

# Learning Curve

Navy tests unmanned surface system applications

By JOHN C. MARCARIO, Assistant Editor

## Autonomous 'Brain Power'

The Navy believes the use of Autonomous Maritime Navigation (AMN) could expand Sailor safety and enhance current operations across the globe.

- Navy officials see the possibilities grow as the technology matures.
- Using "sliding autonomy," AMN can be fully autonomous or operate via remote control.
- AMN testing will include the use of weapons in the coming years.

**D**ata gathered during testing shows the potential for a broad application of Autonomous Maritime Navigation (AMN) technology within the fleet, Navy officials say.

"Everything is experimental at this point, and we still need to iron out a lot of the legal issues that an unmanned boat has. The technology is there, though. ... Our job is to see what's possible and try to make it better," Capt. Carl Conti, director fleet experimentation, U.S. Fleet Forces Command, told *Seapower* during the Trident Warrior 2011 exercise July 20 at Fort Monroe, Va.

Legal issues, he said, could range from following airspace requirements to deciding who cleans up in the event of an accident involving an unmanned system.

Trident Warrior is an annual exercise during which advanced capabilities are temporarily deployed on ships "to collect real-world performance data and feedback from fleet users during an underway experimentation period," according to Fleet Forces Command. Since 2003, Trident Warrior has provided experiment support for more than 600 programs of record.

The development of AMN, under the guidance of the Naval Surface Warfare Center, Carderock Division (NSWCDD), Md., began in 2006 and leverages autonomy software used on the NASA Jet Propulsion Laboratory's Mars Rover. Spatial Integrated Systems

(SIS) Inc., Kinston, N.C., is the lead systems integrator for AMN.

During the week-long Trident Warrior 2011, the Navy demonstrated the cooperative autonomy of unmanned systems; the ability to integrate national, theater and tactical sensors across networks; support for a single, shared common operating picture; and improved tactics, techniques and procedures to prevent hostile applications or malicious programs from gaining unauthorized shipboard Internet access.

More than 60 new technologies were put through their paces on shore nodes, at sea and in the air.

The goal of the exercise was to protect a port area with three different small boats and one Rigid Hull Inflatable Boat (RHIB) equipped with AMN technology. Two of the vessels were developed by NSWCCD, the third was developed by AAI Textron Systems, Wilmington, Mass., and the fourth by Northrop Grumman Electronic Systems, Linthicum, Md.

The vessels patrolled more than 15 million feet of water space. Each was assigned a specific zone to patrol. If an outside ship got close to a patrolled zone, an AMN-equipped vessel would broadcast a prerecorded warning message and follow the vessel of interest until it was escorted out of the designated danger area inside its patrol zone.

"You want to make the vessel of interest show intent for what they may do," Conti said. "The boats being able to know where they are and operating together has greatly improved."

The AMN technology used in the exercise is small, portable and fits on the top of a vessel. It includes a full-spectrum sensor suite that scans for objects and targets at long and short ranges, according to SIS. Also employed are radar, airborne laser detection and ranging, stereo optical cameras, Global Positioning System equipment,



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Autonomous Maritime Navigation 1 and Autonomous Maritime Navigation 2 are put through their paces with human observers aboard during Trident Warrior 2011 July 20 at Fort Monroe, Va. The Trident Warrior experiment, directed by U.S. Fleet Forces Command, temporarily deploys advanced capabilities on ships to collect real-world data and feedback during an underway experimentation period.

autonomous information systems and a 360-degree camera for automatic target tracking and identification.

“The vessels aren’t what’s important. It’s the AMN brain and what eyes and ears — sensors — that the operator wants to use on the vessel that’s important,” Rick Simon, SIS director and program manager for AMN, said in an e-mail response to questions.

As the technology matures, Conti said he has been surprised by the “brain power” of the ships, how they are able to communicate with one another and adjust quickly to changing circumstances.

Last year, AMN technology was tested off the coast of San Diego protecting ships that came into the port. Next year, Conti said he would like to see AMN vessels defending an aircraft carrier as it comes into port.

