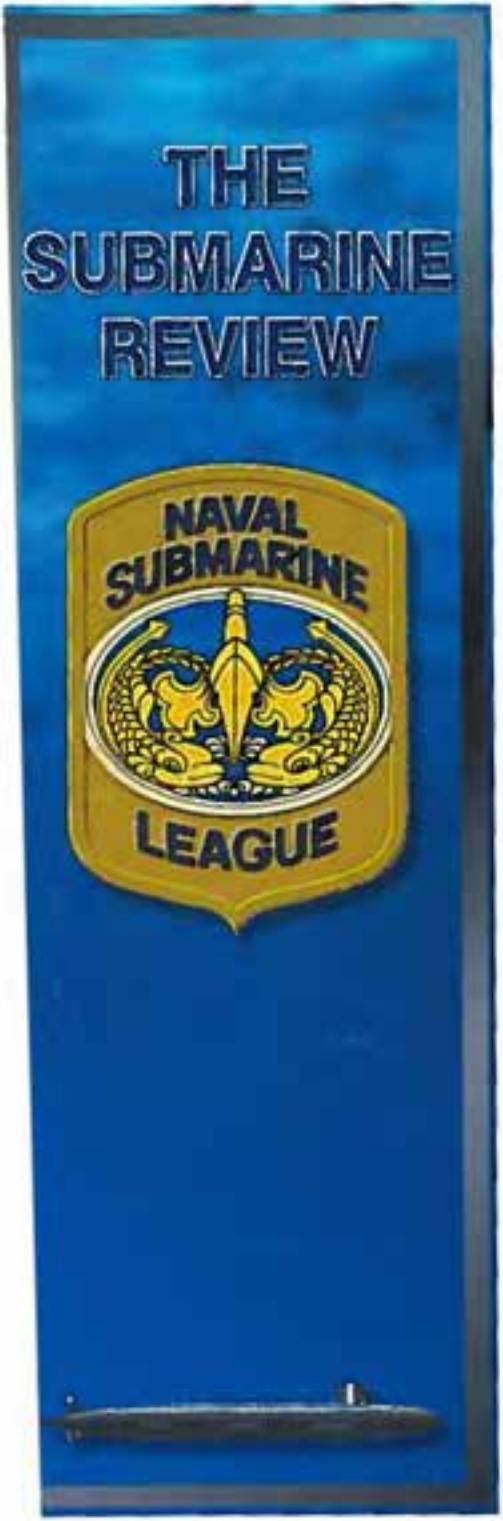


## OCTOBER 2004


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## *EDITOR'S COMMENTS*

If the Naval Submarine League dedicated each issue of this magazine to specific themes, which is not the usual case, it would be most obvious that in this Fall season of 2004 the theme would be on the order of *a new order arrives as an old order passes.* Although the submarine community is not given to the easy use of classic aphorisms, there does seem to be something of rather Homeric proportion indicated by the linkage of the two headline subjects here. On the one hand a major new warship is being introduced for a new century, while on the other a submarine hero of both war and peace in the last century is bid farewell.

Our first two articles each treat the Sea Trials of VIRGINIA in the unique manner, and from the different viewpoint, of the author. Captain Heffron, as the Project Officer, offers the complete picture of how the ship was tested and how it performed in terms which everyone in the submarine community can understand. More than one old submariner have commented, however, that they might understand the words but would have a lot of trouble finding their way around the boat. There are whole new concepts for making this submarine work in the super complex world in which it will perform its multiple mission tasks. It is also apparent there are whole new concepts used in putting the submarine together and making sure all the pieces fit and interact correctly before it goes to sea.

The second of the Sea Trial articles was prepared by Mr. Bob Hamilton, a newspaper correspondent who has been reporting on Defense issues for years. As a member of the staff of The New London Day he has become familiar with submarines, having ridden more different classes (eight) than most submariners who never served on a staff. He was the *embedded* newsman for submarines during Operation Iraqi Freedom and wrote three articles for THE SUBMARINE REVIEW about those experiences (see the July and October '03 and the January '04 issues). His view of the VIRGINIA Sea Trials is as a knowledgeable observer, rather than as a participant in the process. His reporting is in terms of general understanding, therefore it is of great use in VIRGINIA's approach to the public.

Admiral Pete Galantin is the 20th century submarine hero in both war and peace who recently passed away and for whom the funeral was held at the Naval Academy at which several heartfelt eulogies were given. One was from RADM Charlie Young, who is the Navy's Director for Strategic Systems Programs, a job once held by Admiral Galantin. Another eulogy was given by RADM Jack Barrett who made several war patrols in HALIBUT when the Admiral was in command. The third eulogy for Admiral Galantin was by RADM Mike Rindskopf who also served as a wartime skipper. All had specific memories of the man, the skipper and the program manager. Together these eulogies tell of a naval officer who left a legacy of deeds and an example of character for us all.

The FEATURES in this issue are *re-told tales* which together tell a story of submarine performance stretching back from the recent past to the start of the nuclear submarine era. Commander Mike Poirier commanded TOLEDO during a deployment to the Med and Gulf region in 2003. At the NSL Annual Symposium in June he presented a most interesting review of submarine participation in the War on Terrorism as well as the more publicized war in Iraq. VADM Ken Carr's tales of life in NAUTILUS *at the beginning* were told at the Submarine History Seminar at the Navy Memorial in April and are presented here once more so all those who were not around in the 50s and early 60s can see what it was really like. Another piece of history which bears retelling at this time is VADM George Steele's 1960 warning to the Navy about the dramatic impacts brought about by the nuclear submarine. It was a wake-up call for ASW, which has needed reiteration for some time, but it was also a presentment of the great potential of the submarine for effecting step-changes in Sea Power.

Hopefully the ARTICLES in this issue provide the spread of interest which characterizes our submarine community. LCDR Ketter wrote the NSL Prize winning paper on ASW while a student at the Naval War College. Nader Elhefnawy has given us a different aspect on the *Weapons of Mass Destruction* question, and Bob Hamilton reports on new happenings in the world of submarine batteries (as an old diesel-boater and Electrical Officer in an SSN, I could not resist that one). There are two reminiscences here, each of which holds some valuable stories for all of us. ADM Hank Chiles

spoke for all TRITON sailors at the commissioning of a new facility at Great Lakes. At his retirement, VADM Mal Fages gave a career summary which should give heart to those JOs who might have a hard time looking up at the long tunnel of a submarine life.

Not to be missed is another great sea story from Billy Grieves, a WW II Torpedoman and a retired Lieutenant in the Detroit Fire Department. He was in THRESHER when the boat went through a most unusual bit of ASW by the Japanese Navy.

*Jim Hay*

## *FROM THE PRESIDENT*

This has been a great summer for the Submarine Force! First was the very successful sea trials of USS VIRGINIA (SSN 774). This wonderful submarine provides the Submarine Force a step change in capability. USS VIRGINIA (SSN 774) is the only combatant at sea that was designed after the Cold War. She joins the Fleet upon commissioning in Norfolk, VA on 23 October 2004. At the second big submarine event this summer, the christening of TEXAS (SSN 775), VADM Kirk Donald, Commander Naval Submarine Forces, stated "The VIRGINIA class ships are capable of entering and remaining in the backyards of potential adversaries undetected, preparing and shaping the battlespace, and, if so directed, striking rapidly and decisively. And, because of her modular and flexible design, she is ready to adapt to, and excel at, whatever the future brings." I had the opportunity to walk through VIRGINIA as she prepared for sea trials. The only thing more impressive than the ship was the crew! There is an update on VIRGINIA Sea Trials in this issue.

This month the Submarine Force conducts exercise *Silent Hammer*. SSGN capabilities will be demonstrated in a Joint warfighting scenario. SSGN proves that volume counts. The payload capacity of this ship is awesome. SSGN capabilities will be addressed at the Naval Submarine League (NSL) Annual History Seminar on 13 April 2005. The title of the seminar is "Raiders from the Deep." This series continues our partnership with the Naval Historical Center, Naval Historical Foundation, U. S. Naval Institute, and the Navy Memorial in sponsoring a Seminar during the week of the Submarine Force Birthday.

The Submarine Force is celebrating the 50th anniversary of the commissioning of USS NAUTILUS (SSN 571) this year. The NAUTILUS transformed the role submarines play in national security. NAUTILUS forever changed naval warfare.

Preparations for next year's Submarine Technology Symposium (STS) are well underway. The theme is "Submarine Capabilities for the 21st Century". VADM George Emery has identified all the Session Chairs and speakers. STS will be held 17-19 May 2005. This

is one week later than our normal time frame. The Call for Papers has been released and abstracts are due on October 18. You can find more information about STS on the NSL webpage.

This year's Corporate Benefactor Recognition Days are 15-16 February 2005. Corporate Benefactors continue to be the foundation of NSL support. Currently there are 72 corporations actively supporting the initiatives and activities of your NSL. The date for the Annual Symposium has been set as 8-9 June 2005.

This is an exciting time to be in the Submarine Force and I am pleased that the League is working with our members and Corporate Benefactors to support initiatives that assist in making our Force the best in the world. I look forward to working with the new Navy Submarine Force leadership as we continue to partner with them in recognizing our outstanding submariners and providing forums for discussion. Your thoughts in the form of an article for THE SUBMARINE REVIEW are solicited to get ideas in front of those who can act on them. NSL members have the talent, experience and expertise to contribute to our Submarine Force. I commend you to that effort.

Finally, let me wish you a wonderful fall season and ask you to continue to pray for the safety of our troops deployed all over the world. I am pleased to represent you in the leadership of our League and look forward to our continued success together. Please recommend membership to your shipmates and friends.

*J. Guy Reynolds*

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*VIRGINIA UNDERWAY FOR THE 21ST CENTURY*

# PUTTING VIRGINIA TO THE TEST
## A Success Story

*by CAPTAIN JOHN S. HEFFRON, USN*
*VIRGINIA (SSN 774) Class Program Manager*

**Alpha Sea Trials**

Navy officials and shipyard workers strained to catch a glimpse of the attack submarine VIRGINIA through the mid-day fog. On that Friday afternoon, July 30th 2004, VIRGINIA was returning from her first time at sea to the Electric Boat shipyard in Groton, Connecticut where she was constructed. As VIRGINIA came into view, steaming up the Thames River, a straw broom was seen strapped to a mast, evoking the tradition of World War II submarines returning from successful war patrols. "The broom signifies exactly what it should – a clean sweep," said Admiral Frank L. "Skip" Bowman, Director, Naval Nuclear Propulsion. Every test conducted on VIRGINIA's first sea trial had been a success.

VIRGINIA's Alpha Trials were the first in a series of Builder's Trials that every nuclear powered submarine undergoes before entering the Fleet. Alpha Sea Trials brought the ship to life. It consisted of maneuverability testing, propulsion testing, an initial tightness dive, a dive to maximum authorized depth and an Emergency Main Ballast Tank (EMBT) blow. "She performed as expected and more," according to Captain David Kern, CO of VIRGINIA. "Everything went great."

VIRGINIA's initial dive was conducted as a controlled and closely monitored evolution. It started by submerging to periscope depth. After obtaining a diving trim at speed, VIRGINIA continued going deeper step-by-step. The initial trim dive was concluded with a successful emergency main ballast tank (EMBT) blow from 200 feet, proving that the EMBT blow system was operationally ready to support deeper diving evolutions. As the lead ship of its class,

VIRGINIA also conducted a dive to test depth—the maximum permissible depth—on this trial. Later ships will make the first dive to test depth during the second or Bravo Sea Trials. On the dive to test depth, all major hull, machinery, and electrical equipment were checked at incrementally deeper depths. The Crew also monitored for any evidence of leakage from hull penetrating systems. Overall, VIRGINIA performed three emergency blows and dove to test depth three times. She also conducted maneuvers to validate hydrodynamic modeling and observe that responses of the hull and control surfaces were as expected.

Propulsion plant testing went flawlessly. The testing included runs at maximum speed surfaced and submerged. VIRGINIA's top speed met expectations. In addition, a test from *all ahead flank* speed ahead to *back emergency*, called a *crashback*, proved that the propulsion plant could handle rapid changes and slow the ship in an emergency as prescribed. Drills were also used to test the response of the crew and the propulsion plant in abnormal situations. The level of automation in VIRGINIA's propulsion plant has made it more user-friendly and has even reduced the number of crewmen required to operate and maintain it. The new plant design incorporates modern electronics, micro-processing, and digital analysis and displays to a greater extent than ever before. Furthermore, the new design propulsion plant is quieter than that of any previous submarine class. VIRGINIA's reactor fuel will last the lifetime of the ship, which will reduce lifecycle cost and increase the operational availability of the ship.

For Alpha Sea Trials, there were 206 personnel on board or the equivalent of 1 3/4 crews on a submarine designed with 119 berths. Temporary test equipment and supporting instrumentation further limited available space, which is always at a premium on submarines. Nevertheless, the crew and people from the shipyards, navy labs, and vendors adapted to these conditions and smoothly worked together around the clock for three days in order to accomplish all tests. This large number of people on board imposed a test of its own on eating and sleeping facilities, but VIRGINIA was capable, thanks to her new design. A torpedo room which can be reconfigured to accommodate special operations forces greatly aided berthing of non-crew members. The new food service arrangement, which

facilitates serving and eliminates forward and aft traffic through the crew's mess, assisted the cooks in feeding all that were on board.

Overall, successful completion of required tests validated propulsion, ship handling, and safety characteristics, setting the stage for subsequent trials. The ship demonstrated superior dynamic stability and ship handling characteristics, and the fly-by-wire ship control system not only met, but exceeded expectations. There were fifty non-propulsion deficiencies – all minor and more representative of a ship of a mature class of submarines than the lead ship of a new class. The minor nature of these problems was evidenced by our ability to turn VIRGINIA around to be ready for the second sea trial in just three days.

**Preparation Was Key**

Major credit for the triumph of this first underway operation must be attributed to the high level of crew training, dockside testing, and certification that was concluded before VIRGINIA ever proceeded to sea. All the advance preparations significantly reduced the risks of problems at sea and greatly improved the chances of achieving successful test results. As with all new construction submarines, the steps to underway operations for VIRGINIA included Phase I Crew Certification, Salvage Inspection, Habitability Inspection, Dock Trials, Phase II Crew Certification, and Fast Cruise. In addition, VIRGINIA already had successfully completed intensive equipment and systems testing in order to be certified as ready for underway operations. As a result, VIRGINIA had been more fully tested before getting underway than any previous class of submarine.

VIRGINIA's crew had likewise been exhaustively preparing themselves. For several years, they have supported construction of their ship and recently were very busy as the time came for them to accept turnover of ship systems and spaces from the shipbuilder. In preparation for at-sea operations, the crew also spent numerous hours learning new equipment and systems, including time in trainers and classrooms. They also practiced equipment operation, ship evolutions, and casualty drills to satisfy crew certification testing. At sea, I was extremely impressed by their proficiency especially since this was their first time underway in a new class of ship with a plethora of new systems and procedures to follow.

## NPES Testing

A high level of early testing was performed on VIRGINIA's Non-Propulsion Electronics System (NPES), and provided results that gave confidence that the risk of using new commercial-off-the-shelf (COTS) technologies and standards was minimized. In other words, VIRGINIA NPES had gone to sea through computer simulation many, many times, before the ship headed down the channel. The NPES is a system of systems consisting of 23 electronics systems, such as Command and Control, Sonar, and Navigation, integrated into a shipwide network that hosts an impressive 20 million lines of computer code. It was designed to facilitate rapid incorporation of new computer technology or mission capability to keep the submarine technologically current. To meet these goals, the NPES design is almost completely based on COTS electronic systems and the concepts and processes of Open Architecture (OA). OA has simplified many of VIRGINIA's systems and has reduced the cost and time to develop them.

The NPES with its largely COTS-based hardware is not inherently shock resistant. Therefore, it is assembled into a specially designed Command and Control System Module (CCSM), a modularized, shock-isolated, deck structure package. Then the CCSM is tested as a complete system. An off-hull test facility called COATS (Command and Control System Module Off-hull Assembly and Test Site) was built in Groton, CT, for complete NPES system assembly, checkout and integration testing.

At the COATS facility, VIRGINIA's CCSM completed integration testing a full two years prior to sea trials versus the typical nine to twelve months. This process reduced costs and helped to ensure that once the CCSM systems were aboard the ship they functioned reliably. This approach drastically reduced the risk of testing impacting VIRGINIA's delivery schedule by allowing time for fixes or refinements as needed. We also greatly reduced the waterborne testing effort and eliminated an enormous amount of administrative work. Learning alongside the developers at COATS, VIRGINIA Sailors gained important understanding of the interconnectivity of systems that they ably demonstrated at sea.

Upon completion of testing, Commander, Operational Test and Evaluation Force (COMOPTEVFOR) performed an operational

evaluation (OT-IIB) of NPES. During this event, Fleet Sailors participated in 571 hours of system operation under test conditions that increased their familiarity with the new equipment and procedures. VIRGINIA passed this rigorous test on the first try. OT-IIB validated NPES and identified deficiencies while plenty of time remained to make corrections and changes without delaying the construction and sea trials schedule. The testing results of Alpha Sea Trial showed how closely the land-based testing predicted actual performance.

Pre-underway testing of VIRGINIA's torpedo system was passed with 12 flawless firings of torpedo test shapes over two days in March. The tests checked every aspect of torpedo handling and firing systems from loading into the ship, moving and stowing in the torpedo room, loading into torpedo tubes, and firing. Three shapes were fired from each of four tubes. The dozen shots and dozen successes have laid the foundation for repeating the successful test results at sea.

## Certification for Sea

Before PCU VIRGINIA cast off the last mooring line and headed for sea trials, she was certified under the highly structured Submarine Safety (SUBSAFE) Program. Before VIRGINIA could be certified for sea by SUBSAFE requirements, she was subjected to many tests of systems built with certified material using approved assembly procedures that were thoroughly documented. Objective quality evidence (OQE) of material control and work discipline was reviewed to assure compliance with SUBSAFE requirements. Then documentation and information required for NAVSEA Headquarters Certification was reviewed and approved by SEA 07T, the warranted Technical Authority, and SEA 07Q, the SUBSAFE Office. Subsequently, as the Program Manager, I had the responsibility of reviewing all material records and waivers to assess that VIRGINIA met the requirements for diving safely. After approving the package, I presented it to RDML John Butler, PEO SUB, the Certifying Official.

**Ship Control**

SUBSAFE lessons came to mind when a digital Fly-By-Wire Ship Control System (FBW SCS) was specified for VIRGINIA. With Fly-By-Wire (FBW), steering and depth are controlled electronically by computer without mechanical inputs, in both normal and emergency modes. This new method of ship control with no hydraulic or mechanical linkage between the ship control station and the submarine's control surfaces required a new certification process. Therefore the Requirements Manual for Submarine Fly-By-Wire Ship Control Systems was developed under the leadership of Commander Gary Dunlap in my office and instituted to provide a certification program parallel to the SUBSAFE Program. This system uses the same kinds of requirements and disciplined practices as SUBSAFE, but applies them specifically to ensure fail-safe operation of the FBW SCS. The program requirements focus on software and electronics that process ship control related signals. As with SUBSAFE, FBW has critical component material identification and control requirements for elements contained within the FBW boundary.

Much is radically new about the Ship Control Station (SCS), which is the main interface between the crew and 11 ship control-related subsystems. The SCS has a graphical user interface with four miniature operational stations (mini-stations), two joysticks, and a Mode Select Panel. Each mini-station provides complete ship control capability and consists of a large flat panel display screen and a small one. Each display accepts touch inputs. There are two SCS operator stations manned by the Pilot and Co-pilot. In automatic mode, the Pilot or Co-pilot orders course and depth on the touch-sensitive screen for steering and diving. In this mode, the system computes and moves the stern planes, bow planes, and rudder, to attain ordered course and depth. Because VIRGINIA has two sets of stern planes, the mini-station shows if inner and outer stern planes angles match. The inner and outer stern planes are about equally effective, so if one set jams or fails, the other set moves to counteract the effect. When entering a steering or diving order, there is a way to accelerate or limit the automatic performance. Three screen buttons allow selection of normal, limited, or maximal response to cause the system to move the planes or rudder within preset limits

with the desired expediency. One feature is straight from the Starship Enterprise with the computer that spoke with a human voice: A planes casualty in automatic produces a human voice prompting action to take manual control.

In normal manual mode, operators use either of two joysticks for manual control of the rudder, planes and the hovering and depth control seawater flow control valve. The SCS senses the position of the operator's joystick via fiber optic cable and digitally translates this movement into corresponding commands to hydraulics to move the control surfaces. While modern aircraft use this type of link, it is a first for US submarines. Operators previously used an aircraft-style stick and yoke, operating servo-control valves to change the flow of hydraulic oil to the control surfaces.

VIRGINIA Class has no mechanical-hydraulic mode of operation for backup as in the past. The emergency mode for loss of power is the Minimal Electronics Mode (MEM). If AC power is lost, MEM can use battery power for about 30 minutes to command positioning of aft control surfaces independent of computer control. In addition, the SCS system has fault-tolerant and performance-monitoring features to provide reliability.

The SCS Fault-Tolerant Processing System (FTPS) allows the ship control system to operate following failures of ship control electronics, sensors, or actuation systems. FTPS has four redundant processing units that control and monitor all operator interfaces, control outputs, and sensor inputs. All four units are synchronized for real-time data sharing and data comparison. Their performance-monitoring circuitry provides detection of processing and communications errors and auto recovery. Recovery from ship control failures is accomplished by automatic switching from a faulty component to a redundant copy that has not failed. Performance monitoring software development was a major challenge for VIRGINIA Class because of the complexity of dealing with several hundred signals, each connected with various forms of quad, dual, or simplex redundancy in order to build in the necessary reliability.

Why deal with a system that is so complex and different and has lots of new requirements? There are a number of advantages that accrue to VIRGINIA by using fly-by-wire technology. Fly-By-Wire provides a self-stabilizing capability. The SCS receives depth,

heading, pitch and roll data to cause it to react with the right amount of limited control input to maintain stability. The electronic control system enables intelligent operator assistance in hazardous situations and assists recovery from a casualty. For example, there is an emergency-deep algorithm and corresponding screen "button". If "emergency deep" is ordered, the Pilot just touches the Emergency Deep button on screen, and then confirms the order. When he confirms, the system takes all the initial actions to go deep. This reduces the demand on the Pilot and is part of the reason the size of the ship control party is reduced on VIRGINIA. Fly-By-Wire decreases the space and weight requirements of SCS too; always a welcome feature on a submarine. Fly-By-Wire also offers a reduction in cost, especially life cycle cost as it reduces required maintenance, crew size, and training.

Underway, the performance of the SCS in *auto* was very smooth. The operators love it. To go to periscope depth, the Pilot merely brings up the keypad on the depth screen and touches and enters the depth order akin to using a calculator. The system achieved more stability than human operators typically do. This was really apparent during periscope depth operations when depth control is the most challenging. Even on the edge of Hurricane Alex, early in Bravo Trials, depth control in automatic was precise and the ship never broached. VIRGINIA's hovering system is another means of automated depth control when near zero speed. Hovering will aid launching or recovering of SEALs. While maintaining depth by hovering for lockout trunk testing, the need arose to expose the deck because of fouling of a deck hatch. A specific depth was put into hovering that would broach the ship. While planes would have been ineffective under these conditions, hovering took the ship to that shallow depth and held it.

To ensure operator proficiency is maintained for the manual mode of operation a new trainer has been placed in operation at the submarine school in Groton, Connecticut.

## More Trials

All these trials lead up to authorization for "unrestricted operation".

VIRGINIA's second sea trial integrated the standard Bravo and Charlie Sea Trials. The second set of trials concentrated on a noise survey and in-depth testing of all ship control, trim, and ballasting systems, and the weapons and combat systems. These trials lasted three weeks. The majority of time was spent on acoustic testing in the Caribbean for the shipbuilder to characterize the ship's acoustic signature. Later the Navy will conduct more extensive signature definition trials. With initial sea trials complete, VIRGINIA arrived at Norfolk, VA, having already traveled some 6000 miles. At this writing the ship is in dry dock for about two weeks at Norfolk Naval Shipyard, followed by three to four weeks waterborne for correction of trials deficiencies and final preparations. The Naval Board of Inspection and Survey (INSURV), or Acceptance Trials, is combined with the final contract trials. These trials will be conducted for about a week by the INSURV Board as an independent verification of the ship's material readiness condition. Subsequently, VIRGINIA will return to Norfolk to prepare for delivery to the Navy and for commissioning on the 23rd of October 2004. This schedule is in keeping with the Acquisition Program Baseline approved over 11 years ago that set down delivery of VIRGINIA by this year – a very significant accomplishment!

## Conclusion

The success of VIRGINIA sea trials is near-term fulfillment of all the promise that VIRGINIA holds. To my knowledge, no lead ship has undergone trials with so few problems. The superb results are gratifying, but were made highly probable by the measures taken during design, construction, and testing to reduce the risk of problems once VIRGINIA got underway. Yet there is only so much that can be proven from modeling, simulations, and ashore and dockside testing. The full-scale ship tests in the unforgiving ocean environment have now confirmed that the designers got it right. The splendid performance of men and machinery underway should instill even greater confidence in the Program and in our shipbuilders.

VIRGINIA proved by these results that she is quiet, fast, maneuverable, and ready. She is fulfilling in every way the promise

inherent in her design to be a key instrument in the Navy's transformation. With superlative results from Builder's Trials, we look forward to successful accomplishment of the remaining steps to ship delivery when VIRGINIA officially joins the Navy. The multi-mission flexibility that VIRGINIA Class submarines offer to fleet and joint forces, combined with their new and expanded war fighting capabilities, places VIRGINIA on the cutting edge of future Submarine Force operations.


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## VIRGINIA JOINS THE FLEET

*by Robert A. Hamilton*

*Bob Hamilton is a newspaper reporter who has covered the Defense beat for a number of years. He currently works for The New London Day.*

On a warm midsummer Friday afternoon, the PCU VIRGINIA sailed up the fog-shrouded Thames River at New London, and into the history books. Over three days ending July 30, the first U.S. Navy warship designed from the keel up for the post-Cold War period was put through its paces. It was run at maximum speed, taken to its test depth, run through a series of casualty drills, and came through it with a broom on the sail, signifying a *clean sweep* on its Alpha trials, a performance that impressed people who had set very high standards for VIRGINIA—the men who will operate her at sea.

The submarine wasn't particularly pretty as it finished Alpha trials. There were cable trays missing or dangling from the hull and some sections of temporary hull coating material had ripped loose. But even those shortcomings were a point of pride, a testament not to sloppiness, but to speed. After Virginia screamed along at maximum power for six hours, the water flowing over its hull tore off some of the temporary test gear.

"The first dive, in itself, is an event, taking a ship of this complexity underwater for the first time," said Adm. Frank L. "Skip" Bowman, the director of Naval Nuclear Propulsion said during a press conference after the Virginia pulled up to a pier at Electric Boat. "We ran it at its maximum power at a flank bell, reversing that ahead flank to a stern bell in as rapid a fashion as possible to prove that the machinery will take that kind of stressful action. The sonars were tested, the radars were tested, the people were tested, and the electronics were all tested. We did emergency blows, in the highly unlikely event that that ever becomes necessary, we did three of those in fact on this cruise. We took the ship down to test depth, maximum operating depth, three times."

Although the speed it reached is classified, officials were clearly

pleased with Virginia's accomplishments.

"She performed as expected, and more," said a grinning Captain David Kern, commanding officer of VIRGINIA. "Everything went great." As impressive as the machinery, though, were the accomplishments of the crew, he added quickly, who had worked nonstop for months before Alpha trials, training to make sure they could handle any contingency while underway.

"Most of these crew members have worked day and night to prepare for sea, and they performed flawlessly along with the ship," Kern said. "VIRGINIA is powerful, maneuverable, and I was particularly impressed with the fine control for depth and speed—the kinds of things we're going to need to fight in the littorals. I'm excited about taking VIRGINIA to sea, future sea trials, and taking her to commissioning later this year."

At press time, VIRGINIA was scheduled to be commissioned October 23 in Norfolk, Va. It had already completed Bravo trials, in which the crew fully tested its revolutionary fly-by-wire system to make sure the ship will be safe when the controls are placed on autopilot, it performed *angles and dangles*, moving sharply up and down through the water, and it validated the hydrodynamic models, in which the crew looked for any problems at any speed, such as snap rolls in a sharp turn.

"The ship just performed marvelously," Admiral Bowman said. "It will give us a new edge in this war on terrorism, as we marry up even more with the Special Forces. Now we know that this ship is going to be just as good as we could have hoped. We now know the fly-by-wire control system is going to work just fine. This ship is waiting and raring to get out into the fleet."

So well did the VIRGINIA perform, in fact, that it accomplished during Alpha and Bravo trials what other submarines had to do over Alpha, Bravo and Charlie. Kern noted that VIRGINIA spent three days at sea Alpha trials, conducting 33 major tests over 77 hours, then returned to port for less than two days and departed on a second round of intensive assessment, Bravo Trials, during which it conducted 6,000 hours of tests over 24 days.

That means after taking it to sea for the first time, it spent 27 of 30 days underway. Previous classes of submarines generally did a one-day Alpha Trial, returned to port with a list of items to be fixed

or recalibrated, and went out weeks or months later on Bravo Trials, which generally lasted days rather than weeks.

"That's unprecedented—that the ship is that seaworthy, that the design is that mature, this early in the process," Kern said in a telephone interview from Norfolk (Va.) Naval Base on Thursday, as he prepared for the acceptance trials. "We were able to test everything that needed to be tested at sea to present the ship to the Board."

Even more impressive, he said, are the capabilities that the VIRGINIA demonstrated during Bravo Trials, particularly with the automatic, fly-by-wire control system.

"I could do things on my first or second try on VIRGINIA that I was never able to do on a (Los Angeles-class submarine) because you just could not control the ship, could not take that 7,000-ton 688 and just control her at half a knot with one foot precision, whether you were submerged or at periscope depth," Kern said.

"We have some real capabilities we're going to bring to the shallow water fight in the littorals, and it's exciting," Kern said.

If the Board shares his enthusiasm for the ship, the planned commissioning the ship on October 23 in Norfolk will go off without a hitch.

Most of its first year at sea will be spent on assessments of its sonar, fire control, communications and weapons system, and on sound trials, as the Navy tries to determine just how good its new submarine is, before it gets plugged into the operations calendar.

VIRGINIA traces its roots to the early 1990s, in the wake of the fall of the Berlin Wall, when it became clear that the Navy would face a far different challenge in the 21st century, and Electric Boat began the design of a smaller, less-expensive alternative to the Seawolf class of submarine, something that would be more capable in the near-shore littorals, support Special Forces, launch pinpoint accurate strikes and do ISR (intelligence, surveillance and reconnaissance) better than anything before it.

EB won the contract in 1998 to co-produce the VIRGINIA in a special teaming arrangement with Northrop Grumman Newport News in Virginia. Each shipyard built half of the submarine, and the first one was assembled at the EB yard in Groton; the second, USS TEXAS, is scheduled to be commissioned next year at Newport News.

