APRIL 2009

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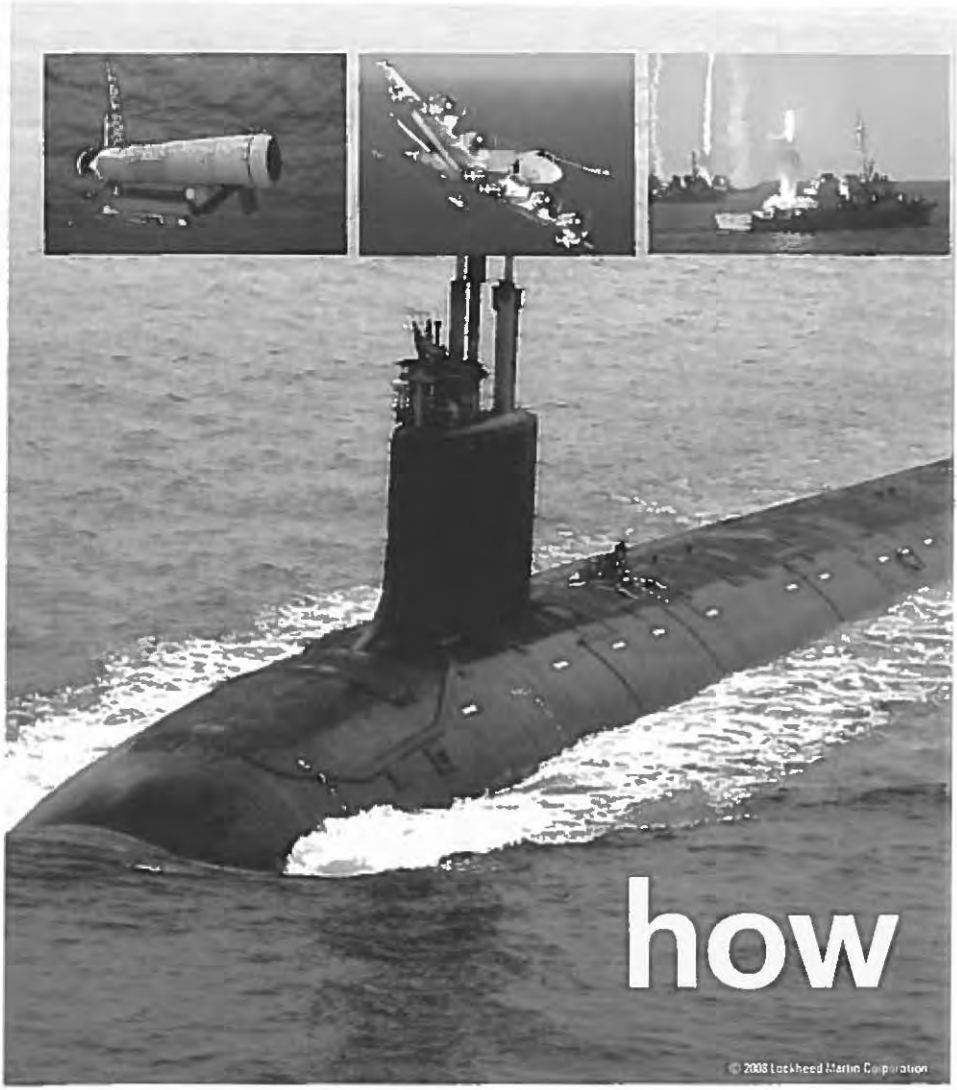

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EDITOR'S COMMENTS

The FEATURES section of this issue of THE SUBMARINE REVIEW is, as usual, important to the community, but it is also more eclectic than usual in its scope of important topics discussed.

As the leading Feature, it is always a highlight to carry the annual address of Admiral Kirk Donald to the Corporate Benefactors meeting. Since his is the key position in Government in maintaining the confidence of the US public in the strength and dependability of the two leading edges of American naval power his words on national policy, the Navy's programmatic efforts and his projections for the future carry a weight which this community needs greatly and values highly.

Rear Admiral Jerry Ellis is the Special Assistant to the Secretary of the Navy for Undersea Strategy and he has spent significant time and effort studying the Navy's current status in and capabilities for ASW. He spoke recently to the faculty and students at the Navy's Postgraduate School in Monterey and has agreed to a wider publication of that speech; it is our second FEATURE of this issue, and in its specifics is also important to the submarine community. Admiral Ellis's status report does not paint a pretty picture, but he does see a *way ahead* through training and focus. As the community which seems to be the most involved and interested in ASW as a core competency of the Navy, it would also seem appropriate for submariners to lead the *way back* to the capable and competent ways of integrated ASW–with everybody on board.

Our third FEATURE is submitted from Dr. Owen Coté of MIT. His is a reasoned crossing of the sometimes difficult-to-leap gap between the complexities of national requirements and the application of military capabilities. He is suggesting a submarine experimentation program for a variation of an existing capability, the submarine launched ballistic missile, to achieve time-critical precision fires to be organic with a ubiquitous, competent ISR potential. His logic extends through the military-political authorization process to present his proposed capability as being highly useful at the extremes of the conflict spectrum, as well as the more predictable middle of it, and a probable application for as-yet-

unforseen circumstances. As an Editorial Comment, we are grateful for this opportunity to cite the Academic side of the greater submarine community for all they have done, and are doing, to look ahead and solve the problems they see there.

Rear Admiral Jerry Holland has put together A Short History of Submarines in Land Attack in conjunction with this year's Annual Submarine History Seminar on that subject. His article appears as our fourth FEATURE of this issue, and even though the *History* is short, the story of the Submarine Launched Cruise Missile is long enough, and involved enough, to leave the reader amazed that we ever got to the current successful point at which we have four SSGNs at sea and a significant SLCM component in our SSNs. One can only conclude that the SLCM story is another example of ***Submarine Tenacity***, and what can be done with singleness of purpose and a belief in the tenets of one's community.

Our fifth, and final, FEATURE of this issue may well be the most varied of the lot, but it is about people, and that is a cornerstone concern of everything done in the US Submarine World. Vice Admiral Dan Cooper has just completed a long and arduous tour as Under Secretary of Veterans Affairs for Benefits, and it is a good bet that no one in the submarine community is well enough informed to not benefit from Admiral Cooper's knowledgeable summary tour of that horizon.

Apart from the FEATURES section there is plenty to enjoy in the ARTICLES and other sections of the magazine. For a different look at Atlantic Cold War operations read Captain Conley's "Black Pig" piece, and for a forward thought about ASW and what the JOs are doing read LT Chris Benotavicious' article on computing in that world. By all means do not miss Dex Armstrong's tales about his young years in REQUIN.

Finally, continue with VADM Jim Sagerholm's insightful look at the U-Boat War in the Atlantic from '39 to '45. There is a lot to learn from Dönitz's failure/US-UK success. Let's all continue to search for those lessons and to benefit from them.

Jim Hay
Editor

FROM THE PRESIDENT

The Submarine Force is taking delivery of submarines ahead of schedule and at or below cost. The commissioning of NORTH CAROLINA in May 2008 and NEW HAMPSHIRE in October 2008 was the first time since 1996 that two submarines in the same class were commissioned in the same year. The keel laying of NEW MEXICO in April, MISSOURI in September, christening of NEW MEXICO and award of the Block III contract for eight more Virginia Class submarines in December, and the deployment of all four SSGNs, provided the capstone for a banner year for the Submarine Force.

The Naval Submarine League completed its fiscal year on 31 March 2009 achieving its goals and objectives. Modest progress was made restoring the corpus. The League's investment portfolio is positioned with securities that have performed better than the overall market. Much of the year's financial success is because of member response to the donation canvas conducted this year. The initiative yielded over $50K in contributions, a 300% increase over recent years. Additionally, the League initiated a sponsor program for the Annual Symposium, Corporate Benefactor Recognition Days, and the History Seminar that resulted in an additional $132K in support. These initiatives provided over 20% of the League's revenue this year.

The costs of providing THE SUBMARINE REVIEW and supporting services continue to increase. I asked the Executive Committee to review the League's dues structure. An actuarial study showed the dues structure did not cover the cost of providing THE SUBMARINE REVIEW. As a result of the review the dues structure will be revised. All members will pay the same price for one and three year memberships and the life membership structure will be modified.

Corporate Benefactors continue to be the lifeblood of the NSL. Eight new benefactors were added during this fiscal year more than compensating for departing benefactors. When you see Corporate Benefactors at one of the League events, please thank them for their continued support. Individual name tags and a blue ribbon identify

Corporate Benefactors. I will continue to encourage new submarine-related businesses to join the League as Corporate Benefactors.

The Corporate Benefactor Recognition Days held 4-5 February 2009 set a record in attendance, with 55 of our 72 benefactors represented including 26 principal executives. This event was a success in every measure. The active duty submarine flag officers' participation and the guest speakers were highlights of the event. More than 270 members of the League's submarine support community attended the reception following Admiral Kirk Donald's remarks and appreciated the opportunity to interact with the active duty flag officers. VADM Mark Ferguson, Chief of Naval Personnel, spoke to luncheon attendees on personnel initiatives being employed for retaining officer and enlisted personnel. At the Congressional breakfast Senator Ben Nelson (D-Nebraska) addressed members on the importance of strategic deterrence and the Submarine Force contribution to this mission. Senator Nelson is a strong supporter of the Submarine Force.

The Submarine History Seminar, "Submarines In Land Attack," will be held on 15 April 2009 at the Navy Memorial and feature the contributions the Submarine Force has made in the strike mission area. This seminar continues to be an outstanding resource in providing first-hand testimonies by submarine pioneers.

The Submarine Technology Symposium will be held at The Johns Hopkins University Applied Physics Laboratory 12 to 14 May 2009. Registration for this classified event is open. The agenda can be seen on the registration website which can be accessed through the League's website www.navalsubleague.com.

The final NSL event for 2009 will be the Annual Symposium to be held at the Hilton McLean Tysons Corner, Virginia on 28-29 October 2009. The Submarine Force Fall Cocktail Party will be held on the first evening of the program. Please look for the mailing to all members this summer which will include a ballot for the election of NSL Board of Directors' members.

Your Naval Submarine League continues efforts to increase membership and focus on initiatives to recruit members who are active duty, retired, or simply submarine advocates. I ask each of you to recruit a new member by asking friends and associates to join the Naval Submarine League.

The online Membership Directory provides an outstanding resource for contact information on League members. Your assistance in updating the address file is appreciated.

Jan joins me in wishing you a healthy and refreshing spring.