“There are a lot of places we could go with this [technology],” Conti said.

Navy officials at the exercise said AMN technology on vessels soon could enter the fleet, and noted that data gathered during testing is being used by the Navy’s Expeditionary Combat Command to support their operations.

The Joint Expeditionary Command and Control Communications (JEC3) Tactical Operations Center (TOC) is where the expeditionary common operating picture (COP) is fused and displayed.

“The sensors that feed the COP are land-based coastal radars, sonobuoys that listen underwater, unmanned underwater vehicles, as well as the surface contacts from the USVs [unmanned surface vehicles] and manned boats at sea. The JEC3 fuses all of this sensor information/contacts into an expeditionary COP. From the JEC3/TOC perspective, the USVs are mobile at-sea sensors which contribute to the COP,” Simon said.

AMN can be fully autonomous or operate by remote control. This “sliding autonomy” capability allows a command center to monitor multiple USVs simultaneously while letting them perform intelligence and surveillance operations or act as intruder interceptors with no human intervention.

In the coming year, Conti said the technology is mature enough that the Navy could use AMN vessels in target training for Sailors. He also said this type of technology would be perfect for counterpiracy operations.

"This is that orbiting piece on the outside of a Littoral Combat Ship, or one of our destroyers or frigates, that can be out there and expand our range a little bit," Conti said.

Cmdr. Benjamin Salazar, director, experiment execution, U.S. Fleet Forces Command, said the Navy is trying to make sure the AMN technology can distinguish among the different behaviors of a range boat, a fishing vessel and a vessel of interest.

"The situations out on the water are a little bit different than Mars," he said.

AMN testing in the future will include the use of weapons, but there are more hurdles to overcome before that capability is added, Salazar said.

"There are more problems when you are dealing with shooting at targets," he said.

The Coast Guard and Customs and Border Patrol usually are tasked with ship escorts into harbors. But when the Navy is needed for escort duties, autonomous vessels would help keep Sailors safer and allow the service to make better use of its manpower, according to the Navy.

"[Escorting] does exist, but it's at a very high premium, especially in the personnel department," Salazar said. "Are we taking a job away? Yes. We have really smart Sailors and maybe we can better use them instead of driving a boat around the water 10 hours per day."

Peter Singer, a defense expert with the Brookings Institution, a Washington-based think tank, said AMN technology is a capability the Navy needs, but history suggests it might be a while before it becomes a program of record.

"The Navy in particular, as opposed to the Air Force and the Army, has not embraced this type of technology as much and particularly faces an issue of moving systems from prototypes to systems of record," he said.

Singer said the Navy, unlike the Marine Corps, which urgently needed intelligence, surveillance and reconnaissance technology in Afghanistan, has not faced situations recently that would cause the service to quickly purchase this type of technology.

"Does [the Navy] look at this as a capability that enables them to do more with less, or do they look at this as a potential threat to an already existing program



U.S. NAVY

A common unmanned surface vehicle patrols for intruders during Trident Warrior 2011 July 20 at Fort Monroe, Va. The experimental boat can operate autonomously or by remote control.

of record? That's the big question: how do you look at it?" he said.

Although AMN may take Sailors out of ships, Singer said this could be a good thing in the long run.

"Driving back and forth on the water for hours is incredibly dull, and that can wear out a crew but it won't wear out a computer," he said.

Singer believes the Navy eventually will get AMN as a program of record.

"It's part of the robotics revolution that's creating a massive amount of change across the battle space."

The three boats and one RHIB used during Trident Warrior cost around \$30,000 each but Salazar said an older vessel could be refurbished and equipped with AMN technology.

"Your cost of operation could be drastically decreased," he said.

The Navy said it did not have a cost estimate for the AMN technology because it is still experimental.

With an emphasis on cutting costs, Conti said that once AMN technology enters the fleet, the Navy will want to get it on ships as fast as possible.

"[AMN technology] is too much of a game changer," he said. ■