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DEEPWATER News

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Tow Tank Testing Guides Cutter Design Effort

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) earlier this year. 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)

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, 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 and computational fluid dynamics modeling, 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 will be 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.

"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 be-

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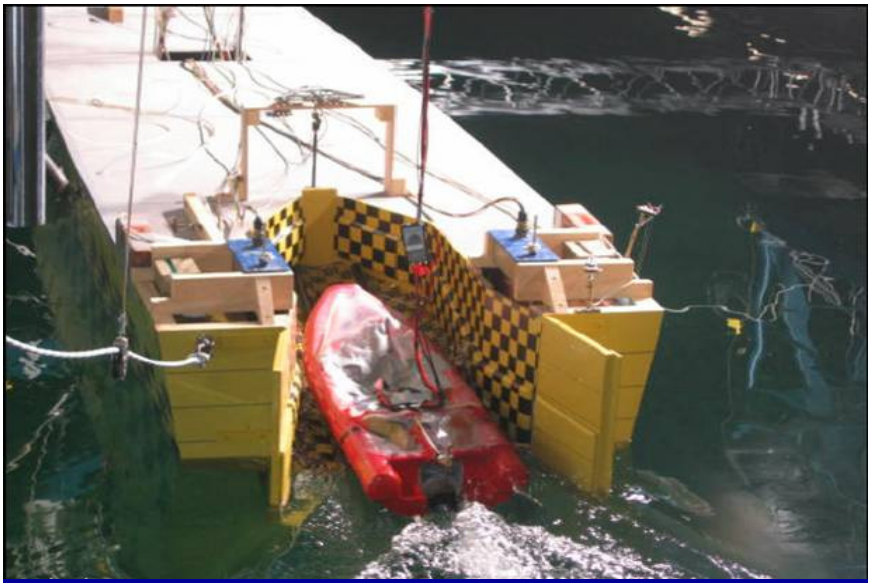
ing performed at the Maritime Research Institute of the Netherlands (MARIN). According to Dr. John Hackett, director of advanced ship design, hydrodynamics and signatures for Northrop Grumman Ship Systems, one of the Deepwater Program's industrial partners under contract to design and build the FRC, 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 Legend 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."



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, the radio-controlled RHIB model 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)

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 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 them 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.

By Gordon I. Peterson

A Collaborative Approach: Deepwater's System of Systems Domain

The Deepwater Program's System of Systems Team
(Photo by PAC Jeffrey Murphy)

Adherence to a sound systems engineering and integration strategy in the execution of the Deepwater system-of-systems acquisition has been an area of continued emphasis since the program's inception more than 10 years ago. The need to balance issues of cost and schedule with the performance of delivered assets and the operational needs of Coast Guard end users has assumed even greater significance since the post-9/11 Integrated Deepwater System (IDS) Mission Needs Statement and implementation plan were approved earlier this year.

"We need to continue our collaborative approach to balance what are often competing goals and priorities," said Greg Mitchell, the Deepwater Program's new system of systems domain manager and chief of the Systems Integration & Management Division (SE&I, G-DPM-1). Mitchell, a Navy veteran, served as an industrial specialist responsible for integrating critical infrastructure protection programs associated with homeland security and defense before joining the Deepwater Program in mid-October.

Mitchell's approach to systems engineering and integration is very much concerned with following an interdisciplinary process to develop, optimize, implement, and maintain the complex Deepwater system of systems.

"Our systems engineering and integration approach reflects the best practices of industry and government," Mitchell said. "We must foster close relationships with our many partners—in both industry and government. Part of this collaboration entails a greater awareness and sensitivity to the cost controls necessary to execute and manage the program properly."

To achieve its central focus for management of project performance, cost, schedule, and risk related to IDS-level systems integration and engineering, the SE&I Division partners with a wide range of stakeholders. Included are the systems integrator (ICGS), the IDS Sponsor's Representative (G-OCD), other support directorates at Coast Guard Headquarters, and the program managers and staff of Deepwater's other domains. Mitchell and his team are responsible for performing systems integration and management for all IDS procurement phases as well as providing contract oversight for the systems integrator's task orders.

A specific function of the SE&I Division is to develop technical assessments and alternatives for all facets of the IDS system across all domains. This process entails full consideration of such factors as supportability, integration, and providing Coast Guard leadership to the Systems of Systems Domain and Systems Engineering and Integration Team.