EB had been working feverishly to support the planned July 27, 2004, start of the sea trials, and on a Wednesday less than two weeks before the deadline shipyard Vice President Frederick Harris was meeting with some key executives involved with the process when he dropped a Shipyard Discrepancy Report on the table before them. For weeks it has been filled with 500 to 1,000 items, details that had to be addressed before VIRGINIA could go to sea. On that morning though, the first two words on the report, in bold type, stated flatly: "**No items.**"

"It was a little hard to believe," said Thomas C. Berl, the ship's manager, who had worked until 10:30 the night before he felt confident putting those words on paper. "To watch this work list dwindle to nothing was just amazing — it beats every lead ship we ever built."

To be sure, there were some surprises in the process, as there is whenever the Navy attempts such a large, complex undertaking. VIRGINIA fell a few months behind the schedule that had been set for it 10 years earlier, but that compared with 25 months for SEAWOLF, 26 for LOS ANGELES, and 30 for OHIO. It had required about 20 percent more man-hours than originally estimated, but SEAWOLF missed the mark by 65 percent, and OHIO by 80.

Key EB personnel credit the design-build process that was employed on VIRGINIA for keeping it so close to the plan. In the past the designers and engineers considered it their job to design the ship, then they would *toss the blueprints over the wall* to the trade professionals to build it.

On VIRGINIA, that all changed. The trades workers, vendors who would supply parts, the sailors who would drive the ship, even the naval shipyard personnel who would eventually decommission it were involved with the design process to make sure the ship was easy to build, maintain, operate and repair.

"On this job, there was a lot of ownership, a lot of pride, across the company, and across the team," said Lennon, the program manager. "I've never seen that demonstrated to the extent it was on this program, and the proof is the product sitting out at the pier, ready to go to sea."

Lennon has been involved with VIRGINIA program in one way

or another since it was a concept 14 years ago, when it was known as the Centurion. He was on the dock when the first cylinder arrived from Quonset Point in February 2000, celebrated the completion of its pressure hull in November 2002, cheered as it floated off in August 2003, and is ecstatic to see how closely it is tracking to a schedule set before the first steel was bent.

"Everyone had their eye on the ball, getting this ship ready for sea," Lennon said. "When it required working through the night, everyone worked through the night—designers and engineers, vendors, sailors, and people from other government agencies. Watching this ship come together gives you all the adrenaline you need to keep going."

David McCall, the director of Combat Weapons Systems, agreed: "If a job needed to be done, there was no lack of people ready to raise their hand and take on the responsibility and then go do it."

And so, just after dawn on Tuesday, July 27, VIRGINIA slipped away from its berth at Electric Boat, and set out to sea. Three days later, it returned through the fog, as shipyard workers and sailors craned their necks to look at the sail, and were pleased to see a straw broom strapped to its uppermost mast.

Admiral Bowman had a spring in his step and a broad grin on his face as he strode to the podium and addressed the assembled shipyard workers who wanted to know how their handiwork had performed.

"We shut down the reactor with casualty training, drill training, twice, and demonstrated the capability to rapidly restore the reactor and rapidly restore propulsion and electrical power to the ship," Admiral Bowman said. "Virtually everything short of demonstrating the combat system and the weapons system is accomplished on the initial sea trial, and it came through with a broom on the sail."

Admiral Bowman said he couldn't comment in detail about the performance of the nuclear plant that his office designed, since that gets into classified material, but he offered this comparison: "It ran like a sports car hepped up on high-test gasoline."

"I will tell you that this propulsion plant is an extremely user friendly plant," Admiral Bowman continued. "Automation that has not been incorporated into propulsion plants before has been incorporated into this, giving us the ability to reduce watchstanding

requirements on this ship, that has reduced the number of watchstanders required to take care of the plant. It's very, very resilient, more resilient than previous plants. It's built in a modular fashion that will make it much quieter, we believe, and we'll find that out on acoustic trials when those take place. It incorporates an energy density never seen before which is good, it means the propulsion plant takes up that much less volume that can be used for payload. It's a completely new design, and it brings the Submarine Force into the 21st century, with electronics, with microprocessing, with digital analysis and displays that have not been used to this extent before on submarine designs."

"Every test was completed successfully (and) we were not disappointed at all with any of the tests," Admiral Bowman said.

VIRGINIA, designed to carry 134 officers and crew, conducted sea trials with 206 people aboard, which made for some cramped conditions. Among the riders were personnel from EB and Navy officials such as Rear Admiral John D. Butler, Program Executive Officer for Submarines, and Rear Admiral Jeffrey Cassius, Commander of Submarine Group Two in Groton. It was also, coincidentally, the day before Newport News christened the second ship of the class, TEXAS.

Berl, the ship's manager, said this was the first submarine he has seen through sea trials, "But most of the veterans on my team are very impressed with the small number of items that need to be addressed." As EB welcomed VIRGINIA back to its dock in a brief ceremony following the trials, dozens of Berl's crew were streaming aboard the ship to being to fix the problems that had been noted, to get it ready for sea again.

"It's good to know we're almost to the end," Berl said. VIRGINIA will be delivered to the Navy after more trials and some final touches. "It will be with some sadness that we see her leave for good, but it's also good to know we did it."

Sonar Technician 2nd Class Joshua Fredrick, who has been in the Navy six years and was assigned to VIRGINIA two years ago, said normally when you take a submarine to maximum depth there are others on board who can reassure you that it has been done before. On VIRGINIA, it was a little unnerving to realize nobody on board had done it yet.

"It was pretty tense," Fredrick said. "I was kind of excited. It was good to know we could go down that far."

But Fredrick said he volunteered for VIRGINIA "because it is the first of a class. It's something new, nobody had done it before, so you get a chance to go do something nobody has done before."

Machinist Mate 1st Class Derrick Jones said most people on board were too busy to be overly worried about testing a new technology.

"You've got a million things that go through your mind, a million different casualties that can happen, and what you're going to do if they happen," Jones said.

Fire Control Technician 2nd Class Patrick Powers said heading out of the Thames and coming back, in particularly, were busy periods, because of all the summer traffic on the water, including about a dozen pleasure and ferry boats that came in as VIRGINIA was maneuvering into the dock.

"But everything came together, and it worked well," Powers said.

"This ship is exactly what the Navy needs, when it needs it," agreed EB President John P. Casey, who was on board during the trials. "There is no substitute for the VIRGINIA-class submarine."

Before he departed for his flight home, Admiral Bowman slipped Kern one of his personal challenge coins, and confided that it was only the third one he had ever given anyone. Kern beamed and thanked the Admiral, but as he turned to address the press, his demeanor became more serious.

"VIRGINIA can do everything that a 688 can do, but we have more capabilities. We have sensors that the 688 class does not have on board. We have the lockout trunk for Special Forces on board. We are much more modular, so when we advance technology it can be put onto VIRGINIA quickly and easily — Commercial-Off-The-Shelf is what took us out to sea and what brought us back," Kern said. "We need enough VIRGINIA's to replace the 688s. We need VIRGINIA's built, and we need two of them a year so we have enough to fill the needs of the future."

*EULOGIES*

## ADMIRAL IGNATIUS J. "PETE" GALANTIN
## USNA CHAPEL
## 13 SEPTEMBER 2004
## BY
## RADM CHARLES B. YOUNG USN
## (Director, Strategic Systems Programs Office)

Joy, Vivien, Linda, Captain Veazey, family and friends of ADM Pete Galantin, I am honored to be a part of this Memorial service and to represent the Admiral's extended family at the Strategic Systems Programs Office ... the successor to the Navy's Special Projects Office, one of many organizations in our great Navy which bears ADM Galantin's handprint! You see, he was the second Director of this great organization ... an organization that will celebrate its 50th anniversary next year!

To put that in perspective, I am the 11th Director of SSP ... I received by commission as an Ensign here at the USNA in June 1970 ... the very same year that ADM Galantin retired from the Navy as a four star admiral! I guess I may have been the Admiral numerical replacement! Not a good deal for the Navy ... trading in an Admiral, a warrior, and a seasoned Veteran for a *wet-behind-the-ears Ensign!*

Although times have changed beyond our imagination since then-RADM Galantin commanded the Special Projects Office, most of the management and leadership procedures, processes, and tools that the Admiral used in his tenure, some 40 years ago, are still in use today by my management team. That is a real testament to his foresight, and management and leadership skill.

In verse 35 of the 18th Psalm, we hear a wonderful philosophy about greatness; listen to God's word:

*Your right hand supports me;*
*your gentleness has made me great.*

David offers an interesting twist to the concept of greatness, saying that God's gentleness made him (David) great. Our society believes that greatness is attained through a combination of opportunity, talent, and aggressiveness. But true greatness comes from living according to God's laws and standards and recognizing that all we have comes from the gentleness of God's mercy. (Life Application Bible 2003 Calendar)

I can only imagine that ADM Pete Galantin lived his life with this knowledge and understanding. That is what made him a great man!

During over 41 years of service to the Navy, ADM Galantin made phenomenal contributions to the Navy in the defense of our Nation. It is my privilege to highlight some of these contributions for you.

From the review of his book SUBMARINE ADMIRAL From Battlewagons to Ballistic Missiles we read that ADM "Galantin learned well the unspoken rules of the silent service: the fate of the entire crew depends on each man's action; that rank has no priority beneath the waves. Submariners got no second chances; fifty-two of the Navy's subs became Iron coffins during the war, the highest mortality rate in the armed forces." As the skipper of the Halibut in WWII he was a highly decorated submariner who stood tall among a number of real war heroes!

We get a sense of his abilities as a submarine warrior and as a courageous leader as we peer into one of his letters.

The Admiral in his own handwriting responded to the following question he received in a letter from a William Stanhope in 1990 (while he was living in Pinehurst, NC): "Of all the many combat situations that you were in, which one is the most vivid in your mind, and why?

RESPONSE

"18 July '90

A good question.

Without doubt, the most vivid is the first in which I was commanding officer. On 29 August '43 I was skipper of HALIBUT, and my first torpedo attack was against a destroyer, the submarine's traditional enemy.

To my officers and men I was largely an unknown quantity, how would I act in combat? Was I aggressive, foolhardy, or what? Conversely, I had not seen my crew tested in battle.

With ideal periscope attack conditions I was able to make not one but two torpedo attacks from excellent positions. That we missed was only because the Mark XIV torpedo was grossly defective. The ensuing depth charging that we endured was all the more bitter. But now I had great confidence in my men and my ship, and perhaps they did in me. In the future we would go into combat with mutual trust and confidence.

Respy'
I.J. Galantin"

That reflects a true leader ... one who led under fire!

Now I would like to reflect on the period when ADM Galantin worked on the FBM – the Fleet Ballistic Missile – program ... 26 February 1962 to 1 March 1965.

The press release upon ADM Galantin taking the helm at the Special projects Office gave the biography of a seasoned veteran, both at sea and in Washington.

Under his direction and leadership the Polaris A2 missile was first deployed, the Polaris A3 missile flight test program was completed, the A3 was then successfully deployed on the first of our "41 for Freedom" SSBNs. He was then given the task by President Johnson to develop the Poseidon C3 missile ... a completely new and more capable Submarine Launched Ballistic Missile.

There is no program more important to the defense of the United States than the Submarine Launched Ballistic Missile System. The systems for which the Admiral was responsible are only successful if they are never used in anger. The purpose of these systems is to deter major war, and to accomplish this mission they must be as effective and reliable as possible... the Admiral understood this. Not only did the Admiral contribute in winning WWII, he was a key factor in winning the Cold War ... ADM Galantin was a major contributor to our National Defense.

The Navy and the nation do indeed owe a debt of thanks to ADM Pete Galantin!

Admiral, your many friends from SSP

- salute your service, we value your influence on the strength of nation's defense through the systems that were designed, developed, tested, and deployed under your leadership at the Special Projects Office.

- We cherish the continued impact you had on our Submarine community, our Navy, and our nation over the years since you were our Director.

In a review of the Admiral's book SUBMARINE ADMIRAL, ADM William J. Crowe, the former US Ambassador to Great Britain and the former Chairman of the Joint Chiefs of Staff, summed up ADM Galantin's influence on the defense of our country in a simple statement: "... Admiral Galantin proved himself to be both a competent warrior and peacetime strategist."

Admiral, you made a difference; you served with a purpose.

# ADMIRAL IGNATIUS J. "PETE" GALANTIN
# USNA CHAPEL
# 13 SEPTEMBER 2004
# BY
# REAR ADMIRAL JACK BARRETT, U.S. NAVY(Ret)

We are here today to say good-bye to the physical remains of Admiral Galantin. But we will never forget his spirit, his soul, his personal and professional leadership.

I represent the U.S. Submarine Veterans of World War II and his WW II submarine HALIBUT. We sailed in harm's way with a young Lieutenant Commander as he attacked Japanese ships, evaded depth-charging and avoided minefields. Four of his crew are here today. Then Lieutenant Jack Hinchey was his Engineering & Diving Officer. I was his Torpedo & Gunnery Officer. Tudor Davis, who came from the West Coast with me, was in the forward torpedo room gang and John Perkins who was in the after torpedo room. Seven or eight more of the HALIBUT crew could not come because of various physical disabilities. All did contribute, however, for this beautiful HALIBUT wreath that Jack Hinchey arranged for us. Tudor Davis, incidentally, was the Chief Torpedoman on the first Strategic Deterrent patrol by U.S.S. GEORGE WASHINGTON (SSBN 598) under the command of Captain (later Rear Admiral) Jim Osborne. He is also a Past National Commander of the U.S. Submarine Veterans of World War II. John Perkins arranged our HALIBUT reunions over the years where we grew to know the warm, humorous side of our Skipper and his wonderful wife, Ginny. As his family just said in describing Pete with his grandchildren and about his accordion playing, he truly was a Renaissance man. He was my model of a superb naval leader and a true gentleman. I never heard him use a foul word—either as a wartime warrior when his torpedoes did not work properly or as a peacetime warrior dealing with various people in the jungles of the Navy and Defense Departments and with the Congress.

I worked for Admiral Galantin twice in Washington, D.C. First, when he initiated a new branch (OP-312) in his Submarine Warfare Directorate. I was given four outstanding submarine officers

responsible for advancing and supporting cutting-edge technological programs in the budget processes—one for sonar, one for torpedoes, one for the Polaris submarine program and one for nuclear propulsion. In this position I witnessed on a daily basis the way in which he delegated authority and responsibility to those who had earned his confidence. Later, after he had become Director, Special Projects (the Polaris program), he brought me over to be his Deputy for Plans and Programs (SP-11).

I would now like to tell Admiral Galantin's children and grandchildren three anecdotes to illustrate his humanity and humor and his personal and professional leadership.

The first happened on Christmas Day, 1943. He pulled away from the Japanese coast where we had been patrolling. He took HALIBUT to 200 feet for a special all-hands turkey feast. Knowing we would be on patrol on Christmas I had smuggled a bottle of wine aboard. I had the wine between my legs at the junior officers end of our small wardroom table. The Captain sat at the head of the table with our Exec, Mac Butler, at his right. After we had done justice to the turkey I placed the wine bottle in the center of the table. The captain gave me a stern glare. He turned to Mac Butler saying "Isn't this against Navy Regulations?" Mac then glared at me while agreeing with the Captain. They then proceeded to hold a Captain's Mast, finding me guilty. He restricted me to HALIBUT for 30 days. We had 40 some days before returning to a submarine tender. The Captain then dipped his fingers into a water glass, sprinkling the water on the bottle to turn the wine into water, making it okay to drink with our dessert. (The Chaplain conducting the funeral service later told me he planned to use this anecdote in conducting his ministry with midshipmen).

My next HALIBUT anecdote is a serious one. In a torpedo attack on Japanese shipping one of our torpedoes in the forward tubes did not fully eject. It was stuck half in, half out. The impeller that armed the torpedo was outside the tube being turned by the submarine's motion through the water. We evacuated the forward torpedo room except for Chief Emil Ade and me. The Chief and I agreed that the torpedo might be armed and would explode if we tried to eject it with high pressure air. We agreed that our best bet was to pull the torpedo back into the tube. I reported our recommendation by phone

to the Captain in the Conning Tower. He approved our proposal to pull it back into the tube. We opened the inner door. Chief Ade crawled into the tube to put a line around the propellers. Throughout this process we had both outer and inner doors open with only the torpedo keeping the ocean out. The Chief and I pulled the torpedo in, inch by inch until we could close the outer door, remove the line and then close the inner door. With great yells of relief we pounded each other on the back. This was my first witness of how the Captain could delegate responsibility to a subordinate. Neither he nor the Exec ever came to the torpedo room to supervise us. I cannot describe how much confidence this gave to me in future wartime and peacetime situations of stress. I would have gone to hell and back for Pete Galantin.

My last anecdote is again illustrative of why it was such a pleasure to work for the Admiral.

While under him in the Submarine Warfare Directorate, I became concerned about the lack of an operational test of the total submarine system. We were firing demonstration (DASO) missiles at Cape Canaveral to prove the readiness of the missiles. I was driven by our disastrous experience with faulty torpedoes in the early days of WWII. As far as I know the responsible laboratories never conducted adequate operational testing prior to issuing torpedoes to the Fleet. I developed a point paper to make the case. Later, after the Admiral had become the second Director of Special Projects he had me ordered over as his Deputy for Plans and Programs (SP-11). I had been pedaling the point paper around the Navy and Defense Departments with no success. Both Admirals Galantin and Levering Smith (the technical genius of the POLARIS program) supported the case.

One Saturday night while having dinner with Joan and our five children I had a phone call from the Admiral. He told me to be at Defense Secretary McNamara's home at 1000 Sunday morning to brief him on the point paper. McNamara was appearing before the Goldwater Congressional Committee on Monday to present the readiness of the Polaris Submarine Deterrent Force. I briefed him and answered his probing questions for hours. He used the point paper proposal in his Congressional testimony the next day. This became the genesis of the POLARIS OPERATIONAL TEST

PROGRAM (OT). This is illustrative both of the Admiral's manner of leadership in advancing submarine programs and of the trust and confidence and delegation of responsibility he gave to his subordinates. It was a privilege to work for him in the bureaucratic jungles of Washington, D.C. just as it was to be one of his wartime crew.

In our many reunions and visits during our retirement years I grew to know him as Pete Galantin, the man. In his multi-roles as HALIBUT's Captain, as the Admiral advancing submarine programs, or as the grandfather playing his accordion and enjoying his grandchildren, he honored us. We honor him this morning here in the magnificent Naval Academy Chapel where he honored his Lord. I grew to know and love Pete Galantin. So now we say good-bye to his physical remains. We will never say good-bye to his soul and his spirit. May the good Lord always hold Pete in the palm of His hand until we meet again.

*Aloha and Mahalo*

# ADMIRAL IGNATIUS J. "PETE" GALANTIN
# USNA CHAPEL
# 13 SEPTEMBER 2004
# BY
# RADM MAURICE H. RINDSKOPF, USN(Ret)

To Joy, to Vivien, to Linda and all your families and to the many friends of Admiral Galantin here today in this hallowed building, I say that I am honored to participate in this celebration.

Sylvia and I knew Ginny and Pete when they were young, and we were younger even than that. Although Pete was senior to me by five years, our careers *in the boats* were remarkably similar.

We both spent two years in a battleship prior to submarine school. At the school we both learned to dive a submarine on a crude mechanical gadget, to make practice approaches in an attack teacher where the staff moved ship models on an upper deck by hand, made escapes in the long-gone 100-foot diving tower, and went to sea in World War I R-Boats.

Before the war, Pete served in ARGONAUT, one of the few mine-laying submarines ever to put to sea; as executive officer and navigator of S-24, and then commanded one of those R-boats that provided services to the submarine school students. My upbringing commenced as a junior officer in another R-boat. Pre-war submarining was a challenge since none of the boats had air conditioning, and computer was a word not in our dictionaries. But in World War II Pete and I were two amongst the 465 skippers who fought the long war. With his loss, I estimate that there are but 40 of us left.

By happenstance he was in command of HALIBUT (SS232) while I commanded DRUM (SS228) in October 1944 in the Luzon Straights just after General Douglas MacArthur landed on Luzon with his famous "I have Returned" speech. There were no fewer than 13 submarines operating against the Japanese Naval Forces fleeing north from the great battle of Leyte Gulf and the convoys the Japanese attempted to send southward in relief of their beleaguered

forces in the Philippines. HALIBUT sank a destroyer and DRUM three merchantmen.

But it was after the war that Admrial Galantin's career took off like a Polaris missile, while mine prospered more like a cruise missile. We both witnessed the growth of our submarines from a pre-war *Model T*, to a wartime mid-size with semi-automatic transmission, to a cold war luxury model with unlimited nuclear power, to a Rolls Royce equipped with missiles which have controlled the oceans for almost 50 years.

Long after our respective retirements, our paths crossed once again. In 1984, when we became plankowners of the Naval Submarine League. It was established by some 100 retired submariners to make the American people and the Congress aware of the importance of submarines to the nation. The League honored the Admiral at its 1987 symposium as "The Submarine Hero" for his offensive success in HALIBUT and his skill in bringing her home after she suffered extreme damage from enemy surface and air counterattacks. I speak for the League's 4,000 members-active and retired submariners and industry representatives-when I say that the League appreciated all Admiral Galantin did in its behalf. The league will miss him.

He was a brave submarine commander, a skilled administrator, a successful delegator of authority to his troops, and a manager who knew Washington so well that he achieved his every goal his four star retirement was his to enjoy.

His passing is a great loss to his family, to his many friends, to the Submarine Force, and to the United States Navy.


The sea dominates the Earth.
This dominates the sea.
It runs silent, it runs deep. The Virginia-class attack submarine is the most advanced undersea weapons system in the world. This nuclear-powered submarine comprises an innovative mix of technology, flexibility and combat effectiveness. Designed to meet changing missions and threats, it is at the forefront of the Navy's push to maintain 21st century sea superiority. Northrop Grumman Newport News is proud to be a partner on the Navy's next-generation submarine. It's one reason there will always be something in the water that keeps America strong.
NORTHROP GRUMMAN
Newport News

*FEATURES*

# AN ATTACK SUBMARINE IN THE GLOBAL WAR ON TERROR

## AN ADDRESS TO THE 2004 NSL ANNUAL SYMPOSIUM BY COMMANDER MICHAEL POIRIER, USN FORMER COMMANDING OFFICER, USS TOLEDO (SSN769)

I'd like to thank you for the opportunity to spend a few minutes giving some observations on the war on terrorism from one SSN CO's perspective. This gives me the chance to give you some insight into what my crew accomplished, and allows me to relive some great memories, which seem particularly interesting compared to my current heavy responsibilities managing a Pentagon desk!

TOLEDO had the privilege of making two deployments in the war on terrorism, one with the JOHN F. KENNEDY Battlegroup during Operation Enduring Freedom and one a surge deployment in support of Operation Iraqi Freedom. To the extent I can at the unclassified level, I'll talk about these two deployments and the war on terrorism.

JOHN F. KENNEDY and her battlegroup deployed in early 2002 and played a role in the final combat operations that overthrew the Taliban and Al-Qaeda forces in Afghanistan. The Battlegroup was split into two—Jim Kuzma's BOISE along with half the surface escorts operated with the 5th Fleet. While JFK hit enemy targets located in Afghanistan during Operation Anaconda and follow-on operations, her escorts and USS BOISE worked off the coast of Pakistan to monitor and choke off overseas escape routes for Al-Qaeda and other terrorists there. The remaining half of the battlegroup escorts and USS TOLEDO were stationed in the Med. I must admit, I was initially concerned that we were too far away from the action—but I was dead wrong—CTF 69 and Sixth Fleet had plenty of *war on terrorism* tasking for us.

We knew that Al-Qaeda had employed aircraft to supply their Afghanistan camps and we also had strong indicators these terrorists employed merchant ships to carry important cargo and people around the world. As a result, Sixth Fleet had stood up CTF-66 whose mission was to monitor merchant ship activity throughout the Eastern Mediterranean. CTF-66 employed ships from virtually all of our allies—indeed we observed British, Danish, Spanish, German, French, Norwegian, Dutch, Greek, Turkish, as well as U.S. ships all participating in an impressive way. Let's talk about the SSN part of that operation and how submarines fit in:

First, for obvious reasons, we are hungry for any knowledge on which merchant ships terrorists use to move material and people clandestinely around the world, including the Mediterranean basin. We clearly want to know how these ships are being used and what type of material they are carrying. Intelligence on various merchant ships and or companies comes from a wide variety of sources. We maintain a list of those ships potentially linked to terrorists. Once there are some indications that a specific vessel might be engaged in supporting terrorists, we and our allies must assess the intelligence and determine if the ship is in fact conducting these activities. There are a variety of ways to do this, including observation from aircraft and surface ships, but the best way to monitor merchant ships suspected of terrorist activity is to do so covertly employing a submarine.

Just as we learned in the Cold War, a potential adversary will go about his normal 'business' and will not modify his behavior when he does not know he is being observed. Submarines have sufficient dwell time that they can observe closely a merchant 24/7 and can classify the activities the merchant is engaged in—this sort of capability is especially important in areas such as the Eastern Med as there are a number of ships engaged in simple smuggling. A submarine is far more likely than another platform to differentiate between a merchant involved in smuggling or one involved in something more nefarious. Covert observation by submarines then allows us to tip off surface ships that can conduct Maritime Intercept Operations and determine exactly what and who is onboard the merchant—and potentially seize assets and/or terrorists. This work is very much a team effort, but again the key is covert observation

employing a wide variety of submarine on-board sensors. We saw the value of covert observation; on several occasions we observed suspicious activity that ceased once a NATO warship or aircraft approached the immediate area of the activity.

Today, throughout the Med, Middle East and Pacific operating areas our Navy constantly observes and, when warranted, boards merchants to observe cargo and crew. Not only are we learning considerable information, but we are also sending out a strong signal that we are watching, thereby making the task of the terrorist more difficult.

A second major concern we have is that terrorists will seize a merchant, load it with a weapon of mass destruction and sail it into a U.S. or allied port. Employment of such a weapon in a U.S. port could cause significant damage. As a result, the Navy needs to be able to respond to such a threat before it arrives in a U.S. port. To do so means we need to be able to react to some cuing, and must be able to identify a merchant whose appearance may have been changed or modified. For perhaps the first time in many years, we are involved in a systematic cataloging of all the merchant ships of the world-determining all their characteristics—acoustic, visual and other—in a way that fingerprints each vessel as unique. For the many Cold War veterans here, this effort will be familiar as we undertook a similar effort to understand the Navy and Merchant fleets of our Cold War Adversaries. The Submarine Force is actively engaged in this effort to document the characteristics of merchants—and TOLEDO played her part while conducting other objectives in the Mediterranean. Of course, our submarines do this *part time* as they pursue other, often-higher priority objectives while forward deployed. Furthermore, while conducting this mission, should we observe an unknown merchant engaged in activities that are clearly suspicious, he now becomes an object of sustained interest rather than passing interest.

In the future, should we learn that a merchant is potentially carrying WMD towards a U.S. port, we would be able to employ a submarine or other platform to verify that we have the right target after comparison with our intelligence data base—even if the merchant's appearance was changed, acoustic signature and other

key parameters would remain the same. Once sure we have the right merchant with a clear threat onboard, we would destroy it.

There are other significant challenges of course, we need to have some sort of cuing data and we need to be able to surveil ships across a vast portion of the maritime environment. Obviously these are difficult problems. Of note, Admiral Fargo recently discussed his Regional Maritime Security Initiative, which discusses this difficult surveillance problem in protecting both our homeland and that of our allies from attack—in his words we "need to gain an awareness of the maritime domain to match the picture we have of our international airspace."[1]

These are the sort of activities that forward deployed submarines can and do participate in. Of course, the boats are conducting a wide variety of missions including various intelligence, surveillance and reconnaissance missions that provide important data to our military and intelligence communities. Although I can't go into the details of various missions, I can tell you that our submarines are actively engaged in the war on terrorism—in TOLDEO's case we conducted four classified operations during our 2002 deployment. Of the relatively small amount of time remaining of our sixth month deployment, we participated in one 8-day exercise; and conducted port calls for maintenance and liberty. So we were gainfully employed.

We returned from deployment in mid September 2002. After a typical one-month stand down and a short period of at sea operations we started a five-week scheduled maintenance period in early November 2002. Our schedule had us underway for two months in the Caribbean starting in mid January with a packed schedule. At this time, it was clear that hostilities in Iraq were a distinct possibility. Our chain of command told us to be ready for a potential surge deployment. What is of interest, our preparations for deployment were relatively modest—we conducted a fire control/weapons system groom, loading Tomahawks and additional torpedoes in January 2003 and worked through a modified pre-deployment checklist. Because of the substantial demands of our planned underway, we made only minor adjustments to our training regimen-in essence, we didn't work for our training but relied on our day-to-day program.

In mid-January we got underway—again with an aggressive schedule, much of it supporting operational testing of new systems. We conducted a scheduled port call in Cape Canaveral where some additional specialized equipment gear was brought aboard. It was during that port call that I received the call that we were deploying for possible operations against Iraq. I was asked—did we need anything, did we have to come home ... and could truthfully reply we were ready to go. One thing of interest—on three separate occasions—once in the Caribbean, once while conducting a high speed transit in the Atlantic and once in the Western Med we linked up with all the 6th and 5th Fleet strike platforms. Like several other boats that were "out of theater" we simulated being present in theater and conducted very realistic strike training with all the units either in theater or scheduled to be in theater. I found this to be an impressive demonstration of our Navy's and our submarines' ability to communicate.

We arrived in the Eastern Mediterranean in early March. Once there, we continued to practice potential strike tasking on Iraq, this time near our planned launch positions. However, concern grew over Turkey's commitment to allow overflight; therefore we received orders to proceed south towards the Suez Canal- new Subnote to follow. Within 24 hours we were lined up in convoy proceeding through the Suez- three SSNs with two surface ships all headed for the Red Sea. The next day three more Mediterranean deployed SSNs and additional surface ships transited the canal. In my opinion a remarkably quick operation by CTF 69, and 6th Fleet and one that demonstrated the importance of mobility that SSNs and ships in general possess.

Of note, we were notified of the move towards the Suez and our destination in the Red Sea while finishing up a strike exercise. I had the opportunity to communicate with USS PITTSBURGH's Commander Jeff Currer. PITTSBURGH was positioned in an area from which TOLEDO was destined to shoot. He provided valuable information on the area including information on shipping, etc. Also, of note, again demonstrating the power of communications, all the SSN CO's connected and exchanged information on key preparations for combat operations as we proceeded in the Fifth Fleet Operating areas. Those that had been in the 5th Fleet area for a while

provided detailed info to ensure, that among other things, we had received all the pertinent lessons learned.