J. Guy Reynolds
President

**Editor's Correction: Due to a reporting error, "Stealth Boat" author Gannon McHale was misquoted in an article on page 148 of the January 2009 edition of THE SUBMARINE REVIEW. McHale said the USS Sturgeon was a "15,000-horsepower underwater hot rod." He did not say it was 125,00 horsepower.*

THE SUBMARINE REVIEW IS A PUBLICATION OF THE NAVAL SUBMARINE LEAGUE

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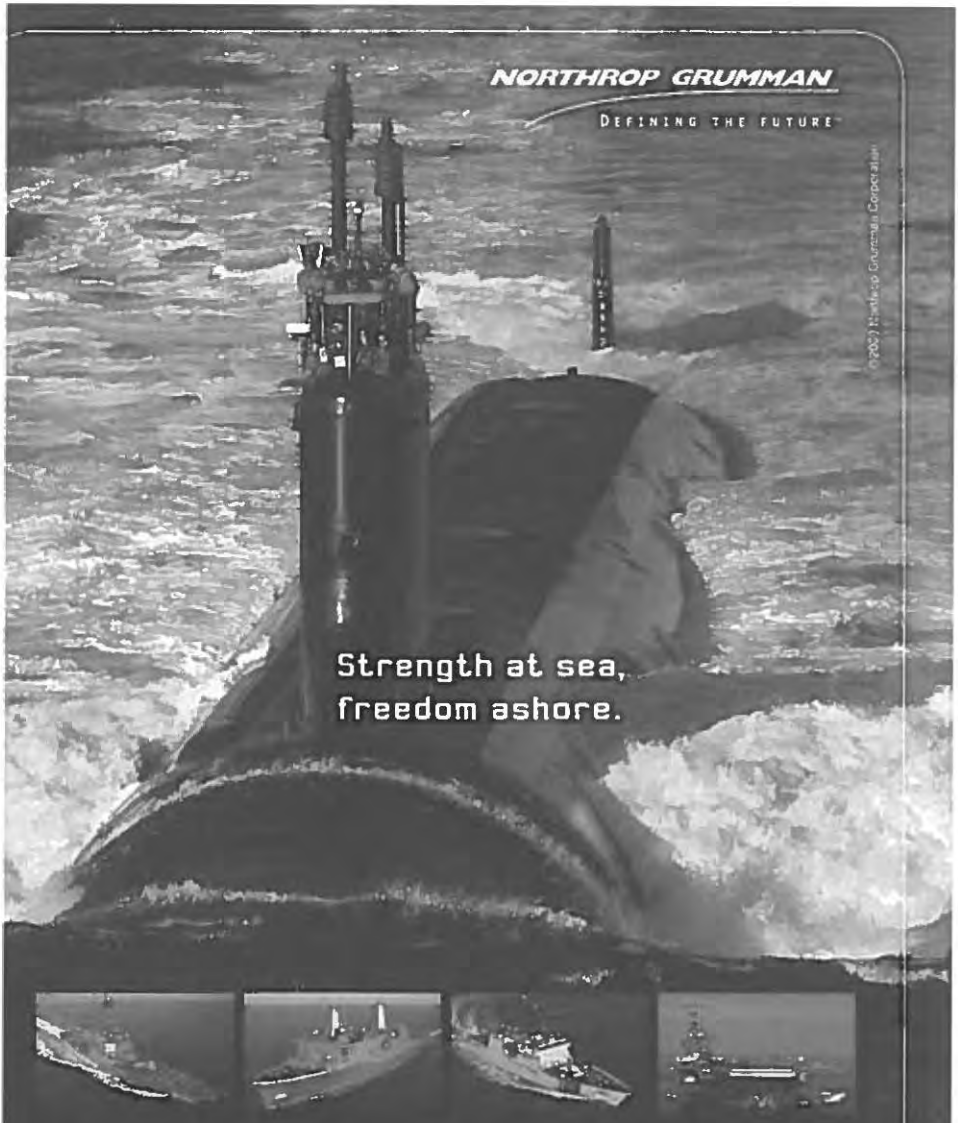

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FEATURES

NAVAL SUBMARINE LEAGUE
CORPORATE BENEFACTOR RECOGNITION DAY
ADMIRAL KIRKLAND H. DONALD, U.S. NAVY
DIRECTOR, NAVAL REACTORS
4 FEBRUARY 2009

Admiral Mies, thank you for that warm introduction. Admirals, Submarine League's Board of Directors, and friends of the Submarine Force—it is a pleasure to share this evening with you. To the Corporate Benefactors, thank you for your ongoing support of the Submarine Force, Naval Submarine League, and this event. I look forward to this night each year as it helps all of us evaluate where we have been, and plot the course for where we are going, and align our messages.

We all saw many good things happen in 2008. Our ships and crews continue to perform to the standards of excellence which we have come to expect. All four SSGNs are operational and USS OHIO has completed her first operational cycle with great success. USS RHODE ISLAND—Gold Crew—is nearing completion of the 1000th strategic deterrent patrol with the D-5 missile. Our nuclear strategic deterrent forces further demonstrated excellence in the course of two external reviews following significant failures in the Air Force nuclear stewardship. Our SSNs have ranged the globe and delivered the goods. Our attack submarines and carriers are in demand as evidenced by Combatant Commander requirements and compressed operational schedules. The Virginia Class Submarine Program has set the standard in shipbuilding. From 774 to 778 the delivery span has gone from 86 months to 71 months. 779—USS NEW MEXICO—is on track to achieve a 66 month span. We are on track to meet our cost reduction goals and as a result the Navy was able to award a 5-year multi-year procurement contract, totaling more than $14 billion dollars, for eight more submarines to the Electric Boat—Northrop Grumman Shipbuilding team. While approval to move on with eight more hulls was based on proven success in the planning and execution of construction to date, this

achievement is a strong indication that our combined investment to educate and inform our Navy and civilian decision makers has yielded a solid return.

The final NIMITZ Class aircraft carrier—GEORGE H. W. BUSH—was commissioned last month in a moving ceremony in Norfolk. The first nuclear powered aircraft carrier—ENTERPRISE—will de-commission in November 2012. Subsequently, NIMITZ is planned to de-commission in 2025. In response to that reality, last September we signed the construction contract for GERALD R. FORD (CVN 78), the first new design of aircraft carrier ordered in more than 40 years. Shifting to strategic deterrence and replacement for the OHIO Class submarine, support within the Navy and The Office of the Secretary of Defense has been noteworthy. The Navy has been conducting an Analysis of Alternatives and supporting studies to evaluate options for replacing the OHIO Class submarines when they start coming out of service in 2027. R&D funding for concept studies, design work, and planning is starting to flow now to ensure this vital capability is not gapped.

We recently awarded a contract for design of the common missile compartment and are finalizing details of cost sharing with the Royal Navy. The FY 10 DoD Program supports necessary funding for concept studies, design work and planning. A Nuclear Posture Review will commence shortly and we expect validation in that process for the ongoing need of our SSBN fleet and the OHIO Replacement Program.

While we celebrated these successes, 2008 also saw the deactivation of NR-1. Many of you in this room were involved in the design, building or operations of that unique ship and she stands as a shining example of how our technology can be used for missions associated with our national interests beyond warfighting.

It goes without saying that both the international and domestic fronts have been and will continue to be tumultuous for the foreseeable future. Clearly, Afghanistan will be the focus of the Department of Defense as we strive to reverse the tide of the revitalized insurgency and to return some semblance of stability to the region. Troop numbers in Afghanistan will increase and with that will come a call for more non-traditional support from the Navy in the form of individual augmentees. Currently, there are

eleven-thousand Navy personnel serving in this capacity in support of the wars in Iraq and Afghanistan, and that number will not go down for several years. The Fleet's presence in the region will be undiminished but will remain in a supporting role to the ground war. In the rest of the world, the demand for the Navy centers around readiness for the unforeseen crisis, demonstrating strength and resolve in support of regional stability, and developing new and reinforcing old partnerships with nations that share our common interests.

Domestically, we have a change in administration under the specter of an economic downturn. The transition from the Bush to the Obama Administration has been about as smooth as anyone could hope, certainly aided in DoD by the retention of Secretary Gates as Secretary of Defense. The engagements with the transition teams were remarkably comprehensive and professional. Particularly on the Department of Energy side, the reputation of the Naval Nuclear Power Program and the nuclear shipbuilding community has put us in a good position with the new administration and that will be important as we work to solidify our budgets to support key programs like OHIO replacement. Work to continue building relationships with our new civilian leadership must continue on all fronts, as many have had little experience with the Navy and, more specifically, nuclear powered warships.

An ailing economy coupled with an ambitious domestic agenda outlined by the new administration will, no doubt, put downward pressure on defense budgets and procurement accounts in particular. Secretary Gates has made it clear as recently as last week in his congressional testimony that some tough choices will have to be made on what equipment we buy. I have no insight into the specifics of those tough choices, but the signal is clear that you had better be able to show relevant warfighting capability and cost stability in your programs—or you're in trouble. We have a good story to tell with the VIRGINIA Program, the NIMITZ Class, and SSGN. I think we will fare well if we "stick to our knitting" building capable, versatile warships and equipment with a watchful eye on affordability. We know how to do that.

2009 will present a new set of opportunities for us all. Keep in mind the successes in shipbuilding and funding resulted from decades of hard work to ensure all stakeholders understood the

need for, and economics behind, nuclear shipbuilding. The new administration and a rapidly changing Congress, including 54 new House members, represent a new set of *bosses* we need to understand and collaborate with, to support our national defense needs. Forming these new relationships, and strengthening existing ones, will be critical in achieving our shipbuilding goals through this economic downturn.

Success in this area will require the Navy and the shipbuilding community to make and reinforce the point of the importance of shipbuilding to national defense and economic security. National security encompasses both of these first order responsibilities of our government and we can show that investment in our nuclear powered platforms reaps rewards economically, militarily, strategically and diplomatically.

The Maritime Strategy effectively establishes the Navy's role in the larger national security context. Soon we will release a Naval Operating Concept that will provide the much needed link between the strategy and the force structure requirements and shipbuilding plan, answering the questions of why we need ships and aircraft that we do. From the economic perspective, investment in shipbuilding will speed recapitalization of our fleet that has been in decline since the end of the Cold War, providing immediate economic stimulation—by creating high paying jobs for skilled workers. There is precedent for using shipbuilding as an economic stimulator. During the Great Depression, the National Industry Recovery Act and the Vinson-Trammel Act provided President Roosevelt both the Authorization and the Appropriation authority to build ships at a rate not to exceed treaty limitations. In fact, those ships placed under contract as a result of economic stimulus efforts were the foundation of the fleet that responded so valiantly in the early days of World War II.

Today the funding in the shipbuilding industry directly supports more than 250,000 working men and women in 49 states and the District of Columbia. Shipbuilding creates jobs—high paying, skilled manufacturing jobs that also help maintain production capability that has eroded significantly in the United States. These jobs are created at companies both large and small from the six major private shipyards to more than 3,000 manufacturers of components that support ship construction.

