Tri-Modal Connection

Four companies vie to build the T-Craft sea-to-shore transport demonstrator

By RICHARD R. BURGESS, Managing Editor

Game Changer

The Office of Naval Research (ONR) is sponsoring a technology demonstration for a transformable sea base connector craft.

- ONR looks to surmount the Iron Triangle of speed, endurance and payload.
- Stringent multimodal specifications pose challenges for design teams.
- Designs incorporate advances in materials and propulsion.

The Navy is funding the demonstration of game-changing technology to transfer heavy military vehicles from a sea base to shore in a project that faces considerable technical challenges.

The Office of Naval Research (ONR), which in 2006 began an effort called Innovative Naval Prototypes for Seabasing, is sponsoring a competition to develop a prototype demonstrator for the Sea Base Connector Transformable-Craft (T-Craft). The high-speed T-Craft will be designed to transport heavy wheeled and tracked vehicles from a sea base to an unprepared shore in an assault or logistics mission. If developed to an operational type, the T-Craft would enable U.S. forces to reduce reliance on friendly ports for access to expeditionary theaters of operation.

The ONR expects to award approximately $10 million in Phase 2 of the T-Craft competition in October to a design team to build and test a model of the winning design. If the project proceeds to a third phase in October 2009, the team could be awarded approximately $150 million to build a prototype.

The requirements for the demonstrator are daunting for a single craft. The T-Craft must be able to travel in an unloaded condition 2,500 nautical miles from a support base to a sea base, where it will be used as a connector to the shore. The T-Craft is envisioned to operate in three modes, according to ONR's broad agency announcement, and shift from one mode to the next without any external assistance.

The craft should be able to operate in a fuel-efficient mode (approximately 20 knots) without cargo for open-ocean transits through Sea State 5, be capable of operations through Sea State 6 and survivable through Sea State 8. Sea State 5 sees, among other things, wind speeds of 21 to 25 knots and waves of eight to 12 feet high, while Sea State 8 involves winds of 49 to 57 knots and waves of 45 to 60 feet.

In the high-speed, shallow-water mode for transit with a full cargo load, the T-craft is envisioned to operate at speeds of approximately 40 knots in Sea State 4 to distances of 500 to 600 nautical miles without refueling.

The T-Craft will be designed to be able to transition to an amphibious mode to transit sand bars and mud flats and discharge its cargo on dry land.

Another desired characteristic is the capability to "mitigate wave-induced motions in Sea State 4/5 to enable rapid vehicle transfer between the T-Craft and a Maritime Prepositioning Force (Future)/Sealift ship," according to the ONR announcement.

The T-Craft is not required to be stealthy, operate from the well decks of amphibious ships or handle pallets and containers.

Although ONR requires the demonstrator vessel to be operated by a crew of two or three, it recognizes that an operational vessel designed for transits of thousands of miles would require a larger crew. The demonstrator crew is small simply for the purposes of economy of the demonstration, but the Navy expects that automation will allow handling of an operational version with a watch crew of only two or three at a time, said Kelly Cooper, ONR's T-Craft project manager.

NAVATEK LTD.

Honolulu-based Navatek Ltd. is proposing a multicraft option for the Office of Naval Research's T-Craft demonstration competition. The design includes a catamaran-hulled transport for long distances that carries an amphibious transport craft to haul the cargo over the final stretch to the shore.

"We've asked each of the concept developers to include weight margins and aspects in the design" to accommodate more crew and habitability features, she said. "So they're considering [those features] in the design, but they're not building it in the demonstrator."

While careful not to reveal proprietary information on the designs proposed by industry, Cooper described some of the technologies being considered for the demonstration, including retractable skirts (the flexible structures that contain an air cushion under the hull) and a variable-geometry bow — one that is adjustable to various dock configurations.

Cooper also is looking at what she calls high-speed flimsy — meaning lightweight — structures made of exotic materials such as composites and other combinations. These materials are key to a strategy to overcome the limitations of the so-called Iron Triangle of design.

"With the Iron Triangle — speed, endurance and payload — you really have to give up one of them or build your design favoring two out of three," she said. "We're looking to get all three out of the design, and — by the way — operating totally amphibious."

ONR also is looking at "a number of very innovative propulsion systems allowing us to be able to switch between a surface-effects ship and an air cushion vehicle," Cooper said. Any advances in propulsion could migrate to current programs such as the Joint High-Speed Vessel and the Joint Modular Assault Connector.

Four contractor teams — each awarded contracts worth approximately $2 million — are proposing designs for selection for Phase 2 of the T-Craft demonstration. Because of the ongoing competition, they were limited in the amount of design detail they could discuss.

One of the teams is led by Textron Marine & Land Systems, builder of the Navy's Landing Craft, Air Cushion (LCAC), an amphibious assault craft that is closest in design to the capabilities desired in the T-Craft, though on a smaller scale. Textron is proposing a catamaran hull that is supported by an air cushion between the twin hulls, according to Dan Mirelez, the company's director for business development.

Textron sees the main challenge of the T-Craft is "getting it off the beach," said general manager Tom Walmsley, noting the large size and mass of the craft. "Everybody can plane across long distances with certain hull forms, but making this transition and actually getting up on the beach at the size of this [vessel] is really, by far, the hardest thing."

Mirelez described Textron's design approach as addressing the amphibious capability — the most difficult — and working back from there to address the other two modes

For ocean transits, Walmsley characterized Textron's design as more of a catamaran ride than an air cushion ride.