We took station in the Red Sea…that sea body was so crowded with U.S. submarines and ships it seemed you literally could have walked across it. Combat operations started soon afterwards. Much has been written and spoken about this, but I'd like to make a couple of quick points. First, actual strike operations were somewhat different from the way we had practiced in exercises. Rather than get a warning message with launch information, we typically got a warning order via chat to spin up missiles. (Chat, by the way is similar to real time messaging or e-mail conducted by laptop and transmitted by a variety of standard radio circuits.) Shortly thereafter we would receive the actual launch order. So the pace of strike operations was even faster than predicted. Obviously this makes sense with some critical targets being short notice targets of opportunity, similar to the widely reported decapitation strike. Regardless, SSNs performed well adapting to the rapid-fire rhythm.

After launching multiple salvos—in our case three salvos—combat operations ended for us. Approximately a week later we left the Red Sea and proceeded back to the Med. But let me briefly mention that SSNs were ready for a lot more than just strike operations. For example, we were obviously prepared for actions against the Iraqi Navy or what was left of the Iraqi Navy, we were also ready to conduct a variety of ISR missions, and we were ready to destroy a terrorist controlled merchant headed for a U.S. or allied port.

On 28 March, TOLEDO accompanied by five other SSNs and one surface ship proceeded through the Suez to the Med. We awaited a short stay alongside EMORY S. LAND, which had repositioned to Crete to better service SSNs. While waiting our turn to pull in, we had a short swim call, which was our first opportunity to relax in a while and one I'll always remember. EMORY S. LAND conducted yeoman service on TOLEDO and three other SSNs alongside. After 6 hours alongside LAND, we headed west at speed and returned from deployment 15 April to a great welcome by the Groton/New London Communities.

**In finishing, let me take a few moments for some observations:**

First, the Navy and your Submarine Force are fully engaged in the war on terrorism. This effort leverages off our traditional strength in Submarine ISR, but is much more. As Al Qaeda becomes more diffuse and spread out, now that the sanctuary of Afghanistan is gone, submarines will continue to be essential to understanding how Al Qaeda and other terrorists employ sea lines of communication. Indeed, without this sanctuary, this terrorist sea trade may drop in volume making our task more difficult—but, to the degree a terrorist will find it even more difficult to move people and cargo by air, sea trade, even in reduced volume, should be relatively more important to our adversary. And the targets are there. A recent Wall Street Journal article quoted a respected think tank analyst who said that today, Al-Qaeda is "believed to operate 15-25 vessels worldwide.[2]" Also we clearly must continue to work on our readiness to stop a seaborne attack employing ships married to WMD.

Secondly, TOLEDO deployed with little additional preparation, five months after our return from our OEF deployment. USS BOISE did one better, deploying seven months after her return from OEF. Other SSNs deployed early or stayed forward deployed well past their sixth month that spells the end of a normal deployment. I think this speaks volumes to the culture of readiness we have in the Submarine Force. And as the Navy is transitioning to the Fleet Readiness Program, which has Carrier Strike Groups and Expeditionary Strike Groups reach and maintain a level of readiness such that 6 CSGs can deploy within 30 days and two more CSGs can deploy within 90 days, it seems to me our submarines will play very well in this new paradigm.

Third, we really have radically increased our ability to communicate. I've already mentioned our strike exercises on the way to OIF. Another example I've mentioned is chat. I was not originally an advocate of chat (again similar to real time messaging/e-mail) but it does provide remarkable situational awareness and young sailors and officers take to it remarkably easily. Overall it was much more effective than voice communications but it does have one drawback-if you're not watching the laptop screen, you can miss critical tasking!

As a corollary, the improvements we are seeing in communications are indicative of what we are seeing in many other places thanks to our "COTS based revolution"... I saw terrific changes in capabilities in just 29 months in command.

Finally, I'd like to highlight that my crew, (and I think every other CO would say the same thing) took all the changes in schedule and tasking in stride and made it look easy. I think this speaks volumes to the quality of the people in the Submarine Force and to the families that stand behind them.

I'd like to thank you for your attention and the opportunity to speak today.

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## ENDNOTES

1. Richard Halloran, "Navy Launches Vast Maritime Security Plan," Washington Times, May 10, 2004, p. 10.
2. Kweilan Kimmelman quoted in "Muslim Nations Reject US Help to Police Vital Oil Routes," Wall Street Journal, June 3 2004.


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## "NAUTILUS AT 50!"

## REMARKS OF VADM KENNETH M. CARR, USN(RET)

## THIRD ANNUAL SUBMARINE FORCE HISTORY SEMINAR 13 APRIL 2004

*Editor's Note: VADM Ken Carr, a former ComSubLant and a two-tour veteran of NAUTILUS, was asked to speak at this year's Submarine History Seminar at the Navy Memorial. It is a distinct pleasure for THE SUBMARINE REVIEW to be able to present this first-person account of the beginnings of nuclear submarining from such an eminent practitioner of the art.*

I figured the first two speakers would take up most of the time so I really didn't have to prepare much. Then I thought, "What if they didn't?" So I prepared too much so you're going to have to listen to it.

As Arnold Palmer said a couple of days ago, "Can you really believe it's been 50 years?"

My first connection with this was in sub school when Admiral Rickover came up to promote nuclear power. He was then a Captain. He gave his little talk. All the senior wartime submariners were sitting in the front row and when it came time for questions one of them raised his hand and said, "When you get this reactor started how are you going to stop it?" And Rickover said, "You're going to turn the switch to off".

But I, being in Submarine School at that time said, "You never want to go to the first one. They'll have all kinds of troubles. You want to put in for the second one." Having established my credibility with that, I'll tell you another little story to further establish my credibility. When NAUTILUS crew was invited up to Electric Boat to critique their ideas regarding a missile submarine by cutting SCORPION in half and adding missile tubes, they asked for

comments. When I was weapons officer we completed a mine plant in NAUTILUS and a torpedo room well over knee deep in water because of the trouble with buoyancy and being able to keep the submarine submerged while we were getting rid of all that weight. So I said, "Sixteen tons each and sixteen missiles, and you're going to shoot them vertically, submerged, and still stay submerged? It will never work." So now you understand that what I think is not always right! Back to how I made it to NAUTILUS.

I applied for the Nuclear Power Program after two plus years on BLACKFIN and was immediately rejected. The first class was six students. They needed five people so one flunked. The second class, which I was in, was nine students. They needed ten or 11 guys so we all passed. Technically, I think two guys passed but we all made it out. I went back to BLACKFIN and made my WestPac run and when I came back I had orders to NAUTILUS, and it said you'll go to NAUTILUS as a non-nuclear trained officer as the ninth or tenth officer. I picked up my Supply Department orders and said, "I'll go be the Supply Officer probably." I arrived and there was the Exec and myself and another officer; my classmate, and all the non-nuclear people like the cooks, radiomen, stewards and the torpedomen. We had six weeks at Bettis so we could get to spell nuclear, then we went out to Idaho so that we could wander around the plant and not be afraid of the pipes and valves and all that. So after that three-month course we went back to NAUTILUS in time for the launching. I was snowed-in in Virginia and missed the launch.

An aside, when I first got to Bettis for this little exercise we had to be in civilian clothes because we were going to school there and we weren't supposed to be any high ranking or low ranking guys, we were all just students. So I was in my sport coat and my string tie, being a Kentuckian, and I was in the chow line and Commander Turnbaugh, who was running this little operation up there, came up and tapped me on the shoulder and said, "We take this program very seriously. I don't expect to see that tie anymore." And I thought, "What kind of a program am I in here? Am I in the right place?"

When you talk about the people in the submarine, we got to the ship, the ship went in commission with one Commander, eight Lieutenants, two Lieutenant (jg)s, one Warrant Officer, and every

enlisted man onboard, save one, was qualified in submarines. So that crew was specifically picked and challenged.

The words "Underway on Nuclear Power" were not spoken. The message from NAUTILUS was sent by flashing light from NAUTILUS to the ASR who then relayed it to SUBLANT by some means. In the first place the officer that drafted the message was the communicator and he wrote, "Underway at 1100 on nuclear power". He brought the message to the Captain on the bridge for release, and the Captain crossed out 1100 and said, "The CNO told us to get underway at 1100. We don't have to tell him we did that." So when you see that message you'll see that 1100 has been crossed out and the message says "Underway on nuclear power." I was the gunnery officer then responsible for the line-handlers, and I was not going to be the person who was going to hold up being underway at 1100 on nuclear power, so at every line that day we had a fire axe and if the lines happened to snag we were going to cut them. We were going to be underway at 1100 on nuclear power, in any event and I wasn't going to be the one to hold it up. Fortunately we didn't have to use them. But I ended up with a nickname from that—"Careful Ken" that turned out later to be added to the words "Cautious Communicator."

On the sea trial, we went out when it was stormy weather and came back in with the deck broken. We had taken a big wave over our teak deck and it crashed through alongside the sail. We had an aluminum superstructure, and that was supposed to be insulated from the hull and we were supposed to have one ohm resistance between the superstructure and the hull. Well you can imagine trying to get one ohm on a salt water environment between the hull and the superstructure. It didn't work but when we got in with all that wreckage on the deck, which was about this big—a big hole in the deck—they started making cribbage boards and little plaques that said, "Taken from the deck of the NAUTILUS on its underway . . ." If you put those things end to end you could pave a road from New York to Washington, D.C.. There are a lot of those little plaques and cribbage boards around.

Admiral Wilkinson's first goal was, "We've got to get this crew trained." So we went out on shakedown—first we did 50 dives. We got up one morning and it was diving day. We were going to train everybody to dive and surface, so we did 50 dives in one day and the

thing about nuclear power is you didn't have to worry about running out of air for blowing the tanks. You could run the air compressors all the time. You know, you could go up and down like a cork. So we all learned to dive.

They next day was torpedo shoot day. We shot seven torpedoes, and now most people don't realize that, without an ASR along in those days, you had to recover your own torpedo. You shot it, then you went out and found it, and then you put a diver in the water who put a big cable around it. In the meantime, you were rigging this gear on the deck and you reached over and plucked it out of the water and put it back in the ship. And then you had to store all that gear and dive again and go make another run. So a seven torpedo shoot, the seventh torpedo we shot, we had made ready onboard and shot it again, so the seventh one was a reshoot of the first one and we were one tired bunch of puppies, I'll tell you.

*Angles and Dangles* was Admiral Wilkinson's favorite fun. Our planesman could not stand watch on the planes until they were well trained. Of course any distinguished visitor could sit on the planesman' seat in two minutes. I mean it didn't take anything to qualify those guys. They knew how to do it. So we would go up and down a lot. But NAUTILUS had a very unique capability. Captain Wilkinson would put the boat over in a 30 degree down angle at 20 knots and then tell his planesman, "Put the planes on zero." And they'd put the planes on zero and it would level out just above test depth. And so he would say, "See, it works very easy. You don't have to worry about controls. You've just to be careful." We did that for lots of times for lots of people.

Interestingly enough, one of the things that we did on NAUTILUS nobody had ever done. We could run submerged at high speeds for a long time—even the newest class of diesels ran submerged at high speed for at the most 30/40 minutes—NAUTILUS ran for hours. Well, the first thing we found out was you couldn't talk to anybody in the torpedo room. The room bounced up and down. You could almost see under the torpedoes. I mean we were vibrating something awful. We were trying to figure out what was causing that. In addition we kind of vibrated sideways.The Trigger class had had the same problem when they were running, so they called up a professor from MIT or Webb Institute; one of those naval architects.

He came down, sat in the wardroom with his cup of coffee and watched it a little while. He said, "Cut about twelve inches or so off the back of the sail and make it round." They did that on the Trigger class. It worked like a charm; solved their problem. So when NAUTILUS was designed , the same mod was done. However we were vibrating sideways.

They called that same guy. He came down and sat in our wardroom, watched his cup of coffee and said, "You've got to put that sharp thing back on the end of the sail. They put it back on the end of the sail, solved the problem.

But the torpedo room problem was really serious. I mean it was really bad and we were worried about it, and we finally found that if we put air in the tanks it changed it. So we experimented. We'd go into the drydock. We'd fill some tanks with water and we found out that if we welded up the flood holes, and put water in the tanks and went to sea, the problem went away.

However with the flood ports welded, you couldn't blow them. I didn't like that very much, but that was one of the experiments. We finally figured it out. What was happening was with the openings in the bottom of the tanks at high speed, we were getting a Hemholtz Resonator effect. We had a pipe organ going through the water and so we were putting pressure in there and the pressure in the tanks was enough to rupture the hull of the tanks. The plating on the outside of the tanks actually had eight foot splits in them. So that's why everybody now has baffles on the bottom of their ballast tanks. So we did a little bit of experimentation while we were checking out the impact of high speeds for long periods of time.

Captain Slade Cutter was Chief of Staff and Aide to SubLant at the time we were training. Admiral Watkins was going to ride the boat. So we were going to take him by highline from an ASR. We got out to sea and Slade Cutter was going to make a trial run to make sure this works alright, he looks over from the ASR who was to provide and first thing we know we got a flashing light saying, "NAUTILUS provide", meaning, "You guys rig it and send us the highline." Well we were trained to do that and we knew how to do it, but on the ASR it's a lot easier than it is trying to do it on a submarine. Anyway, we got that set up; rigged, brought him over, didn't get him wet and got him on deck. He explained, "I looked

around at those ASR guys and I decided they wouldn't care if I got wet or not and I knew you guys would."

The first thing that was going to cause us to have to come back to port if we were to go out and stay as long as we could without coming in, was lube oil. We had lube oil leaks and we just didn't seem to have enough lube oil to keep the ship running. We were thinking about converting a fresh water tank to a lube oil tank and it was kind of a serious problem, and then we got a Machinist's Mate transferred from surface ships. Up 'til then we only had Motor Machinist's Mates, as we used to call them, or Enginemen as they became to be called, and diesel Sailors, and this Chief Machinist's Mate came aboard from a destroyer and he looked around and he said, "My God." He got his rag out and started wiping up oil and fixing the leaks, and the first thing you know we weren't using any lube oil at all. He saved our day because we really didn't know a lot about steam plants and how to best maintain them, but he taught us a lot.

Atmosphere control was going to be a major problem if you stay down a long time. You had to worry about oxygen, CO and CO2. We used to say about TRITON—who had a CO, and the XO was an ex-CO, and the Engineer was an ex-CO—we said the trouble with TRITON is they've got too much CO in the boat. Well, we too had a lot of CO, but a different kind. We had to figure out how to remove it. They invented CO burners that were very high temperature burners and they turned the CO into CO2 and then we used CO2 absorbent to remove the CO2. We bled oxygen from oxygen bottles which were air flasks mounted inside the hull, which also worried me. You don't want to run around with a lot of 3,000 pound oxygen inside the boat. It's not very safe. If you had an oxygen leak you could have a nice fire. Well anyway, we were going out on our first 12-day sealed boat submergence and we were going to see if our atmosphere control equipment worked. BuMed in their wisdom decided, "We better send along a psychiatrist because nobody's ever been submerged for 12 days without coming up for air." So they sent him along and our crew always enjoyed working people over and we decided, "If we stayed out until the first guy broke, it would be the psychiatrist."

One of the quartermasters (who shall remain nameless) decided he would take a piece of marlin out and tie it around a package of Camels and he dragged his pet camel around the boat for a week. The cooks not really wanting to be out shone, decided they would manufacture camel droppings and leave them around the boat in various places, and then the mess cooks would go around and curse that camel for leaving all this stuff and they had to clean it up. Sailors can have a lot of ways to have fun!

On that same cruise one of the officer's wives had given us a pet canary. We were going to be submerged for 12 days. Canaries know when the atmosphere is bad or not bad, so we'll give the boat this canary. On our way out we had a wild canary land on the sail, so we thought, "Oh, that's an omen." We took the wild canary and put him in the cage with the tame canary and went on our way. Well the wild canary died and the tame canary lived through it. We packaged up the wild canary that died, put him in a box, sent to BuShips and said, "This is not an atmosphere for things that are wild or have any kind of desire to go out and do things, so you better check our atmosphere control equipment".

We were called "Lola" and if you've seen "Damned Yankees" you'd know why. Whatever Lola wants, Lola gets. We had Brickbat 01 priority so whatever we asked for we got. One of my classmates on another submarine said, "You guys leave more value of spare parts on the pier than are in my allowance," and we had left a lot on the pier. However, there was only one ship of our class so if you didn't have a key spare part, you couldn't get underway, and there was no one you could borrow from!

Coming back from Key West on a long submerged run (we were going to make a long submerged run and set a record, Captain Wilkinson liked to set records) and we were making a high speed run outside the hundred fathom curve. There was a loud pop in that CO burner I was talking about started smoking so we had a little fire in the crew's mess that we had to contend with. When we surfaced we saw kind of a cable mark all the way across the top of the sail and we kind of scratched our heads. Finally we got a message that says, "Where were you on such and such a time?" And so we looked and there was an hour difference in time but we figured, "Well, we hadn't reset our clocks." What had happened was a nice fishing boat was

going south at six knots with trawler gear, and we were going north at 20 knots and suddenly he was going backwards at 20 knots. Finally his line broke, fortunately before we sank him, so we figured out, "Yeah, we had dragged that trawler." We didn't hear him. At 20 knots sonar wouldn't tell you much about fishing boats. He then put in a claim for his lost nets and the Navy was ready to pay him because he only wanted, a little less than $10,000 and they could pay immediately a $10,000 claim, but if it went over that it had to go through some adjudication. Some lawyer got to him and it went over $10,000 and I don't know if he's got his money yet. But he couldn't speak English. I think he was Norwegian and when the crew told him, "You've got a whale", he said, "No we don't. We've got a submarine", but he knew what he had and they got loose alright.

NAUTILUS had a lot of visitors in the first three years I was on there.

I think we got underway two times without visitors on board. We called it, "The four-star playhouse." Anybody who had four stars immediately had a ticket. We said USS meant "Underway Saturdays and Sundays." SSN meant "Saturdays, Sundays, and Nights", so we really enjoyed selling nuclear power.

We had a young ET2 onboard. We were in port. We were conducting tours and there was a tour for about 15 Ensigns from the radar school in Great Lakes, and they went up and were touring around and they came down to the wardroom after the tour was over. We had people stationed in the boat so they could tour them around. When they came down they said to me—I had the duty—they said, "You know, that's the smartest Engineman I ever saw." I said, "What do you mean?" They said, "Well, we were up there in the Control Room area and we noticed the radar there." He said, "The Engineman that was running us around the Control Room started talking about the radar and we started talking to him about ring time. We kept talking to him and the more technical we got the more answers he had." They said, "Is that the kind of qualification you require on submarines?" We said, "Oh yeah, you've got to know a lot about submarines if you want to be qualified!" Well what had happened was our ET2 on the duty section had gone back and borrowed an engineman's jumper and put it on and so he was conducting this tour

around the Control Room, which was his area and he was an expert in radar and he was really impressing those guys.

When Dr. Teller rode us, we had the Press along at the same time Dr. Teller was there and the Press asked "Dr. Teller, could this reactor blow up like a bomb?" Dr. Teller rose up and said, "It takes skill to make a bomb!" The next morning I got up and here's Dr. Teller in the wardroom, and you know, with submarine drawers you have to push a button and then pull the drawer out because it's locked; that was too much for Dr. Teller. He couldn't figure out just how to get that drawer open. I just kind of smiled but I did help him.

The last of my first three years on there I was coming in to get detached. I had already submitted my Qualification for Command Thesis on why we don't have better torpedoes and so I was ready to qualify for command. Captain Wilkinson said, "Okay, tomorrow is your Qualification for Command day." They got me up at dawn and everything that went on that day I did. I shot a torpedo. I made the dive and the dive was very interesting. Okay, we're ready to dive. I'm on the bridge. "Clear the bridge." Everybody goes down. I shut the bridge hatch, come on down. The quartermaster lets me down. I get down to the Control Room, nobody there but me. I look around. We're going down with about a 20 degree down angle and there's me in the Control Room, so I said, "Oh", and I went over and got the planes on zero so we could level out and I went over and blew negative and got everything squared away, and finally all the guys came out from behind wherever they were. It was okay. Then I got to navigate my way in and then I got to make the landing. It was a busy day and it was another tired day.

But I departed there and then went to Nuclear Power School, having cleared Admiral Rickover finally, thanks I think mostly to Captain Wilkinson who probably paved the way no doubt, because when I went in Admiral Rickover says, "What have you been doing in your spare time?" I said, "I've been writing my thesis on torpedoes; why we have to slow down in this nuclear submarine to shoot a torpedo, which was invented in 1898, and we have to slow . . . we catch up with the carrier, we're ready to shoot, we have to slow down so we can open the outer doors and then by that time the carrier's gone and the torpedo can't catch him." And he says, "Oh, have you told the CNO?" I said, "Well, I really didn't call him up and tell him

about that." "Well why not?" I said, "I'll write him a letter." "Well good, go get it", and he said, "Bring me a copy." He said, "You know it's your responsibility to tell the CNO", and he shouted to his secretary for a copy of Navy Regs. His secretary looked around and said, "Admiral, you know we don't allow Navy Regs in the building."

So I came back to NAUTILUS in Seattle when Captain Wilkinson was going to get relieved by Captain Anderson. We're on Pier 99. We're standing there and the boat's due in at 3 p.m. This is one of Captain Wilkinson's favorite stories. The boat's due in at 3 p.m. I'm standing on the pier with all the people who are there to watch NAUTILUS come in. No sign of the boat. It's about 2:30/2:40, no sign of the boat, and they said, "Well where's the submarine? It's supposed to be here at 3 p.m.", and I said, "It's not 3 p.m. yet", looking at my big pocket watch. Fortunately about that time the submarine surfaced right off the pier. Pier 99 is deep water. So they'd come in submerged, surfaced off the pier, and I talked to Captain Wilkinson, I said, "What happened?" He says, "Well you know, we stationed the Maneuvering Watch and there weren't any planesmen on the Maneuvering Watch."

On our first Arctic trip, you all know that history, we tried to surface under a block of ice that had the size such that every family in the United States could have had their own ice cube so the aluminum sail didn't survive and the periscopes didn't survive. We came back and fixed those problems but in the meantime we had taken Lord Mountbatten to sea and it was a very interesting day. We asked Lord Mountbatten to sign the guestbook. He opened it up to a clean page, wrote "Mountbatten of Burma" right across the page so nobody else could write in that page.

After the aborted Atlantic effort we went west for the North Pole try and en route we had a fire in the lagging in the engine room. It was a smoldering fire and people's eyes got bad but that is why all submarines today have an Emergency Air Breathing System. It was invented on that trip up to San Diego. We realized we had to have something in case it happened under the ice, so we invented basically just a scuba dive mask on the 225 pound air system. We called that in NAUTILUS, "The Emergency Saltwater Breathing System" because our air to the whistle was also connected to that

system and the whistle leaked so every now and then you'd get salt water in your EAB instead of air. But you have to invent as you go along. That's what I'm doing in this talk, you can tell it.

We had a little saltwater leak in the condensers. The computation said it was the third the size of a human hair but we could detect that small amount of salt water in the condenser, so we tried everything. We couldn't find it. We couldn't do anything with it and the question was, "Do we abort this polar trip or do we not?" Admiral Rickover came out and talked to us and it's the first time I got a view of Admiral Rickover that I had not yet seen. He sat there and he said, "Well, you know, leaks this small usually rust themselves shut", and we never did find it and it never did cause us a problem but it was a different approach than he always took, but I think he really wanted that polar trip to go off and so did we. But that's why you see Bars Leak now has NAUTILUS on top of the cap and it implies that it was what fixed NAUTILUS. Well in the book by Captain Anderson and Clay Blair Jr., it was "Stop Leak" that Captain Anderson gave credit for stopping the leak and the Bars Leak guy called him up and said, "You know, that was Bars Leak", and so they made an agreement that if he could put NAUTILUS on the top of his cap to his little bottle then he wouldn't argue with the book that said it was Stop Leak, so now you know as is said " the rest of the story."

We didn't get under the ice on the first try and we went back to Hawaii. Admiral Grenfell flew the entire crew back to New London; half at a time. We went back to Hawaii. No leak got out of what we were trying to do. I couldn't believe that you could turn a hundred Sailors loose for a week, home with their families and then have them go back to Pearl and keep a secret like that but they did. It was a very well done job.

NAUTILUS' Inertial Navigation System was a Navajo missile system, inverted and put in the ship with the nose down and the rest of the guidance up above, and that was our inertial navigator for the trip across the Pole. We took out the surface radar mast and put this thing right down in the hole, and we had two guys along who could run this thing and it was only supposed to run a minute and a half on air cooling when they fired the missile but we had to run it for a long time so we water cooled it and these two guys had to read it out on an oscilloscope and so it was just a green dot that they were reading.

If you'd want to get a fix you ask Dr. Curtis, you'd say, "I want a fix", and he'd say, "Okay, tell me when to mark." "Mark". Two hours later he'd come up and tell you where he thought you were, and he had figured it all out on his Global Slide rule and it wasn't very accurate, but when we were getting to the Pole I said, "How are we going to know when we get to the Pole?" He said, "You see that little dot going around the Oscilloscope?" I said, "Yes." He said, "When we're there it'll turn and go the other way." I said, "Okay." So I watched it and it did. He knew what he was talking about.

After that trip nearly everybody in the wardroom got some kind of good deal out of the trip. The Captain went to Italy. The Exec got a new convertible from his home town. My good deal out of the trip was a trip to Paris to a trade fair and I was to go over . . . the NAUTILUS was part of the trade fair. On one side was Jules Verne's NAUTILUS from the movie. On the other side was EB's Control Room from NAUTILUS and I was due to describe the Control Room and tell them what was going on and all that, and I was supposed to be in the fair, describing this for four days and then I could have four day's leave. Molly had a set of orders from the CNO telling her that it was advantageous for her to go with me and the last paragraph of that set of orders was very interesting. It said, "On completion of this Temporary Duty, return all copies of these orders to the CNO's office". So we went over and did that but the interesting thing about that—I was standing there—one day this little French schoolteacher came in with a bunch of kids and she rattled along in French for a while and then I told them about my side and she translated. After it was all over she came up to me and she said, "You know, the Frenchmen dream and the Americans build", and I thought, "You know, that's an interesting comment."

Let's see, first overhaul... I was fortunate enough to be the Engineer of the first overhaul. They had refueled once before. We overhauled in Portsmouth Navy Yard. We thought it should take six months. Portsmouth took nine months and we thought it was a disaster. As it turns out it was probably the best overhaul anybody ever did. There was one point in time—and you can see the pictures there. They exist probably in the Historian's office. There was a shot taken down in the engine room, there was no rotating machinery in the engine room at all. Every piece of rotating machinery in the

engine room had been removed from the ship. I didn't think we'd ever get it back together. We had 28 pound air as our computer system; everything that was controlled in the reactor plant and aft was run on 28 pound air; the Bailey Meter Control System.

Lando Zech; the third CO, relieved in that yard and fortunately while we were in the yard we had gotten agreement from BuPers to freeze the crew. I mean we didn't transfer anybody off the ship for the nine months of the overhaul. I had 12 commissioned officers in the engineering plant when I was through with the overhaul. I could put an officer at a meeting on anything so we were able to do as you say, manage it from my control. That's the only time in my naval career that I remember where I was when I got notice that I'd been promoted. I was in the Lower Level Reactor Compartment crawling around. I came out to go to my locker and change out of my clothes there and put on my uniform. I got it out of the locker and started to put it on and I noticed there was a Lieutenant Commander insignia on it and I said, "This is not mine." I looked back at the locker and then I found out I had been promoted to Lieutenant Commander.

After the yard was over we went to the Med on the first detached operation. We operated in the Med. I went and we transferred White and Hall, who happened to be Ops and navigator. . . anyway I ended up as Ops, Nav and Engineer on the trip to the Med and so everybody who didn't work for the exec worked for me so I had a pretty good run there. They gave me a hard time as Navigator you understand. I was looking for the entrance to Valletta Harbor in Malta and I thought it would be pretty easy looking at the chart. It had a church and a church steeple. You know, I thought, "Well gee, that's a piece of cake." The only problem was there were about a thousand church steeples and Valetta Harbor entrance is an overlapping one meaning you can't see an opening. You've got to come around and find it. I found it, but I was a little late finding it and I haven't lived that one down yet.

One interesting happening; Captain Zech had a former shipmate on the cruiser SPRINGFIELD who ran the movie exchange. When we went alongside the SPRINGFIELD for something and got underway and we had six of the newest movies in the Mediterranean on NAUTILUS. Within a dozen hours we received a message from

ComSixthFleet that said, "Come alongside and transfer those movies."

My entire time on NAUTILUS was great.

I left to be XO of SCORPION and I carried away three problems to solve: a new periscope (the Air Force had taken pictures from 30,000 feet and one could read the license plate. I had to get in to 600 yards to read a sign that was four feet high on the side of anything); Torpedoes—we still didn't have a torpedo; and something that would dry an antenna when you stuck it up so you could communicate.

In closing. I've got one thing I need to read. I want to read you a message from Admiral Carney on the commissioning.

> "On the occasion of the commissioning of NAUTILUS, I wish to extend to you, to your officers and to the crew of your revolutionary ship, my congratulations on the fact that you've been entrusted with the writing of a vital page of the maritime history of the world. I also wish that you would convey to your officers and men my complete confidence in their will and ability to discharge their remarkable responsibilities in distinguished fashion. No new ship was ever blessed with a more carefully selected ship's company and no new ship's company has ever had more thorough preparation for the assumption of its duties. You and all hands in NAUTILUS are leaders in the best sense of the word and your opportunities for the future go far beyond the performance of NAUTILUS herself, for the plankowners of NAUTILUS will be the disciples of nuclear power in the fleet and their capacity for leadership and devoted service will surely have a profound effect on the fleet of the future. Rarely has a ship's company earned a well done on commissioning day, but you and your people have already earned that distinction and I am confident that many more will be earned in the months and years to come. I speak for the entire Service when I extend my congratulations to all hands in NAUTILUS and wish her all success as the pioneer in a tremendously significant field of maritime endeavor."
>
> Signed Robert B. Carney, Chief of Naval Operations.

Thank you.

# KILLING NUCLEAR SUBMARINES

*by Commander George P. Steele, USN*

*Editor's Note: VADM George Steele was the first Commanding Officer of USS SEADRAGON (SSN 584) when he wrote this article for the PROCEEDINGS in 1960. At the time we had no more than a half-dozen nuclear submarines, but it was already obvious that ASW practices honed in World War II would not do for the future. This was a clarion call for action within the Navy. Six years later, a surface warfare Commander was awarded the USNI Annual Prize for sounding the same call (see THE SUBMARINE REVIEW of April 1994 for a reprint). As our Navy now reawakens to the need for Navy-wide ASW efforts after a post-Cold War step down and a recognition of world wide AIP implication, these original warnings can be reread with benefit.*



Enough is now known about the performance of the nuclear-powered submarine at sea to indicate a review of the changes that must come about in the navies of the world as they seek to defeat it. It would be too much to ask that all established concepts pre-dating the SSN should stand unchallenged; or to expect that any basic challenge will be popular. But professional naval officers can normally be expected to take the objective, practical approach to the novel, which is characteristic of seamen. The present and future threat to our control of the sea which is posed by the modern submarine is of such magnitude that our national policy is in jeopardy. Our duty is serious indeed.