As I look forward to the year ahead, I see an array of tactical challenges and one significant strategic challenge. First, the tactical: Gain support of fiscal year 2010 funding for the OHIO Replacement Program to maintain a glide slope toward procurement of the first replacement in 2019.

We have some significant infrastructure issues that must be addressed to ensure the Naval Nuclear Power Program adequately supports the fleet to include moored training ship replacement, refueling and technology insertion in the S8G Prototype and recapitalization of the Expended Core Facility in Idaho to handle our spent fuel.

Finally, properly manage our most valuable resource, our people. It is expected that over the next decade cost of personnel will increase about 8% per year even if end strength is held constant. There will be pressure to hold and even decrease end strength. The economic downturn is already resulting in rapidly increasing retention outside the nuclear field which is triggering action to be more selective in who is allowed to stay in the Navy. At the same time, we are seeing continued indication of a strong civilian market for nuclear trained operators, and, consequently, we are not enjoying the same bounce in retention. Many of you in this audience are feeling the same competition of talent. Retaining our great people requires bold action across the spectrum of compensation, quality of life, and rewarding work, if we are to remain strong and effective.

And our strategic challenge: Secretary of Defense Gates recently published an article in *Foreign Affairs* magazine entitled "A Balanced Strategy" where, and I don't think I am overstating, he outlines the de facto National Defense Strategy. In summary, he states that the Pentagon has to do more than modernize its conventional forces; it must also focus on today's unconventional conflicts —and tomorrow's. While I believe this strategy holds great opportunity for the Navy, we will be challenged to articulate our relevance. Despite significant contributions to ongoing conflicts across a wide spectrum of capabilities as well as providing a strategic hedge against major unrest in the rest of the world, the Navy is still, in the minds of many, a conventional force designed for major conflict on the seas and of diminished relevance in the asymmetric wars we find ourselves in today.

Even our self-talk is sometimes myopic. I recently attended a Navy conference featuring a discussion of strategy for the upcoming QDR and a slide appeared with the statement, "The Navy is a conventional force"—as opposed to suited for irregular warfare. Simply, that is wrong. The Navy is survivable, flexible, adaptable, and agile while remaining lethal and dominant in our spheres of influence.

When Secretary Gates speaks of hybrid warfare encompassing irregular warfare tactics utilizing the lethality and sophistication of conventional systems, the Navy's ability to contribute is limited only by the size of our fleet, imagination and innovativeness. When we design our ships there are warfighting attributes considered that likely reflect what we know about current adversaries and their intentions, to be sure. However, designs are just as much about building in flexibility and growth margin such that our ships remain relevant over their 30, 40, even 50 year lifetimes.

We have reaped the benefit of that strategy as we see jets from our nuclear powered aircraft carriers providing close air support for soldiers in Iraq while at the same time USS ABRAHAM LINCOLN provided the critical staging base for disaster relief following the tsunami in Southeast Asia. We see the benefit as our submarines stand ready to strike ashore while, at the same time, at sea to support irregular warfare with surveillance operations, Special Forces, and information operations. Plus we enjoy the advantage of near unlimited access through our endurance and stealth. But I suspect this crowd doesn't need convincing. What we need to do, however, is to better inform our leadership on these facts; make the case that a strong Navy represents the model for success in hybrid warfare; that we are ready to answer the call across the spectrum of conflict with dispatch and without the logistical encumbrances of land based forces and land based aviation.

It is also appropriate to take criticism onboard and honestly assess where we fall short in meeting the vision inherent in our National Security Strategy; how can we better range the spectrum of hybrid warfare with our ships, weapons, sensors, and our people?

A couple of thoughts:

ASW—This is an inherently Navy mission and you won't hear much about it outside the Navy until the capability is needed. I will

concede there has been more focus on this area of late; however, we still have not adequately addressed large area search, cueing, surface ship torpedo defense, and, closer to home, towed array performance.

Weapons—Submarine torpedo development and performance is healthy, but the same can't be said of surface and aviation borne weapons. With respect to strike: What's next? TLAM has been with us for a long time and it is still a superb weapon. But where do we want to be in 10 years or more? Ground forces will tell you that responsiveness is vital in the types of wars we are fighting today. TLAM is hampered by relatively lengthy planning cycles, flight time, and, consequently, challenging deconfliction in the air domain. Can we do better?

Unmanned Undersea Vehicles—It's time to get real. We have vacillated around this business for years and driven down a couple of blind alleys. I think we are at the point where we can declare large diameter UUVs deployed from SSGNs or VIRGINIA CLASS with large diameter vertical tubes as our objective and start getting capability to sea.

We will have an opportunity to tell our Navy story in the upcoming QDR, but we are going to have to be ready with it since my sources tell me this QDR will move more quickly than in previous years. Secretary Gates has expressed a desire to shape the FY10 budget with significant QDR findings and certainly PR-11 development will be influenced. Rear Admiral Bill Burke is leading our QDR cell in the Navy as well as the discussion among senior leaders.

To our corporate benefactors, many representing our industrial base, you will play a key role in this strategic effort. First we must maintain our credibility as competent operators and shipbuilding stewards of the public trust. Do your work on time, on budget, with quality. Your craftsmanship continues to be the envy of the world.

Foster innovation in your workplaces and don't be shy about telling us about your new ideas. Be persistent—there will be a tendency to jealously guard the status quo in times of declining budgets at the expense of new ideas. Look at the example of Advanced Rapid COTS Insertion as a case where a bold step away from legacy systems proved to be both revolutionary and affordable.

I am also calling on you to partner with us in reminding and informing our national leaders of the unique and significant contribution of the Navy to our national security and the importance of our shipbuilding industrial base with respect to our national defense and economic security. Much like binding energy which holds the nucleus of an atom together, our collaboration in maintaining and promoting our Navy requires all stakeholders to stay together in making this case.

I will close by thanking you for allowing me to be part of this great event. I look out and see the faces of many who stood the watch and held the standard for many years. Our nuclear navy is strong today with a bright future. I know that with your help we will continue down a path of safety and mission accomplishment from the design and construction of ships to the execution of our mission. Thank you for your contribution to the Program and our Nation.

With that - I will be happy to take questions.■

REMARKS BY
RADM (RET) WINFORD G. (JERRY) ELLIS
SPECIAL ASSISTANT FOR UNDERSEA STRATEGY
OFFICE OF THE SECRETARY OF THE NAVY

NAVAL POSTGRADUATE SCHOOL
ALL U.S. NAVY AUDIENCE
OCTOBER 14, 2008

REGAINING CONTACT: THE RE-EMERGENCE OF ASW IN THE US NAVY

It's a pleasure for me to be here today to share with you a few thoughts on our Navy and what I see as the re-emergence of anti-submarine warfare (ASW) as a high priority capability. Your presence today is vital and necessary because ASW is one of those navy core competencies that affects all navy warfare communities— air, surface, submarine, special warfare as well as intelligence, logistics, facilities, medical, legal, just to mention a few. Whether you are a SWO driving an ASW surface ship, or a JAG Corps lawyer handling sonar/mammal litigation. You are a part of the ASW team.

Today I'm going to begin with a story that hopefully will put my remarks in perspective. Some of you may have heard this story as it has been around for awhile. It concerns Oliver Wendell Holmes, the famous chief justice of the supreme court. Mr. Holmes once found himself on a train, but couldn't locate his ticket. While the conductor watched, smiling, the eighty-eight year old justice searched through all his pockets without success. Of course, the conductor recognized the distinguished justice. So he said, "Mr. Holmes, don't worry. You don't need your ticket. You'll probably find it when you get off the train and I'm sure the Pennsylvania railroad will trust you to mail it back later." The justice looked up at the conductor and with some irritation said, "My dear man, that's not the problem at all. The problem is not where my ticket is. The problem is, where am I going?"

Well, that's an appropriate question for me to address today—where are we—the United States Navy—going in dealing with the growing worldwide submarine threat? What are the challenges we have to deal with to ensure our navy will be able to project power in the maritime domain anywhere in the world?

Let me start my remarks by setting some context for you. As you should know, there is a tremendous proliferation of modern diesel electric submarines throughout the world which has the potential to seriously threaten freedom of the seas. There are over forty countries that operate modern diesel electric submarines, many with the increased undersea endurance enabled by air independent propulsion systems. These submarines, some of which carry long range supersonic anti-surface cruise missiles, have the potential to threaten our Navy as well as global commercial shipping. The world's economy depends on the oceans since over ninety percent of the world's traded goods are transported over the seas. We often focus on countries such as Iran, China, Russia and North Korea, as we should; however there are many other countries that we need to keep a watchful eye on. For example, Venezuela is purchasing very quiet diesel submarines from Russia that in the very near future could be patrolling the Gulf of Mexico. We are clearly very concerned about Chinese submarines. They have exceeded our intelligence projections as indicated by the surprise appearance of the YUAN diesel submarine. This submarine is highly capable, has air independent propulsion, and is projected to also have a small nuclear reactor giving it unsurpassed endurance and range. The Russian built Kilo 4B submarine, which they bought, carries the SSN-27 *Sizzler* anti-ship cruise missile. When this missile reaches its supersonic terminal phase, it will be very difficult to defend against. That is, when it acquires the surface contact, it kicks the termination speed to Mach 3, making it almost impossible to avoid no matter what you do. Additionally, with the proliferation of wake homing torpedoes, our surface ships are at great risk. These torpedoes are very forgiving. They don't require a really accurate solution to be effective. All the submarine needs to do is to get within range, anywhere from 4— 15,000 yards, get into a firing aspect, and shoot it into the wake. You don't need many periscope observations to get a shooting solution! I am very concerned about China and where they are going with their

submarine program.

These modern diesel electric submarines present a very different challenge than what we faced during the Cold War. They are extremely quiet and operate in challenging acoustic environments of the littorals and the U.S. Navy needs to be ready to face this threat. The loss of a ship, particularly an aircraft carrier would be devastating. It would be like a 9/11 event in this country and the world all over again—a great tragedy. Unfortunately, in much of our analyses and war games, this is exactly what is occurring under the conditions of certain scenarios.

The Secretary of the Navy has been concerned about this and about eighteen months ago asked me to come on as his special assistant and take a hard look at the Navy's undersea warfare strategy and capability. I had just completed eight years heading up some very special programs for the Navy, both as a Flag Officer and civilian SES. This was following 36 years on active duty as a nuclear submariner with my last major operational tour as COMSUBPAC. In fact, I thought I was going to transition to the private sector last year when I received the call from SECNAV with an offer of an opportunity that I simply could not refuse. The Secretary of the Navy tasked me to do two things—advise him on all USW matters and to lead a team tasked with developing a strategy to evaluate what it takes to ensure our future undersea warfare dominance. To anyone that knows anything about undersea warfare they would recognize that this is a daunting task, particularly since the Secretary wanted it done prior to his leaving with the administration turnover.

