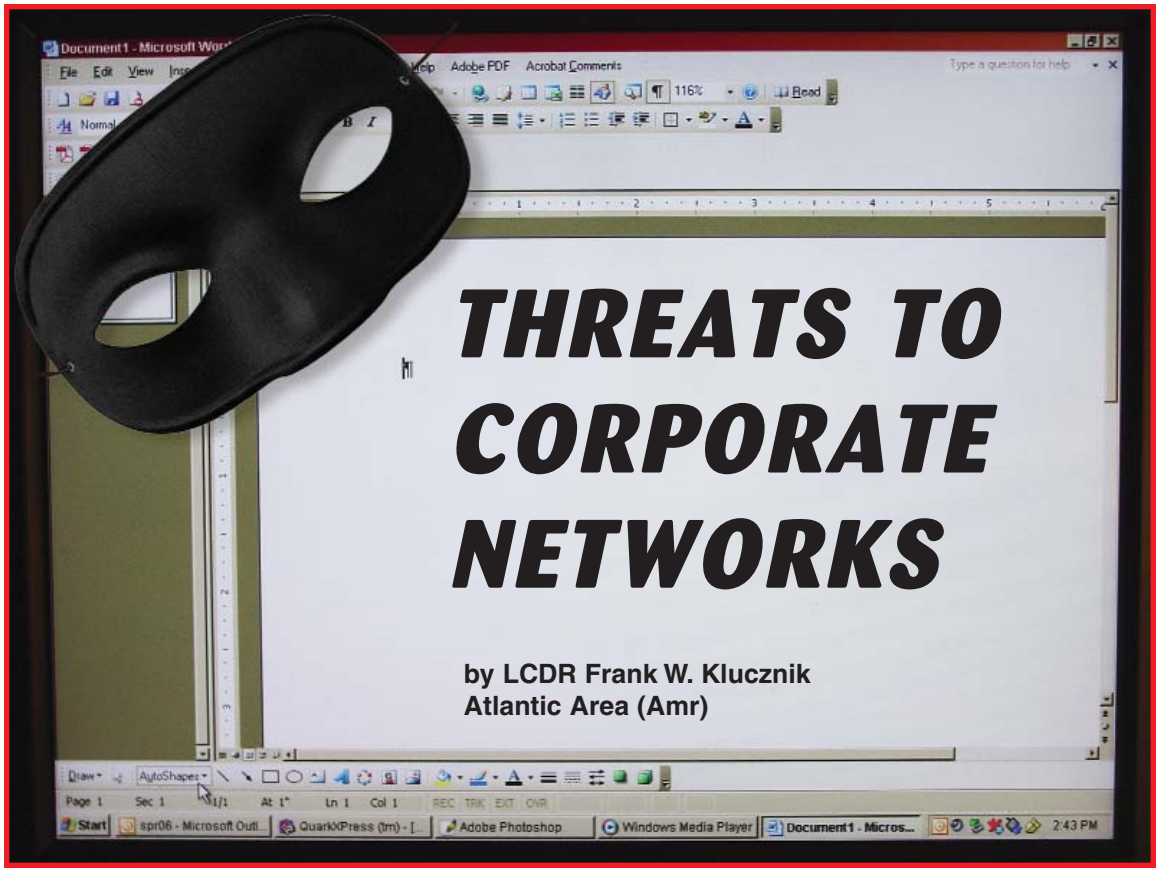
In December of 2005, CG-63 expanded and extended the authorization to operate the ONSS system in all LANTAREA MES ports for a period of 90 days. As a result, all LANTAREA ports began using ONSS for Scorecard reporting as of 1 January 2006. This extension to operate ONSS is expected to give the development team and project sponsors sufficient time to submit the remaining documentation to catch up with system development. Once all of the SDLC documentation is submitted and approved, the authority to operate the system will be extended to PACAREA (Pacific Area) as well.

The January release of ONSS V2.0.0 contains a new MS Outlook graphical user interface, vertical alignment with Sectors, enhanced administration functions at the unit level that allows users to better manage daily and unvalidated periodic reports, fixed all list sort functionality, added sort functionality to system documentation, added advanced System Administration ability to upload and remove system documentation, and updated all training and briefing materials.

