

The Day

Subs Going Higher Tech

New Equipment Provides Better Control, Smoother Ride

By ROBERT A. HAMILTON

Day Staff Writer, Navy/Defense/Electric Boat

Published on 10/18/2004

Aboard the Virginia — When he was told his new submarine would have a fly-by-wire computerized control system with a joystick instead of a steering yoke, Chief Fire Control Technician Damon Rubin admits he was a bit wary, even after several trips to a simulator that showed it working just fine.

"We still weren't going to be convinced until we could get it to sea and see for ourselves that it operated as good as the trainer," Rubin said. "It turned out it operated even better."

In the past submarines have relied on speed and steering planes to reach and maintain depth, but when a submarine is doing surveillance or special operations, it often has to be nearly dead in the water.

On a trip from Connecticut to the state of Virginia over the weekend, Rubin maneuvered a barely moving submarine Virginia 100 feet down through the water, stopping within two inches of the 300-foot depth Capt. David J. Kern had ordered. A computer filled and emptied ballast tanks in about three minutes.

"We've always had depth control on submarines, but we've never had the fine control we have with this system," Kern said.

Sonar Technician 1st Class Daniel Braman, who has qualified as a co-pilot on the Virginia, said during sea trials the ship was put through several high-speed turns to see how it would react.

"We tried to get it into a snap roll, and it just wouldn't do it," said Braman.

The submarine force has a history of being pretty conservative about accepting new technology, particularly in areas such as ship control. But submariners seem to have embraced the radical changes of Virginia.

Machinist Mate 1st Class Robert Arsego, who is also qualified as a pilot, said the extraordinary capabilities that Virginia has delivered have won over most.

"I know the ship control system has gone through a lot of testing, and I know they wouldn't put it out there if it wasn't safe," Arsego said. "It's a lot different. There's no force feedback like you get with a yoke, for instance. But once you get used to it, you can make it do anything."

With the ship delivered to the Navy only last Tuesday, the crew is still learning a lot about its operating characteristics.

Kern, the captain, said he has noticed Virginia tends to be more stable when surfaced than the 688-class submarines it will replace. In addition, Virginia tends to plane a bit as it drives through the water, giving it a smoother ride than older boats that tend to push down and take more water over the bow, he said.

Chief of the Boat Casey White said even more impressive is the ship's computer-controlled hovering capability, which can pump up to 350 pounds of water a second to raise or lower the ship and keep it steady. At one point in sea trials it maintained its depth to within about six inches while at periscope height for 90 minutes.

"There isn't a 688 in the fleet that could do something like that, even with the best planesman in the world," White said. "Computers don't get tired or distracted. More than 7,000 tons of steel, and a guy with a joystick can lock it right in the water."

That capability will be important when the Virginia is loitering off a potential enemy's shores trying to gather electronic intelligence, or deploying Navy SEALs on a surveillance mission without surfacing.

Special Forces have played an increasingly important role in modern warfare, and Virginia is the first with a special chamber that will allow up to nine commandoes with full gear to exit the submarine while it is submerged. It is also designed to deploy with a mini-submarine for special missions.

In addition, it is the first submarine with the capability to recharge SEALs' scuba tanks, and a hot-air blower to dry their gear when they get back to the boat.

"This is going to be SEAL heaven," White said. "It was built to take those guys to sea, help them do their mission, and bring them back safe."

"This ship is going to make its money in the littorals," White continued. "In the global war on terror, we have to go places we've never gone before, and this ship is going to be able to do it."

Virginia is the first Navy warship designed specifically for the post-Cold War environment, so it is smaller than the Seawolf class that preceded it, cannot carry as many weapons and cannot dive as deep. The Navy will not discuss depth limitations for its submarines, other than that all can go deeper than 800 feet.

Virginia was designed to be at least as quiet as the Seawolf, a goal that has been achieved, multiple Navy officials have said, and even with a smaller reactor it is supposed to be nearly as fast.

White said some of the critical systems have three backups, a level of redundancy that should allow Virginia to come through even a serious combat situation with its capabilities intact. It also boasts one of the quietest torpedo launching systems in the world.

"When I stand in control, if someone flushes the head in the forward berthing areas, that makes more noise than firing a torpedo," Kern said. "And by the way, when we were doing sound tests I made sure flushing the head was undetectable, also."

"We tried to focus all the Virginia investment to where we would get the most bang for the buck, in making it quiet or improving its combat effectiveness or reducing its life cycle costs," Kern said. "And we're right on track."

Chief Yeoman Robert York said everyone who was going to “drive” the Virginia had to log more than 300 hours in a sophisticated simulator at the Naval Submarine School in Groton.

“Once we got down here and operated the real boat, we found out the simulator was very, very close,” said York, who has qualified as pilot.