After six years of operating nuclear submarines, we still do not have at sea a weapon system able to cope with even one of them. There are rare, lucky hits; the submarine captain might make a gross

error and expose himself. But we cannot, with any degree of assurance, prevent him from working his will. The SSN can destroy our cities or our ships. Let us examine the present capability from the air and sea surface against this predator.

Passive sonar detection of a nuclear submarine is possible during those fleeting moments when she is making high speed and is therefore relatively noisy. Still, control of speed belongs to the submarine's commander. He will use it when he needs it to close a target or to evade imminent attack.

The sonobuoys in use today are of little value since the SSN normally puts out too little of the necessary noise. The fixed-wing aircraft is thus reduced to other detection means such as magnetic anomaly detection (MAD), radar, radar intercept, and visual. But these also are ineffectual.

MAD has value in localizing a moderately shallow, slow submarine; however, its small search radius renders it nearly useless for the initial detection.

The nuclear submarine could be detected if she surfaced, snorkeled, transmitted by radio or radar, or exposed her radar intercept antenna or periscope. She does not have to do any of these things. The sea is so vast that as a practical matter the SSN can often prudently use periscope or radar intercept antenna with entire safety. It has been shown that the odds are good that a submarine can even surface briefly without detection in areas of heavy air/sea surveillance. And the Regulus II missile program that the Navy abandoned so reluctantly is full recognition of that fact.

The nuclear submarine is as detectable by active sonar as is any other submarine, but her great sustained speed and depth can be used to pass through today's detection zone in a very brief period. Sometimes good thermal conditions enable surface ships or helicopters to detect the SSN penetrating the screen, but fully aware of sonar conditions itself, the submarine will use the speed advantage she possesses over most formations to approach from astern. The wakes, noise, and sonar blind spots are excellent cover. Sea exercises do not always show this point fully—they may be so short that the SSN cannot use the proper tactics. But then the detection problem of a submarine penetrating from other quarters must be solved first.

In fact, surface and air ASW forces today normally detect a nuclear submarine only when she attacks—and often the detection consists of sighting the submarine's flare firing signal, or of hearing his announcement by sonar. The Navy's number one priority program, Polaris-loaded nuclear submarines, is based on the premise that such submarines are nearly impossible to find at sea.

It would be only fair if the SSN were similarly in doubt as to the location of her foes. As it happens, only the aircraft is invisible. The nuclear submarine is a good sonar platform. She can hear an enemy ship's propellers long before coming within active sonar detection ranges prevalent; a hovering helicopter can sometimes sound like a destroyer to a submarine. Modern active sonars can be heard great distances by the quarry.

When the nuclear submarine makes high speed, she tends to become like a destroyer of comparable speed and can receive information from her active sonar only. But even then the submarine can hear surface ship propellers a few thousand yards away and she can home on surface ship echo ranging from many miles away. Thus the SSN has a very appreciable *detection advantage* over the surface and air ASW forces and will keep her distance if she chooses.

But if the nuclear undersea ship decides to force action and a contact is made on her, the difficulties have just begun. Instantly the deadly question of identity is posed. A significant percentage of sonar contacts made by surface and air ASW units are non-submarine. Classification remains one of the most difficult of the unsolved problems. A crafty submarine will add to the confusion of the opposition by various tricks, and when these are used in conjunction with the speed, depth, and maneuverability available to the SSN, the puzzle is very complex—just long enough, perhaps, to decide the issue.

The blinding speed with which a nuclear submarine can burst into a formation worn out by days of fruitless pinging, fire torpedoes, shift position while reloading, fire again, and pull clear, leaving a trail full of tricks and booby traps (a circling steam torpedo, for instance), must be seen to be fully understood.

Tracking by MAD, sonobuoy, or sonar has proved uncertain and generally unreliable. Occasionally there will be an instance when, in fine weather and sonar conditions, tracking is successful for a time.

But even the *slow* SSN can nearly always make her escape by heading into a sea that surface ships cannot weather at high speed or by getting under a deep thermal layer. Whether the nuclear submarine would not prefer to stay and fight it out is a question sometimes missed in sea operations of the *canned* type.

For the submarine the classification and tracking of surface ships is much simpler. A formation is heard many miles away and the various light and fast, or heavy and slow screw beats, the echo ranging, and perhaps the radars are studied. Continuous bearings are available. A single ship can be an enigma requiring some time to identify if she does not echo range. And so, far from being blind and deaf in the opaqueness of the depths as the layman might suppose, the submarine actually has a great advantage in classification and tracking over the enemies above. The trained submarine captain is able, through his long apprenticeship, to extract tactical information from the sonar in the same fashion that the American Indian followed a fresh trail. The SSN captain may use his detection advantage to pick the time of the attack—after he has carefully observed the situation. General Braddock would have understood.

Such circumstances demand a deadly weapon for the ASW forces of air and surface with which to club the submarine quickly. We do not have it in usable form.

Conventional depth charges and ahead-thrown weapons are totally inadequate against such a high-speed, deep diving enemy. Service torpedoes are not sophisticated enough. The ability to localize the nuclear submarine is not good enough. Nuclear depth-bombs would do the trick, but the submarine seems always to be too near friendly ships to use one, or at large in an area of uncertainty too great to bomb. And one must be just a little uneasy about pinning everything on the nuclear blast.

The other side of the picture is also dark. The submarine has weapons effective against surface ships. Fitted with the nuclear warhead, perhaps in retaliation, the submarine torpedo can destroy the strongest and largest ship in a single hit or near miss. It would be a grave mistake to judge our own rate of progress in this area as equivalent to that of the Soviet Bloc. We must be prepared to see tactical missiles rise out of the sea and attack. Under these depressing circumstances of detection, classification, tracking, and kill

capability, the nuclear submarine is a deadly and effective enemy to any surface formation. It is a genie that we could wish back inside the bottle but for our fleet ballistic missile submarines.

The first successes of the Confederate iron-clad VIRGINIA against the Union fleet one hundred years ago should be a haunting memory today. Yet VIRGINIA met her match—USS MONITOR. The Chief of Naval Operations, Admiral Arleigh Burke, recently wrote "These (nuclear) subs are one of the best systems in our ASW arsenal."* This idea will seem strange to many. The landsman imagines the surface ship and aircraft up in the bright sunshine where they can "see" what they are doing as far better off than the groping, sightless submarine below. The naval officer knows that he can save his pity, for beneath the sea there is excitement and high hope. To understand just why, one must appreciate the differences that exist between the problem presented to a surface ship and to a cannibalistic submarine.

The submarine is down out of the weather. Her speed is unhampered by the most mountainous waves. The submarine's sonar dome does not plunge noisily through the seas. There is no question of the length of the variable depth sonar cable or the weight of the transducer. The undersea ship takes her sonar with her above or below any thermal layer within her operating range.

The SSN does not need to make the noise of all kinds that the surface ship must make. She does not have to protect herself by using radar. There are no frequent radio conversations.

The propeller of a surface ship normally cavitates heavily. The deeper the submarine goes, the greater the sea pressure and the faster she can go without making cavitation noise. The SSN can go deep enough to avoid cavitation completely, even at top speed.

Searching surface ship sonars practically "boil" the water around their transducers by the terrific power output of their ping. Some are not unlike the trademark of the British J. Arthur Rank film which shows a giant striking a huge gong. A submarine may, and often does, carry the very same sonar set; but she normally does not search actively with it.

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* CNO letter to retired Flag Officers of 19 February 1960.

Submarines use the only ASW weapon of any effectiveness that a surface ship has today—the homing torpedo. These torpedoes the submarine can fire at a significantly greater range than can the surface ship, due to the superior ability of the submarine to detect another submarine.

Only one nuclear submarine makes up a complete attack team that is fully capable of detection, tracking, and killing a conventional submarine without support. This is significant. A surface and air team would be using a division of destroyers, carrier aircraft, the carrier (and her destroyer screen), and the tankers, and other logistic ships needed to stay at sea.

The SSN can carry out her submarine hunting mission anywhere an enemy submarine operates. Not so the air/sea team which is endangered by moving very close to enemy territory. The surface team is increasingly subject to being tracked and reported to enemy submarines, or to attack from sea or air, as she nears the very bases and focal points where hunting is best.

Because of the eerie nature of underwater combat, people are inclined to imagine that it is nearly impossible, or too unconventional to be taken seriously. Let there be no mistake, there is no enemy that the submarine captain fears more than another submarine.

A hunting submarine runs silent, listening. The detection advantage belongs to the most quiet, most alert undersea ship—assuming sonars of equal capability. Then starts a stalking approach to within weapon range. Ever so carefully—then a salvo!

Nuclear submarines have had quite good luck at sea against conventional submarines. It has been found that a snorkeling target can be destroyed with relative ease. If the target stops snorkeling before the attack can be consummated, the problem is more difficult.

Although submarines running on their batteries have been followed quite successfully by nuclear submarines without the use of active sonar, the odds are that the SSN will not be close enough to hear the low noises of the target after she secures her diesels. The SSN now has the option of taking the most likely direction, hoping to parallel the enemy course, and wait for him to snorkel again some hours later (as he must); or alerting the other submarine by using active sonar. The unprecedented endurance of the nuclear submarine

enables her to hunt the conventional submarine to exhaustion, reattacking until her enemy is destroyed.

Nuclear submarines have proven their deadlines many times against conventional submarines by actually hitting them with practice torpedoes. But what can they do against one another? So far we have not had enough nuclear submarines to gain much experience. There are some tentative conclusions to record.

The SSN conflict of today is a fight of bushwhackers. If the target is alerted, our weapons are not good enough to make a hit likely. A slow running SSN must pass fairly close or he will not be detected at all; that is, the target must pass within what is reckoned today as a destroyer's assured sonar range. However promising the future may be, our existing SSN's do not have adequate sonar or weapons to do the sure job that must be done. Lest there be any discouragement, it is reassuring to recall that MONITOR could not sink VIRGINIA, either.

Such is the outline of the problem faced today in trying to kill the new U-boats—if indeed that name describes any longer an underwater ship five times larger than the U-boats of World War II. Security veils more detail, but not the essentials. So the future may now be considered.

The natural laws do not favor the surface ship in antisubmarine roles. As the hunting surface ship gets more powerful active sonar, it can only transmit its awesome warning ever farther into the sea. As it unconsciously tries to get under water with the submarine by running awash, or by lowering its sonar transducer on a cable, it still must put up with the weather and the deep thermal layers that the cable cannot reach. The surface ship cavitates thunderously making even moderate speed. It dares not eliminate the use of telltale radar completely.

The surface ship will not obtain a detection advantage. Nor does there appear to be any chance that a single surface ship will prove a match for a single SSN.

But improved sonars and weapons, quieter ships, and many other improvements can and are being made to fit the nuclear submarine to do battle with her own kind. The classic struggle of two ships at sea has been resolved by that ship with the best combination of strength factors, no mortal weakness discovered by the foe, and the

smile of Providence. A more skillful and daring captain, a more reliable and effective weapon, and a hundred other things add up to superiority. An unreliable engine, a blind spot, a tactical misconception, and all may be lost if the enemy can find and exploit his advantage.

Inside the sea the natural laws deal impartially with both sides. One SSN may fully expect to do battle with another unaided and be successful. Of course a "wingman" SSN would be a comfort, but the high command would have a dreadful time distributing the medals in case of a kill so it might be best to remain alone.

Nor is this all—the submarine will become ever more deadly to the surface forces. In a few years our submarines will have tactical as well as ballistic missiles. In the tactical missile field submarines of the U.S.S.R. may be ahead. It will not be long before the surface ship will find that she can be brought under attack by a homing missile. The detection advantage thus takes on added significance.

The aircraft, at the moment ineffectual, is by no means without hope of improvement. If expendable, directional sonobuoys or improved magnetic detection could localize a submarine sufficiently for a nuclear depth-bomb kill, and do so with acceptable reliability, we could all breathe more easily. An X-ray machine for the ocean mounted in an airplane could yet result from some quirk of physics. So far, the process of aircraft capability improvement has been slowly frustrated by the curious anomalies of the sea. Meanwhile, the race is being won by the steadily improving design of submarines and the end appears to be far off.

The submarine may have an unpleasant surprise for the aircraft as missile development enables them to shoot back. But this ability will not come very soon, either, unless forced by aircraft success. The helicopter would be particularly vulnerable to this form of attack. But it must be taught to fly in all weather and at night, and be given better weapons and detection equipment before becoming a serious threat to the SSN.

Some people question whether the nuclear submarine threat is real. In this era of the massive deterrent, do we really have to be able to beat a mere warship to save our skins? The answer is that the submarine, particularly the nuclear-powered submarine, may be the

vehicle for the next serious challenge to our ability to guard our widespread interests abroad.

The Navy believes that the United States must still be able to project its authority overseas. That ability has kept Formosa whole, Korea at least half-whole, and our other outer bastions from being overthrown at a dozen dangerous moments in recent history.

We know of only one basic way to project this authority in sufficient strength without the use of nuclear weapons full-scale. Armed men must be landed at the affected point. This is done by using quantities of ships and aircraft. The effort can be sustained only by the frequent arrival of more ships with all kinds of supplies.

If an aggressor thought himself capable of beating us in such an effort at small cost, and perhaps without even being positively identified, he might well give it a try. A communist probing effort at Quemoy by artillery fire and air attack has failed. On land they have found us resolute and able to stand our ground.

Another bloody probe by sea is likely. The submarine is the perfect agent for this effort. Enough submarines have now appeared in unfriendly, non-Soviet hands to make it impossible for us to identify an attacker except by capture or recovery of personnel or debris. Such identification is highly unlikely before the outcome of the probe is foreseen.

Now if a probe succeeded in inflicting major, crippling damage upon our forces in an objective area, we could only brace for the quick series of powerful thrusts throughout the world that our demonstrated weakness would invite. *If the Communists had a small force of nuclear submarines today we could expect such a result.* Even the conventional submarines arrayed against us could put the issue in doubt.

In the event of such a challenge we would surround our vital forces with every ship and aircraft available. Our few nuclear submarines, together with conventional types, would try to bar access to our operating areas. With more nuclear submarines we could station one beneath each important formation—a defense which would chill the blood of the attacking submariners. In this fashion the Navy would fight a battle of attrition getting through to the beaches. The bulk of the antisubmarine forces of our fleet, including submarines, could be absorbed in short order.

If the enemy wished, we might have to fight off attacks from the air at the same time. In this effort against aircraft and missiles, the U.S. Navy's submarine of today would be of no help. The decks of all surface ships and the territory under our control would be the platforms from which our defense would face the sky. This keystone in our defense structure must be strengthened.

It seems evident that the state that controls the air over the sea can prevent movement upon it. The state controlling the sub-surface of the sea can also deny movement upon it. And if a state can control both the air above and the sea beneath the surface, it may use the surface of the sea as it wills and deny it to its enemy. Perhaps only for the time being, combat between nuclear submarine and aircraft is impractical.

Our reaction to the news of the success of the SSN has been correct. A substantial building program is being pushed for nuclear submarines with ballistic missiles and for those intended to do battle against naval forces and particularly other submarines. Increasing attention is being paid to development of the weapons and equipment for these two basic types of ship. Now, as the Soviet nuclear submarine is about to show itself, our efforts must be redoubled. Ideas, long cherished, should be re-examined.

Tactically, a new force has been born, and it should be used as such. In the early days of aviation, the first thought of the oldtimers naturally was to use the airplane as a sort of auxiliary to the fleet. It could chase down game and then spot the fall of shot. The idea that is should be anything very much more was often the subject of ridicule. But this role chained the highly mobile airplane to a big gun on a slow platform. It was not to last, however. The aviators saw carrier warfare in the future, dimly at first but with enough prescience to get an aircraft carrier into operation and then a few more in time to save the day in World War II. Now the aircraft itself delivered the principal blow.

Today, as we all grope for knowledge, there are efforts to treat the first nuclear submarines as the first naval aircraft were treated. Why should the SSN be sent out hunting in company with a noisy, radiating, echo ranging, conventional hunter/killer group? Why degrade the performance of the submarine by making it spend time at the interface of sea and air in communication with the HUK

group? It should be in a place close to the enemy windpipe, stalking the enemy submarine at the best depth for its sonar. Why should the SSN train to get other forces into contact? It can kill by itself.

The best help that the nuclear submarine can get in the hunt for submarines is from friendly submarines in order to cover an area or to box in a detected enemy. Long-range patrol aircraft can help at present by forcing enemy conventional submarines to snorkel (making more noise); air reconnaissance can help by looking into enemy harbors.

The SSN is unique in her ability to carry our attack on enemy submarines to the enemy front porch. Since she need not expose herself at all to enemy air opposition, it is much more effective off the enemy base of nearby focal points than the conventional submarine which must snorkel; the present HUK group could not survive there. The nuclear submariner is the only ship that can pursue a submarine under the polar ice.

Used as single units or in groups, nuclear submarines will be the only effective hunter/killer groups of the future against their own kind. They will form the only practicable screen about today's battleship—the fleet ballistic missile submarine.

Expensive as the first SSNs have been to build and maintain, they do not suffer when compared with the large force that each one replaces, or when it is seen that the job cannot be done by the surface/air group. In fact the nuclear-powered submarine is far cheaper on a replacement cost basis.

Attractive as this kind of reasoning might be to the ever poorer taxpayer, the destroyer types of today are going to have to be replaced with surface ships much like them. Once again their function is changing. These work-horses of the Fleet, lately torpedo boats designed to attack the big ships, now jacks-of-all-trades, will carry the awesome burden of defense against air attack and the many other tasks that can only be handled by a surface ship. It may comfort harried destroyermen to be relieved of the principal role in antisubmarine warfare. And concentration on proper armament for air defense is sorely needed if we expect to get ships through determined attack. No, no one is going to be put out of a job by the SSN.

The aircraft carrier is still indispensable to our landings in limited war or to conduct operations to enforce the peace. The SSN joins the long list of enemies that the carrier must face; at the same time the carrier gains a potent protector in the undersea ship. While it is the fashion to write off the carrier as an obsolete weapon of war, a viable substitute to perform its functions has not been found. It would be nice to find something smaller, less vulnerable, and less expensive. But until we do, we must set ourselves to defend the carrier with a force of anti-air escorts and antisubmarine submarines.

The lesson of six years of operations of nuclear submarines is twofold. First, because of the ineffectiveness of present antisubmarine measures, the nuclear submarine armed with the ballistic missile is an outstanding deterrent weapon system. Second, because of the advantages of operating in the same medium with her enemy, the nuclear submarine must now be assigned the primary role as an antisubmarine ship.

The lesson indicates the need for a heavy effort. Programs to improve our submarines must be strengthened. They must be kept ahead of the Communist versions in every respect: in speed, in quietness at a given speed, in weapon effectiveness, in operating depths, and in quality of that most important item, the crews. The organization of the Navy Department and of the operating forces must be stronger in order to stimulate and control the submarine's progress. There is grave danger in underestimating these requirements or in failing to follow through. Our present lead may be precarious.

# ANTI-SUBMARINE WARFARE IN THE 21ST CENTURY

*by LCDR Timothy N. Ketter, USN*

*A paper submitted to the Faculty of the Naval War College in partial satisfaction of the requirements of the Department of National Security Decision Making. This paper was awarded the NAVAL SUBMARINE LEAGUE 2004 prize for the best submission on Undersea Warfare.*

The military forces of the United States are at a crossroads. Much of the force was planned, funded, and fielded to provide security against the symmetrical threat presented by the Soviet Union during the latter half of the 20th Century. That enemy has withered away and currently the US is the world's only remaining military *Superpower*. In the near term it is unlikely that the US could be defeated in a traditional force-on-force conflict. The costs of developing such a force are prohibitive and as a result potential adversaries are investing in a variety of asymmetrical capabilities to offset US conventional military strength; hoping to exploit vulnerabilities that have developed in the current US force structure over time. Potential gaps became evident as a result of the September 11th attacks, Operation Enduring Freedom, Operation Iraqi Freedom, and through analysis of US military spending trends. This paper will analyze the diesel submarine as an asymmetrical capability which threatens the US Navy's vision of Sea Power 21.

Advanced diesel boats, if manned by capable crews, have the potential to disrupt Sea Strike missions, force the allocation of additional resources to Anti-submarine Warfare (ASW) to meet Sea Shield requirements, and put at risk the Sea Bases which must be developed to project power and support forces ashore. For these reasons it is vital that the US Navy re-examine its current ASW doctrine, strategy and force structure, and make investments now for a future force that can overcome the challenges presented by the diesel submarine. This operational refocusing must be completed preemptively rather than waiting for a calamitous event to shock the

system and force change. Time and money are limited resources, and the attention span of the American public has never been shorter. The combination of these factors make it unlikely the Navy will have the capacity quickly to develop a credible, calculated ASW response in a political environment, where attempts to assign blame override the reform necessary to meet the challenge.

## Historical Background

This is not the first time the Navy faced an adversary possessing a credible diesel boat force. During WWI and WWII, the US Navy developed a strategy and doctrine to combat the German U-Boat threat in the Atlantic Ocean. However, this occurred reactively after an enormous quantity of US and British merchant vessels were sunk by the U-Boats. Also, the ASW lessons of the First World War seem to have been forgotten in the inter-war years. The US Navy at that time was focused on building battleships and training for an epic Fleet on Fleet engagement that would never occur, at least not in the manner naval leaders envisioned at that time. Given that Germany did not have the industrial capacity to build a large number of battleships; it developed an innovative naval strategy to use U-Boats as asymmetrical weapons against British and American merchant shipping and, given favorable conditions, warships. In response, the British and Americans developed sonar or ASDIC with which they hoped to remove from the submarine the cloak of invisibility which was its principal source of strength late in WW1.[1] However, the ASW training conducted by both the US and Royal Navy was deficient. Conducted under unrealistic environmental conditions, it led naval officers to believe that U-Boats could be easily detected by radar when they went to periscope depth just prior to attack. Further, ASW training was limited to a small percentage of the officer corps of both countries' navies.[2] When the Battle of the Atlantic was finally won, it was due to a combination of factors: first, the development of ASW tactics which combined ASW aircraft operating from escort carriers and land bases with surface ASW forces; second, the convoying and escort of merchant vessels; third, improved ASW weapons; and last, the ability to decipher German naval messages which enabled the Allies to redirect merchant convoys and ASW Task Groups hunting the German Wolfpacks.

Immediately following WWII, the threat of nuclear conflict with the Soviet Union began to dominate US Naval Strategy and would continue to do so until the 1990s. The aircraft carrier, combined with forward operating submarines, would attack Soviet submarines in their home waters before they could threaten the United States or its allies.[3] In the 1950s, the Navy codified this into a three prong strategy to meet the Soviet challenge: strike submarine bases and shipyards in the USSR, intercept and destroy Soviet submarines as they sortied from their bases, and develop a strategic nuclear weapon delivery platform.[4] The last two depended upon the development of nuclear powered submarines which could operate submerged indefinitely. The move to nuclear powered submarines caused the Navy's diesel submarine community to lose influence and ultimately become a part of naval history. It is during these years that naval submariners began to argue the best platform for tracking and killing submarines was another submarine, even though there was little empirical data supporting this statement. Surface and Air (carrier and land based), ASW forces were also modernized during these years. The large numbers of Soviet submarines made surface surveillance and coordination a secondary mission of every naval platform. US Naval commanders knew that the solution to the submarine threat did not lay in a single platform. Instead it required highly trained operators on ships, submarines, and aircraft, integrated into a fused ASW network which maximized the efficiency and reach of every contributing platform. By the end of the 1980s, this solution finally came to fruition. At the conclusion of the Cold War, much of the US ASW force was allowed to atrophy due to a lack of funding for modernization programs, a reduction in ASW-centered training, and a shift in primary mission areas as warfare communities sought relevance in a post-Soviet world.

## The Current Challenge

The majority of conflicts of the late 20th and early 21st century have been fought against landlocked countries or ones which possessed few or no naval units. During these engagements the overwhelming focus of the Navy has been providing overland strike and support missions. Sea superiority had been taken as a given for

all of these operations. Whether it was off the shores of Somalia or the Balkans, during Operation Enduring Freedom or Operation Iraqi Freedom, the Navy has been able to act with impunity. The most dangerous threat during this time has not been from other naval or land based units, but from free-floating mines or small boat suicide attacks, like the one experienced by the USS COLE in the port of Aden, Yemen. The diesel submarine may become the perfect asymmetric weapon for countries which can afford to purchase them, and who wish to disrupt US power projection operations off their shores at some future date.

The collapse of the Soviet Union had the unintended consequence of allowing the proliferation of advanced submarine technologies to occur. Russia and other former Warsaw Pact countries have sold their most advanced technologies around the globe with little thought or care to the shifting balance of power these sales precipitate. Even traditional US allies have contributed to proliferation by selling weapons and sensor systems to the highest bidder. Diesel submarines are very flexible platforms. They may operate as, or deploy, mines, use stealth to attack an unsuspecting/unalerted target with torpedoes or submerged launched anti-ship cruise missiles (SLASCM), deliver Special Operation Forces (SOF), or conduct Intelligence, Surveillance, and Reconnaissance (ISR) missions. When operating on batteries or in congested shipping lanes they are extremely difficult to detect. Battery improvements over time have resulted in shorter recharge times, greater efficiencies in maintaining a charge, and miniaturization has allowed a greater number to be installed on submarines. These improvements have significantly reduced a diesel submarine's exposure time during battery recharge operations, historically the time when they are most vulnerable to detection. Air Independent Propulsion systems currently under development by many countries threaten to make the diesel submarine nearly equal with nuclear submarines regarding submerged endurance.

US Naval ASW doctrine, tactics, and weapons were developed to counteract a mirror image foe. Years of Cold War intelligence gathering missions against the USSR lead to the development of extensive operational and acoustic databases from which determinations could be made regarding how the Soviets would use their

submarines if conflict became unavoidable. Currently, US global information requirements do not always allow for the focused intelligence gathering required to determine the operating characteristics of potential adversary submarine forces. ASW has always been, and will continue to be dependent upon operational knowledge of the enemy and external cueing which leads to tactical interactions between opposing forces.

As previously mentioned, current and future diesel submarines possess an increasingly lethal array of weapon systems. Improved torpedo ranges and seekers, as well as automated fire control systems simplify and compress the attack timeline for the shooter and leave US commanders with shorter reaction times. These afford the submarine greater freedom of maneuver and decrease the chance of counter detection by US forces during weapons employment. Focused weapons development is also being pursued by many countries. For example, wake homing torpedoes were specifically designed by the Soviet Navy to attack US aircraft carriers. Conversely, US anti-submarine torpedoes were designed to attack large nuclear submarines in deep water, up to 1000 FT bottom depth. Diesel boats are significantly smaller and it is assessed they will operate in the littoral regions of the world. However during both World Wars, diesel submarines operated throughout the Atlantic and Pacific Oceans, therefore this assumption may be challenged in the coming years. The SLASCM may be the weapon system which pushes diesel boats forward once again.

The SLASCM possess a number of challenges for the US Navy, however, to be used effectively against an enemy the launching platform must possess over the horizon targeting (OTHT) data. Few countries currently have an operational OTHT network capable of employing these weapons at their maximum ranges. However, many countries are investing heavily in building the required infrastructure to make such a network a reality by the end of the decade. The network would connect land based, maritime, and air units through real time voice and data link circuits, allowing for the rapid transmission of information up, down and across the network. Once a reality, a SLASCM equipped diesel submarine could operate well outside traditional Carrier Strike Group (CSG) ASW search areas, receive cueing data via its OTHT network, launch a weapon submerged, and

reposition totally undetected. Studies undertaken by the US Navy to demonstrate the survivability of the Trident SSGNs under construction indicate that even with an enemy submarine positioned within two nautical miles (4000 YDS) of a submerged missile launch event, no enemy firing solution could be achieved.[5] Some may argue that comparing a US Trident submarine to a Russian KILO or Chinese SONG is like comparing apples to oranges, and they would be correct. What the study indicates is that SLASCMs pose a significant challenge to US naval commanders. Solving the problem is more complex than just building more submarines. For example, if the SLASCM has a nominal launch range of 20 NM, the "launch basket"[6] for such a weapon would be 1,256 $NM^2$. For a 60 NM range weapon, the basket expands to 11,304 $NM^2$. The waterspace which must be searched for these potential threats is immense. If the aforementioned study's 2 NM baseline is tripled, to account for the US's technological edge in sensor technology, the resultant submarine datum[7] is 113 $NM^2$, which translates to 1% of the 60 NM weapons launch basket and the probability of having a US and adversary submarine in that same 1% of water at launch time is very low. As mentioned previously, the OTHT network required to employ these weapons at extended ranges is not yet fully mature but the capabilities are rapidly increasing. The United States Pacific Command (USPACOM) Area of Responsibility (AOR) will be used to demonstrate the growing diesel submarine challenge facing US commanders.

During Admiral Thomas B. Fargo's recent Congressional testimony before the House Armed Services Committee he stated "USPACOM faces the greatest undersea warfare challenge in the world." There are currently 250 submarines based in the Pacific and only 75 of these belong to the US or allied countries.[8] The majority of the remaining submarines are split between China and North Korea. All of North Korea's submarines are diesel electric boats used primarily to insert SOF personnel. They have rudimentary ASUW and ASW weapons. China, on the other hand, has a robust indigenous submarine production and maintenance base. They are currently constructing two classes of diesel submarines, identified as MING and SONG, as well as nuclear powered submarines for attack and ballistic missile missions. Lastly, the Chinese purchased a

number of KILO submarines in the 1990s and have orders with Russian firms for a number of additional KILOs which will be delivered during the remainder this decade. The SONGs, Type 093 nuclear attack submarine, and new KILOs should be capable of launching SLASCMs. They will also be carrying some of the most advanced ASUW torpedoes in the world. The new construction MING and SONG submarines are replacing old noisy classes of boats. This modernization program is likely to continue in the second decade of the 21st century if not indefinitely.

Currently, US ASW forces are shrinking in numbers and a revitalization of ASW doctrine must take place. The attack Submarine Force level is set at 55 submarines. Maritime Patrol and Reconnaissance aircraft (MPRA) are reaching the end of their service lives and there will be approximately 150 active P-3s until the Multi-mission Maritime Aircraft (MMA) is fielded at the end of this decade. The S-3B, the only ASW capable carrier based aircraft has begun retirement, with the last squadron decommissioning in 2009. Surface combatants have been reduced in numbers and capabilities. For example, the new Flight II Arleigh Burke destroyers are no longer equipped with a passive towed array sonar system due to cost and space constraints that developed when the original hull was modified to incorporate a dual helicopter bay, required to deploy with ASW capable helicopters. ASW doctrine must be updated to address the ASW resource constraints and the emergence of the SLASCM equipped diesel submarine threat.