ONSS ... involves automating a manual reporting process that captures Coast Guard Homeland Security activities.

Development over the next three months will focus on creating the GIS map functionality, allowing all users to generate dynamic Scorecard reports for all MES ports, Areas or Districts, and allowing Sectors commands to manage Scorecard data for multiple MES ports without requiring a separate username and password for each port.

The development team and I welcome any suggestions and / or feedback from ONSS users. Please email your comments to: frank.w.klucznik@uscg.mil.



INTRODUCTION According to a recent survey conducted by Securitas Security Services USA, Inc. three of the top ten threats to corporate security reported by Fortune 1000 companies involve computer security.[1] The three included: Computer Crime: hardware / software theft; Computer Crime: Internet / Intranet security; and fraud and white-collar crime. See Figure 1 for the complete list.[1] This top ten list also indicates the most significant threats to computer systems come from within the organization rather than outside company walls. This paper briefly discusses the threats to computer security and how technologies may serve as potential solutions to corporate security threats.

Top 10 Threats to Corporate Security

- Workplace violence.
- Crisis management/executive protection.
- **Fraud and white collar crime.**
- Employee screening concerns.
- **Computer crime: hardware/software theft.**
- General employee theft.
- **Computer crime: Internet/Intranet security.**
- Drugs in the workplace.
- Unethical business conduct.
- Property crime (external theft, vandalism.

Figure 1.

THREATS Threats to computer systems come from one of three sources: external, internal or physical. External threats include hackers, Denial Of Service (DOS) attacks, bots and malware in the form of computer viruses, worms, Trojans and spyware. Hackers are individuals or groups of individuals who try to break into a secure computer system for either malicious or non-malicious intent. DOS attacks are designed to overrun a website with activity to the point where Internet users cannot gain access to the site.[13] They are often used to bring down a website and prevent a particular company from doing business on the Internet for a period of time.[13] Bots are one of the newest computer threats and involve a silent form of malicious software designed to create a real-time communication link with other computers over the Internet.[6] Once installed on a computer, bots operate invisibly in the background and are programmed to join a private chat room where a human

master often controls thousands or even ten's of thousands of bots to create a botnet.[6] The master then can use the botnet to initiate illegal DOS attacks against retail Internet websites, affect the outcome at a web-voting site, or steal sensitive information such as user names and passwords from other computers.[6] Malware is any software developed for the purpose of doing harm to a computer system, and the two most common types of malware are viruses and worms.[13] A computer virus is a program that propagates or reproduces itself and infects other programs on the same computer.[8] Viruses can seriously damage your computer by erasing system files necessary for the computer to run, erase all of the data on a hard drive or they may just generate annoying pop up windows.[8] In order for a virus to spread, it must be placed on another computer by trading files through over the Internet or by copying files through email attachments, floppy disks, jump drives, etc. A worm is similar to a virus in that it reproduces itself. However, unlike a virus, a worm can spread itself automatically from one computer to the next by taking advantage of automatic file sending and receiving features found on many computers.[8] Worms may be transmitted by email attachments, floppy disks or Trojan. The term Trojan refers to a malicious computer program disguised as something benign.[8] For example, you may receive an email and attachment from a friend or family member, or perhaps from someone you don't know. Regardless, once you click on the attachment to open it, the dangerous program it contains is unleashed and quickly erases all the data on your hard disk, sends credit card numbers and passwords to a stranger, or lets a stranger hijack your computer to commit illegal activities such as DOS attacks.[8] Finally, spyware is any computer software designed to gather and report information about a computer user without the user's knowledge or consent.[17] Unprotected Windows-based computers are particularly vulnerable and can rapidly accumulate a great many spyware components. The consequences of a moderate to severe spyware infection include a substantial loss of system performance (over 50% in extreme cases), and major stability issue.[17]

Internal threats come from trusted sources; that is individuals or people who have a legitimate access to computer systems, information or records. Internal threats may go undetected for longer periods of time than any other security breach and are therefore much more dangerous because they often do more damage. Trusted sources may use their access to steal proprietary company secrets, copy personnel information about other employees, redirect company funds into private banking accounts or consume company resources downloading music, movies or other fraudulent abuses. One of the most well known internal security breaches occurred at the Los Alamos National Laboratory several years ago. It was discovered employees and contractors working at the laboratory were stealing and selling our nation's nuclear weapon designs and secrets to foreign entities. The resultant damage to national confidence and security is incalculable and may never be completely determined.