If selected, Textron would build the T-Craft at its facilities in New Orleans.

Umoe Mandal, a Norwegian company, proposes a skirted hovercraft/surface effects ship hybrid design that will feature electric drive propulsion designed by teammate General Atomics, San Diego.

John Vonli, vice president of naval systems for Umoe Mandal, said that the Iron Triangle can be overcome by lowering the weight of the ship. The company has extensive experience in building ships with lightweight composite material, he said.

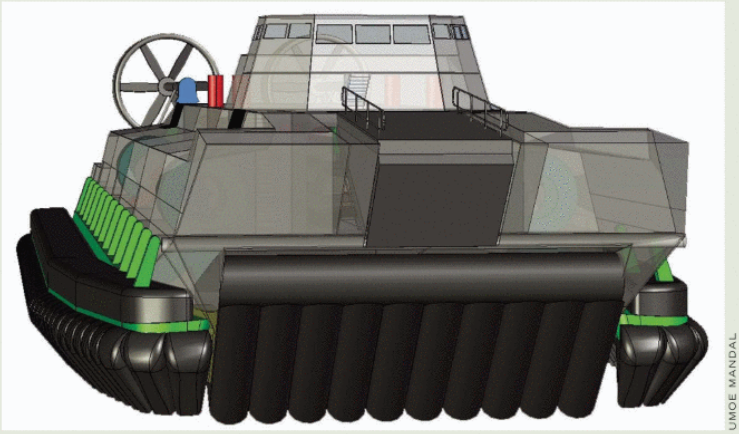
Umoe Mandal's design features a flexible connection for loading and unloading that Vonli claims will operate effectively at speeds up to 15 knots, allowing the T-Craft to accept cargo from a moving sea-base ship if the ship is configured to receive the T-Craft. The loading connec-

tion also would be able to unload at a beach, pier, ramp, well deck or almost any kind of platform, he said.

Navatek Ltd., based in Honolulu, has proposed a multicraft solution for the T-Craft demonstration: a catamaran-hulled transport for long distances that carries an amphibious transport craft — called a Captive Air Amphibious Transporter (C-AAT) — to haul the cargo over the final stretch to the shore.

"We view it as a high-speed ferry on steroids," said Jeff Kline, vice president of naval architecture and systems for Navatek.

The high-speed catamaran ferry will be equipped with lifting foils and a multiload propulsion system (with propellers and water jets), which, he said, "give you fuel efficiency, not only for long-distance transit at cruise speed, but also fuel efficiency for high speed, up to 40 knots."



UMOE MANDAL

Norway's Umoe Mandal is proposing a skirted hovercraft/surface effects ship hybrid design for the T-Craft demonstration competition.

Kline said material transfer at sea is the most challenging aspect of the demonstration. Current technology allows for transfer under conditions of Sea State 2.

"Sea State 4 is quite a jump," he said.

The catamaran ferry also will have a deck that tilts for interfacing with a sea base platform.

The LCAC-sized C-AAT is designed to carry two-to-three times the payload of a current LCAC. Unlike an air cushion vehicle, which allows air to continually escape from under its skirt, the Navatek catamaran hull uses more of a captive air cushion, "like a large buoyant belt that wraps around the vehicle," Kline said. "By using that captive [air cushion], we are able to obtain a large payload fraction."

Navatek has designed the catamaran ferry and the C-AAT to operate either as manned craft or unmanned under autonomous or supervisory control. Both craft will be built extensively with composite material.

If selected, the catamaran and amphibious craft would be built by team members Atlantic Marine of Jacksonville, Fla., and General Dynamics Robotics Systems, Westminster, Md., respectively.

Alion Science and Technology, a relatively new company to shipbuilding based in McLean, Va., acquired experienced naval architect firm John J. McMullen Associates two years ago, enabling Alion to compete in shipbuilding competitions.

Mark Redmond, assistant vice president at Alion and manager of its ship design management division, declined to reveal design features of the Alion T-Craft proposal. He said his company is "looking at several alternatives" to surmount the tri-modal requirement.

"There's never been a design like this to something that has so many varied configurations or missions that it has to do and transformation that has to take place," he said. "Unfortunately, there are issues with hovercraft. There are requirements for long ocean transit, and that's something where hovercraft are not maybe at their best."

Redmond said advances in high-speed propulsion have made its design more "attractive" but stressed that, "in some ways, propulsion becomes a challenge because something that is very efficient over the water may not be efficient over land, or vice versa."

If selected, Nichols Brothers Boat Builders in Freeland, Wash., would build the Alion team's design. Nichols built the Navy's Sea Fighter twin-hull experimental ship.

"Under this program, we have really tried to spur innovation," ONR's Cooper said. "What I have seen are very innovative concepts. Three of the four contractors have proposed pretty traditional methodology. They worked around a good ship design and then they tried to put in the other capabilities that we were looking for.

"One company really was innovative in [its] approach," she said, declining to identify the company. "They designed a cargo transfer amphibious capability and then they built a ship around it, and that truly is innovative. It's yet to be seen whether that's a feasible design."

The T-Craft is the only one of four proposed Innovative Naval Prototypes for Seabasing to survive the Navy's approval process for demonstration. The terminated concepts included a personnel transfer demonstrator, an intermediate transfer station and an automated warehouse, Cooper said. However, ONR also is sponsoring a $2 million, 24-month concept development for a crane ship by a team led by Florida Atlantic University. ■