The SE&I Division's program-wide technical services include: (1) coordination of cross-asset and cross-directorate cost, schedule, performance trade-off analyses; (2) preparation of system Test and Evaluation Master Plan and Developmental Test and Evaluation plans and reports; and (3) coordination of Developmental Test & Evaluation and Operational Test & Evaluation activities for all assets. Oversight also is maintained for the technical activities of the IDS Integrated Product Teams for Systems Architecture, Operational Effectiveness, Total Ownership Cost, Life Cycle Engineering, and Testing & Evaluation.

Past studies of large engineering projects have documented that a well-structured approach to systems engineering and integration will minimize overruns in cost and schedule and improve overall system effectiveness. For the Deepwater Program, this approach can lead to higher levels of equipment commonality across program assets and systems, im-

proved interoperability with the Navy and other agencies, and substantial cost avoidances by maximizing the use of existing and proven products and systems.

Early in his assignment, Mitchell has identified several areas of emphasis. “I see a clear need to control cost,” he said. “We also must deliver interoperable and capable assets and systems to meet established performance requirements suitable for the Coast Guard’s expanding mission set.”

“We are focused on productivity and performance,” Mitchell said in describing his outlook as a new member of the Deepwater-industry team. “We also must focus on our end user—the Coast Guard operator. In the end, we must ensure the Integrated Deepwater System is well-engineered and integrated from a system-of-systems perspective.”

Gordon I. Peterson

Bell Helicopter Opens Unmanned Aircraft Systems Flight Test

The Eagle Eye prototype will be the first Bell unmanned system to use Wrangler Field for flight-testing. Scheduled to begin flight test operations in January, the Eagle Eye recently received its certificate of airworthiness for experimental flight-testing from the Federal Aviation Administration.

This certification represents the first certificate of airworthiness for experimental flight-testing ever issued by the FAA to a vertical lift UAS.

"Our vision at Bell Helicopter is to be the premier global provider of vertical lift technology," explained Bob Ellithorpe, executive director of unmanned systems. "This vision includes unmanned systems like the Eagle Eye TR918 and the opening of this new XWorX UAS Flight Test Center of Excellence."

Bell Helicopter Textron Inc., a Textron Inc. company, recently cut the ribbon on its new Unmanned Aircraft Systems Flight Test Center of Excellence. Located in Graford, Texas, the new center is an extension of Bell Helicopter's XWorX facility and will serve as the test field for all of Bell Helicopter's unmanned systems.

"The opening of this facility clearly shows Bell Helicopter's commitment to develop and produce cutting edge unmanned aircraft systems now and into the future," said Kevin Connell vice president of Bell Helicopter's XWorX facility "This facility extends our XWorX organization geographically, but more importantly, extends the capabilities into the unmanned systems market."

Bell Helicopter senior executives, Bell UAS team members and officials and residents of Graford and surrounding cities and counties attended the public ribbon-cutting event.

"This is a great day for our city," said Graford Mayor Carl Walston. "We welcome Bell Helicopter and their unmanned aircraft program to Graford."

"This is the first of many unmanned systems Bell Helicopter plans to introduce," said Jon Rudy, director of unmanned programs business development. "This flight test center of excellence will allow us to test and develop new and unique unmanned technologies with global applications in both the military and civilian markets."

From L to R: Bob Ellithorpe, Bell Helicopter Executive Director of Unmanned Systems is joined by Graford Independent School District Board President Jakie Long, Graford Mayor Carl Walston and Bell Helicopter Executive Vice President for Admin and Chief Human Resources Officer as they officially open Bell's new Unmanned Aircraft Systems Flight Test Center of Excellence, and extension of Bell's XWorX facility. (Photo courtesy of Bell Helicopter)

Courtesy of Erin Dick
Bell Helicopter Textron

Deepwater Assets Respond to Hurricane Katrina

The Coast Guard Cutter Spencer, a 270-foot medium endurance cutter homeported in Portsmouth, Va., sits at anchor in the Mississippi near the heart of downtown New Orleans Sept. 1, 2005. The cutter Spencer was in town to aid in the relief efforts for Hurricane Katrina victims in the greater New Orleans area. USCG photo by PA2 Bobby Nash.

The U.S. Coast Guard's response to Hurricanes Katrina and Rita was the largest mobilization in response to a natural disaster in its 215-year history. Over a four-week period, boat, cutter, and aircraft crews distinguished themselves rescuing and assisting more than 33,700 people during high-tempo operations along a wide swathe of the Gulf Coast reaching from eastern Texas to the Florida panhandle.