Physical threats may be either internal or external, but ultimately result in physical damage to computer systems. Examples include fire, flood or total destruction of computers and entire computer systems. Hurricane Katrina's impact to New Orleans is a recent example. Floodwaters completely ruined thousands of computer systems in the city, and without proper backups and redundant systems untold amounts of data and information may have been lost. Other examples include construction workers severing communications cables when digging holes, computer hard drive failure, lightening strikes and other electrical surges, etc. The list goes on and on. It is just as important to plan for physical threats, as it is to protect against internal and external attacks.

TECHNOLOGY Technology offers a wide variety of potential solutions to the threats discussed above. Some of these solutions include: firewalls, establishing Demilitarized Zones (DMZ), backups, antivirus software, passwords, encryption, Uninterruptible Power Supplies (UPS) and surge protectors. In computing, the term **firewall** is used metaphorically to refer to a piece of hardware, software or a combination of both hardware and software that prevents unauthorized network communications.[15] In essence, a firewall stops intruders from gaining access to a network or computer. Firewalls may be established on a network level to prevent individuals or other computers from accessing the Local or Wide Area Network (LAN / WAN), or they may function as an application layer firewall by preventing software applications from accessing the network or individual computer.[15] A **DMZ** is a network or part of a network separated on both ends by firewalls.[12] The portion of the DMZ between the firewalls normally contains web servers, email servers, Domain Name Servers, etc., that communicate directly with the Internet and other private networks.[12] These servers create a buffer between a private LAN / WAN and the public Internet. As a buffer, a DMZ does not allow computers in a private network to receive data directly from external sources.[12] External sources communicate with servers housed within the DMZ, which filter and verify information before passing it onto the private network destination.[12] Figure 2 (next page) depicts a DMZ between a private network and the Internet. **Computer backup** refers to the copying of data for the purpose of having a second copy of the original information in case the original data is damaged or lost. Backups may be saved onto a variety of formats including CD-ROMs, DVDs, tapes and even other computer hard drives. Regardless of the storage media, backups allow point-in-time restoration of computer systems after all other security measures have failed. Although any information saved or stored between the time the backup was created and the data loss occurred, backups significantly minimize the amount of data loss. **Antivirus software** identifies, thwarts and eliminates computer viruses