Although undersea warfare covers many missions, today I will be focusing on anti-submarine warfare. With my extensive background in submarine ASW and considering the growing interest in ASW, I was hopeful that I could make some positive contributions. The first thing I did was to form a team of experts to develop a framework to examine the complicated and broad ASW mission area, identify key issues that should be brought to the attention of SECNAV and CNO, and develop some options and recommendations on how to solve those problems. One of the most important aspects of this effort was that I wanted to make sure it wasn't a DC-centric study. For those of you with DC experience, you know that you can conduct almost any study just by going from

desk to desk and talking to all the action officers in the Pentagon. Well, that would give us the DC perspective but not much else. I was committed to not have this be an *inside the beltway* assessment, so over the last year I engaged a broad spectrum of the ASW community. I met with the Atlantic and Pacific fleet commanders; the submarine, surface, air, and special warfare enterprises; the Navy's Mine Warfare and ASW Command (NMAWC); group, wing, squadron and unit commanders across the three warfare enterprises; training commands; and sailors and officers at the unit level from both fleets. I visited Norfolk, San Diego, Groton, Kings Bay, Jacksonville, Mayport, Pearl Harbor, Hawaii, and Japan, just to mention a few, and added some serious miles to my frequent flier account! I have met with top Navy leadership including Admirals Greenert, Keating, Willard, and Rear Admiral Frank Drennan at NMAWC, among many others. I visited laboratories and industry to see their ideas and new developments. Finally, I engaged the OPNAV leadership and the ASW stakeholders inside the beltway and reviewed requirements, assessments, and programs. I heard firsthand what the issues were and developed my view of the state of ASW. As a result I came to the conclusion that since the end of the Cold War we had indeed lost contact in ASW. I also came to the conclusion that because of the current and projected threats, ASW must re-emerge as a high priority among Navy leadership and that we must begin to regain contact in ASW.

During our study efforts, I reflected on the historical perspective of ASW to see what had happened in the past. I noticed that although the submarine threat has always been challenging, the US Navy has nonetheless overcome these ASW challenges throughout our history. As you look at this ASW history in the Navy you will see that our capability has been sinusoidal in nature from WWI until the present. This trend appears to be caused by the Navy's reactionary vice proactive approach to the ASW challenge. During WWII, the TENTH Fleet was created when the U.S. was faced with a desperate ASW situation in the Atlantic. With the power and resources provided, and the lessons learned from actual encounters and battles, TENTH Fleet corrected deficiencies in doctrine and organization and turned around the Battle of the Atlantic.

Following WWII, our ASW capability started on the down slope of the sine wave. As a result, Task Force Alfa was stood up by

Admiral Arleigh Burke in the early fifties. He "wanted to know why the Navy's ASW effort, despite all the high technology, was so weak and ineffective." In response to Admiral Burke's charge, Rear Admiral Thach, the first commander of Task Force Alfa, composed hunter-killer groups that had forces assigned on a semi-permanent basis with a single mission, ASW. Fifty percent of the time was spent at sea conducting ASW exercises for teamwork, tactical development and equipment improvement. The actions taken by Task Force Alpha started the US Navy undersea dominance back up the sine wave. However, with no real submarine threat over the next decade, unfortunately, the US Navy became lax and started the slide back down the sine wave. Meanwhile, the Soviets continued to advance their submarine programs. We failed again to pace the threat.

To combat the growing Soviet submarine threat during the Cold War, OP-95 was established under Vice Admiral Charles Martell in 1964. OP-95 had power with direct resource responsibility in ASW, most notably for the new development, the sound surveillance system (SOSUS). OP-95 was able to achieve unity and drive the effort in ASW and by the mid to late 1970's, the US Navy was again at the zenith of the sine wave by clearly achieving undersea dominance against soviet first and second generation nuclear submarines. Our undersea dominance continued with the creation of OP-71 who chaired a cross-functional team known as Team Alfa. They met regularly and addressed various issues across the ASW enterprise. They produced an ASW master plan and ASW top level requirements endorsed by OP-07. Team Alfa gave OP-71 significant influence within the beltway in terms of ASW planning.

However, following the fall of the Berlin wall and the end of the Cold War, ASW was again viewed as a lower priority, and subsequently OP-71 was disestablished. The post-cold war era saw the US Navy's undersea dominance plummet back down the sine wave. Questions were asked such as *do we need submarines in our Navy and why was ASW important now?* OPNAV N84 later was created to address various emerging ASW issues. Unfortunately, the influence of the assigned Navy captain with flag leadership varied and was generally constrained by staff and resources. Basically, this captain, who had to deal with admirals, had no real power or resources. These constraints continued through subse-

quent organizational transitions and ASW continued to languish and be viewed as a *billpayer* for other higher priorities. We were again in the trough of the sine wave.

Finally, in 2004, CNO Admiral Vern Clark directed the standup of Task Force ASW and the Fleet ASW command—which subsequently has evolved into the Navy Mine and Anti-submarine Warfare Command—and once again stressed the need for anti-submarine warfare and to start the progression back up the sine wave. The point that I am making from this history lesson is that the Navy's organizational structure that drives its priorities and decision making can be directly linked to the upward and downward trends over the decades of Navy ASW capability. When the organizational structure is such that ASW does not have a strong voice in priorities and investment decisions, that is—no power and resources, Navy's ASW capability suffers and ends up on the downward slope of the sine wave ... and the converse is also true.

I am hopeful that we will start moving up that curve with the recent changes directed by CNO giving NMAWC a much greater role as the center of excellence for ASW similar to NSAWC's (Naval Strike and Air Warfare Command) role in navy strike warfare. In its relatively short existence, NMAWC has begun to make some impact. They have developed strike group ASW and theater ASW metrics, supported and analyzed a series of major fleet exercises and developed the global ASW CONOP's as a construct for fighting the ASW battle, just to name a few of their initiatives. The last three CNOs have stated that ASW is one of their top priorities and I have seen an increase in focus on ASW during fleet exercises. This re-emergence of ASW as a priority must continue and, more importantly, gain momentum and move much farther up the slope on the sine curve I have been talking about.

However, as I looked extensively at ASW for the last eighteen months, it's not all good news. Unfortunately, it was mostly bad. We still have some tremendous challenges ahead of us. These challenges include increasing priorities, improving training, defining the gaps and requirements, and resourcing to mitigate the capability gaps. These challenges exist for the near, mid, and far term. The situation at present is difficult though. During the Cold War era, the enemy submarine threat was very real and at the forefront of every ship and squadron commanding officer's mind.

You potentially faced it every time you got underway. In today's operational environment, the submarine threat is not there yet. It is coming! It is a future evolving threat that we must be able to overcome when it eventually is there. But, as the Commander of the Pacific Fleet, Admiral Bob Willard, told me, we need to be practicing ASW even though we don't have submarines on our sonar screens. That is the lead in to one of the Navy's biggest challenges as we look ahead, and that is ASW training. I have many concerns of the current state of training.

I spent a lot of my first year closely examining training and as I researched this area, I was surprised at how much it had atrophied over the years. For example, the number of exercise lightweight torpedoes fired for operator training and verification of torpedo reliability has dramatically dropped over the years, from hundreds to tens. The amount of submarine contact time across all communities has also greatly been reduced and the amount of time on deployment practicing ASW has also markedly decreased. Nearly every measure that I looked at showed areas requiring significant emphasis and improvement.

To add to this challenge, today's Navy is clearly a multi-mission Navy. All Navy commands are experiencing at various levels the impact of multi-mission requirements resulting in insufficient time and resources being applied to ASW training, both pre-deployment and while on deployment. ASW training has clearly taken a backseat since the end of the Cold War and it continues to be a low priority in today's war on terror, particularly in the surface community. The press of the day to day operational requirements such as visit, board, search and seizure operations, anti-piracy operations, humanitarian operations, and the like have pushed ASW way down on the list of training and proficiency priorities. During deployments, there is a lack of a *perceived submarine threat* by the fleet, which leads strike group and unit commanders to allocate insufficient time for ASW training.

Navy is pursuing synthetic training solutions to mitigate the impact of reduced at sea ASW training opportunities. These systems show promise to help close this gap but we still have a long way to go to deliver the systems to the fleet and prove their effectiveness, particularly in the surface and air communities. It will be important that a correct balance between synthetic and live

training be established. In my view, no amount of synthetic training can substitute for the need to practice ASW at sea against real targets. The trainers will never effectively model the environmental and operational challenges experienced through at sea training. As most of us who have served at sea know well—the ocean can change dramatically very quickly which is very difficult to replicate in a trainer. However, given the reality of a shortage of submarine targets, both now and in the future, more needs to be done to provide the most current and effective synthetic training that we can.

Finally, the unintended consequence of the years of reduced ASW training is that our leaders and instructors have less and less experience with ASW. In other words, inexperience is breeding inexperience, which is a significant problem. We learned during the Cold War that ASW is an art and takes years of training and practice to develop a cadre of experience. We are rapidly losing that core of expertise to teach the next generation of operators and it will take years to rebuild. Remember, it has now been over eighteen years since the Cold War ended, which is when the US Navy achieved superior ASW proficiency and experience. Those Master Chiefs and LDO's that had exceptional ASW skills are gone. A particularly compelling example occurred during one of my fleet visits. A recently promoted leading sonar chief in Norfolk told me that he was very concerned. He knew he was responsible for training his sonar gang and teaching and providing them with the skills to do their jobs. He knew he was now expected to be the expert in finding and tracking enemy submarines when, in reality, he had never tracked a threat submarine himself.

The last area that needs attention is identifying the requirements and providing adequate resources to resolve capability gaps. This has been a significant challenge. There is no consensus within Navy whether the program of record is sufficient to reduce ASW risk to acceptable levels, or whether we have sufficient capability to understand our potential adversaries, or what the real urgency is. Due to the existing budget constraints, there is great hesitancy to identify new requirements for fear of putting other programs at risk. Although this is a reality of the fiscal environment, I am concerned that we aren't fully appreciating the increasing ASW risk.

An example of an area in which we don't fully understand the

requirements and, therefore the gaps, is ASW C3 (command, control, communications). How important is that? Let me illustrate with another short story. There is a story about an incident aboard a train en route from Paris to Barcelona. In a compartment are four people: a beautiful young girl traveling with her elderly grandmother, and a stately general, who is accompanied by his young, handsome second lieutenant. The foursome is sitting in silence as the train enters a tunnel in the Pyrenees, the mountain range on the border between France and Spain.