## Submarine ASW

The current US submarine force is divided almost equally between the Pacific and Atlantic Fleets. Many in the US Navy believe that the submarine will remain the premier ASW asset for the future.[9] Undoubtedly, US submarines now carry and will continue to deploy with the most capable ASW weapons in the Fleet; however they alone are not the solution to the diesel submarine challenge. Submarines are the ideal ASW attack platform, but their slow search rates do not make them the optimum search platform unless cueing is available to focus their search. Also, the sheer number of potential adversary submarines demonstrates the need for

greater numbers of improved ASW platforms to manage and reduce the risk to naval operations. A recent Congressional Budget Office study concluded that attack submarines spend only about 10 percent of their service life carrying out required missions; a very low return on investment.[10] Since funding and the industrial capacity is lacking to build additional submarines, the Navy needs to maximize the number of mission days available for each submarine during a given year. By permanently forward deploying submarines to Guam and Europe in greater numbers, the mission days available increases due to reduced transit times. For example, a single Guam based submarine is the equivalent of three continental United State (CONUS) based boats when comparing mission days available.[11] It will also go a long way to meeting the CJCS mission day requirements in the 2015-2025 time frames for attack submarines.

The disposition of the Fleet must also change to meet the evolving strategic environment in the Pacific AOR. By 2015, the 1999 CJCS study on attack submarine requirements concluded, 60 percent of the fleet would be needed in the Pacific "to counter the threat in the Asia Pacific region."[12] Submarines should be re-allocated to Pacific squadrons along a phased timeline which begins immediately to offset the economic impact on communities which now host these boats. Once in the AOR, they would be ready to meet challenges as they arise. Additionally, the most capable submarines should enter service in the Fleet as members of Pacific squadrons. These boats will require less maintenance at the beginning of their service lives, further increasing the number of mission days available to the operational commander increasing his flexibility and reach. Future innovation involving unmanned underwater vehicles (UUV), autonomous or tethered, operating from a host attack submarine or surface ship may radically increase ASW search rates. If the UUVs potential is to be fully realized the information gathered must be tactically relevant and transferred in real-time for interpretation by highly trained individuals on those vessels. Furthermore, ASW weapon capabilities must evolve to take advantage of the increased detection ranges offered by the UUV. This will give the operational commander a wider range of options as his units move into the joint operations area. (JOA)

## Air ASW

Land-based Maritime Patrol and Reconnaissance aircraft (MPRA) and unmanned aerial vehicles (UAV) can search large areas at higher speeds with reduced revisit times when compared to submarine search rates.[13] Currently, the Navy's air ASW force is modernizing current airframes and waiting for approval, funding and fielding of new airframes as old aircraft become unsustainable. The procurement of more capable fixed wing ASW assets is critical to operational success against diesel submarines. The P-3C is nearing the end of its service life and at the same time, the Navy has chosen to retire the S-3B Viking. Operating from the aircraft carrier, the Viking's long endurance and APS-137 Inverse Synthetic Aperture Radar (ISAR) operating in periscope mode make it a valuable search and hold down platform against diesel submarines. Operating with similarly configured P-3C's enabled operational commanders to sanitize a large amount of ocean prior to CSG arrival, maintain search integrity and investigate only those contacts that meet periscope criteria. In the future, commanders will be completely dependent upon land-based maritime aircraft for ASW support. To increase asset availability and improve responsiveness in the PACOM AOR, consideration must be given to forward deploying a P-3C squadron to Japan, permanently. CONUS based squadrons would maintain their normal deployment schedules to PACOM augmenting the forward deployed squadron and doubling the total number of aircraft in theater.

The future of this community is dependent upon the MMA and Broad Area Maritime Surveillance (BAMS) vehicle. The MMA will have increased range/on station time, more diverse sensor packages, and incorporate the latest acoustic and non-acoustic ASW technologies. The BAMS should incorporate radar and infrared sensor packages capable of searching large ocean areas, detecting periscopes, snorkels, and cruise missile launches at a minimum. Both the MMA and BAMS will be fully networked platforms whose information will be available across the joint fires network in real time. MMA and BAMS need to be acquired in sufficient numbers to meet the current and expected global combatant Commander requirements through 2025. Employed simultaneously, they will provide a

persistent, overlapping ASW coverage umbrella which forces the diesel submarine commander to modify his scheme of maneuver.

The last piece of the air ASW triad is the MH-60R/S. These new SeaHawk helicopters will be responsible for maintaining air coverage in close proximity to the HVU or Sea Base. They will be the defensive rapid reaction force the Sea Combat Commander (SCC) has at his disposal to engage submarines. They are the only remaining organic CSG air ASW platform and it is critical that the program remain on timeline and fully funded. If not there is a risk that future CSGs will lack the defensive air ASW coverage necessary adequately to protect itself. Improved radar and acoustic systems on both helicopters should increase detection ranges and shorten prosecution timelines, enabling the SCC to prosecute a higher number of targets simultaneously.

## Surface Community

Surface combatants and their embarked ASW capable helicopters will provide defensive ASW coverage for the HVU. The surface ASW community is recovering after many years of neglect. New destroyers have the ability to embark helicopter detachments, permanently increasing their ASW reach and mitigating somewhat the loss of their passive towed array sonar system. The Littoral Combat Ship (LCS), although not finalized, is being designed with an ASW module, including the ability to launch and recover UUVs. CG(X) and DD(X) will also incorporate improved acoustic ASW sensor suites and automatic periscope detection systems as they enter the Fleet in the next decade. These ships and ASW upgrades and retrofits must be funded in numbers sufficient to meet the expanding threat.

An area still under investigation by the surface community is the use of active sonar as a search sensor when water conditions are conducive. High ambient noise in the littoral regions of the world can limit the capability of passive sonar sensors. Using active sonar may increase detection ranges over what is available passively due to the water environment. Advances in acoustic planning tools allow the SCC optimally to place all available ASW units in the water column, maximizing the efficiency of those sensors, increasing

detection opportunities, and reducing the probability of counter-detection. The use of SURTASS ships in passive and active roles is increasing. All of the ships have been moved to the PACOM AOR. The challenge with SURTASS is integrating the information they provide into the current operational network. The goal is to enable tactical decision making based upon SURTASS generated contact reporting.

**ASW Doctrine**

ASW has not received the focus it deserved in the last decade. ASW is a slow, time consuming, asset intensive warfare area. The training required to maintain proficiency is lengthy and perishable. To the untrained observer, ASW can be extremely boring. However, the most likely threat to the vision of Sea Power 21 is the diesel submarine. To meet this challenge the Navy must change the way it views and conducts ASW. The organizational model for the conduct of ASW at the theater level is outdated and ineffective. The historical areas of responsibility for a CSG Commander are too large for effective management. The number of combatants deploying in a Strike group has been reduced significantly, which limits the Commanders flexibility. Timesharing of combatants between the SCC and the Air Warfare Commander (AWC) is increasing, and at times there are not enough combatants to meet all the CSG's requirements.

Today, theater ASW organizations exist but they do not have the resources or doctrine required to manage a complex multi-contact ASW problem. Standing Task Force Commanders for ASW exist in 5th, 6th, and 7th Fleet AORs; however, they are not focused on managing tactical interactions. Doing so would allow for the resumption of direction, control, and coordination of ASW units outside of the CSG's area of influence. Close coordination between the SCC and the Theater ASW Commander (TASWC) will be critical for successful contact prosecution and asset protection. In this new alignment, the SCC would be responsible for defensive ASW within a bubble centered on the HVU; everything outside this bubble would be the TASWC responsibility. ForceNet will enable

this shift of ASW responsibility and control to the theater level commander.

## Conclusion

In the future, US adversaries will attempt to disrupt naval operations through the use of asymmetrical weapons. The diesel submarine is simultaneously the most dangerous and most likely weapon to be used in that role. Its stealth and flexibility in the littoral regions of the world give the opposing commander a variety of employment options against joint forces flowing in by sea. It is crucial that the Navy rediscover its ASW ancestry and prepare now to meet and overcome challenges to US Sea Superiority created by diesel submarines. Many would argue that "our quiet submarines with superior sensors are the best resource to counter the threat posed by the growing number of quiet diesel submarines being employ by regional powers."[4] Simple math indicates that the US Navy will not have the number of submarines required to meet the challenge alone. Success, instead, requires a return to diesel ASW basics, increased intelligence gathering on potential hostile submarine forces, ASW force structure realignment and modernization, the construction of a fused ASW network which maximizes the efficiency and reach of every contributing platform whether they be air, surface, or submerged, the incorporation of UAV/UUVs into ASW, and doctrinal changes to organize and manage ASW assets effectively from the theater to the tactical levels of war. Change is never quick or easy, especially when the choices are complex, involving people and billions of dollars, but decisions must be made. Lastly, they must be based upon what is best for the security of the United States, not what is best for a specific warfare community, Fleet commander, congressional district, or even the United States Navy.

## ENDNOTES

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6. The launch basket is a circle centered upon the naval unit the adversary wishes to attack. The demonstration values were chosen for demonstration purposes only.
7. A datum "is the last known position of a submarine or suspected submarine after contact has been lost." *DOD Dictionary of Military Terms*, available from http://www.dtic.mil/doctrine/jel/doddict; Internet; accessed 4 May 2004.
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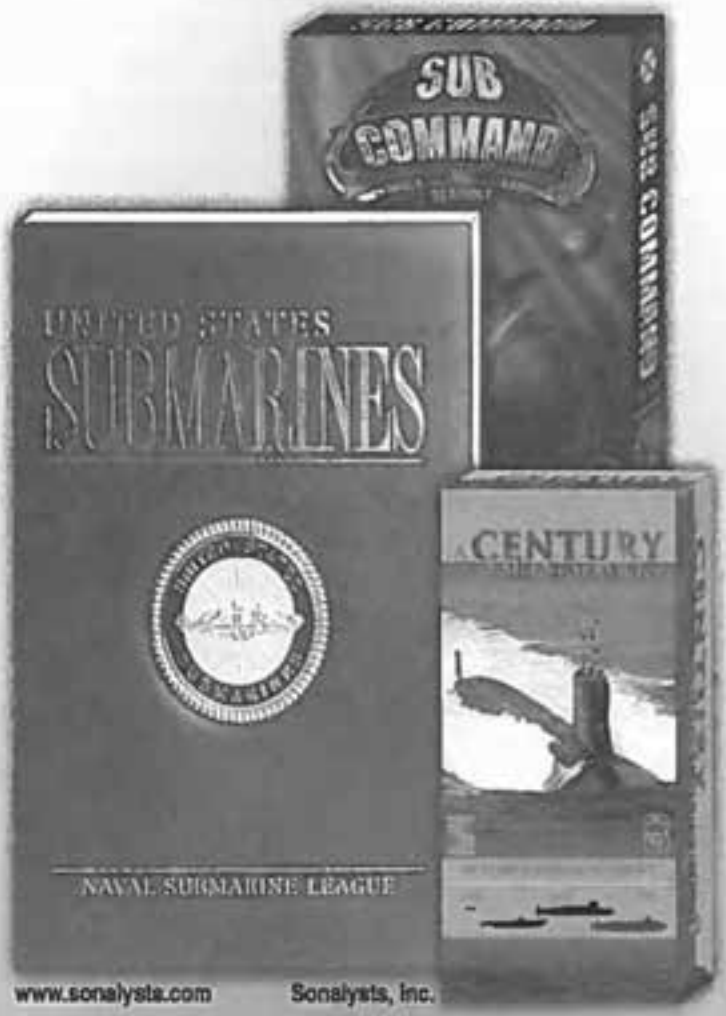


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# SUBMARINES AND WMD PROLIFERATION

*by Nader Elhefnawy*

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In a story recently broken by *Jane's Defense Weekly*, it was reported that North Korea may be developing submarine-launched ballistic missiles (in this case knock-offs of the R-27/SS-N-6)[1]. While it may seem astonishing that backward and bankrupt North Korea is pursuing something as ambitious as a fleet of ballistic missile subs, such a move fits a broader pattern. Smaller and newer nuclear powers in general are looking into submarines as platforms for such weapons, including not only North Korea, but also India, Israel and potentially even Pakistan.[2]

This is in part a prestige issue, enhanced prestige being one of the principal benefits of nuclear weapons—and the prestige of a state which arms its submarines with them is higher still.[3] Bureaucratic politics is also a factor, the nuclear mission being a good way for navies to angle for a bigger slice of the budget. There is, however, also a practical element involved in the diversity and flexibility offered by a triad of land—sea—and air-based weapons, each element of which has its advantages. Accuracy and quick reaction-time are traditionally the edge that land-based ICBMs can bring to bear. Aircraft, as with strategic bombers, are highly flexible and recallable.

Submarines, however, are stealthy and survivable, given the sheer difficulty of hunting them down, and it is the latter attribute which may be of the greatest interest to insecure states seeking to maximize the survivability of a small nuclear arsenal. Submarines, admittedly, are not the only option in this area. Mobile launchers and underground bunkers and tunnels certainly confer a measure of protection, and may be more feasible. It is also possible to base missiles on

surface ships, either warships or launch vessels disguised as merchant shipping, an option that the North Koreans are also thought to be pursuing as the Soviets did before them in the Project 909 and 111 vessels of the early 1960s.

Nevertheless, the increasing effectiveness of air- and space-based surveillance, a shortening sensor-to-shooter cycle, and the stealth, defense-suppression and precision-strike capabilities of the most advanced air forces hold out the possibility of at least partial effectiveness against a dispersed, concealed missile force. (Indeed, the B-2 bomber was expressly designed for the purpose of ranging about Soviet airspace with impunity to hunt down mobile ICBMs.) Even on a theoretical level air and space power simply can not be as effective against submarines.[4] Two options exist in this area, ballistic missiles and cruise missiles, and this article will discuss the situation with regard to each in turn.

**Third World SLBMs**

The history of the submarine-launched ballistic missile goes back to World War II, when the German navy hit on the concept of using its U-boats to tow encapsulated V-2s – weapons which would have been developed against the United States in 1946, had the war dragged on. While both submarines and ballistic missiles have proliferated widely, the latter have tended to remain land-based, only the five permanent members of the United Nations Security Council (and also the five original members of the nuclear club) actually possess ballistic missile submarines—and China's status in this area has generally been questionable, given its difficulties with its Xia submarine program.

This, however, is beginning to change. Besides North Korea, India has displayed an interest in ballistic missile submarines of its own. Such a program could well be an overambitious boondoggle, another instance of Pyongyang's overreaching in the course of a prestige project, as with its space program. (This may also have been the case with China's Xia program, and could well be the case in the near-term with India's plans for its own missile boats, given its own unhappy experiences with indigenously-built subs.)

This is due in part to the slowness with which the nuclear weapons that are their primary weapon have spread, but also to the formidable technical problems involved in a submarine-launched ballistic missile program.[5] First and foremost among these is the problem of acquiring adequate submarines. Today's diesel boats are not meant to cross oceans as those of World War II were, but rather to operate in coastal waters, and the equivalents of towed V-2s in capsules may be judged not worth the trouble. For the most part it is the nuclear submarine (again, a monopoly of the UN Security Council's permanent members) that makes the sea-launched nuclear missile practical, given the sheer capacity necessary to contain a significant number of missiles, their ability to remain submerged for extended periods and deploy at strategic distances – and their need to be able to avoid or survive attacks by other, nuclear-powered attack boats.

There are also the design problems inherent in the missiles themselves, since this is not a matter of taking an ordinary ballistic missile out of its silo on land and dropping it into a submarine's launch tube, if only because they are too large. Given the need for miniaturization and reduced certainty about firing positions, submarine-launched ballistic missiles are typically shorter-ranged and less accurate than their land-based cousins at a given level of technical sophistication and expense. Only the Trident II has a comparable combination of throw-weight, accuracy and range to land-based missiles like the Minuteman III, making it the first SLBM to have a "credible hard target kill" or "first strike" capability.[6] There is little question that North Korea's effort to develop its own submarine-launched version from the Soviet SS-N-6 has met with far greater difficulty than the development of the land-based variant, which is also believed to have greater range—possibly 4000 kilometers to the sea-launched missile's 2500.

Finally, maintaining the deterrent at the level of at least one operational submarine deployed at all times can be relatively taxing. China's Xia program does not suffice in this regard, even after three decades. Britain and France have generally required four or more for this purpose. In navies using poorer equipment or having lower proficiency, more vessels may well be required, and as a practical matter few of them can operate a large enough Submarine Force to

commit the requisite percentage of it to this mission—though some could try and do it on the cheap. There is no reason why (geography permitting) a submarine can not fire its missiles from in port, or why they can not attempt to conceal the facts in a situation where they have no operational submarines.

Nevertheless, these problems are not necessarily insurmountable. There have been diesel ballistic submarines, notably the Soviet Golf-class boats which were built in the 1950s and continued to serve in the Soviet navy until 1990. China also worked with Golf-class submarines for some decades, and North Korea's own program is believed to be based on a purchase of used Soviet Project 629A (Golf) and Project 641 (Foxtrot) submarines (the Foxtrot of course being the basis for the Golf).[7] In contrast with larger, more modern vessels these had their deficiencies, being not only slower and having less endurance, but able to carry only relatively short-ranged missiles and needing to surface for twelve minutes to fire them. Even so, for the purposes of a small state deterring an opponent, rather than planning on the waging of a superpower-level strategic nuclear war, not every ballistic missile submarine must carry twenty-four missiles with ten warheads a piece to provide a credible strategic deterrent. The submarine's inherent stealth, and the challenges inherent in shooting down ballistic missiles, make virtually any workable capability a factor.

Technological and political changes could also improve the performance of such systems. Improvements in conventional propulsion (like air-independent propulsion) make the most recent diesel boats more formidable opponents. Given the regionalization of most future conflicts, and the longer reach of missiles, they need not be able to deploy to strategic distances to get the job done. Moreover, North Korea's exceptionally large submarine fleet—twenty-six diesel patrol boats, excluding the dozen Foxtrots and Golfs purchased in 1993—makes it an exception to the rule.[8] The same would apply to India, which operates nineteen submarines, five of which might perform the missile-carrying role according to reports in the press over the years.

Other, smaller submarine forces are unlikely to do the same. Iran, with its Submarine Force limited to three Russian Kilos (which seem to have been purchased for interdiction in the Strait of Hormuz), is

unlikely to follow suit even if it were to acquire nuclear weapons. While Pakistan would likely feel pressured to develop capabilities matching India's at some point, it too would be hard-pressed to dedicate a portion of its seven-boat Submarine Force (excluding small, special-forces versions) to the ballistic missile mission. The Israeli navy, which has three German-built Dolphins, is eschewing the ballistic missile option—in favor of cruise missiles.

**Cruise Missiles: The Israeli Choice**

The ability to fire anti-ship cruise missiles is increasingly a standard on attack boats, both nuclear and diesel, and a range of land-attack cruise missiles which can be fired from a submarine has long existed (as with the American Tomahawk or Russian SS-N-21). Pakistan's French-built Agosta and Daphne-class submarines can fire Harpoon and Exocet anti-ship missiles, and Israel's Dolphins can also fire the Sub-Harpoon. Some of India's Kilos are configured to fire anti-ship missiles, and the same goes for China's Song (diesel) and Type 93 (nuclear) submarines. Some of the latter may also be equipped with land-attack missiles, a capability that Britain imported in the Tomahawk and repeatedly demonstrated in Kosovo, Afghanistan and Iraq. In the foreseeable future a number of Indian submarines may also be configured to launch land-attack missiles.

Israel, however, has arguably taken the lead in developing a sea-based nuclear deterrent around sub-launched cruise missiles.[9] While Israel possesses ballistic missile technology, and at least the capacity to build weapons with intercontinental reach, it is instead, developing a cruise missile capability, likely based on the indigenous Popeye Turbo missile.[10]

Such an approach has much to recommend it from the standpoint of a small navy with limited resources. Medium- and long-range cruise missiles are slower, shorter-ranged and more susceptible to air defenses but, aside from being more easily built on a limited budget, they are considerably less demanding in terms of payload. As a consequence they do not require specialized vessels, being insertable into the diesel submarines that are easiest to come by, and which can be committed to other missions. They can also be more accurate. The latest versions of the Tomahawk may be accurate to within a meter

because of satellite navigation aids, thus being within the Circular Error Probability of the most accurate ballistic missile.

Other states are likely to follow course. Especially if they encounter difficulty with ballistic missile programs, China and India will see fit to proceed with the nuclearization of their sub-launched cruise missiles. Given their smaller fleets, forces like Iran's and Pakistan's may also pursue this option, as could any other states which in the future seek to acquire weapons of mass destruction, not only nuclear, but also biological or chemical. (While rarely discussed as proliferators the same could be the case with South Korea or Taiwan, for instance, should they opt to nuclearize.) Indeed, equipping subs in this way may be one of the ways in which poorer or smaller states can maximize the potency of their Submarine Forces.

**Conclusions and Recommendations**

Especially after the recent revelations about North Korea, it is important to recognize that just as with combat aircraft capable of delivering nuclear weapons (such as the F-16s Pakistan purchased from the U.S.), submarine proliferation is of concern to those following the spread of weapons of mass destruction. Nevertheless, North Korea's particular approach is unlikely to be representative of such efforts, as Israel's decision to go with cruise missiles demonstrates. For logistical and political reasons it is a far simpler matter to keep large, nuclear-powered subs and ballistic missile technology from spreading than it is to keep diesel boats and cruise missiles from proliferating, but the effort must be made. Political counterproliferation efforts aside, threat planning in the future may do well to include cruise- and ballistic-missile armed submarines in the arsenals of rogue states in the future. This may have implications for homeland security planning, but also represent an important mission for American and allied submarine forces in regional conflicts.

## ENDOTES

1 Joseph S. Bermudez, "North Korea Deploys New Missiles," *Jane's Defense Weekly*, August 4, 2004, p. 6.

2. Pakistan does not appear to be pursuing such systems at the moment, but its leaders have suggested that Pakistan may deploy nuclear weapons at sea in the future. Gaurav Kampani, "Pakistan: Missile Overview," Nuclear Threat Initiative. Accessed at http://www.nti.org/e_research/profiles/Pakistan/Missile/index_3066.html.

3. Robert Gilpin, *War and Change in World Politics* (New York: Cambridge University Press, 1981).

4. Nader Elhefnawy, "Submarines and Space Power," *Submarine Review*, Oct. 2001, pp. 71-77.

5. Despite all of today's anxieties about weapons proliferation it is well worth remembering that President Kennedy predicted 15-25 nuclear powers by the mid-1970s. Cited by Tanya Ogilvie-White, "Is There a Theory of Nuclear Proliferation? An Analysis of the Contemporary Debate," *Nonproliferation Review* (Fall 1996), p. 44. In a similar vein, Arthur C. Clarke, in his novel *2001* (written in 1968), predicted 38 nuclear states by the turn of the century, with China selling complete arsenals for a mere fifty million dollars per kit. Such fears seem positively quaint from the standpoint of 2004.

6. Center for Defense Information, *Nuclear Weapon Database: United States Arsenal*. Accessed at http://www.cdi.org/issues/nuke/db/database/usnukes.html#21. Also see Federation of American Scientists, *Nuclear Forces Guide*. Accessed at http://www.fas.org/nuke/guide/index.html.

7. These dozen submarines were decommissioned Soviet boats purchased for scrap by way of the Toen Trading Company of Tokyo in 1993. While their missiles and electronics had been removed, critical elements of the launch systems remained, including the launch tubes and stabilization systems, which may have been integrated with Russian, East European and Chinese technology. Recent coverage of the program suggests that the missiles may be equipping a refurbished Golf or a heavily modified Romeo-of which North Korea has twenty-two. See Bermudez, 6, for details.

8. For current data on Submarine Force sizes see International Institute for Strategic Studies, *The Military Balance 2003-2004* (London: Oxford University Press, 2003).

9. Britain's Tomahawks are not known to be nuclear-equipped, and very little is known about China's Land-Attack Cruise Missiles.

10. Federation of American Scientists, "Popeye Turbo," *Nuclear Forces Guide*. Accessed at http://www.fas.org/nuke/guide/index.html.

# COMMISSIONING OF USS TRITON HALL
# NAVAL TRAINING CENTER, GREAT LAKES, IL
# 25 JUNE 2004
# KEYNOTE ADDRESS BY
# ADMIRAL HANK CHILES, USN(Ret)

Veterans of TRITON (SS 201), Shipmates of TRITON (SSRN and SSN 586), families of both TRITONS, Captain Moran and staff members of Naval Training Center, Great Lakes and Recruit Training Command, Guests.

Today we celebrate the service of two great American submarines that contributed immensely to the military success and history of our country, and dedicate this building: USS TRITON, carrying on a proud tradition by keeping the name in our Navy of the shellfish or from Greek mythology, The God of the Sea, represented as a bearded man from the waist up with a mermaid tail.

The first two USS TRITON's share a number of similarities: By the design standards of their day, each was a large submarine: TRITON I at 310 feet and 1500 tons displacement; TRITON II at 447 feet and 5900 tons surfaced. Each would be surpassed in length/tonnage a few years after construction. Each was designed for a mission, which would turn out NOT to be the primary accomplishment of the submarine's life. Each made its mark quickly. Each submarine was operated aggressively and took its mission seriously. As far as I have read, each was sincerely appreciated, if not loved outright by the bulk of its crew, and each submarine was decorated for performance. Both submarines had a short life relative to the design and relative to many contemporaries. We hope that will not be the case for USS TRITON III.

**To mention a few specifics:**

TRITON I was commissioned on 15 Aug 1940, led by Captain Willis Lent, was underway for a 42 day patrol commencing in December 1941, fired the first U. S. torpedo of World War II and by June 1942 had sunk 7 ships displacing over 21,000 tons. TRITON pioneered use of the deck gun to attack enemy shipping. At the time

TRITON I was lost on 15 March 1943 TRITON was credited with sinking 19 ships and damaging 7, the leader of Pearl Harbor submarines in the category of ships sunk at that time and awarded 5 battle stars and 4 Navy Unit Commendations. Jeanine McKenzie Allen has already read a fitting tribute from Adm Halsey. She and her husband Lorie, have done a marvelous job of keeping alive the spirit of TRITON I.

**After World War II submarine missions changed**

TRITON II was designed as a radar picket (SSRN). But TRITON under Captain Ned Beach came out of the blocks quickly in 1960, making history with the 36,000 mile, 84 day submerged shakedown cruise replicating Magellan's circumnavigation of the world in 1519. I'm told that the original plaque commemorating this cruise was somewhat at fault in translation. Instead of stating in Latin: "It has been done again, Noble Captain"; TRITON lore (at least with the second crew) had it that the plaque really read: "We have been had again, Noble Captain". Of course, the plaque was quickly replaced when the mistake surfaced, and special-delivered by Pan Am flight to the Naval Attachee in Spain to avoid a political faux pas. We deeply regret that Ned Beach, George Moran, and Frank Wadsworth are not with us today. I first rode TRITON for a day during the Springboard exercise of March 1961 operating from San Juan, while I was assigned to the destroyer USS BORIE. What a superb impression TRITON made!!!!!

TRITON's mission officially changed in the first overhaul of 62-64. Significantly, the Cold War operations conducted by TRITON contributed greatly to our overall knowledge of the Soviet Union and their maritime capabilities. TRITON's missions remain classified. That is unlikely to change. But I can personally attest to the skill of Captains Moran and Rawlins and our experienced officers and enlisted personnel in training us to operate unsupported for long submerged periods far from homeport, engaged in difficult missions, often in shallow water. The "R" in SSRN should have been for *reconnaissance*; *reconnaissance* was far closer to TRITON's real contribution to winning the Cold War than "radar".

Although all TRITON's missions remain classified, two missions have been declassified that indicate the skill of our Cold War Submarine Force. I'll discuss one:

This entailed the covert trail of a submerged Soviet ECHO II cruise missile nuclear submarine by USS GUARDFISH, a 594 (Permit) class submarine commanded by Dave Minton, during the period 12 May to 6 June 1972. GUARDFISH detected her contact while on patrol north of the Tsushima Strait (between Korea and Japan) an area familiar to many submariners. The contact was proceeding south toward US forces engaged off Vietnam. Once West of Okinawa, the ECHO submarine, turned Southeast into the Philippine Sea and the South China Sea where the ECHO conducted an anti-carrier patrol for 10 days. GUARDFISH remained with the Soviet submarine throughout until ECHO departed the Vietnam operating areas and proceeded northward through the Philippine Sea. These Cold War missions afforded us substantial intelligence information regarding Soviet operating areas, patrol habits and tactics, acoustic signatures, and tracks to and from station. GUARDFISH mission directly supported protection of 7th Fleet forces conducting operations in the vicinity of Vietnam and helped us understand Soviet anti-carrier tactics.

So we are here today with three generations of our Navy family to dedicate this building:

The first generation: the heroes, the legends, those of incredible bravery who dared the odds in diesel electric submarines with limited submerged endurance, cramped spaces, poor air, limited sensors, torpedo problems. It took 1600 patrols, 52 lost submarines, including TRITON I, and the lives of over 3475 submariners to win that war. Sailors, especially submarine sailors, were *Peacemakers* in World War II.

They had no choice but to fight to restore the peace in a terrible war we didn't start and didn't want. These peacemakers we honor for doing the dirty jobs of war that we, your grateful successors, might know peace and a better world.

The second generation here is the *Peacekeepers*. Following the legends, those heroes, the peacekeepers had a much different situation, winning a Cold War. With the advent of nuclear power and

subsequent technological advances we had a far more capable submarine: practically unlimited endurance illustrated by TRITON's circumnavigation, greater firepower, better sensors at longer range, a strategic weapon with incredible accuracy over thousands of miles, a tactical weapon that can strike far inland. We've taken a more active role internationally since World War II.

We learned that American strength, judiciously applied is an essential ingredient to peace preservation. The Cold War never went hot between the superpowers. The Submarine Force performed invaluable missions throughout, typified by USS TRITON II's operations and the aforementioned declassified patrol enabling us to develop countermeasures to weapons, understand the military capabilities and plan accordingly, to be more confident in dealing with the other superpower of the day.

Finally, there is the third generation, the 21" Century generation; those who serve today. Many of our sailors entering the Navy today were in kindergarten or grade school at the Cold War's end. The Cold War has no meaning for them. The book has started to be written on their exploits in this new Century. The pages are largely blank. The "War on Terrorism" is starting a violent chapter. Sailors, above and below the waves, will write that history with novel equipment, innovative techniques, skill and daring. We know they have the intelligence, the work ethic, the will to defend our Country. We have turned over to them a Navy that's smaller than we'd prefer, but with the unique, advanced capability such as a new carrier, RONALD REAGAN, Aegis cruisers, SEAWOLF submarines, VIRGINIA class submarines that are on the way, an all Trident ballistic missile Submarine Force, weapons and aircraft that can reach a long distance to take the fight to an enemy. Not a bad way to start. Their era undoubtedly will be demanding, thought-provoking, mentally and physically challenging. We hope they'll only have to be *Peacekeepers*, but we should never doubt their readiness to be *Peacemakers*. We look to them to keep the " torch of freedom burning for all" as John Paul Jones once said; that those who sing the praises of their service to our Nation 60 years from now will tout their successes, perseverance, and imagination in solving the problems of our Nation at sea.