The critical relationship between the Deepwater Program's progressive modernization and recapitalization of aging Coast Guard legacy assets with improved operational performance was well-documented during Katrina operations. As part of the approximately 40 percent of Coast Guard aviation assets deployed for the operation, 18 HH-60J and 25 HH-65 helicopters assisted with the rescue of 12,661 people. Legacy cutters, modernized with the first increment of Deepwater command, control, and communications upgrades, also demonstrated a high return on recent investments.

Three more powerful HH-65C helicopters, re-engined and modernized as part of the Deepwater project, flew 85 sorties to save 305 lives. The more-capable "Charlie" aircraft can hoist twice the number of people and remain on station for twice as long as older and less-reliable Bravo models.

During one HH-65B rescue mission, the pilot was obliged to leave his rescue swimmer behind after airlifting five people in distress owing to his "Bravo's" maximum weight limit. Another helicopter pilot radioed him to confirm his crew would pick up the rescue swimmer. The "Bravo" pilot responded, "I thought you already picked up five people? If you have that capability, you must be in a 'Charlie.'"

"It's a beautiful bird," said Lt. Kevin d'Eustachio, an HH-65C pilot stationed at Air Station Elizabeth City, N.J., who deployed for Katrina.

Several more powerful HC-130J long-range search aircraft, slated to be modified as part of the Deepwater Program over the next two years, also were among the C-130 aircraft that deployed from Coast Guard air stations on both coasts to transport emergency relief supplies and aircrews.

Command-and-control communication upgrades to high and medium endurance cutters also proved valuable in enabling more effective on-scene coordination of rescue operations in New Orleans and Gulfport with local first responders and other federal agencies.

Crews aboard upgraded legacy cutters CGC Decisive, CGC Spencer, CGC Gallatin, and CGC Northland, for example, helped establish a significant federal presence soon after the hurricane's eye went ashore in New Orleans. The cutter Decisive was the first major cutter on scene, and the cutter Spencer arrived downtown on Sept. 1 to establish a significant federal presence. The cutter Gallatin also supported recovery operations in New Orleans.

Upgraded with the Enterprise Communications Wide Area Network (ECWAN) installation as part of the Integrated Deepwater System, the cutters operated effectively in enabling on-scene coordination of rescue operations with other military units, federal agencies, and local first responders. ECWAN provides for a classified local area network (LAN) and access to the Secret Internet Protocol Router Network

(SIPRNET), a classified wide-area network providing for more effective operational command and control.

The cutter crews also conducted homeland security boardings offshore and served as emergency command, control, and communications platforms for the recently established Mississippi Coastal Recovery Base in Gulfport, Miss. The cutters supported local law enforcement, search-and-rescue efforts, ports and waterways restoration, and humanitarian aid deliveries.

As federal first responders, Coast Guard men and women must have the right tools to perform their demanding and dangerous missions more effectively, reliably, and safely. Hurricanes Katrina and Rita demonstrated the importance of the Deepwater Program's role in improving the Coast Guard's operational performance. In short, program officials say, Deepwater will help to ensure crews are prepared for similar natural disasters or contingency operations in the future as part of the Coast Guard's multiple maritime missions.

By PAC Jeffrey Murphy and Gordon I. Peterson

ASNE Sponsors First Launch and Recovery Conference

The first "Launch and Recovery of Manned and Unmanned Vehicles from Surface Platforms" conference, sponsored by American Society of Naval Engineers, was held Nov. 8-9 in Annapolis, Md. The conference drew significant attention from government and industry, with 320 people from 14 nations in attendance. Program Executive Officer Coast Guard Rear Adm. Patrick Stillman, Integrated Deepwater System (IDS) and Program Executive Officer Navy Rear Adm. Charles Hamilton, PEO Ships kicked off the conference as key note speakers, stressing the critical role of launch and recovery in mission accomplishment. With launch and recovery being a major point of intersection between the Coast Guard and the Navy, both addressed the challenges and opportunities to improve system performance and the need for flexibility and interoperability.

The first National Security Cutter. The aft end of the extended flight deck and the stern ramp/boat stowage area are featured above. (Photo courtesy of Northrop Grumman)

More than 60 presentations from government and industry created a vibrant forum for sharing technology and discussing new ideas to improve system capability. Topics included stern-launched small boats, over-the-side handling, VTOL aircraft, UAVs, USVs, electromagnetic launch systems, standards & safety, guidance and control, and modeling and simulation. Representatives from the Deepwater Program were front and center;, giving presentations and serving as moderators. The conference, which was conceived by Mr. Steve Cohen, IDS Technical Director, with Mr. Scott Littlefield, Office of Naval Research and Dr. Larrie Ferreiro, Noesis Corp, has already been planned again for November 2006.