It is pitch-dark in the tunnel. Suddenly the sound of a loud kiss is heard. It is followed by a second sound, that of a loud, hard smack. Upon exiting from the tunnel, the four people remain silent, with no one acknowledging the incident.

The young girl thinks to herself, "Boy that was a swell kiss that good looking lieutenant gave me. It's a shame that my grandmother slapped him, because he must have thought that I slapped him. That's too bad, because when we get to the next tunnel, he won't kiss me again."

The grandmother thinks to herself, "That fresh young man kissed my granddaughter. But fortunately, I brought her up to be a lady, so she slapped him real good. That's good, because now he'll stay away from her when we get to the next tunnel."

The general thinks to himself, "I can't believe what just happened! I personally handpicked him to be my aide, and I thought he was a gentleman. But in the dark, he took advantage of that young girl and kissed her. But she must have thought it was I who kissed her, since she slapped me instead of him."

The young lieutenant thinks to himself, "Boy, that was wonderful! How often do you get to kiss a beautiful girl and slug your boss at the same time?"

This story is a simplistic illustration that while people can have the same information available to them, they may arrive at entirely different conclusions... I think you can see the analogy to ASW. Effective C3 is needed to reduce the detect-to-engage timeline and it is the glue that ties together all of our hardware and people into a synergistic system. Over the last several years, we have seen exceptionally long detect-to-engage timelines sometimes averaging over an hour in real exercises resulting in unacceptable risk to our high value units. Defining the requirements and devoting the

needed resources to resolve this problem is critical to reducing risk to our carriers and other major ships.

Another area that has received a lot of attention and *fanfare* is distributed netted systems, commonly referred to as DNS. Several years ago, the S&T and R&D communities, in response to Admiral Clark's ASW vision, embarked on research to identify DNS options to achieve that vision. Many of these projects were science projects but some seem to be promising. The challenge is that the requirements have not been clearly articulated enough to provide the demand signal to complete the development efforts and transition the most promising technologies to acquisition. In my view, DNS is a viable option to mitigate the effects of continued force structure reductions and enable the transition of our ASW CONOPS to a more offensively focused warfighting strategy.

Now with some of the good news; yes—good news! In the past year I have seen progress addressing some of these challenges.

- Significant fiscal resources were reallocated to fund the cruiser and destroyer version of the surface ship torpedo defense system, with future increments for our high value units in the works. This system has the potential to greatly reduce risk to our ships.

- Great strides are being taken to resolve deficiencies with our torpedo programs. During my research, I was astounded to learn that we had not fired a lightweight torpedo warshot since 1994. The great news is that we fired a successful service weapons test in August with plans to restore this as an annual requirement.

- There was also a restoration of funding for the MK 46 maintenance program in order to address our lightweight torpedo inventory issue. This program had been cancelled in 2004.

- More exercise torpedoes are now in the budget—the POM-10 submittal for firing each year by the surface and aviation communities will greatly increase and the

submarine community will continue to maintain their standard of approximately eight exercise torpedoes per crew per year.

- Navy is re-examining the LCS ASW mission package to fully define the requirements and identify the right capability solutions to meet fleet needs.

- The surface warfare enterprise has re-instituted the ASW officer training course. The fact that this had been cancelled by the surface community several years ago told me volumes about their priority on ASW.

These are just a few examples of the positive progress that is being made within the ASW community. I hope that my team's actions the past year helped in achieving some of this progress.

Before I wrap up my remarks I would be remiss if I didn't mention the one significant issue that threatens our ability to exercise and train for ASW; that is the marine mammal litigation issue. It may surprise you but this is the one issue that the Secretary of the Navy spends a significant amount of time on. Why does he do that? Because it is critically important to our Navy to be able to exercise and train like we fight and active sonar is a key element of our ASW CONOPS to be able to counter the modern quiet diesel.

However, this is a very difficult issue. The Navy is clearly a leader in developing and promoting environmental technology to preserve the maritime environment. We have a track record that we are proud of, and we have a policy of transparency that invites public scrutiny and accountability. Over half the money spent on marine mammal research in the world is from the United States Navy. We agree with the activists that protecting the environment is very important. But serving the public interest encompasses more than serving just one interest, to the exclusion of all others. Our interests in national defense are also important and must be appropriately balanced vs. environmental stewardship. I am very concerned with how this will play out in the courts and hope that a reasonable solution will prevail that will allow sufficient at sea training using active sonar. As you probably know, this issue is now before the United States Supreme Court.

So, why am I telling you all this about ASW? Because I believe you can help!

Since their birth over a century ago, it has been clear that submarines are a potent threat against surface ships. That history has not been lost on our potential adversaries. Submarines and associated advanced sensors and weapons continue to proliferate greatly threatening our navy's ability to project power to defend our nation's vital interests. It should also be clear that anti-submarine warfare is a unique Navy core competency. No other service is going to do it! ASW is time consuming, challenging, and requires continuous leadership emphasis. As a submariner, we used to say ASW stands for *awfully slow warfare*, since it requires long periods of tracking, analyzing and much patience.

Fortunately, I do believe there is a re-emergence of ASW as one of our top Navy priorities. Navy leadership is focusing again on ASW to get it back on the upward slope on the sine curve. Increasing the priorities, providing resources, and taking steps to clearly define requirements are among the actions that I see the leadership is taking. To deal with the challenges facing us, we don't need drastic measures or crash programs... they never work anyway. What needs to happen is for Navy leadership to apply a steady pressure to keep the positive momentum going. We aren't there yet, but I am optimistic that we are on the right track.

How can you contribute? We need officers, sailors, and civilians that understand this complex but critically important warfare area. We have few left with this expertise and their numbers are dwindling. You can contribute to the *re-emergence* through your research and studies here at Monterey and later in the fleet. The technical complexities of advanced ASW technologies offer a fertile ground for examination and research projects. You can also participate in curricula that are relevant to ASW. In the end, this school can contribute to the future of ASW as a US Navy priority. As I look ahead to my future job here as the undersea warfare chair, I am very excited and look forward to working with you on a wide range of efforts.

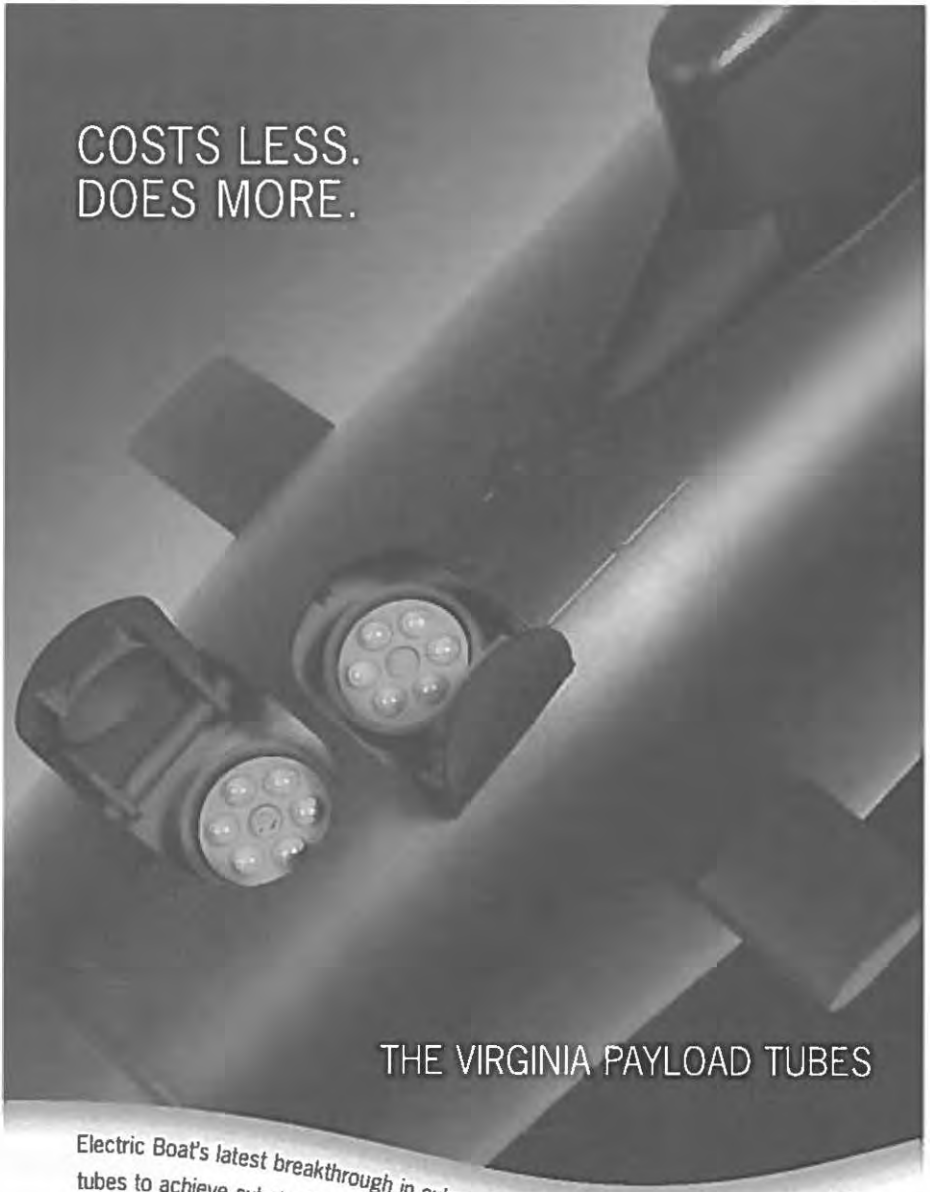
In closing, I will leave you with one of those famous Augustine's Laws. For those of you that don't know Norm Augustine—he was the president and chief operating officer of Martin Marietta and wrote a book titled Augustine's Laws which

outlined the pitfalls facing today's business managers. I believe that one of his laws is extremely relevant as we move forward in ASW:

> "The more time you spend talking about what you have been doing, the less time you have to do what you have been talking about. Eventually, you spend more and more time talking about less and less...until finally, you spend all your time talking about nothing."

So with that in mind, I think it's about time for me to get back to work so that I have something to talk about later. Again, thank you for the opportunity to speak to you today. It was an honor and a pleasure.■

Thank you.



Electric Boat's latest breakthrough in submarine design adds larger and less complex tubes to achieve substantial savings on Virginia-class attack submarines while increasing their capability. The boat can deploy a wider range of payloads than ever before and the cost is $40 million less per ship. That gives the Navy a fleet with the flexibility it needs for tomorrow at a price it can afford today.

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AN AGENDA FOR SUBMARINE FORCE EXPERIMENTATION

by Dr. Owen R. Coté Jr.

Dr. Coté is the Associate Director of MIT's Security Studies Program. He is also the author of The Third Battle: Innovation in the U.S. Navy's Silent Cold War Struggle with the Soviet Union. This article is a summary of a conference he organized at MIT in February 2008 that looked at options for Submarine Force experimentation with new sensors and weapons.