USS TRITON, this building without "SS" or "SSRN" or "SSN" after it's name, in a sense follows in the tradition of the first two TRITONs. It is large. We *think* we know USS TRITON's mission, but the world changes and thankfully, TRITON III is large enough to accommodate a significant mission change. That's planning. We hope this building will make it's mark quickly; training the world's finest sailors of today's generation proudly to take their place with a fleet that extends American influence and Sea power, not simply *around* the world, but to the far ends of the globe. We trust TRITON will be led by professionals, skilled and serious in mission execution, if not loved, then mightily respected for their professionalism and performance. And again, we wish USS TRITON the Third, a long life in great service of the United States.

God bless those who have gone before us, those who serve today and those who will make this Country proud in this new century. God bless the USA.

# A SAILOR'S FAREWELL
## VADM MALCOLM I. FAGES ON HIS RETIREMENT
## 16 APRIL 2004 at 2:00 PM
## NAVY MEMORIAL, WASHINGTON, DC

Kirk, John, thank you for your warmth and kind remarks. They cause me to recall a story I once heard about a NYC Councilman named Chauncey Depew. Depew was making a rather long-winded, grandiose introduction of then Senator William Taft. He went on and on, ad nauseum, and in one particularly curious turn of a phrase characterized Taft as pregnant with courage and pregnant with integrity. When Depew finally concluded, Taft stood up to thank him and to begin his remarks. But before he offered his formal remarks, he wrapped his arms around his rather large belly and said, "Ladies and Gentleman, if I am pregnant and it is a boy, I shall name him Courage. And if I am pregnant with a girl she shall be known as Integrity. But if, as I suspect, the size of my belly is due only to gas, I shall refer to the condition as a case of Chauncey Depew." Now neither Kirk nor John is a gasbag, but for those of you who have heard me speak, I always like to start with a story. This one seemed appropriate for a ceremony in which there is often a tendency for, how can I politely say, verbal excess!

On a serious note, I am so proud of Shirley for all that she has done for our Submarine Force, our Navy, and our nation, and I am thankful that she could be formally recognized for contributions whose rewards are only psychic. Just as the recognition bestowed on me is an acknowledgement of all those with whom I have worked so closely, Shirley's recognition is also of the countless Navy spouses who have taken on leadership roles in our services. I salute you all. What an even more wonderful place our country would be if communities around the nation were blessed with so many caring people who give so freely of themselves as many of our spouses do.

I have given countless retirement speeches on behalf of shipmates. What an honor and how much easier than offering one's own remarks... What can one say to capture the lessons and significance of a life's work? Should the speech be inspirational? Should I offer forthright advice to the institution that has nurtured me for 36 years? Is it to be a round of thank you's and acknowledgements? Or should it be a final opportunity for reflection, to come full circle, to end the final chapter of a really great book, but in full anticipation of the next volume of the series. I have opted for *Reflections* as a theme and *how far we have come* as a framework...how far personally, professionally, as an institution, and as a nation.

As I opined during my welcoming remarks, I do feel a lot like the last man standing. There are no more than a handful on active duty today who were commissioned before me in 1968. The changes in the world since that ceremony on 22 August in Auburn, AL are profound beyond recognition. The country was truly in crisis. Vietnam was raging; men were dying by the thousands in SE Asia; campuses were rocked by riot and demonstration; racial tensions were high in the cities and race riots occurred on some of our ships. Many of us had joined primarily to avoid the draft and the Green Machine, and precious few, yours truly included, had any intention of remaining beyond initial service obligation. We were committed to doing our jobs, but in those years, for me at least, it was just a job. Certainly it was not the calling it would become. Most of us just wanted to blend in and be part of society. No better indication of that than the picture on the inside front cover of your program. You are looking at a full Lieutenant in the US Navy!

In those years there was no human resource strategy, there were no Family Service Centers, no Ombudsmen, no support for those left behind. It was an era that gave real meaning to being run hard and put away wet. Nine and ten month deployments were the norm, only to return home to port and starboard, or if you were lucky, three section duty. The Cold War was raging. The Soviets had nukes and they were aggressive. Surrogate conflict between East and West raged in Africa; preventing the domino theory in SE Asia was the organizing principle of the day; Russian subs outnumbered us three to one; submarine deployments were focused on protecting the

carrier against the cruise missile threat posed by Charlie class submarines and on holding the Soviet SSBN force at risk.

Today's geopolitical environment is unrecognizable from those early years, and missions have changed dramatically. I have been to Russia more than 20 times, have visited virtually every Republic of the FSU, have a warm, professional relationship with the VCJCS equivalent on the Russian General Staff, with whom I have co-chaired two NATO-Russia conferences focused on combating terrorism. The icing on this *through-the-looking glass, Alice in Wonderland* experience is the fact that I was recently awarded a medal by the Russian Minister of Defense for efforts to promote military to military cooperation between NATO nations and Russia. That, my friends, represents a long, long journey for a guy who grew up eyeing Russian stuff through a periscope.

I will never forget my first visit to Moscow in 1995, standing alone in Red Square, on a cold, snowy October evening, marveling to myself how far our countries had come from the dark days of the Cold War. Russia, of course, remains a vast work in progress. Lately, the trend lines for democratic ideals, as we know them in the West, have not been encouraging. That said, I remain cautiously optimistic about our future relationship with this vast country. So that, in a nutshell, is how far we have come, at least in this man's opinion.

Well, that's a world view. What have the changes been in the institution? In 1968, the Navy was a sorry institution. It was a hide-bound, lily-white, aristocratic, only men need apply outfit. We were rocked by racial tensions and infected with drugs. It was not easy to serve in those days. Military service was not held in high regard by the public. We knew only a conscript mentality and people were treated accordingly, officer and enlisted alike. Abolition of the draft in the early 70's was the most significant transformational event of the past three decades, and this enabled the Navy to become the service that visionaries only dreamed of. Today we are a force with no equal and no peer competitor on the horizon for another 15 years. The diversity of our work force is representative of society. We could not put our ships to sea without the contributions made by the women in the Navy. We are essentially drug-free. Our technical sophistication is eye-watering and most of the equipment is operated

by men and women in their 20's. Our non-commissioned force is the envy of every Navy on earth. This is no throwaway line. I have spoken of this with Chiefs of Defense from many NATO nations. More than the equipment, the size of our budgets, the support of our public, it is the quality of our force that these Chiefs of Defense covet.

CNO has characterized the nation's number one asymmetrical advantage as the genius of our people. That is exactly right and it is recognized around the world. Today our Navy has a very bright future. We have an operational strategy that maximizes our utility to the President as a war-fighting force or as tool of diplomacy. We are the iron fist in his velvet glove. My god, how wonderful it has been to be able to play a small role in this transition to greatness.

Well, what have I learned in 36 years? What are the enduring lessons from my career that I would wish to pass to those who still wear the cloth of service?

GATO was a great place to start. My first skipper, RADM (ret) Larry Burkhardt, was a man you would follow to hell. He was a warrior. There was no discernible gentle side to him, at least not on the ship. He had a short fuse and a fast burn rate and we measured the output of his temper in BEBs, Burkhardt Energy Bursts-megaton explosions that could melt flesh at 1000 meters. But, the storms passed quickly and one returned to his good graces as quickly as one could fall into disfavor. In those days, this style was not uncommon and it would be unfair to characterize a screamer in the negative way we do today. What the JOs learned from him in terms of submarine tradecraft was of the highest caliber. The lesson I carried with me through all of my years at sea was how critical it was to have well-honed war-fighting skills that had been tempered in the arena, not just in the trainers, and how those skills had to be founded on a detailed knowledge of one's ship. *Qualification in Submarines* with Larry Burkhardt was immersion in a crucible of fire.

Shirley and I were married near the end of that tour and rather than resign from service, as we had intended, we took a two-year assignment in Spain. We became fast friends with Gail and Alan McCurry, here today. Alan worked his tail off as the Tender RADCON Officer. My squadron job sent me to sea, but also gave us

an opportunity to travel. Our love for Spain and Europe was kindled here.

My department head tour as Engineer Officer on VON STEUBEN was not a happy one, but in retrospect I can say it was the only tour in 36 years I would characterize that way. I wasn't well prepared, never quite figured out how to improve, and always seemed out of sync with my Skipper. The takeaway-learning how you don't want to ever do certain things again is just as valuable- perhaps even more valuable- than the run of the mill positive experience!

I first came to know Al Konetzni at this career point and he is the reason I am here to today. If you don't like what you see, blame Al. At one point, I thought I should dedicate my remarks to him. Why, you may ask? Al was my detailer. Before getting underway for my last patrol on VON STEUBEN, I called him to tell him I intended to submit my resignation when we returned from sea. He immediately responded with what we called then "verbal notification of orders". In those days verbal notification of orders trumped verbal intent to resign. The operative SECNAVINST required a minimum activity tour at the next duty station before being again allowed to request to resign, and all of this was put into play with verbal notification of orders! As you can ascertain, the Navy was not too touchy-feely in the mid 70's. I was not happy with my detailer, but Al stuck to his guns and his intuition was good, and I am forever grateful that he maintained a hard line.

Shirley and I have never looked back. Two years on the NPEB in Hawaii taught me a lot about engineering that I hadn't learned as a DH. I had the opportunity to be a team member for an exam we gave to J. Guy Reynolds when he was a Tender CO. I saw this as an opportunity to get even. He had cleaned my clock as an NPEB Senior Member when I was Engineer on VON STEUBEN. So much for that strategy, his ship was evaluated as Outstanding in every area! Frankly, I don't know how Admiral Rickover ever saw fit to agree to my assignment to the NPEB, based on my DH experience. Even then, NR worked in mysterious ways!

Our XO tour on SEA DEVIL was really special. Mark Kenny was a young JO, the DCA, I recall. It was clear even then that he had a bright future and no one was more dedicated to mission than Mark.

Bob Boyce, one of the honorary side-boys, was a tremendous skipper who gave me wide latitude, taught me graduate level ASW, and most importantly, demonstrated by example how to balance life, work, and family. What's more, he demanded that we all do the same. There is no better way to learn how to delegate authority and give people the freedom to learn, grow, and yes, even make a mistake. I was an XO for 44 months. I don't recommend it but there was no better way to be prepared for command and that is where we headed next. No intervening shore duty. Life for my year group was, how shall we say, sea duty intensive!

Command of NARWHAL-what a marvelous three years! She was a one of a kind ship with a world-class crew. She had special characteristics that facilitated some very unique capabilities. RADM Ben Wachendorf was an exceptional XO and Payne Kilbourne was a knock your socks off Engineer. Jon Yuen, another of the honorary side-boys, was the caliber of Supply Officer for whom skippers would offer live animal sacrifices to have assigned. What did I learn from NARWHAL that I would wish to pass along? Not what you might expect. No, the ship was great, the crew unequalled, the operations stunning, and our waterfront reputation amongst the best. But, those are attributes of which many skippers could boast. From NARWHAL, I learned to deal with adversity, learned how to keep it sublimated, and how to dig deep and press on. On New Year's Eve 1986, at anchor in Palma, the anchor chain parted in heavy weather and before we got control of the ship's head, we grazed the bottom. Actual damage was minimal. We continued our deployment after the requisite inspections, and had great operational success. When we arrived home in Charleston, unbeknownst to me, I was presented an investigation report recommending an admiral's mast for myself and for others. I won't recount the details; charges were ultimately dismissed; but suffice it to say that the months of uncertainty as the process grinded along at glacial pace were very, very hard. So, what are the lessons? Be prepared to find those personal reserves you must call on at no notice. Recognize that nothing is more sacred than receiving due process, and finally, trust the system to generate the right outcome. I would later become a GCM convening authority and would have to rule on some very significant cases. The lesson of due-process was not lost on me. I demanded that every due-process

related benefit of the doubt be offered to those who came before me. NARWHAL saga ultimately ended on a very high note. I must say, though, that there was a period when I was certain I had topped out as a Commander.

As a Deputy Squadron Commander, following the NARWHAL tour, I was sent in to command BONEFISH, a diesel submarine, when her CO was detached for cause. Another phenomenal learning experience. Within weeks after getting her ready, and turning her over to the new CO, BONEFISH experienced a catastrophic battery well fire, while at sea. Several died and the ship had to be abandoned, and then towed back to port. Dealing with the families throughout the ordeal, which unfolded first on CNN, courtesy of the pilot of a small plane flying through the area, was another defining moment for me. I was later assigned as the Investigating Officer for the casualty, and that, too, was an experience that could not be taught.

I was then blessed with orders to command the NFAS in Orlando. This school provided apprentice training to every enlisted person who entered the nuclear propulsion program. I really understand why VADM Al Harms gets so excited discussing our Navy's education and training initiatives. I felt much the same way in those days when I witnessed firsthand how far we could take young people from a cross-section of America, fresh from Recruit Training, and after not too many months, turn them into skilled technicians. My takeaway: the value of strong enlisted and LDO leadership and mentorship. The enlisted staff and LDOs were the ones who made possible the metamorphosis of these young Americans. To give an example of the talent pool with which I was blessed at NFAS, Master Chief Jim Herdt, former MCPON, was my command master chief. At NFAS we learned that when you can capture their hearts and minds, control their environment, foster an atmosphere of growth and learning, and make it clear that homework and study were not optional, then the sky was the limit in what young sailors could be taught!

Command of PENNSYLVANIA, a Trident submarine, came next. The Soviet Union had just collapsed and it was a challenge to keep the crew motivated for a mission of strategic deterrence against an enemy that had just imploded. It was also a challenge to convince the Congress that an investment in the ultimate insurance policy,

which is what the SSBN force is at the end of the day, was a necessary expenditure of national treasure. Walt Yourstone, another of the honorary side-boys was my Exec, and like Bob Boyce had done for me on SEA DEVIL, I gave Walt the reins and he found his head. Don Kelso, son of former CNO Frank Kelso, and a rising star in his own right, was the Engineer and best in the Squadron. Ours was the number one ship in Kings Bay. That Team played a huge role in my presence here today. When I was sent to PENNSYLVANIA, I must say I was a bit disappointed that I had not been given squadron command. We Trident COs joked that we were not sure if we had been sent to major, minor commands or minor, major commands; but, there was a method to the madness. Our Force leadership wanted to demonstrate that there was a path to Flag from every conceivable vector. I'd guess it was part of our human resource strategy, though I doubt we referred to it in that way. Anyhow, it was another blessing to be given the chance to move up from this direction.

After PENNSYLVANIA I was awarded a Federal Executive Fellowship to Harvard for a year. I had completed an MA in Political Science while in command at NFAS and pol-mil affairs had become a new passion for me. One Friday afternoon I got a call from the Submarine Force Front Office asking if I would take an assignment as a Battle Group COS in lieu of going to Harvard. You can well imagine my "you've got to be kidding" response. I thought about it for the weekend, sought advice from mentors, and then said "what the hell", I'm a waterfront sailor. VADM George Emery, COMSUBLANT, had cajoled Jay Johnson, the TRBG CDR to try a submariner on for size as his COS. I was given the chance to pioneer, as one of the very first from the silent service. This was naval warfare at graduate level with two phenomenal teachers, Jay Johnson and Steve Abbot. Bosnia, Iraq, Haiti, major joint exercises, and broad exposure to big Navy were all part of the mix in this tour. I am convinced that this experience resulted in my Flag selection. My, oh my...this was the ultimate win-win assignment. If I didn't promote to Flag it would be a wonderful way to cap a career, and if somehow, I did get selected, there was no better way to be prepared for the challenges that would lie ahead.

My first Flag assignment was on the Joint Staff and this was my first DC tour as Director International Negotiations for General Shali. I had the arms control portfolio and the Former Soviet Union pol-mil desk. This was a great tour for a pol-mil junkie and it was the tour that would set me up for the NATO assignment. I was also a direct report to LTGEN Wesley Clark, and that too was an experience of a lifetime, albeit one that I won't describe! My takeaway from this assignment was a very nuanced understanding of inter-agency and national decision- making, and a recognition that there were points of view outside of DoD that occasionally had real merit.

Commander Submarine Group TWO and Commander Northeast Region-attack submarines; oversight of Naval installations throughout the NE US; privatizing excess Navy property; face of the Navy in the NE; interaction with the Reserves; learning more about the business side of the business; GCM convening authority; and even going to sea to certify SSN deployment readiness. This was a full plate and a wealth of opportunity...what a blessing to serve.

Three years as Director of Undersea Warfare for CNOs Johnson and Clark was the toughest assignment of my career. I walked in believing the future of the Submarine Force rested on my shoulders. Of course that was not the case but it did give one a certain edge to be a bit nervous about such things and I believe that holds for any assignment inside or out the service. The Navy was still organized around the major war-fighting platforms and it was the responsibility of the resource sponsor to maximize the resource allocation to his sector, with the certain caveat that the funds would be used to deliver executable programs which would provide real, needed capability for the Navy. I am proud to say that on my watch we delivered modernization, increased the SSN inventory, began the Trident life extension program, delivered the JCS SSN Study, set the stage and kept alive SSGN, and funded JIMMY CARTER. I offer no excuses or apologies for maintaining a laser focus only on undersea warfare programs during my three years. But then again, I wasn't hired to be the advocate for interplanetary space travel...or another resource area! Today, the Navy's focus on platforms has changed. I hope the pendulum has not swung too far and that we ensure complete intellectual honesty as we evaluate capabilities and decide where they must reside. The Submarine Force is a national treasure, with

national as well as Navy missions. I trust we will give this due regard in our deliberations.

My final three years at NATO was an over-the-top experience. Serving in an international organization at three star level, living in Europe, and working daily at level of Ambassador, Minister, and Chief of Defense was intellectually stimulating, eye-opening, and frankly, a bit of a heady experience. My job, in a nutshell, was to facilitate consensus military advice from the viewpoints of 19 NATO nations, in order to advise and inform the political decisions made by the Alliance. When I arrived at NATO, I also undertook a personal commitment to work towards improving military to military relations with Russia, which were at a low point after the Kosovo War. Today we have a NATO mission in Moscow, over which is flown the NATO flag. Think about that…a NATO flag in downtown Moscow! There will soon be a full time Russian military presence in General Jones' HQ at SHAPE, focused on improving Russian interoperability with NATO forces, with a view to joint action and joint decisions in peacekeeping operations. We now have agreed procedures between NATO and Russia for assisting in submarine escape and rescue, a development that came about following KURSK disaster. I was privileged to lead the negotiations for NATO that put these elements in place. Improvements in our military relationship with Russia have been profound and the implications for the future are staggering. I am humbled to have played a role.

The personal and professional relationships from NATO will last Shirley and me a lifetime. I must confess. We have gone to the dark side. We actually like most Europeans, even the French, and we enjoyed living in Belgium! The insights I have gained will, I imagine, form the basis for my next career. I will be forever grateful to the CNO for his confidence in my nomination and the Chairman of the Joint Chiefs for selecting me to complete my service to the nation in Brussels. When I first arrived at NATO, I was convinced that ours was the only right approach to world affairs and that if we listened to other nations, it was only to be polite. I leave NATO in full recognition that the composite points of view from nations big and small, from Old and New Europe, from governments of the Left and the Right, produce a world view that is the most appropriate for dealing with the challenges of the 21st century.

Yes, my friends, it has been quite a ride. I will never regret making the decisions to wear the cloth of service for 36 years. Few have the opportunity afforded me by my country. The standard by which we are expected to live is very high. Some would say we live in fish bowls. That is the price we pay to have the opportunity to lead, to influence the lives of countless thousands, to be afforded the opportunity to leave a legacy for the next generation, and to make decisions that could call for the ultimate sacrifice of those entrusted to our care. So the price is high, but the price is right, and it has been an experience for at least two lifetimes.

Shirl, Meredith, words can't do justice to all you have meant to me, and all you have done to keep me going, during good times and hard times. Meredith, watching you mature has been an intense joy and it has been a source of unfathomable pride to witness your accomplishments and your humanity.

Shirl, there is no way to capture how much of all that we have together is a direct consequence of all you have done for me, and with me, at my side, or on my shoulder, serving as my conscience. You are my touchstone. Ours has been a journey of love and commitment and discovery. We have had 32 joyous years together and I expect at least another 32 as we move to the next chapter of our lives. You raise me up, so I can walk on mountains; you raise me up, to walk on stormy seas; I am strong when I am on your shoulders; you raise me up to more than I can be. I love you.

Friends, family, colleagues, I thank you for sharing this fine day with the Fages family. Oh, how far we have come in 36 years, as a Nation, as a Navy, in my own professional development, and in a wonderful personal relationship with my family. Somehow, I made it to a rather lofty level in this outfit without ever being early selected; without front office exposure as an MA or EA; after having spent an unusual amount of time on the waterfront as a straight-stick nuke; a man who has stood at the wrong end of the long green table; who never attended War College; and who went to DC for his first assignment as a Flag Officer. If it can happen for me, take heart it can happen for any one of you in the audience. Work hard, stay focused, go where they tell you to go, worry about what you are doing today and not where your next assignment will be; maintain a balance in your life; keep your sense of humor; be blessed with a

loving family; and be lucky. That is my recipe for success and it applies whether one is 25 or 55, military or civilian. I humbly pass it along.

In 1963, John F Kennedy wrote, " Any man who may be asked in this century what he did to make his life worthwhile, I think can respond with a great deal of satisfaction, I served in the United States Navy". I say AMEN to that !

Admiral Donald, I am ready to go ashore.

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# NEW BATTERIES COMING FOR SUBMARINES

***By Robert A. Hamilton***

*Bob Hamilton is a reporter for The New London Day covering defense issues.*

As an electrician's mate striker on a diesel-electric submarine, retired EMCS (SS) James Christley recalls the dirty, dangerous job of checking the batteries every couple of days to see if they were charged properly or needed water, climbing through a tangle of pipes and getting his lungs full of sulfuric acid fumes.

"You could always tell an electrician coming from two blocks away in those days, because of the look of his dungarees, which had been eaten away by the acid fumes," Christley recalled. "Only the junior guys had to do it. One of the perks of seniority was you didn't have to go into the wells."

There were two types of boats in those days, the early two-battery boats that had 252 cells and a closed-cell ventilation system that was difficult to maintain, and the post-World War II Guppy (Greater Underwater Propulsion) boats with a simpler ventilation system that took half as much time to maintain, but with four batteries and 504 cells it still took about 2,000 man-hours a year.

Modern nuclear submarines have only one battery, with 126 of the 1,000-pound cells, and because they run on the reactor most of the time the battery wells stay cleaner and the maintenance requirements are reduced. In addition, improvements in the chemistry of batteries have made them safer, such as the use of calcium in the lead-oxide positive plate to reduce gas generation and water use. But it's still manpower intensive, taking up about 1,000 hours a year. And they still generate explosive hydrogen gas when they are charging or discharging, and have to be checked regularly to make sure they don't run low on water.

"And you're still crawling around on a thing that looks like an old car battery, and if you're doing that at sea when the whole ship is rolling you're going to get zapped once in a while," Christley said. "That's the life of an electrician."

But starting next year battery maintenance, a chore that's as old as submarines in the U.S. Navy, will become a thing of the past. The San Diego-based USS DOLPHIN, AGSS 555, has already been outfitted with a new generation of sealed battery cells known as Valve Regulated Lead Acid or VRLA batteries, and a Los Angeles-class will get the new system some time next year, said Rear Adm. William G. Timme, deputy commander for undersea technology at Naval Sea Systems Command in Washington, D.C.

VRLA technology has been available for more than 20 years, but until recently they didn't have sufficient energy density to be considered for undersea use. Better materials and design have yielded a product that makes sense for an SSN, and by 2010, the new batteries should be in use in all 72 attack and ballistic missile submarines in the fleet. The development work and original batteries will be done by Exide GNB Industrial Battery Division, Fort Smith, Ark.

Timme said one of his chief concerns in recent years has been that the company that makes the batteries uses about 15 percent of an otherwise unused old factory building in Kankakee, Ill.

"We're the only people still using these large, open lead-acid batteries, so they're getting more expensive," Timme said. "The company could walk away from this business at any time. The door is shutting behind us, and we have to do something about it."

David S. Brugger, plant manager for the Fort Smith operation, said the Illinois plant was constructed some time in the early 1950s, and is the only one Exide GNB has still producing the old lead-acid open-cell batteries. The Navy batteries only use a small fraction of the capacity of the building, he said, and the plant will be mothballed once the Navy production there comes to a halt.

The new batteries will be sealed systems, similar to what are used in cars today, which not only require less maintenance, but are far more durable than their open-cell counterparts.

"In a compressed design like we're going to be using, it can take a tremendous shock and still hold together, which is a distinct advantage for use on a warship," Brugger said. In addition, the VRLA battery won't leak much even if the casing is broken, Brugger said. "They're more like a sponge, because of the way it's con-

structed," Brugger said. "From a safety standpoint, that's a big plus in a submarine."

In addition, although there's a pressure relief valve on the VRLA battery, it would only vent in the event of a catastrophic failure that would probably be detected before it happened, he said. That means no more explosive and harmful fumes in the battery wells.

"It will actually charge and discharge, and all the gases produced during the process are recombined into the chemistry," Brugger said. "You notice the difference even in the plants where the batteries are built. You walk through a plant that is making flooded-cell batteries, and it'll clear out your sinuses. You walk through a plant where they're charging VRLA batteries, and you'll never even notice it. It's a noticeable difference."

Similar sealed-cell batteries are already in use in surface ships, as well as military aircraft and a variety of Army and Marine vehicles. The batteries also offer a longer power supply, and will take up less space than the flooded batteries that they will replace.

Submarine battery production will be moved to Fort Smith, Ark., in a plant that is decades newer than the Illinois facility. And there won't be the huge development costs typically associated with a military product.

"You're getting a technology that was developed commercially over the years, with a lot of improvements just in the last few years," Brugger said. "The product the Navy wants is one that we use extensively in the telecommunications industry, so all we're going to have to do is tweak it, just change the size and the internal geometry, and it will be ready to go."

The Navy is also hopeful that even with a smaller submarine fleet, the move to the new type of batteries will allow for competition in procurement contracts. EnerSys, a battery company in Reading, Penn., has already said it will enter the business with its thin-plate pure lead VRLA batteries, which offer a high energy density.

Timme said competition not only allows the Navy to negotiate for a lower price, but it no longer faces a situation where, if its sole supplier goes out of business, it would have to scramble to find another vendor.

# CLASSROOM PERFORMANCE IMPROVEMENT PROJECT
## Improving Submarine Training by Increasing Lecture Interactivity.
## A Pilot study using data from 1200 persons over a 3 Year Period at Trident Training Facility-Kings Bay, GA.

*by LCDR Al Brady, USN*

**Introduction**

With the advent of revolutionary computer-based training techniques in civilian classrooms, new methods of improving the traditional classroom have been discovered and perfected in corporate training classrooms and college auditoriums across the nation. One technique studied by Trident Training Facility Kings Bay (TTF) is improved classroom interactivity. Using the technique of frequently asked questions, this study investigated improvements offered by asking every student, rather than just one. The results of this study show the Science of Learning benefits found in the civilian world can also be obtained in a submarine training environment. This holds exciting promise for the future of all Navy training. These benefits include:

- Improve training effectiveness
- Reduce wasted time
- Increase training command (supplier) to war fighter (customer) collaboration

**Background**

"The bulk of the Navy's current professional development is based on the 'lecture and listen' teaching technique - the instructor lectures, while the student listens. Though lectures may be a good way of providing basic information, a greater percentage of information is retained through teaching methods that include student interaction."

The above quote, from the Task Force Excel "Science of Learning" website http://www.excel.navy.mil/science.htm, formed the basis of this pilot study. Underpinning this endeavor were the

learning benefits uncovered by William Thalheimer[1] that show learning improvements on the order of 150%. These techniques reduce the time to administer training and determine a student's weak area and are shown in figure 1 below.

| Learning Factor | Representative Minimum Improvements | Representative Maximum Improvements |
|---|---|---|
| **Retrieval Practice**<br>Retrieval practice – even without feedback – has been found to improve learning results. | 30% | 100% |
| **Feedback**<br>Feedback produces better learning results than no feedback.[1] | 15% | 50% |
| **Focus Attention**<br>Prequestions and learning objectives produce similar effects and improve learning outcomes when presented before learning material.2 | 5% | 45% |
| **Repetition**<br>When meaningful repetitions of learning material are provided, learning results are better than if no repetitions or fewer repetitions are provided.3 4 | 30% | 110% |
| **Motivation to Study**<br>Tests and other forms of examination are generally considered to motivate studying.[5] | Percentages Not Known | Percentages Not Known |
| TOTAL IMPROVEMENTS | 40% (a) | 150% (b) |
| | *a, b – to be conservative, the totals are divided by 2.* | |

**Figure 1. Thalheimer Science of Learning Chart**

These techniques-combined with 21st century technology-now enable instructors to tap into the vast unused portion of their 19th century classrooms to access the modern Science of Learning training benefits during Instructor Led Training (ILT).

Socrates discovered eons ago that students learn more from a lecture by answering questions than by being told the answer. Exercising the mind to make synapse connections recall recently learned (or forgotten) information, the brain paves those information super-highways to better retrieve the information later, i.e., improve recall. By asking the audience frequent questions during a lecture, the instructor exercises the audience's synapse connections and improves its memory recall capability. Additionally, the instructor receives feedback on the effectiveness of his lecture when questions are used after the fact. Pre-questions are used before a subject is presented to better tailor an instructor's approach to the subject based on the audience's baseline understanding. They can be used by the instructor to validate a benchmarked starting point on which to base further discussion, or to help highlight the audience to salient points upcoming in the topic at hand. Post-questions are posed after the instructor presents the topic and help to build memory recall skills in the respondents as well to ensure students are engaged throughout the lecture. How many times have sailors sat through a lecture, day-dreaming... the "lights were on" but "nobody was home," ...and the instructor could effectively tell the difference. Post-questions also help to determine when a sufficient portion of the audience understands the concept just presented in order to move off that topic and on to the next if a sequential train of thought is being followed. Review questions usually come a short period of time after the topic is presented and evoke the longer-term memory recall capabilities in the brain. The time spacing between the initial learning or *last-time-learned* of the material and the review question is important here in that, if too soon, the *information pathways* in the brain haven't had time to *cool* yet; if too long the they may have become *repaved*!

With the advent of low cost, reliable technology, each student attending the ILT can be required to respond-and therefore be engaged-throughout the lecture, especially effective in a military environment where participation isn't optional.

Thalheimer found improved performance results ranged from 40-150% in his settings. Nearly all of the high quality ILT settings on board a submarine use a Microsoft Power Point lecture given to a group or division of sailors (students; typically in 6-45 person training groups). By integrating technology into this training environment Thalheimer's learning factors can be better employed in our submarine learning settings as well and the results below show our initial benefits start upwards of 20%.

The computer-based technology used in this study is the Classroom Performance System (CPS) shown in the below figure. The system consists of software, infrared (IR) response pads (that look like a TV remote) and an IR receiver. This system was recently chosen by the OPNAV functional area manager for Training and Education as the sole application in its class for any future use on the NMCI network. This selection was based on a functional evaluation of a large number of similar software products in use today.