Senior Chief Electronics Technician Bradley Johnston said it also helped that the entire Virginia command module was constructed in a building at the north end of the EB shipyard a year before it was installed. It was tested there under conditions so real that most of the navigation team earned preliminary certification, and the weapons and sonar divisions were able to get experience as well.

On previous classes of submarine, two of the most junior enlisted men on board handled the helm and plane steering-wheel type controls, while two more senior people sat behind them and made sure they did it properly. On Virginia, two senior enlisted men use joysticks to drive the ship.

Senior Chief Torpedoman Joseph Blackwell said that eliminated two positions in the normally crowded control room. He said he isn't worried that enlisted men will have to wait longer to get experience driving the ship.

“It allows them to get into their divisions, it allows them to go do the job they were trained to do,” Blackwell said. “If the Navy is paying them to be a mechanic, they should be a mechanic.”

Virginia also has fewer positions in other departments. Blackwell supervises just three men in the torpedo department, where older boats would have needed five or six.

A network of electromagnetic actuators moves torpedoes or missiles from tray to tube, said the weapons officer, Lt. Joseph Santos.

“It's a lot easier to move weapons around the room, there's a lot less maintenance, and it's just a lot more user friendly,” said Machinist Mate 1st Class Shane Johnson. “I came on board, and learned the system so quick, within two weeks I was training my younger guys on it.”

The entire system can quickly be replaced with alternate equipment, such as a 50-person berthing setup that was used during sea trials, when more than 200 people were on board. The process took just an hour.

Virginia was designed to accommodate the vertical launching system for missiles that was backfitted onto the Los Angeles class of submarines that it will replace. The controls are more logically laid out, easier to reach, and don't share a space that is also used for spare parts storage.

••• And there are a host of other improvements on Virginia as well. Fire Control Technician Seaman Michael James quickly came to appreciate the next-generation equipment in Virginia.

“Things that took three or four people at battle stations before, you can do all by yourself now,” James said.

In the machinery spaces, Machinist Mate 1st Class Derrick Jones proudly showed off an oxygen generator designed to be started in just eight minutes, compared to 24 hours on the 688. It operates at low pressure, which reduces the risk of explosions from hydrogen gas buildup.

Machinist Mate 1st Class Chris Frank said one of the improvements he appreciates most in the machinery spaces is the new 12-cylinder Caterpillar diesel that provides emergency power. For the first time the engines have preheaters that keep them ready to go on a moment's notice, so the 30-minute startup process has been trimmed to about a minute.

Frank said one of the chief creature comfort improvements on Virginia, though, has to be the toilets. Older submarines had a gravity system that required you flood the bowl, turn a valve to flush it, then refill it. Virginia has a vacuum system that is nearly foolproof.

White, the chief of the boat, said he's also pleased so much thought went into making life easier for the sailors. On older boats as many as 80 men would share a common berthing area, which meant there was always someone coming or going, making noise that would keep others awake; on Virginia, most men are berthed in 12- and 18-man spaces, and some as few as three to a room.

Culinary Services Chief Frank Chandler said he has a kitchen about three times as large as on a 688, with a dining area that serves more men and is not part of the main passageway for the first time. He also has storage room to bring aboard provisions for as much as 100 days; on 688s, the only way to accomplish that is to cover the floors with food cans, and walk on them until you have eaten down the excess.

Of course, not everything goes as planned on a machine as complex as a submarine, but people who helped to build it were amazed at the relatively minor nature of most problems so far. The supply officer, Lt. j.g. Timothy Bartha, said on the computer design every spare part had a storage space, for instance.

"When we brought the stuff down here, though, we found some of it didn't fit on the ship the same as it did on the computer," Bartha said. So the crew quickly devised temporary bins, and during a repair period after Virginia's first year at sea the storage systems will be fixed.

The manual backup valves that force high-pressure air into the ballast tanks to send the submarine shooting to the surface in an emergency are the same as those on submarines for more than 30 years, White said. "Some things they got right many years ago, and there's no need to change them."

But White also points out some bright orange cutouts in the walls between the berthing areas and the passageways. Those were backfit onto Virginia when the crewmen realized a firefighter in full protective gear would have a tough time making it through the berthing area doors. The cutouts are being designed right into follow-on ships.

Kern said one of the key advantages of Virginia is its modular design, which allows new equipment to be added and old equipment to be taken off quickly, or even to insert an entire hull section, as is under consideration, without much redesign.

"I'm not sure we're going to need another submarine class for a long time, because as needs change, as the technology changes, we can just keep adapting this one," Kern said. What's new about Virginia is that it puts so many advanced technologies onto one platform, he said.

"But whether you're talking about the performance of the propulsion plant, or the weapons, or the combat system, we are at the cutting edge of submarine technology," Kern said. "But it's not the technology that is going to win the war, it's the sailor. We just putting the technology in their hands to go do that." ■