Both today's and tomorrow's wars demand that the U.S. have better capabilities to strike high value mobile targets from the sea. The nuclear submarine's ability to access politically sensitive areas in today's wars and denied areas in tomorrow's wars give it an important role to play in this mission area across the full spectrum of conflict. Defeating high value mobile targets requires persistent sources of both intelligence, surveillance, and reconnaissance (ISR) and precision, time critical fires. Toward this end, the U.S. Navy's submarine community, together with its surface community, should engage in a program of operational experimentation with sea-based tactical ballistic missiles and small, high endurance UAVs. Operational experimentation can simultaneously serve two important objectives; it can give today's operational commanders a 75 percent solution to an important unmet requirement in today's wars, and it can make the Navy a more educated buyer of the 99 percent solution in the same mission area that tomorrow's operational commanders will need in tomorrow's wars.

In addition to prosecuting the current wars in Iraq and Afghanistan, the U.S. military must be prepared to deter or fight two very different opponents under any conceivable defense policy. Al Qaeda, and groups linked to it, swim within the vast sea of Sunni Islam populations in significant parts of Africa, the Middle East, and Asia. They seek sanctuaries from which to attack what they perceive to be corrupt local governments, as well as those government's more distant supporters in the West, and particularly the U.S. Their ultimate goal is the overthrow of those local govern-

ments, some of whom the U.S. indeed has a vital interest in supporting. Because these groups lack the means to do this using traditional military means, they use terrorism instead. The defeat of this opponent cannot be accomplished using only military means, but such means will remain necessary as a component of the overall struggle against this opponent. For lack of a better term, one can call the military side of this struggle irregular warfare.[1]

The second opponent that the U.S. military must be capable of deterring or defeating is any state that might seek to contest the U.S.'s global control over and exploitation of the sea, air, and space, or as Barry Posen has put it, the U.S.'s "command of the commons."[2] There is no state with the capability to do this today and the U.S. has an interest in preventing the emergence of one. As with the struggle against terrorism, efforts toward that end cannot be accomplished using only military means, but an important element of any U.S. defense policy will be the maintenance and modernization of military capabilities sufficient to ensure its command of the commons, and the littoral space that abuts it, against both regional powers and any so called peer or near-peer competitor of the future. For simplicity's sake, one can call this ongoing effort command of the commons.

Irregular warfare and command of the commons will form the foundation of any future defense policy, but there will likely be other requirements whose demands are less clear because they involve national security issues where there is more debate about the proper course forward. First, there will continue to be debate over whether the U.S. needs to retain the ground force structure needed to invade and change the regime of states of concern, with the attendant risk of years of nation-building under fire to follow, as it did in Iraq and Afghanistan. Second, and possibly alternatively, there will be debates over whether and how to use preemptive force to prevent states of concern from acquiring the capability to produce nuclear weapons. Third, there will be debates over the degree to which the U.S. military will be asked to deal with humanitarian disasters. One can call these three different uses of force regime change, counter-proliferation, and humanitarian relief.

In many ways, irregular warfare and command of the commons occupy opposite poles of the conflict spectrum, and therefore often present quite different demands on the military forces needed to

execute them. These differing demands in turn make some forces appear more relevant to one side of the conflict spectrum than the other. For example, the fact that irregular warfare is happening now and that wars for control of the global commons appear to lie well in the future, if they occur at all, makes some forces appear relevant to a real fight that is happening today, while others appear relevant only to a fight that might happen well in the future. Inside the beltway, these perceptions lead to budget battles that imply the need to choose between funding forces for today's wars or tomorrow's wars.

A more systematic way to assess the future relevance or irrelevance of various types of military force is to ask whether they are relevant to both irregular warfare and wars over the commons, one or the other, or neither. Certainly the U.S. should not be in the business of making major investments in forces that fall in the last category. Decisions over whether and how much to invest in forces that are clearly more relevant to today's wars than tomorrow's, or vice versa, will likely hinge on other decisions yet to be made concerning the future of wars of regime change, counter-proliferation, and humanitarian relief, and the potential relevance of forces to those types of conflict as well. But, contrary to much public debate today, there are forces which can adapt to the demands made by the full spectrum of conflict. This process of adaptation is best served by operational experimentation with technologies and mission areas that are clearly common across the full spectrum of war.

One overarching demand common to both irregular warfare and command of the commons is the need to decrease the dependence of U.S. forces on the use of local bases ashore in areas of concern. A second is the need to defeat high value mobile targets. This second demand in turn generates the need for ubiquitous and persistent, multi-spectral intelligence, surveillance, and reconnaissance (ISR) and equally ubiquitous and persistent sources of time critical, precision fires. In response to these demands, the Navy should engage in operational experimentation with small, long endurance UAVs organic to both its surface ships and submarines, and with tactical ballistic missiles on both those platforms capable of promptly striking the targets identified and located by those UAVs, by other ISR assets, or by engaged forces ashore.

The key to minimizing the dependency of U.S. forces on bases ashore is to base as much capability as possible at sea. Because this comes naturally to maritime forces, the Navy Department has been less involved than the other two services in the zero sum budget debates described above. Its basic relevance to the struggle against the U.S.'s two core opponents is less in dispute because its ability to reduce U.S. dependence on local bases ashore is so clearly relevant in both cases.

Yet, if relevance is not the problem, the Navy still faces the challenge of supporting the theater commanders fighting today's irregular wars against terrorists and insurgents, while at the same time ensuring that future theater commanders will be provided the capabilities needed to defeat a peer competitor in the future.

For example, today these targets might be terrorist leaders who repeatedly change their location and seek to blend into civilian populations, but who must occasionally use some form of wireless communication in order to coordinate their activities. Tomorrow, those targets might be the engagement radars for the modern air defense systems that are among the pacing threats that will determine success or failure in a future war against a peer competitor. Today, operations against high value, mobile targets are conducted in a relatively benign threat environment, but there is a premium on covertness, both so as not to alert the opponent and so as to create deniability. Tomorrow, this mission might need to be conducted in an extreme threat environment, where covertness and stealth would be necessary simply to survive. In today's war, simply being at sea and just over the horizon will often provide the requisite level of stealth and survivability, but there are cases when the greater stealth provided by a submarine is of great value. This situation reverses in tomorrow's war, where the threat will likely be such that submarines will be the only platform that can close with the enemy early in a conflict under many circumstances.

Developing forces on these two very different timelines, for use in these two very different threat environments presents a real challenge. Secretary Gates recently described this challenge, and his words are worth quoting at length:

> "In the past I have expressed frustration over the defense bureaucracy's priorities and lack of urgency when it came to

> the current conflicts – that for too many in the Pentagon it has been business as usual, as opposed to a wartime footing and a wartime mentality. When referring to "Next-War-itis," I was not expressing opposition to thinking about and preparing for the future. It would be irresponsible not to do so – and the overwhelming majority of people in the Pentagon, the services, and the defense industry do just that. My point was simply that we must not be so preoccupied with preparing for future conventional and strategic conflicts that we neglect to provide, both short-term and long-term, all the capabilities necessary to fight and win conflicts such as we are in today....Our conventional modernization programs seek a 99 percent solution in years. Stability and counterinsurgency missions – the wars we are in – require 75 percent solutions in months. The challenge is whether in our bureaucracy and in our minds these two different paradigms can be made to coexist.[3]

The key tradeoff here is between the 99 percent solution in years and the 75 percent solution in months. One powerful way of addressing this tradeoff is through near term operational experimentation with essentially off-the-shelf capabilities in mission areas like ISR and time critical strike where there is both an urgent near term need and an enduring requirement.

Operational experimentation can be done cheaply and quickly, which helps with the challenge of adaptation and innovation. It is often difficult for a platform community to embrace new missions. The new missions are unfamiliar and lack an internal constituency within that community, there are usually other platform communities that will defend their primacy in those mission areas even when that primacy may be waning, and the benefits of innovation remain uncertain and in the future, whereas the costs are clear and occur up front. This last fact in particular, combined with the traditional "99 percent solution in years" procurement system, is one of the main reasons why much innovation is stillborn.

It is exactly at the point early in the process of innovation when the learning curve is steepest and the potential returns on investment are highest that it is most difficult to project future benefits, but under the traditional procurement system it is necessary to

project costs for the lifetime of the system and weigh them against those projected benefits. Alternatively, with operational experimentation, up front cost can be significantly reduced by substituting the 75 for the 99 percent solution, while an idea of future benefits can be more quickly and clearly demonstrated in the field, rather than merely on power point slides, and theater commanders engaged in current operations can be made into advocates for the new system early in its development when it is most vulnerable.

Experimentation with organic, sea-based capabilities to find and strike high value, mobile targets that only expose themselves intermittently and that never remain in one place for long can build on tremendous advances already made in Operations Enduring and Iraqi Freedom. Off-the-shelf technology is available to execute a 75 percent solution to this challenge in the near term, and there is great potential for future growth in these capabilities relevant to the demands of tomorrow's wars.

Small, high endurance UAVs have become the tactical surveillance asset of choice in irregular warfare because GPS has solved the navigation problems that long bedeviled UAVs of all sizes; miniaturization has given them more potent sensors; they can be organically launched and controlled by small units; and they can be deployed in sufficient numbers to cover large, distributed battlefields. The first and still dominant "killer app" that small UAVs brought to today's wars was the ubiquitous, real time, and continuous provision of optical images and streaming video for enhanced situational awareness and as a cue for weapon targeting systems. The next step, which is already being taken, is to extend their sensor coverage from the optical to the radio-frequency (RF) part of the spectrum, and to exploit new targeting algorithms which allow them to serve as closed loop surveillance and targeting systems in support of time critical strikes. These new targeting algorithms, which operate in both the optical and RF spectra, break the traditional links between antenna aperture and targeting accuracy, allowing small UAVs with tiny antenna apertures to not only detect, identify, and track high value mobile targets, but also to locate them with precision sufficient to target GPS-guided weapons.

At the same time, surface-launched, GPS-guided tactical ballistic missiles are becoming the weapon of choice in attacks

against mobile, high value targets because ballistic missiles fly faster than cruise missiles, and because surface launchers have more persistence than aircraft. Because they fly faster, ballistic missiles greatly simplify the targeting problem against mobile targets compared to cruise missiles by significantly reducing the dead time between target location and weapon arrival during which a target might move. At the same time, when they are based on the surface, ballistic missiles have essentially unlimited persistence compared to aircraft-delivered weapons because their launchers do not run out of fuel every few hours and return to a distant base. Surface-based ballistic missiles are therefore capable of holding any target within their range continuously at risk of attack day or night and in all weather conditions within minutes.