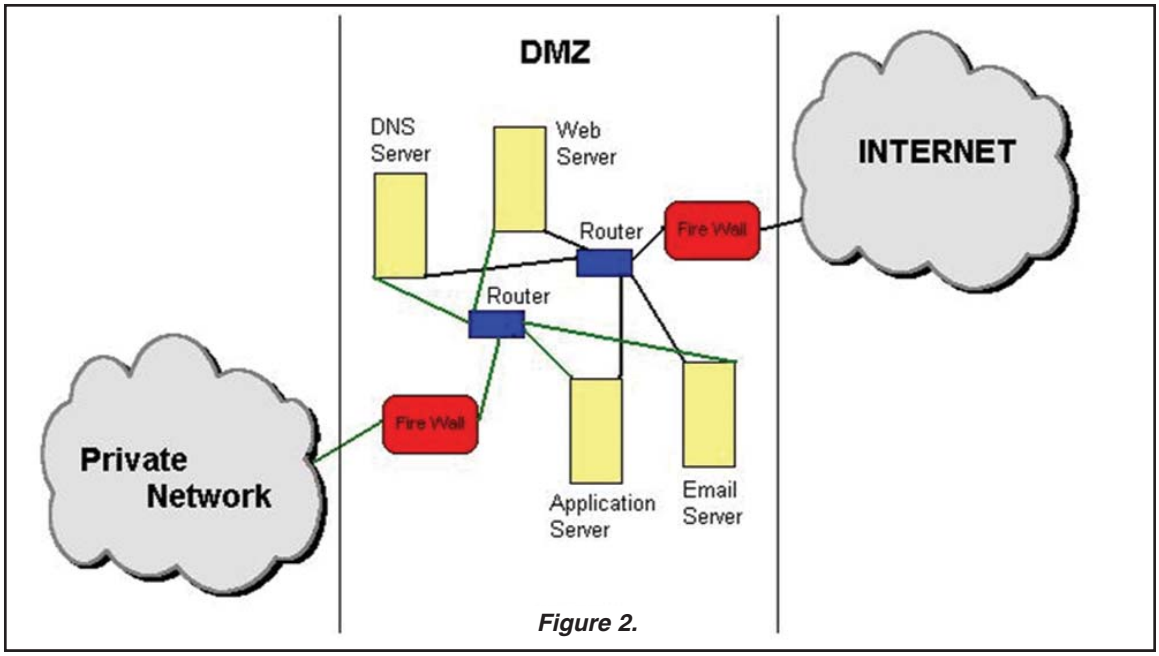


Figure 2.

and other malicious software from computer systems by either examining files to look for known viruses, or identifying suspicious behavior of computer programs.[9] A **password** is a form of authentication designed to control access to a resource, and is kept secret from those not allowed access.[16] Passwords are commonly used to control access to computer systems, mobile telephones, automatic teller machines, etc.[16] **Encryption** is the process of obscuring information to make it unreadable without special knowledge of how to decrypt the data, and may be used for authentication to exchange passwords in a secure environment.[10] As a security system, all passwords and encryptions may be broken if given enough resources and time. The primary goal of modern security systems is to make breaking passwords and encryptions difficult enough, that it is not practical to accomplish. A **UPS** is a device or system designed to maintain a continuous supply of electrical power to essential equipment, while **surge protectors** are designed to protect electrical devices from surges in power and voltage spikes.[18] The primary difference between the two devices is that if electrical power were turned off to both pieces devices, a UPS would continue to supply power for a period of time, where as a surge protector would not.

Figure 3 is a matrix displaying the relative effectiveness of each solution presented above with the threats discussed earlier in this paper. Effectiveness is couched in terms of protection, detection or does nothing to mitigate each threat. Prevention was not considered as a relevant measure of effectiveness because none of the solutions can absolutely prevent any single threat. The primary goal of computer security is similar to encryption: make accessing the data sufficiently difficult that it is not practical to pursue.

RELATIVE EFFECTIVENESS OF TECHNOLOGY SOLUTIONS AGAINST COMPUTER THREATS

SOLUTION	THREATS									
	Internal	External	Hackers	DOS	BOTS	Malware	Power	Fire	Flood	Destruction
Firewall		P,D	P,D		P	P				
DMZ	P,D	P,D	P,D		P	P,D				
Backups	P	P	P	P	P	P	P	P	P	P
Antivirus Software		P,D		P,D	P,D	P,D				
Passwords	P	P	P	P	P	P				
Encryption	P	P	P							
UPS							P,D			
Surge Protectors							P,D			

Figure 3.

P= Protect, D= Detect

At first glance, it appears backups provide the ultimate protection against all of the threats listed. However, backups alone are not a practical form of protection because they only restore data to a point-in-time when the backup was conducted. Any data stored between the time the backup image was created and data loss is gone forever, and data restoration may take many hours or even days to accomplish. In addition, backups only restore information; they offer no protection against theft. As a result, a complete analysis of the matrix indicates there is no single solution currently available to completely protect computer systems against the combination of internal, external and physical threats present in modern computing environments. The best available protection against computer threats appears to be a combination of technology solutions, and even then nothing can stop floods, fires and other natural disasters from destroying computer systems.

SUMMARY Three of the top ten threats to corporate security reported by Fortune 1000 companies involve computer security. Threats to computer systems come from one of three sources: external, internal or physical. External threats include hackers, Denial Of Service (DOS) attacks, bots and malware in the form of computer viruses, worms, Trojans and spyware. Regardless of whether the threat is internal, external or physical, the results are the same; potential loss of communications, data and productivity, all of which impact an organization's ability to function.

Modern technology offers a wide variety of potential solutions to computer security threats. Some of these solutions include: firewalls, establishing a Demilitarized Zone (DMZ), backups, antivirus software, passwords, encryption, Uninterruptible Power Supplies (UPS) and surge protectors. No single solution will protect a computer system against the threats listed above. Proper protection against security threats can only be accomplished with a combination of technology solutions.

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