Figure 2. The components of the Classroom Performance System (CPS) showing five IR response transmitters, the receiver (top left) and the carrying bag with software.

Two shipboard physical settings are shown in figures 3a/b and demonstrate the small physical footprint this system requires and ideal suitability of such a system for the cramped submarine environment.


**Figure 3a. A wardroom onboard a submarine set up to serve meals and training.**


**Figure 3b. A crews mess onboard a submarine set up to serve meals and training.**

CPS response pads were assigned to each student during a Microsoft Power Point lecture. The instructor asked the students pre- and post-topic questions periodically through the use of pop-up type windows on top of the lecture slide (See figure 4). The students also received CPS quizzes at the end of a lecture covering material from that lecture or past lectures to assess memory retention and to engender more serious preparation. CPS pre-quizzes were utilized more often by ship-board instructors. This was used as a method for students to validate a lecture and to spend the remainder of the lecture period engaged in more productive endeavors than covering material that they had already competently grasped.

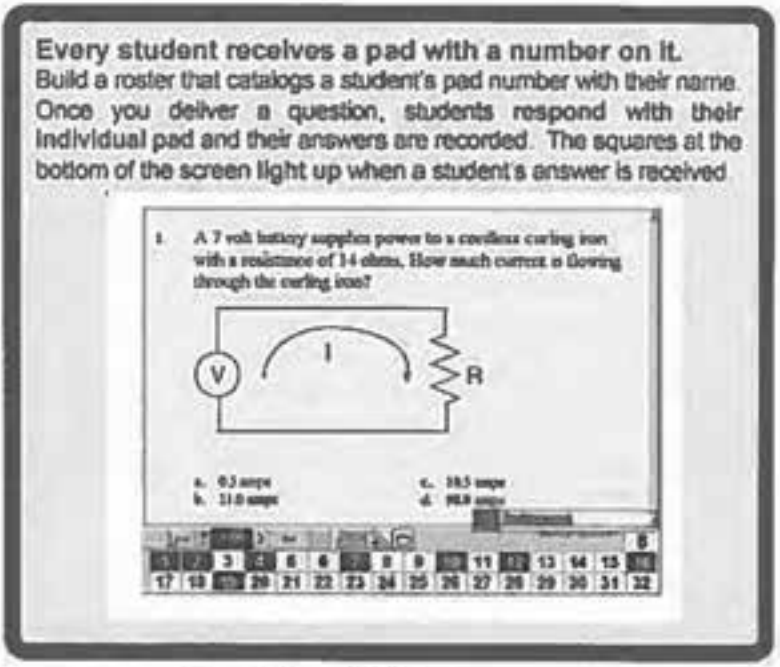



**Figure 4. Example CPS screen.**

These settings required only the preexisting computer set up for the power point system in use; therefore, the physical differences between the shipboard and TTF spaces were minimized. A TTF setting is shown in figure 5. The true target audience of this study is

the student at sea; a close surrogate was found to be the students at TTF, both in human and physical setting qualities.

**Figure 5. Interactively engaging students in a TTF KBay classroom.**

## Methodology & Results

This study used results from students at TTF and onboard 6 submarine crews based near TTF to study the Instructor Led Training (ILT) environment onboard a submarine. The TTF portion examined the final exam scores for classes taught by the same instructors both before and after the introduction of computer-based interactivity techniques. A survey captured student and instructor impressions of the new system, and a series of lecture observations by senior TTF staff determined interactivity improvements and lecture quality. Aboard ships, these techniques were introduced based on command priorities, and available results were investigated along with the results from the same surveys as above. Also, senior shipboard personnel were interviewed for their impressions of the new technology's enabling effect to save time as well as improve ILT effectiveness.

## Exams

Assessments are a normal part of any training environment. TTF exams and quizzes can be administered and graded using a multiple choice (MC) format in the Unclassified Corporate enterprise Training Activity Resource Systems (CeTARS)/ Standard Training Activity Support System (STASS). The results from these assessments are maintained in the Naval Education and Training Command (NETC) databases located in its Pensacola, FL headquarters complex and accessed by remote Navy instructors worldwide via the

World Wide Web. Selected classes were just starting, represented the target audience on board a submarine yet still had history data easily accessible for review. These courses were:

- Junior Officer Qualification Courses: Phases 1, 2 and 3
- Advanced SONAR Employment
- Missile Technician "A" School: Phases 1 and 3

Missile Technician (MT) A school instructors had tenures going back three years which enabled a long-term comparison between new and old techniques.

Instructors in each course were given a short initial training on the use of CPS and how to create good multiple choice content and how to access the large repository of submarine related CPS questions on the TTF Website. Using a one page handout, an instructor who has no familiarity with the CPS software can be up and using the system in less than a half hour. Reusable Learning Object (RLO) content was then quickly prepared for CPS use during lectures as outlined by the curriculum. Instructors taught their courses keeping in mind the Science of Learning factors outlined by Thalheimer. Researchers compared final exam scores for classes taught using CPS to previous classes. The extent of historical data used to compare current results differed for each class and was determined by the amount of time the current instructor had been teaching that course; one instructor had taught fewer than 30 students (JO1) while another had over 500 (MTA phase 3) to his credit. TTF results for exam score improvements are shown in figure 6 below. Analysis of this data shows an average improvement of 4.3% in exam scores for the 1,100-person sample size, with an average standard deviation (SD) improvement of 25%. The black "Hi-Lo" error bars in each column represent Exam SD. As students' grades went up, their scores became more tightly grouped about that higher average; this points to a more consistent, higher-quality *product* delivered to the fleet *customer* by using the interactive CPS learning environment. The numbers above the bars in the figure represent the number of students counted in that sample. The figure shows that all courses had improved exam performance. Even

instructors with less ILT experience (as represented by a smaller number of historical students to their credit) were still able to capture learning benefits, although (as expected) more seasoned instructors tallied the best improvements. Experienced instructors averaged exam score improvements of 4.4% with SD improvements of 3.0 as compared to 2.1%/ 2.1 for the less experienced instructors. Analysis of Variance (ANOVA) analysis shows the test statistic (exam scores) vary significantly from the control group (traditional teaching method) scores with a > 99% confidence interval.

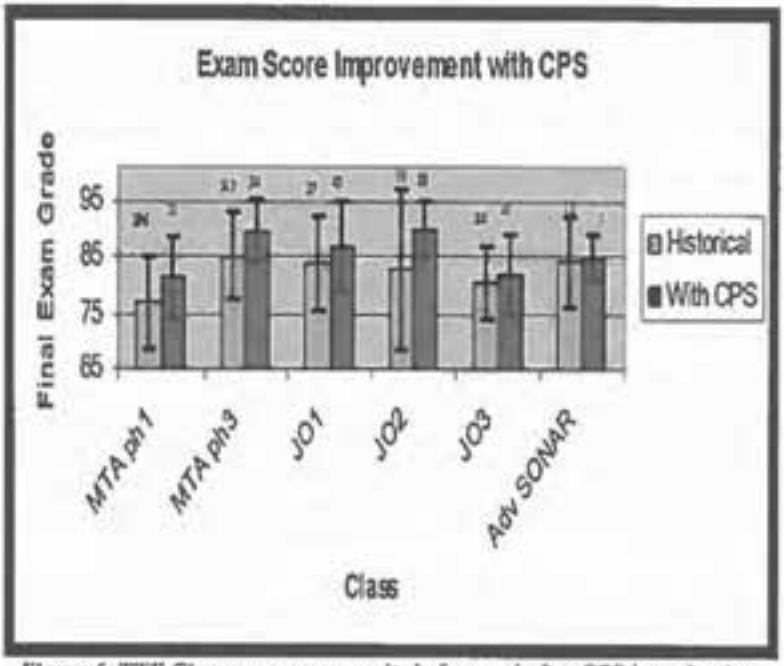



**Figure 6. TTF Classroom exam results before and after CPS introduction.**

Training topics on board a ship are continually changing, unlike the set curriculum of the TTF schoolhouse. Trend analysis over shorter periods of time, such as one deployment cycle, were required for this ship board setting. Figure 7 shows averages from one unit's weekly CPS quizzes. A weak area emerged early in the deployment and concerted effort was applied toward it. By the end, exam scores

in that weak area rose by more than 20% with an associated 35% SD improvement.

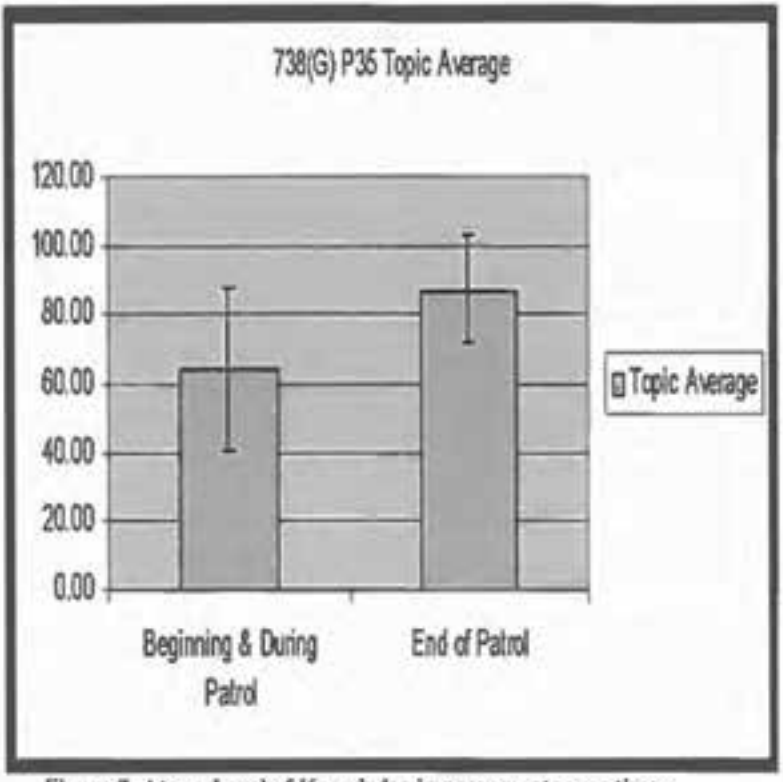
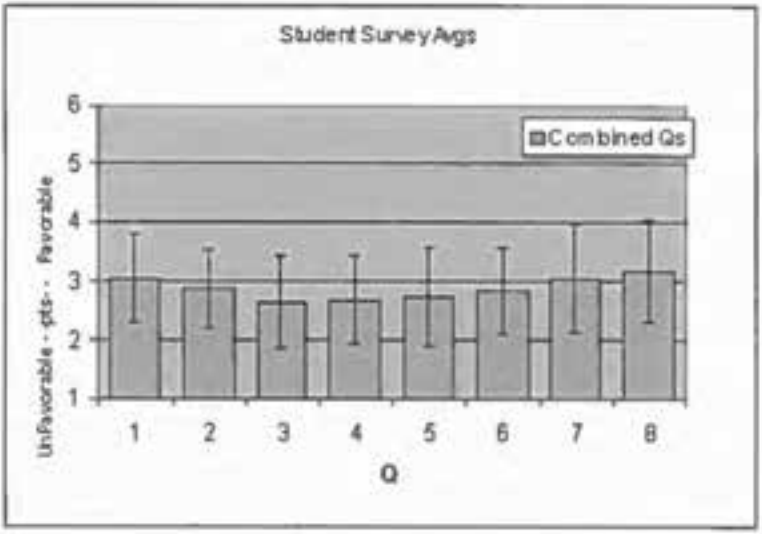



**Figure 7. At-sea Level of Knowledge improvements over time.**

## Surveys

Surveys were developed to capture the attitude of study participants toward these classroom improvement techniques. By doing an in-depth literature research and relying on Naval Postgraduate School's business research curriculum, a set of Likert Scale surveys were developed for students (Training Group Participants) and Instructors. The questions were set on a 1-4 scale with any score

above the center point (2.5) scored as a *favorable* attitude toward the study stimuli. (Results are shown in figure 8 while the surveys are themselves shown in figure 9)



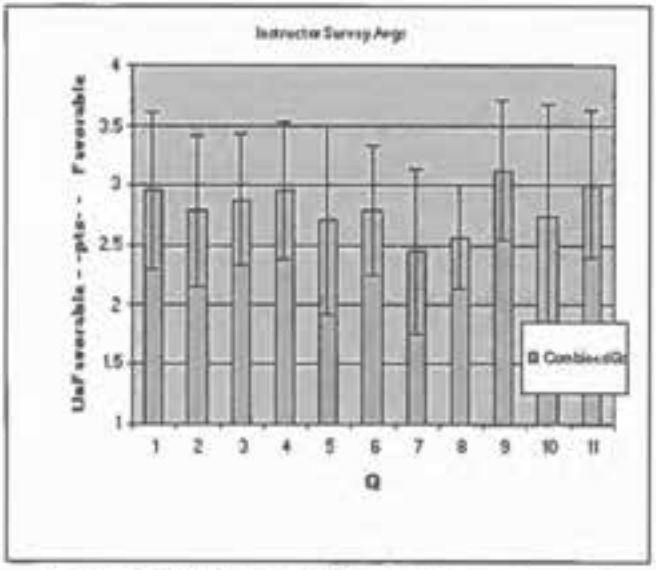




**Figure 8. 143 Students and 24 Instructors were surveyed.**

On average, all eight student questions presented to the 143 submarine and TTF students recorded an overall favorable CPS impression. Similar to the student surveys, instructors also had an overall favorable attitude on their 11 question survey. Note that instructor question 7 clearly falls below the midrange value, indicating that instructors felt that 'while using the wireless system, classroom lecture time was used less productively and the same material could not be covered in the same allocated time.' This question dealt partially with instructor CPS proficiency concerns. More investigation exploring the amount of material able to be covered in the allotted ILT period may be warranted. What may be discovered is that instructors put their backs to the students and just plow through the material at their own pace in the past, but now had to stop and receive feedback and possibly re-teach topics they had taught poorly. In reality, the effective amount of material being covered would actually increase because with this new system, no student can be ignored without the instructor's explicit knowledge.

Training Group Participant Survey

| A | B | C | D | E |
|---|---|---|---|---|
| Strongly Agree | Agree | Disagree | Strongly Disagree | No Opinion |

In light of your recent exposure to the wireless CPS system, please respond to the following statements using one of the above letters in the spaces provided.

1. ___ I have enjoyed using the wireless system.
2. ___ The wireless system helped me to learn material presented in the lecture.
3. ___ The wireless system helped me pay closer attention to the ideas and concepts presented in the lecture.
4. ___ The wireless system helped me understand the lecture better by catching and correcting my mistakes.
5. ___ Using the wireless system after a short lecture took time that could have been more productively devoted to lecture.
6. ___ I enjoyed the increased lecture involvement the wireless system provided.
7. ___ The wireless system increased my level of anxiety and tension and I had to participate whether I wanted to or not.
8. ___ I do not like active learning and thus do not like the wireless system.

Instructor Survey

| A | B | C | D | E |
|---|---|---|---|---|
| Strongly Agree | Agree | Disagree | Strongly Disagree | No Opinion |

In light of your recent exposure to the wireless CPS system, please respond to the following statements using one of the above letters in the spaces provided.

1. ___ I have enjoyed using the wireless system.
2. ___ The wireless system helped me to better understand presented in the lecture.
3. ___ The wireless system helped lecture participants pay closer attention to the ideas and concepts presented in the lecture.
4. ___ The wireless system helped increase learning outcomes by involving lecture participants in more active learning.
5. ___ Using the wireless system offers short lecture task time that could have been more productively devoted to lecture.
6. ___ I enjoyed the increased lecture involvement the wireless system provided participants.
7. ___ While using the wireless system classroom lecture time was used more productively and the material could be covered in the same class time.
8. ___ The wireless system assisted me to complete all the learning points within the allotted time and more course material was learned.
9. ___ The wireless system helped me to quickly survey the students understanding of basic points and identify points which students missed after a short lecture.
10. ___ Thought provoking questions stimulated the participants' desire to seek self discovery and provided them with the opportunity to compare their answers to those of the rest of the participants and their peer groups. The subsequent discussions explored issues at greater depth and encouraged participation from a much larger percentage of the participants.
11. ___ The use of Interactive Engagement strategies can increase course effectiveness well beyond that obtained with traditional methods.

**Figure 9. The surveys used for students and instructors.**

## Interaction

Interaction deals with the influence of one factor on the effect of another. For the purposes of this study, one unit of interactivity is defined as one instructor's question to the audience and one

associated student response. Although improved classroom interaction on the order of 1007% may seem high to the casual observer, when one stops to think about traditional training methods and this study's definition of interactivity, vast improvements become intuitive and almost a foregone conclusion (See figure 10)

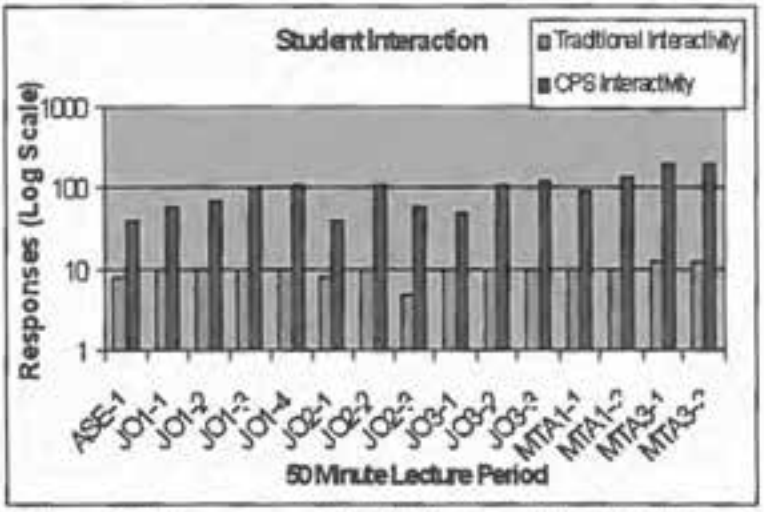



**Figure 10. Lectures were monitored for lesson quality and student interactivity.**

**Anecdotal Evidence**

All six senior submarine crew leaders provided interviews to researchers. Researchers then developed a set of lessons learned. In general, for the crews that adopted these approaches, CPS saved time and improved training effectiveness. Similar to the intuitive increase in lecture interactivity, the content collaboration between the SLC learning site (TTF) and submarine crews naturally improved. Increased collaboration also grew between TTF and SLC's Submarine On Board Training (SOBT) staff, the local Submarine Support staff and local Squadron staff. An appendix was included with the full report outlining these lessons learned.

**Conclusions**

Through a controlled pilot study involving six submarine crews, six TTF courses and over 1000 CPS response pads, Trident Training Facility Kings Bay demonstrated a commitment to the Science of Learning techniques espoused by Navy Personal Development Command (NPDC) and Naval Education and Training Command (NETC). The study highlighted the learning benefits Navy students and instructors could achieve through methods already perfected by Commercial Off-the-Shelf (COTS) systems. For a relatively minimal cost, the entire submarine fleet could be outfitted with the interactive hardware necessary to gain a substantial return on investment from:

- Improved training effectiveness
- Reduced wasted time
- Increased training command (supplier) to war fighter (customer) collaboration.

Learning benefits as outlined by Thalheimer and others show that 150% improvements over our current training methods are fully achievable and that the return on investment (ROI) analysis just on administrative time savings for senior submarine leaders alone could provide a break-even point somewhere within the 6 months of fielding the system.

**ENDNOTE**

1. Thalheimer, W. "The Learning Benefits of Questions." Retrieved 28 May, 2003 from http://www.work-learning.com/ma/PP_WP003.asp.

## SUBMARINE NEWS FROM AROUND THE WORLD

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*From the June 2004 Issue*

**SWEDEN–Viking Program Dead?**

On 02 June 2004, the Danish Government released its new white-paper Danish Defence Agreement 2005-2009 outlining Denmark's new defense posture. One of the provisions was for the phasing out of Denmark's Submarine Force, which effectively eliminated the Danish from the Viking Submarine Program. Denmark was one of the remaining two participants in the Viking Program, with Sweden being the other. Norway, the third participant, officially canceled its involvement in the Viking Program in April 2002 due to funding shortfalls.

Original plans were for the Danish Navy to purchase up to four Viking class submarines beginning in 2007. However, since 2003 it was reported that the Danish Navy would purchase two used Swedish Vastergotland class submarines instead of purchasing the new Viking class submarines, saving the Danish Navy over DKR 2B (US$325M) and further delaying the Viking in regards to Denmark. The sale of the Vastergotlands from Sweden would also reduce their Submarine Force from seven units to the required level of five units again allowing Sweden to delay its Viking participation until a much later date.

However, with the Danish Navy now departing the submarine business, the Viking Program, although not yet official, appears to be dead for the Swedish as well. With a requirement for five hulls over a decade away, it would make absolutely no sense to procure minimal numbers of hulls with technology that will be over two decades old when construction would actually start. When Sweden's Submarine Force does finally meet the end of its useful service life around 2019, it is questionable if Kockums will still be in the business of designing submarines. Therefore, if there is a follow-on class it may well be a HDW/Kockums design.

*From the July 2004 Issue*

**CHINA–Surprise, a New Submarine is Rolled Out**

In early 2004, China launched the first of a new class of submarine from Wuhan shipyard. Reporting from July 2004 indicate that this is the first time the new submarine has been observed publicly, virtually a surprise to sources outside China.

From AMI's analysis, the submarine appears to be based on the Russian Amur 1850 design, perhaps a larger version than the 1850. However, this has not been confirmed. In fact, Russian sources responding to AMI's query reported, ". . .does not belong to Amur type since Russia did not supply the submarines of this type to China and did not grant the rights for their license construction."

If true, this suggests that this is an indigenous design developed by China even though it is amazingly similar to the Amur 1850. Identified as the Yuan class, the submarine is a diesel powered attack submarine and appears to have followed the commissioning of the last Ming (Type 035) class vessel which was commissioned at the end of 2002 at the Wuhan shipyard. If the submarine began construction in mid-2002, it could have easily been launched by early 2004 and may be commissioned by late 2005 or early 2006. It is undetermined how many of the new Yuan class will be built, however, if the People's Liberation Army–Navy (PLAN) expects to maintain current diesel boat force levels (round 51 units), the sea service will probably build at least twenty units of the Yuan class to replace the aging Romeo class and the oldest units of the Ming class. Of note, Wuhan shipyard has consistently operated two submarine construction lines since the late 1960s (currently Song and Yuan classes).

Currently, the PLAN is involved in three diesel submarine procurements including the Song class of which seven units have already commissioned, the new Yuan class as well as the procurement of eight additional Kilo (Project 636) class submarines from Russia. This new program suggests that China will continue to build two classes of indigenous submarines while procuring foreign-built submarines from Russia in order to keep its industrial shipbuilding base intact while at the same time importing sorely needed technology from foreign sources.

*From the August 2004 Issue*

## UNITED STATES

### Proposed Revision of Naval Shipbuilding Plan

In August 2004, the US Navy (USN) announced its Proposed FY-06 Shipbuilding Plan, which has sent shockwaves through the naval community. What has Navy and industry officials concerned is the fact that only four ships are scheduled to be constructed in FY-06, which is a reduction of two ships from what was proposed in the FY05-09 Shipbuilding Plan. The worst hit by the proposed shipbuilding plan is General Dynamics Bath Iron Works (BIW) Shipyard.

With the last three DDG-51s being awarded in FY-05, BIW will have to wait until FY-08 for the second DD(X). Originally, the first DD(X) was scheduled to begin construction in 2005, but has now been pushed to the right by two years, and will not commence construction until 2007 and the second in 2008. With this pause in new ship construction, BIW faces the risk of having to lay off experienced engineers due to the lack of work. AMI International anticipates that the FY-06 Shipbuilding Plan will be fiercely debated right up until June/July 2005 when Congress is expected to approve the FY-06 defense budget.

A major problem for the Navy, is that it is attempting to build a transformational sea service under the strategy SEAPOWER 21 while at the same time, continuing with programs that were started under the pre-transformation era. As an example, the USN is attempting to procure at least 30 Virginia class attack submarines at the rate of two units per year in order to maintain an inventory of 55 attack submarines. The concept of a total force of 55 attack submarines was scripted before the USN's transformation ideology.

Due to new technologies, reduced maintenance requirements, and reduced manning, a force level of 55 attack submarines may not be needed. Recent studies suggest that the post-transformation Submarine Force may require as few as 30 units, although some USN and industry officials are still pushing for a force of 55 units. Other examples of pre-transformation force levels that may require reductions include Expeditionary Strike Groups (ESGs), which in this new plan have been reduced from 12 ESGs to 10. As a result the planned procurement of 12 LPD-17s is being reduced to 10. Other

programs will undoubtedly also be affected. Legacy systems such as those listed above, in combination with transformational programs such as Littoral Combat Ship (LCS), DD(X), CG(X), and Maritime Pre-position Forces (MPF) have forced the USN into an unattainable ship building program that needs to be rationalized.

The USN as well as industry officials must make some tough decisions in the coming years. Although the defense budget has grown by over US$100B in the last 5 years, the USN still does not have the funding to maintain its current procurement plan. The USN must make a firm decision on its pre/post transformational programs as well as taking an evolutionary approach vice a revolutionary approach for the post-transformation era programs. With programs such as LCS, DD(X), and CG(X), the USN is currently moving away from the evolutionary approach. The revolutionary approach that the Navy is taking may increase the risk to transformational programs substantially as can be seen by Congress' reaction.

This confusion in the shipbuilding plan is simply a symptom of the important debate being conducted by the U.S. Congress, the DOD and the Navy in their effort to establish a level of capability that will meet the needs of the nation. The leadership is finally admitting that the *bow wave* of large number of new ship construction, which is always found in the out years of the Future Year Defense Plan (FYDP), is never going to come. A clear course for the Navy is unlikely to be in place until the FY08 budget, the first budget that will reflect the policy of the next Quadrennial Review.

**INDIA—Hike in Defense Budget**

Press reporting of 10 August 2004 indicates that the Indian Armed Forces may receive a substantial increase in the 2004-2005 defense budget. The new national budget drawn up by Parliament, which is over four months late (should have been approved in April), raised the overall defense budget to US$16.74B for the 2004-2005, up US$3.14B from the US$13.6B 2003-204 budget.

The majority of the increase is to pay for recently approved procurement programs such as the Hawk trainers, Su-30s fighters and the Phalcon early warning aircraft for the Air Force and Howitzers for the Army.

Specifically for the Indian Navy, the sea service will receive US$2.7B or 16% of the budge total and US$400M over the 2003-2004 budget. Procurement funding increased from US$1B in 2003-2004 to US$1.3B in 2003-2004. The funding increase is expected to fund new and continuing programs such as the:

- Aircraft carrier GORSHKOV
- Six SCORPENE submarines
- Funding for a new deep submergence rescue vehicle (DSRV) program
- Six Barak surface-to-air missile systems.
- Lead funding for the Air Defense Ship - now with the design assistance of Fincantieri.
- Possible lease of an AKULA II class submarine from Russia.

Although the procurement increase is considered significant for the Indian Navy, these major increases were needed by the sea service in order to carry out its ambitious naval plans as set forth in fifteen-year naval plan 2002-17. Without the injection of additional procurement funding this year and in future years, the Indian Navy will find it difficult to re-capitalize and expand its fleet as envisioned under the current naval plan.

For the Indian Coast Guard, the proposed budget for 2004-2005 is US$152M, an increase of US$10M over 2003-2004 levels. Some of these funds will be utilized for continued acquisitions of the Advanced Offshore Patrol Vessel (AOPV) program, which began in 2004.

## GERMANY, NETHERLANDS

### Plans to Revive Stalling Shipbuilding Industry

Since early 2004, naval shipyards in Germany and the Netherlands have both begun to look at ways to stop the impending slow down due to a lack of naval shipbuilding orders. Both navies, with major modernization programs completing in the past several years in conjunction with continued reductions in force levels have left the shipbuilding yards in both countries looking forward to very difficult times.

The German Navy, due to recent force reductions and the cutting back of future programs, is now in the process of completing its last major programs for the foreseeable future, leaving the ship building industry in search of future work. Major programs that will be completing in the next several years include the SACHSEN (Type 124) class destroyer program, of which the final unit will commission by 2005. The Type 212A program, initially thought to be a class of up to twelve units, now appears to have been reduced to six units with the final three units of batch I (first four units) due to commission by around 2006 and two additional units scheduled to be ordered in 2008. The main shipbuilding program that was expected to carry the shipbuilding industry for the remainder of the decade was the 1,600-ton K-130 corvette program with a total of 15 units.

However, in the latest rounds of reductions in April 2004, the German Ministry of Defense announced that the K-130 corvette program would be reduced from its original number of 15 to 8 or perhaps even as low as 5 units. Additionally, the German Navy's plans for two large Amphibious Transport vessels was also canceled and the future Type 125 future destroyer, expected to start in 2013 was also reduced from eight units to four.

The only bright spot in the latest reduction announcement was that a third Berlin (Type 702) combat support ship would be built. This single Berlin class in conjunction with eight K-130 corvettes will apparently be the mainstay of naval construction for the shipbuilding industry through 2014, which is very light considering three major shipyards generally split the majority of work for the navy.

What these cutbacks have lead to is a push from various circles within the Germany Navy and the shipbuilding industry to move up the construction of the Type 125 destroyer program by several years to 2010 and the two additional units of the Type 212 submarine to 2006 from 2008 to reduce the gap in naval building programs. Press reporting indicates that the Defense Ministry has in fact also moved in the same direction in order to avoid any slow down at the nation's shipbuilding yards. It appears that the biggest stipulation is that the yards must provide advance financing in order to move forward with the Type 125 as well as batch II (units five and six) of the Type 212 submarine. German budget regulations do not allow for the financing

of programs, which will leave it entirely up to a slowing and consolidating shipbuilding industry to work out the financing terms. It appears that financing models are now being discussed by Thyssen Krupp (owner of TNSW, Blohm + Voss, and HDW) in order to proceed forward with a new time schedule for both programs.

If there is a failure to advance these programs as currently planned, HDW and TNSW completing the first batch of the Type 212 submarine program by 2006 will be out of domestic submarine work until 2008 and TNSW completing the Sachsen class destroyer program by 2005, will only be left with portions of the domestic K-130 corvette program, which will be shared with Blohm-+ Voss as well as Luerssen Werft.

One bright spot that exists within the German Naval Industry is its export opportunities in cooperation with other indigenous and international corporations such as Thales Naval Nederland, EADS, Atlas Elektronik, Raytheon and Lockheed Martin that may assist in bringing in new orders. One prime example is the German Navy destroyer SACHSEN (F219), which just finished successful test firings of Raytheon's STANDARD Missile 2 and ESSM from the Lockheed Martin MK 41 VLS during the month of August 2004. This advanced destroyer with its European developed combat management system (Thales Naval Nederland, EADS, ATLAS Elektronik, and others) proved its ability in managing the world's most advanced and robust anti-air warfare missile solutions.