Together, small UAVs and tactical ballistic missiles are already providing a significant improvement in the Army's, the Marine's, and SOCOM's capabilities to defeat high value mobile targets in Iraq and Afghanistan. Putting them aboard Navy ships and submarines would expand the reach of this capability throughout the entire Mediterranean-Indo-Pacific littoral. In the near term, this will greatly enhance DOD's irregular warfare capabilities, and it will also provide a basis for further developments relevant to wars for control of the global commons. For example, more advanced versions of today's small UAVs launched by submarines will likely be needed to deal with the "sensor lockout" that advanced air defenses and other anti-access weapons cause by forcing other surface and airborne surveillance platforms to stand off outside their sensor ranges, and submarine-launched tactical ballistic missiles will likely provide the only means of quickly attacking the mobile components of a peer competitor's anti-access system when they expose themselves.

Operational experimentation toward this end can take many paths and it is not necessary to simultaneously pursue all of them at once, but there are several key capabilities that could be explored in the near term, either together or in sequential fashion. First, is the integration of an off-the-shelf tactical ballistic missile with combined inertial/GPS (INS/GPS) guidance aboard surface ships and submarines. Several candidates exist for such a program and the choice among them should factor in maximum range, compatibility with existing vertical launchers, and payload flexibility.

Second, is the development of a simple means of launching and controlling existing small UAVs from submarines (surface ships are already engaged in this activity). Ideally, the submarine force could experiment with a range of UAV options, including smaller vehicles that would not require use of existing vertical launchers, as well as larger, longer endurance vehicles that would. Third, is to experiment with recently developed targeting algorithms, some of which involve networking among several platforms, that can now be exploited using the small array apertures, low power, and narrowband data links available on small UAVs. For example, surface ships and submarines could experiment with the use of time-difference-of-arrival (TDOA) techniques employing small UAVs networked with their organic SIGINT assets to identify and precisely geolocate RF signals of interest in the littoral environment, or techniques that allow imagery or streaming video from small UAVs to be quickly converted into fully mensurated digital point precision database (DPPDB) imagery.

The proposed path of operational experimentation using off-the-shelf technology could provide today's operational commanders with an important capability they now lack in the near term. This is the 75 percent solution referred to above by Secretary Gates. But much additional experimentation and development could evolve from this baseline. Synthetic aperture (SAR) radars have been developed for small UAVs and further miniaturization may lead to the possibility for combined sensor payloads that include optical, IR, SIGINT, and/or radar. Very sophisticated sub-munitions, many of which have already been developed, could be substituted for unitary warheads, giving individual tactical ballistic missiles a multiple kill capability. And of course, many of these capabilities would be potentially applicable with some modification to the war at sea as well. Over time, building on the base of operational experimentation, 99 percent solutions needed in the event of a struggle over the global commons could be developed in the timeframe in which they were needed.■

ENDNOTES

1. On irregular warfare, see RADM Mark Kenny, USN, "Navy Irregular Warfare," *The Submarine Review*, January 2009, pp. 52-58.
2. Barry R. Posen, "The Command of the Commons: The Military Foundation of U.S. Hegemony," *International Security*, Summer 2003.
3. Speech delivered by Secretary of Defense Robert M. Gates at the National Defense University, Washington, D.C., Monday, 29 September 2008.

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A SHORT HISTORY OF SUBMARINES IN LAND ATTACK

Rear Admiral William J. Holland, Jr. USN (RET)

Jerry Holland is the Vice President of the Naval Historical Foundation and the organizer of the annual Submarine History Seminar sponsored by the Foundation and the Naval Submarine League. The 2009 seminar discussed development of the weapons systems and the 2010 will address the submarines and command and control systems to deploy the weapons.

At the end of World War II, the Submarine Officers Conference (a convocation of flag officers actively engaged in submarine commands) endorsed a recommendation to build two types of submarines to launch ballistic missiles (SSB) and tactical missiles (SSG). Through the rest of the decade design studies and development experiments worked to develop the weapons while designs for their launch platforms lingered in the sidelines. Short lived was PROJECT TAURUS that envisioned a barge towed by submarines. PROJECT DERBY to convert LOON rockets— developed from the German V1—to a missile that could be launched from a submarine lasted about three years until detonation of the liquid fueled rocket on a simulated ship demonstrated the catastrophic effects of such an explosion.

After TAURUS was cancelled in 1948, the Submarine Launched Assault Missile (SLAM) began. The program envisioned three weapons systems: REGULUS with an IOC in 1953, RIGEL with a longer range and larger warhead in 1955 and TRITON with a projected IOC of 1960. A guidance program to allow the missiles to be steered to the target by the way of guidance ships, i.e. other submarines, or by aircraft, was designed and installation planned for submarines to be constructed in the mid-50's. By 1950 contracts were let for REGULUS and in 1952 full scale development was authorized. The RIGEL was cancelled.

Preliminary studies for SSG's began in 1953 coincident with the recommissioning of USS TUNNY (SSG-282), CDR James Osborn commanding. TUNNY operated out of Point Mugu in a develop-

ment and test program until 1957 when she shifted home port to Pearl Harbor to begin deterrent patrols the next year. USS BARBERO (SSG-317) became the second submarine in the Regulus Program and USS CARBONERO (SS-337) was recommissioned as the first boat to be equipped with the Trounce guidance system. Trounce was planned for SKIPJACK class attack submarines.

In 1956 development of SUBROC began. The following year the TRITON program was cancelled as development shifted to the POLARIS program. In 1958 all cruise missile development programs were cancelled in cost cutting measures. That same year the third SSG, USS GRAYBACK (SSG-574) was delivered and the year after the fourth, USS GROWLER (SSG 577). These two submarines were the first two that were not conversions but designed from keel up for the REGULUS missile. In 1961 the final SSG, USS HALIBUT (SSGN 587) was launched.

REGULUS patrols continued until 1966 when the weapon system was withdrawn from service, replaced by ballistic missile patrols. The submarines involved were retired or converted to attack submarines (SS/SSN).

In the late sixties, the Kaufman Panel recommended development of a Submarine Tactical Anti-ship Weapons System that included a dedicated submarine with 20 cruise missiles in 30 inch diameter vertical tubes. The recommendation was rejected but a long range anti-ship missile development (Advanced Cruise Missile (ACM)) began. In 1972 the Secretary of Defense (Laird) proposed converting the ten oldest SSBN's (598 and 616 Classes) to submarine launched cruise missiles. The Director of Development, Research and Evaluation (DDRE) (John Foster) pushed for a cruise missile (ACM) to be equipped with a nuclear warhead and able to attack targets ashore. In the meantime, HARPOON was encapsulated and used successfully in a submarine tube launched system.

In 1973 the House Appropriations Committee directed the development of a strategic cruise missile to be stopped and the efforts be put into a tactical cruise missile. The Deputy Secretary of Defense (Clements) directed merger of the Air Launched Cruise Missile (ALCM) and the nascent Submarine Launched Cruise Missile (SLCM). The Air Force was assigned to continue the engine development and the Navy to develop the guidance systems.

In the next year the Operational Requirement for both submarine launched sea and land attack missiles was written. A common program was mandated, contracts were let to General Dynamics (ALCM) and LTV (SLCM). Captain Walter Locke was named SLCM Program Manager.

In 1975 the Navy proposed three versions of the missile: TASM (sea targets), TLAM (N)—a land attack version with a nuclear warhead, and TLAM (C), a land attack version with a conventional warhead. In 1977 a Joint Cruise Missile Project Office was established with Locke as the Director; he served until 1982. The Ground Launched Cruise Missile with nuclear warhead was to be operated by the Air Force in mobile launchers stationed in Europe. Development proceeded through this period in fits and starts because of varying levels of funding and general objections to further deployment of nuclear weapons.

Operational evaluation to support a milestone III full rate production decision on the Tomahawk missile began in January 1981. This OPEVAL was conducted in six phases. The first three phases all involved testing of the submarine launched Tomahawk missiles. The sub launched anti-ship version (TASM), conventional land attack missile (TLAM/C), and nuclear land attack variant (TLAM/N) were tested from January 1981 to October 1983. The ship-launched variants were tested from December 1983 to March 1985. The All Up Round (AUR) was determined to be "... potentially operationally effective and potentially operationally suitable...", and full rate production was recommended. In April of 1988 the OPEVAL of the conventional land attack sub munitions missile (TLAM/D) was tested, determined to be potentially operationally effective and potentially operationally suitable and limited fleet introduction recommended.

As missile improvements were made, follow on test and evaluation continued. Block II improvements were made and tested with all variants in July 1987 through September 1987. Some of these improvements included a TASM improved sea skimming variant, an improved booster rocket, cruise missile radar altimeter, and the Digital Scene Matching Area Corellator (DSMAC) Block II. In October of 1990, the OPEVAL of the Block III missile began, the first time GPS was used to aid missile guidance. The testing was performed on both surface and subsurface units under various

environmental conditions, continuing through July 1994. Both conventional variants (TLAM/C and D) were tested and determined to be "...operationally effective and operationally suitable...", with full fleet introduction recommended.

On 27 September 1991 President Bush announced a number of initiatives affecting the entire spectrum of US nuclear weapons. The United States removed all tactical nuclear weapons, including nuclear cruise missiles, from its surface ships and attack submarines. The nuclear equipped UGM-109A TLAM-N Tomahawk was withdrawn from service in 1992. The conventional versions remained operational.

In 1991 288 Tomahawks (TLAM/C) were fired in Operation Kuwait Liberation/Desert Storm from both surface ships and submarines. The accuracy and flight patterns became a much-publicized subject by observers. In 1993 and 1995 small numbers were used for selected targets in Iraq and Bosnia (Deliberate Force).

A five-year study of the Tomahawk missile performance began in 1995. The objective of the program was to verify, in a statistically significant manner, that missile performance, accuracy, and reliability met operational requirements and thresholds. The program tested approximately eight missiles each year emphasizing realistic test scenarios, including battle group operations, for missiles launched from Tomahawk capable Block II and Block III surface ships and submarines. End to end testing was completed with every mission.

Since the Gulf War, the Navy has improved its Tomahawk missile's operational responsiveness, target penetration, range, and accuracy. It has added global positioning system guidance and redesigned the warhead and engine in the missile's Block III configuration that entered service in March 1993. The Tomahawk TLAM Block III system upgrade incorporated jam-resistant Global Positioning System (GPS) system receivers; provided a smaller, lighter warhead, extended range, Time of Arrival, and improved accuracy for low contrast matching of Digital Scene Matching Area Correlator. With GPS, TLAM route planning is not constrained by terrain features, and mission planning time is reduced. China Lake designed, developed, and qualified the WDU-36 warhead in 48 months to meet evolving Tomahawk requirements of insensitive munitions ordnance compliance and range enhancement, while

maintaining or enhancing ordnance effectiveness. The WDU-36 uses a new warhead material based upon prior China Lake warhead technology investigations, PBXN-107 explosive, the FMU-148 fuse (developed and qualified for this application), and the BBU-47 fuse booster (developed and qualified using the new PBXN-7 explosive). Block III was first used in the September 1995 Bosnia strike (Deliberate Force) and a year later in the Iraq strike (Desert Strike).