The test firing results signify the great success enjoyed in US and German cooperation. This cooperation is further highlighted in that the builder of the SACHSEN (F219), Blohm+Voss, has also enjoyed great export success of its various MEKO Frigates, most of which have been outfitted with U.S. weapon and other key system solutions. Blohm+Voss also developed the MEKO containerization system. For example the German Navy frigate SACHSEN (F219) has MEKO containers with the U.S./German developed RAM launcher, as well as the Lockheed Martin/United Defense Mk 41 VLS. This type of system makes great sense for flexibility in changing out various weapons, sensors, and other mission systems on a ship - much like is envisioned on Littoral Combat Ship. Indeed, Blohm+Voss is teamed with Lockheed Martin for the Littoral Combat Ship.

This cooperation of German shipyards with other international corporations could very well also be an alternative to the slowing of the German naval industry as a result of declining orders from home.

The Netherlands' shipbuilding industry also faces a similar situation. With the De Zeven Provincien class destroyers being completed by Schelde Naval Shipbuilding in 2005, the shipyard faces a similar crisis as in the German shipbuilding industry. The original plan by the Dutch Navy was to follow the De Zeven Provincien class destroyers with a smaller class of corvettes in order to replace the Karel Doorman class frigates. However, in late 2003, the Defense Ministry released its latest white-paper, Integral Defense Plan (IDP) 2004-2013, which cut the frigate force from ten units to six, effectively canceling the corvette program in favor of a new frigate program with construction beginning in 2016.

In recognition of the dire consequences to the nation's shipbuilding industry, the National Maritime Cluster (NMC) (all the major Dutch naval players are represented, such as Thales Nederland, Imtech and Damen Shipbuilding) ordered a study by the Clingendael Center for Strategic Studies (CCSS) In April 2004.

The Clingendael study highlighted the naval force that will be needed to meet the RNLNs current and future requirements and follows several other studies recently conducted by the Research and Technology Organization (TNO) and the Policy Research Corporation (PRC). The basic conclusion of the study is that the RNLN has a requirement for a new force of corvettes as well as a large helicopter support ship (HSS) to replace the ZUIDERKRUIS fast combat support ship (AFS) as well as serve as a general-purpose amphibious ship (LHD). The study believes that the LHD should begin no later than 2006, which would be beneficial to schedule Naval Shipbuilding since it will have no naval work following the commissioning of the two Sigma corvettes for Indonesia in 2007. Additionally, if the canceled corvette program (four units) would be re-instituted starting in 2008, Schedule Naval Shipbuilding would have naval work through at least 2013 or 2014 significantly closing the gap with the future frigate program, which is presently scheduled to start in 2016. If these programs do not materialize, Schelde Naval Shipbuilding could literally be out of the naval new construction business for the better part of a decade.

## RUSSIA

### Increasing Defense Budget for 2005

Reporting on 24 August 2004 indicates that the Russian defense budget for 2005 will be increased by 28% over 2004 levels. The 2005 overall government budget of US$114B was approved by the Cabinet and contains US$18B for defense. The higher budget is a trend that started over four years ago when President Putin took power and reflects his personal commitment to rebuilding Russia's defense.

Russia's defense budget has grown steadily from US$5B 1999 and 2000 to US$7.5B in 2001, US$8.3B in 2002, US$11B in 2003 and US$13.5B in 2004. The increasing budgets in conjunction with the de-militarization of the country since the end of the Soviet-era in 1991 are finally starting to pay dividends, although this must be considered only the beginning. It also appears that the Russian economy is finally starting to stabilize with significant growth rates over the past several years enabling the country to invest more in defense.

Although the budget continues to increase, the Russian military services are trying to make up for over a decade of neglect and the higher defense budget is only the beginning of what is really needed over the long term. The importance of the recent defense budgets is that the Russian Armed Forces may have finally stopped the slide of the past decade and be headed in a positive direction.

For the Russian navy, additional funds will enable the sea service to finally move forward with stalled programs such as the BOREY (Project 955) class nuclear-powered ballistic missile submarine (SSBN), YASEN (Project 885) class nuclear-powered attack/guided missile submarine (SSN/SSGN). SAINT PETERSBURG (Lada - Project 677) class diesel submarines, STEREGUSHCHY (Project 20380) class corvettes and SCORPION (Project 12300) class fast attack craft (FAC). All of these naval programs have been on hold for the better part of up to five years.

For complete details on these and other naval and Border Guard programs, see the new Russian country report that will be released by AMI International by 15 September 2004.
Http://www.amiinter.com/wnpr/russia/index.html

# LEVERING SMITH CHAPTER OF THE NAVAL SUBMARINE LEAGUE

*by Captain William Bancroft, USN (Ret)*

The Levering Smith Chapter of the Naval Submarine League began its life on July 10, 1990, when Admiral R. L. J. Long officially signed the document establishing the sixth chapter of the Naval Submarine League, initially named the Central Florida Chapter because of its location. The Levering Smith Chapter has the responsibility of encouraging continued interest in submarines all the way from Orlando, Tampa and south to Miami.

A few months ago, during a Board meeting, someone suggested that naming the Chapter after a significant contributor to our Submarine Force would be a good idea. Immediately the name of Vice Admiral Levering Smith came up as the person most appropriate for a Central Florida Chapter as many of us who had worked in the program remembered Admiral Smith coming to our Chapter's area for almost every US and UK SLBM launch– if not all of them.

The Cape Canaveral area, the center area of our Chapter, has been and continues to be the focal point of all SSBN FBM Weapon System Testing. All 41 boats of the "41 For Freedom" passed through *The Cape*, as well as all of the Tridents. FBM testing operations continue to be conducted at *The Cape* and should be for some time.

Vice Admiral Smith graduated from the Naval Academy in 1932 and served in various billets on board the battleship USS TEXAS. During World War II he served as USS BULMER's Executive Officer and later as Flag Lieutenant on the Staff of Commander Task Force 17 and as Chief Staff Officer to Commander Task Force 67. He participated in eleven campaigns and engagements in the Pacific and survived the sinkings of the carrier USS HORNET and cruiser USS NORTHAMPTON. His last battle, with guns, was in the Battle of the Philippine Sea as Gunnery Officer of the cruiser USS INDIANAPOLIS. In September 1944 he returned to the Navy Department and served in various ordnance commands culminating in 1954 with his command of the Naval Ordnance Missile Test

Facility, White Sands Proving Ground, New Mexico before joining the FBM Program in April of 1956.

The FBM Program began in December 1955 when Admiral *Red* Raborn was called back to Washington by the then CNO Admiral Arleigh Burke, and given a task to develop a 1500 mile sea based ballistic missile system. Admiral Raborn was allowed to pick his own people and in April 1956 he asked then Captain Levering Smith, a proven and respected ordnance expert, to join the Special Projects (SP) team. Captain Smith was given responsibility for SP's Missile Branch and in June of 1957 took charge of all SP's Technical Branches as its Technical Director. In September of 1961, because of Captain Smith's unusual talents and significant contributions in the scientific field, President Kennedy bypassed the selection board process and directly selected him to the rank of Rear Admiral. The promotion was made permanent in April 1963. In 1965 Admiral Smith became the Director of the Special Projects Office, a position he held until his retirement in November 1977.

Vice Admiral Levering J. Smith was a most prominent force in the development and deployment of the FBM Weapons System, where all of its developmental and demonstration missile flight tests have been conducted at *The Cape*. Having been recognized for his achievements by many, his most cherished may have been when, in 1972, he received a *High Order of Chivalry* from Queen Elizabeth II of England making him an *Honorary Knight Commander of the Most Excellent Order of the British Empire*. Sadly he left this world on April 5, 1993, but his personal integrity and professionalism will always be remembered as the catalyst that produced an effective and reliable strategic deterrent for this Nation. The members of the Naval Submarine League here in Central Florida are proud to call their chapter the Levering Smith Chapter.

# PRESERVING OUR SUBMARINE HERITAGE

*by LCDR Austin T. Jordan, USN(Ret)*

*Lieutenant Commander Austin T. "Butch" Jordan is a retired limited duty officer who qualified in submarines (enlisted) as a YN3 on board USS ALBACORE (AGSS569) in January, 1967. He is currently serving as Executive Director, The Hartford Guides, Inc., a nonprofit community service agency located in Hartford, Connecticut.*

Few would diminish the contributions of USS NAUTILUS (SSN571) in making the United States Submarine Force what it is today. And for those whose education has been incomplete, a visit to the Submarine Force Museum in Groton and a tour of the historic ship is particularly helpful in developing an understanding of the early years of the nuclear submarine and the beginnings of modern undersea warfare.

In addition, there are many who would argue that another submarine, commissioned one year earlier than NAUTILUS, made an equally important contribution to the development of modern submarine design, operation and technology. Although much less known to the general public, one need only look at the groundbreaking hull design of USS ALBACORE (AGSS569) to understand that her role was of no small significance in *shaping* the design of the undersea platforms of today.

So what's the point: that my submarine is more important than your submarine? Of course not; the point is that, as of this writing, of the over 600 submarines[1] that have proudly served our nation as commissioned vessels, only twenty have been preserved for future generations and each has a unique story to tell. From Portsmouth, New Hampshire to Honolulu, Hawaii and at eighteen other points in

[1] Hull numbers 427 through 434, 436 through 474, 491 through 521, 526 through 554 and 556 through 562 were authorized but never built, cancelled before construction was completed or built but never commissioned.

between, the *old boats* are out there for all to see. And nearly all of them are in the care of private organizations who have taken on the task of displaying these monuments to our proud *underseafaring* heritage.

Since 1984, for example, the historic ship ALBACORE has been open to the public in Portsmouth, New Hampshire under the auspices of the Port of Portsmouth Maritime Museum Association, a private nonprofit organization in whose care the historic ship is entrusted. Not surprisingly, funds to preserve and display our privately held historic submarines, like ALBACORE, are not easy to come by. Many organizations, like the Port of Portsmouth Maritime Museum Association, are hard pressed to generate sufficient revenue to develop and present interpretive programming for the vessels in their care and still pay the bills they incur just to keep the doors open.

So what's the answer? Some of us who served in ALBACORE, with the custodial organization's support and endorsement, have formed a group we call *Friends of Albacore*. Our mission: "...to preserve, maintain and present the historic ship ALBACORE in a manner befitting her important role..." in submarine history. One of the more significant (and challenging) aspects of our mission is fundraising. Yes, sir, we've hoisted that task aboard! At a ceremony that doubled as both a reunion and a commemoration of the fiftieth anniversary of the ship's commissioning, the commissioning Ship's Superintendent Steve Cuff conveyed a generous challenge grant of $25,000 to ALBACORE with the understanding that it must be matched dollar for dollar through the efforts of ex-crewmembers and that the money be used for presentation of the ship to the public.

Appropriately, the *Friends of ALBACORE* are rising to the challenge. We've written to every former crewmember for whom we have an address, contacted regional and community foundations as a first step in initiating a grant writing campaign, are taking steps to involve the local community and are developing a periodical ad campaign intended to reach out to others who may have an interest. We have some other ideas, too, but they're not sufficiently developed to discuss publicly at this point. We've received excellent response from the crew, found that the foundations are most definitely interested and learned that we've still got significant growth potential with the rest of our ideas.

And just what, you may ask, do we intend on doing with the money that we raise? In addition to the usual presentation requirements, projects that are on the building ways include: a crewmember oral history project, interactive shipboard exhibits, updated and enhanced promotional and educational material, docent crewmember of the month and student docent programs, public/private school outreach and a variety of others.

Lest you think our expectations may be too lofty, there are those of us in *Friends of ALBACORE* who either work in the nonprofit sector or who serve on nonprofit boards. We do understand the process and the pitfalls. Our approach to the task at hand is one of realistic optimism and we have charted our course accordingly. That said, the sign outside our door reads "New ideas always welcome." Drop us a line if you've got one, are interested in learning more about what we're doing or you'd like to participate financially in the Steve Cuff challenge. Our address is: *Friends of ALBACORE, P.O. Box 392, Kittery, ME 03904-0392.*

*USS Albacore as a dry berth exhibit in 1988. Photograph provided by Portsmouth Maritime Museum and Submarine Memorial.*

***SEA STORIES***

## THRESHERS GRIPPING SAGA

***by Billy Grieves***

*Billy Grieves enlisted in the Navy April 13, 1939 at the age of 18. After Submarine School and duty in USS R-10 he was assigned to USS THRESHER (SS-200) which went to Pearl Harbor in April of 1941.*

*During World War II he particdipated in 13 war patrols, 11 aboard THRESHER and 2 aboard LIZARDFISH (SS-373). He served as a TM 1/c in charge of the Forward Torpedo Room and was awarded the Submarine Combat Pin and 2 Bronze Stars.*

Many of our boats had exciting stories to tell of patrols in WWII. But the THRESHER (SS-200) story was unique. No submarine in history ever went through an attack like THRESHER's fourth war patrol

On the day of departure from Pearl, we picked up our escort, the old "four-pipe" destroyer, LITCHFIELD, in the harbor and following closely in her wake we transited the channel and the mine field and turned west toward the Marshall Islands. In due course we passed Midway Island and the International Date Line and approached the Marshalls at the island of Maloelap. The first day on station the skipper, CDR Bill Millican, sighted a four ship convoy coming through the channel. But the last ship in line was a tanker and, in compliance with orders by COMSUBPAC to sink the tankers first, we let the first three go by and fired two fish at the tanker. One hit. She burst into flames and sank in two minutes. The escort attacked and dropped nineteen charges during the next couple of hours but we surfaced after sundown and escaped in the darkness.

The next day we approached the Island of Kwajalein submerged through a pass called Gea Pass. Gea Pass is good submarine water. The pass is deep and wide enough to maneuver in and we had learned that Kwajalien was now the eastward most naval base of the Japanese navy. We could just picture a nice big aircraft carrier or a

big, fat battleship. To hell with these tankers, we wanted a man-o-war. Throughout the day the skipper sighted several ships through the periscope including three "I boats" (Japanese submarines) but none came within torpedo range. At sundown, we surfaced but remained in the pass.

As dawn approached, the batteries were charged and the cooks had finished their baking in time for the ovens to cool down. We dove just before sunrise. It was about 0800 hrs. and the skipper raised the periscope for his regular sweep when he was momentarily blinded by a flash of white light through the scope. When his eyes became accustomed to the light he could see it was the sun gleaming off the side of a brand new ship. Her decks were lined with Japanese sailors in white uniforms. *Great!* A navy ship! She was the 4,836 ton Motor Torpedo Boat Tender, SHINSHO MARU. She was steering a straight course without escorts! The sky above was dotted with aircraft but a ship, holding her course and speed and without escorts, which comes within a submarines torpedo range. . .*is dead meat!* The set-up was perfect.

The skipper took his first bearings: "Range, 7000 yards. . .angle on the bow, 5 degrees starboard . . . estimated speed, 12 knots. Down scope!" Now, this was the way a torpedo approach was made: The periscope was raised for only a few seconds because it left a white "feather" on the surface which could give our position away. And we knew there were lookouts on the flying bridge of that target, sweeping the water with binoculars, looking for periscopes. So a torpedo approach consisted of a series . . . maybe 12 or 15 . . .sometimes more depending on the chase . . . of very brief bearings until the skipper could determine the exact course, range and speed of the target. These factors were then fed into the torpedo data computer in the conning tower together with our own course and speed and the torpedo speed. The computer then transmitted the proper angles to the gyro regulator between the tubes and from there to the gyros of the torpedoes in the tubes. As the target drew near, these angles gradually reduced to zero. The torpedo could be fired as much as 160 degrees to port or starboard but the ideal shot, to avoid error, was a straight bow shot . . . zero degrees. In the torpedo room we knew exactly when we would fire.

As the target came within range we were ordered to make tubes three and four ready for firing. I had the starboard bank and went to work on number three while my buddy, Charlie Fry, made ready number four. In short order we raised the ready-to-fire levers giving them the light in the conning tower. As the target angle approached zero the skipper ordered, "Final bearing and shoot! Up scope!". He zeroed the periscope on the target, checked the azimuth overhead, and said, "Stand by three!" Then: "Fire three!" and five seconds later by the skippers wrist watch: "Fire Four!" The boat shuddered with the recoil. In the torpedo room we listened in dead silence as the fish sped down the track.

But the torpedoes were not set to strike the target. The were set to pass *beneath* the target. Because the exploder on the Mark XIV torpedo contained a magnetic feature which, when the torpedo passed within the magnetic proximity of the hull, detonated the war head at the ships most vulnerable point, her keel. Salt water is incompressible and an underwater explosion can only go one way . . . *STRAIGHT UP!*

The wait was short because the range was under a thousand yards and the . . . BLOOM! And five seconds latter . . . BLOOM! Two hits! The first fish passed directly beneath the bridge and when 600 pounds of *Torpex* exploded, it blew the entire bow off the ship. The second fish passed beneath her quarter and blew the stern off. Within two or three minutes the three sections sank beneath the surface in a huge cloud of steam. Breaking up noises were clearly audible for some time as SHINSHO MARU's watertight compartments ruptured. Where the ship had been the water came alive with white uniforms of survivors.

The skipper knew that somebody would be coming out to rescue those sailors and when they did, we would be here to meet them.

We were cruising slowly at periscope depth, the scope was down, the boat was silent . . . when suddenly the loudest, most violent explosion we had ever heard went off right beneath our bow! We were rudely reminded of a basic fact of modern warfare . . . aircraft carry depth charges too . . . but we were lucky.

Where the charge went off right beneath the bow, the configuration of the hull is very narrow. Most of the charge passed us and went to the surface. Had the charge exploded five seconds

later beneath the For'd battery or control room . . . THRESHER would have been history.

The bow erupted with such violence that men sitting on the bunks were lifted clear off the bunks. Men standing back aft were thrown to the deck and Charlie and I grabbed onto our tubes and hung on. The order came out almost immediately: "All ahead full! Depth, 300! All compartments check for damages!"

I checked my starboard bank and the bilge, Charlie checked the port bank, other guys checked the Pitometer Log well and the sound heads. . .no damage. The man on the phones: "For'd room to control, no damage in the for'd room." The report continued compartments by compartment to the after torpedo room . . . no damage . . . or so we thought then.

What we didn't know was this: The Mark XIV torpedo weighs 3,421 pounds and leaves the tube at 47 knots. It receives this impetus from 400 pounds of air stored in impulse bottles located in the superstructure above the tubes. And when the charge went off, the seal to #1 impulse bottle was cracked. THRESHER was laying a brilliant stream of bubbles on the surface of Gea Pass. . .and we didn't know it. We were at 300 feet, well out of visual range of the aircraft but the depth charges followed. Then sonar picked up the sound of three sets of screws coming off the beach.

Unerringly the destroyers homed in on our wake. As the captain gave orders to evade and try to get us out of the channel and into the ocean, the depth charges followed relentlessly. But then, *amazingly*, all depth charging ceased. We knew they had a dead fix on our position and our depth and yet the sea was dead quiet. The ominous silence continued for some time.

We were at 300 feet, running silent, when suddenly the silence was broken by a loud "clanking" noise moving aft down the starboard side of the hull: CLANK . . . CLANK . . . CLUNK, CLUNK . . . CLANK! The man on the phones: "For'd room to control, we are experiencing a loud clanking noise moving aft down the starb'rd side!" The message was repeated by each compartment, and then it was gone. *What now?*

It was the planesmen who discovered we were not out of trouble. The stern was rising appreciably and they were losing their bubble and there was nothing they could do to stop it. Then came the

realization: We were hooked by a large grapnel into the starboard stern plane guard and we were being brought up, stern first.

The boat displaced 1500 tons on the surface, but submerged it had a neutral buoyancy, neither heavy nor light. A relatively small ship can bring a submarine to the surface.

The captain's first order was to pour more power to the screws. He ordered: "Rudder amidships! Full dive on the planes! All ahead full!" The power hit the screws and the boat began to vibrate. . .and vibrate . . . and vibrate. No change . . . the grapnel held fast. Then: "All stop!" With such extravagant expenditure of amperage the batteries could not last long. The next order was to add more weight to the stern. In the series of orders that followed, After Trim tank was flooded from sea, then After W.R.T. tank was flooded from sea, then the after torpedo room bilges were flooded to the deck plates. We took on tons of ballast with no slowing in the rise. Then we passed 250 feet.

As time slowly passed the captain tried every maneuver he could think of to get us off the grapnel, but THRESHER continued to rise inexorably. When we passed 100 feet it became apparent we were going to lose our boat. The captain gave the order for the radiomen to demolish all decoding equipment. They went to work with sledge hammers and the pounding could be heard all over the boat. Then he ordered the gunners mates to the torpedo rooms to position the demolition charges for scuttling.

Each torpedo room carried a 55 lb. charge of T.N.T. which, when placed between the war heads of the re-load torpedoes and detonated would obliterate both these compartments and, hopefully, that S.O.B. who was pulling us up. But as we placed the charges it was recognized that for our THRESHER crew, there would be no survivors. But there was no objection to this. Some of the men bowed their heads in prayer. Wes Headington stood up and came over to me and as I stood up we shook hands, eye-to-eye, no words, but the silence was eloquent . . . "It was good sailing with you." No one spoke . . . only quiet resignation.

I don't know how deep we were then, our periscopes must have been very close to the surface, then the captain tried one last desperate maneuver. He ordered Forward Trim flooded from After Trim. The down angle, already steep, now became steeper. Then he

ordered: "Left full rudder! All ahead emergency!" The power hit the screws with a shudder! The boat heaved slightly into a port list, and then, *incredibly*, we were off the hook! Buy why? Did the grapnel cable part? Did the maneuver cause the stern plane guard to lift off the hook? Nobody knows the answer, but with the extra ballast and steep down angle, we headed for the bottom. "Blow Bow Buoyancy!" came the order, and as 3000 lbs. of air hit the forward tank, the bow heaved upward and we were saved from striking the bottom. For the next several minutes all concern for silent running was disregarded as tons of ballast were pumped and blown overboard to regain our lost trim and the depth charges rained down.

We remained at 300 feet maneuvering evasively until the sun went down and they could no longer see the bubbles. . .or possibly they ran out, and sometime after dark we surfaced, chased by the destroyers. But we eluded them in the darkness. We had taken 41 depth charges.

We continued the patrol past Truk Atoll, then Yap and Palau then turned south across the equator, through the Dutch East Indies to the Indian Ocean and we made port in Freemantle, West Australia. We had made two more attacks but with no success . . . shallow waters . . . torpedo trouble.

Captain Millican made four more runs with us earning two Navy Crosses for the tonnage we sank and the first submarine mine plant of the war. Then he was relieved and transferred back to the states to take command of the new ESCOLAR. He took several THRESHER officers and key enlisted men with him.

In time, ESCOLAR went into commission and joined the Pacific fleet at Pearl Harbor. The first war patrol was to the Yellow Sea off the coast of China. We know she arrived on station but then nothing was heard from ESCOLAR again. She was lost with all hands on her first run. Our crew was deeply saddened when we learned this.

But that's the way it was then. Some of us made a lot of war patrols, I made thirteen, and when we came into port from many of these, the message was the same, *overdue and presumed lost*. One or more of our boats failed to return, some on their very first run.

*BOOK REVIEW*

## COLD WAR SUBMARINES

**The Design and Construction of U.S. and Soviet Submarines**

**By**

**Norman Polmar and K. J. Moore**

**Brassey's Inc., Washington D.C.,2004, $60, 405 pages**

**Reviewed by CAPT James C. Hay, USN (Ret.)**

Norman Polmar and K.J. Moore have made a contribution to the bibliography of submarines with their comprehensive accounting for, and description of, the dynamic evolution of submarines since World War II. Their method in doing this was by constructing a side-by-side chronology of the U. S. and Soviet efforts, referring to developments in Britain, France, China and the lesser submarine powers only as they were impacted by the super-power advances. Students, researchers in shipbuilding technology and Cold War historians, as well as those with an active interest in submarines, will find this book both interesting and useful, with submarine information, particularly Russian, not readily available elsewhere. Those who participated in American submarine matters during the Cold War will find much here to clarify experiences, perhaps reinforce or change opinions and maybe justify further all the hard work of those days.

The logic of the side-by-side chronology starts with the *Genesis* of the German end-of-World War II Type XXI submarine which both the Americans and the Soviets exploited as a spoil of war. The result was the TANG class in the U.S. and both the WHISKEY and the ZULU classes in the Soviet Union. The authors were careful, however, not to press the *mutual Genesis* literary device too far, ensuring that no inference can be made of a Cold War submarine arms race. The divergence of both design and production was made clear as each superpower followed its own needs and strategies.

The development of the combat submarines of each nation is sequenced according to the *four generations* of nuclear submarines. That categorization system has been used in both official and semi-official writings for some time. For the general reader who might not recall just when each grouping started and stopped, a table of Nuclear Submarine Generations is presented at the beginning of the

book. The list, and the book, covers both U.S. and Soviet ship classes from NAUTILUS and the Novembers to VIRGINIA and the Russians' latest SSBN, YURI DOLGORUKIY. Helpfully, the Soviet/Russian ships are designated throughout by both the project number (which the Russians use most of the time) and the NATO name, with which most of the western readers are familiar. On that note, it can be reported also that the coverage of the Soviet/Russian submarine programs appears to be quite thorough and attests to the authors' extensive post-Cold War interviews and associations with the appropriate design bureaus in Russia.

Intermingled with the chapters describing the *generational* differences and noting the advances on both sides, there are a number of special topics of interest covered. Chief among those, of course, are the in-depth treatments of the development of Cruise Missile and Ballistic Missile Submarines and the weapons which they carried. One example of the divergence in U.S. and Soviet building programs can be found in the descriptions of cruise missile employment by each of the superpowers. One of the early chapters is devoted to Closed-Cycle Submarines. The description of that Soviet effort will make most American submariners of a particular age quite glad that our Navy did not chose to exploit the Walter engine the way the Soviets tried to do.

There is a later chapter titled "Diesel Boats Forever" which covers the extensive building program for Foxtrots, Zulus, Romeos, Kilos, Amurs and all the special use non-nuclear submarines which the Soviets continued to build throughout the Cold War. As part of that chapter the authors recalled the dispute in the U.S. government about building advanced diesel-electric submarines in the U.S. for foreign allies. They also put forth all the reasons, such as ASW training and other combat and support roles, for incorporating non-nuclear submarines into the U.S. Navy. The active opposition to those suggestions was laid to the "submarine mafia" of post-Rickover senior submarine admirals. This chapter lacks the balance that could have been achieved by addressing the persuasive argument for an all nuclear US Submarine Force.

In addition to all the really serious discussions of nuclear submarine advances, three chapters discuss the largely unrealized potential of submarine variants. These are not all Cold War projects

but also reflect tangential submarine thinking from the first World War and the 20s and 30s. The first of these is a chapter on Unbuilt Giants which deals with cargo submarines, submerged tankers, a submarine LST with an aircraft launch facility, large minelayers and other assorted concepts which seemed like good ideas at the time. Interestingly enough, the demise of most of those concepts was laid to the higher priority given to production of military submarines. Another chapter is Aircraft-Carrying Submarines which concerns itself largely with the giant models of I boats the Japanese Navy built during World War II to carry two or three aircraft which could bomb U.S. cities, or perhaps the Panama Canal. Also described are the various attempts by the British, French and German submarine services to gain an organic air capability before and during WW II. Interestingly, also recounted is the story of a concept for a submerged aircraft carrier which was formulated by Boeing and seriously considered by the U.S. Navy's BuAer during the height of the Cold War. The idea seemed to be based on a HALIBUT-like submarine with a somewhat bigger power plant which could house and launch Grumman F11F Tiger fighters. The third of these submarine variant chapters is Midget, Small, and Flying Submarines. The features of that chapter are the WW II British X-boats, our post-war X-1, the Soviet Piranya class of 218 tons and our later day ASDS for SEAL delivery. The authors have also included the concept for a flying submarine, actually a submersible seaplane, proposed by Convair in the 1960s.

The real substance of the book, of course, lies in those chapters which deal with the development of American and Soviet front-line military submarines. In the end this is a book about submarine design, characteristics and performance. It is not about undersea warfare and the strategies which were generated in support of national objectives, approved by national authorities, and implemented by seagoing, experienced, professional submariners. Accordingly, this reviewer can recommend this book on the basis of its sub-title; The Design and Construction of U.S. and Soviet Submarines. This recommendation, however, carries one caveat, one warning and one request.

The caveat is that there is an obvious anti-Rickover bias throughout that part of the Polmar/Moore history which deals with the U.S.

Navy's submarine evolution. To this reviewer that bias was so pervasive that the descriptions of all U.S. submarine development decisions seemed very one-sided. To me this degraded those descriptions because it is just hard to believe that Rickover, and those he trained, were always wrong, yet always won the argument. If, however, that was the case, we certainly need an explanation as to how things came out as well as they **really** did in the Cold War. Rickover's nuclear Submarine Force **was** a significant element in winning the Cold War.

The warning is to recognize that many factors affected what was actually done in the submarine building programs on both sides of the Cold War. It was not only the technological possibilities and the military requirements which had to be compared and resolved. There were bureaucratic fights for funding, political realities of major defense programming to be faced, and perhaps even an imperfect understanding of the place of force in the affairs of men which had to be debated at high levels. It is not too much to say that a proper **evaluation** of Cold War submarine programs, even at the unclassified level, cannot be made without an accompanying relation to the national, and political, situations of each era in the U.S. and Soviet Union.

This is a wide-ranging, open-source treatment of a subject which was highly classified, and very important for a long time, about which so much has been said, and so much is still left unsaid. It can be expected, therefore, there can be a fair amount of discussion about the reported details of these accountings, even with general agreement about the overall historical facts of *what* was done. Given some amount of apparent basis for honest disagreement, one can deduce that the real story is in the *why and how* of the building programs. Perhaps the full value of this book, therefore, lies in its potential to generate meaningful debate about the *process* whereby U.S. submarine evolution was brought about. The request I leave with the reader is to see what these authors have to say, then enter that debate if you have comments on, disagreements with or additions to, the *record*. One must remember that every printed word is part of the *record*, no matter what you may think of those words, the *record* is something which can be cited in later arguments.

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Articles for this magazine will be accepted on any subject closely related to submarine matters. Article length should be no longer than 2500 to 3000 words. Subjects requiring longer treatment should be prepared in parts for sequential publication. Electronic submission is preferred with either MS Word or Word Perfect as acceptable systems. If paper copy is submitted, an accompanying 3.5"diskette will be of significant assistance. Content, timing and originality of thought are of first importance in the selection of articles for the **REVIEW**.

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Comments on articles and brief discussion items are welcomed to make **THE SUBMARINE REVIEW** a dynamic reflection of the League's interest in submarines. The success of this magazine is up to those persons who have such a dedicated interest in submarines that they want to keep alive the submarine past, help with present submarine problems and be influential in guiding the future of submarines in the U.S. Navy.

Articles should be submitted to the Editor, SUBMARINE REVIEW, P.O. Box 1146, Annandale, VA 22003.