On August 18, 2004, the US Navy awarded Raytheon a $1.6 billion multi-year procurement contract for the purchase of 2,200 Tactical Tomahawk missiles from FY2004 through FY2008. The contract also approved full rate production. The US Navy will receive 2135 missiles worth $1.56 billion and the United Kingdom will take over the remaining 65 missiles valued at $47 million. Production work is scheduled to be complete in June 2011.

The first two launch tests of production Tomahawk Bloc IV missiles were conducted on September 16, 2004, and on September 21, 2004. The first launch was conducted at Naval Surface Warfare Center's Indian Head Division using a Tomahawk equipped with an inert warhead and flying a simulated mission. The second test was conduced by USS STETHEM (DDG-63) destroyer. The production missile was launched from the Burke-class destroyer and flew a land attack mission. These tests validated Tomahawk Block IV's rocket motor (booster), engine, guidance and navigation systems and the entire weapon.

On December 6, 2004, United Defense was awarded a $104 million, if all options are exercised, for the production and delivery of Mk 14 mod 2 canisters in support of the Tactical Tomahawk missile. Mk 14 mod 2 canisters have been specially designed to fit into Mk 41 vertical launch system (VLS) aboard US Navy's destroyers and cruisers. The contract includes options for the upgrade of 688 existing Mk 14 canisters and production of 439 Mk 14 mod 2 canisters. Mk 14 mod 2 are fully compatible with the newest Tomahawk variant.

In June 2005 the US Navy reported its estimated cost for the Tactical Tomahawk program totaling $4.2 billion including production of 3,404 missiles.

In February 2006 Raytheon was awarded a $14 million modification to a previous contract for 65 Tactical Tomahawk missiles for the United Kingdom. The contract provided funds to

convert these 65 submarine vertical launch missiles into Tactical Tomahawk Torpedo Tube Launched (TT TTL) missiles.

In March 2006 Raytheon was awarded Tomahawk Block IV cruise missile fiscal year 2006 production contract valued at $346 million. The contract includes 473 missiles for both the United States Navy and the Royal Navy to be delivered from 2006 through 2009. Under this contract the United Kingdom was slated to take over 65 submarine torpedo tube-launched missiles.

TBIP provided a single variant missile, the Tomahawk Multi-Mission Missile that is capable of attacking sea- and land-based targets in near real time. TBIP also enhanced its hard target penetrating capability beyond current weapons systems thus increasing the target set. TBIP provided UHF SATCOM and man-in-the-loop data link to enable the missile to receive in-flight targeting updates, to transfer health and status messages and to broadcast Battle Damage Indication (BDI).

Tactical Tomahawk added the capability to reprogram the missile while in-flight to strike any of 15 preprogrammed alternate targets or redirect the missile to any Global Positioning System (GPS) target coordinates. It can also loiter over a target area for some hours, and with its on-board TV camera, allow the war fighting commanders to assess battle damage of the target, and, if necessary, redirect the missile to any other target. Tactical Tomahawk would permit mission planning aboard cruisers, destroyers and attack submarines for quick reaction GPS missions.■

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SUBMARINERS CAN BE VETERANS TOO

by VADM Dan Cooper, USN(Ret)

VADM Dan Cooper is a retired submarine officer who commanded PUFFER, SUBRON TEN and SUBLANT. During the Administration of President George W. Bush VADM Cooper was Deputy Secretary for Benefits in the Department of Veteran Affairs.

Since the vast majority of our readers are veterans, know veterans or can spell "veteran", the goal is to make each of you more aware of some aspects of the Department of Veterans Affairs. One Secretary has referred to it as the "greatest story never told". And, it might cause the reader to at least think how the VA may help – you or a veteran you know.

Based on the author's recent full immersion into "the world of veterans' benefits", that will be the primary focus; but, the more subtle messages are:

- The United States is the most generous country in the world toward its veterans.
- The Department of Veterans Affairs is not *your father's VA*
- The adjudication of disability claims and the execution of medical and non-medical benefits for our veterans are quite complicated but accomplished daily by a highly professional group of dedicated individuals (called government workers or *bureaucrats*—the majority of whom are themselves veterans)

Every day, in the job, there was one consistent message—emphasized in person, in speeches and in writing:

"We have the best mission in government – we help veterans!"

Brief History

Veterans' benefits have always been a major topic of discussion —be it George Washington's plea to Congress for pay for his troops or the veterans' *bonus march* of the mid-30's. As Rudyard Kipling emphasized in his well-known poem, *Tommy*, the appreciation of veterans is expansive during conflict; and , rather quickly, becomes dormant after *victory is declared.*

A further point to consider is that the term *veteran* brings a different mental image to each of us; it might be one of WWI, WWII, Korea, Viet Nam the Gulf War, or the Cold War—and each vision might vary with respect to both the conflict and the participants. The myriad problems faced by the soldier, marine, sailor, airman or coastguardsman have been and are quite disparate based on the *enemy*, the physical and mental stress after each of these conflicts, and the *home-town reception* to which the young veteran returned.

The VA motto is engraved on the wall of the department headquarters building on Vermont Ave in Washington, D.C. The words, taken from the second inaugural address by President Abraham Lincoln, state:

> *"To care for him who shall have borne the battle, and for his widow and his orphan"*

In 1944, President Roosevelt signed the Servicemen's Readjustment Act better known as the GI BILL. This was one of the greatest pieces of social legislation in the history of our republic. It ensured that 17 million personnel from the Atlantic and Pacific Theaters could be absorbed into our civilian society. (As an aside—it passed by one vote.) By the time the bill expired, it had provided:

- Education (training or college) for 7.8M veterans;
- Home, business or farm loans: 5.9M loans valued at >$550B;
- Unemployment Compensation at $20 for 52 weeks; and
- Priority for construction materials to build VHA hospitals.

Economic historians will tell you, this bill was the foundation for our country's prosperity in the decades to follow.

In 1989 the *Veterans Administration* became the Department of Veterans Affairs, the second largest in the Executive Branch. Only the Department of Defense is larger in both number of personnel and size of budget.

Organization of the Department

The Department of Veterans Affairs (DVA) is composed, primarily, of three Administrations, each led by an Under Secretary, duly nominated by the President and confirmed by the Senate.

The largest, and no doubt the most recognized, of the three administrations is the Veterans Health Administration (VHA). Today, VHA oversees nearly 160 hospitals, about 800 Community—Based Outpatient Clinics (CBOC) and 137 Nursing Homes—with close to 250,000 personnel. A less realized point is that VHA is a leader in medical research. Over the years, it has been instrumental in advancements in pacemakers, CT scans, prosthetics, as well as the treatment of Post Traumatic Stress Disorder (PTSD) and HIV AIDS. VHA is arguably the best medical system in the world today.

The second largest (but interestingly, with a higher budget than VHA) is the Veteran' Benefits Administration (VBA) with 57 offices including at least one in each state, Manila and San Juan. Presently, VBA has over 15,000 personnel and an annual budget around $50B, 99% of which is for veterans' entitlements as a result of five non-medical benefits programs which it executes.

The third of the administrations is the National Cemetery Administration (NCA). This oversees over 125 national veterans' cemeteries today, and has six presently under construction. NCA also coordinates with individual states in the oversight of the various *state veterans cemeteries*. As an aside, the one cemetery over which NCA has no responsibility is Arlington National Cemetery which is run by the Department of the Army.

The Veterans Benefits Administration

In VBA, there are the five primary non-medical benefits programs. Each of these serve veterans; however, a couple pro-

grams are, specifically, available to active duty military, and in some cases, national guard and reserve personnel.

Insurance (INS)

The largest insurance program is the Servicemembers Group Life Insurance (SGLI). VA, working with OSD, oversees Life Insurance for all participating active duty personnel. The SGLI benefit was dramatically improved in 2005 when the face value was increased from $250,000 to $400,000. (Some of you may remember when we were insured up to $10,000 by the government.) Simultaneously, with the increase in SGLI, the Department of Defense increased its program for the dependants of personnel killed on active duty to $100,000 (from $12,000). Today, the family of a deceased active duty person receives $500,000 relatively rapidly. Additionally, the VA has a special volunteer program to assist and advise the recipient on fiscal responsibility. There are Veterans Insurance programs available; the primary purpose of these is to help veterans who are disabled and therefore subject to higher premiums for the same insurance on the open market.

A second major *insurance* program, established as a result of the present conflict, is Traumatic Servicemembers Life Insurance Program. (T-SGLI). A member could be eligible to receive financial assistance, while on active duty, if she or he is seriously wounded and evacuated to a medical facility. The objective is to help defray the costs for the *families* to visit the seriously wounded and help in the healing process at the medical facility. (The fact is most *caregivers* will be far from home and away from their work.) The TSGLI is given in $25,000, $50,000, $75,000 and $100,000 packages. The eligibility and actual amount is determined by the individual military service (as written in law) and based on the specific disabilitie(s) and the seriousness of them.

Vocational Rehabilitation and Employment (VRE)

VOCREHAB was established to provide training and education, up to a college degree, for those individuals disabled to at least the 20% level. Further, the program is meant to establish the ability for *Independent Living* for those most seriously disabled. The primary goal of the program, for most veterans, is *employment*. In that

regard, we have counselors and *laboratories* in every Regional Office where the veteran can have access to all sources of information as well as assistance in resume' writing, job preparation and guidance. Special agreements have been established with colleges to assist in the education and with businesses across the nation to make jobs available for veterans. One *business* agreement was signed in 2007 with the FAA to assist veterans in training for air traffic controller, and another, with NAVAIRSYSCOM, for engineering candidates.

Loan Guaranty (LGY)

For active duty personnel, as well as veterans, the Loan Guaranty program is one of the best available for buying a home with no down payment. This is the follow-on to the 1944 GI Bill which, originally, included not only homes but also businesses and farms. In 2008, the VA made the 18,000th home loan, since the inception.

The Loan Guaranty program has a superior reputation not only for the opportunity for the military personnel home ownership but also for outstanding management. The delinquency and foreclosure rates are almost one-half those of the FHA loans and about 1/9th of the sub-prime foreclosures. There are several reasons for the success, not the least being the maturity and reliability of the military member. Quality is also ensured by the facts that VA uses well-trained appraisers whom VA continually monitors and qualifies (thus assuring standards not always present industry-wide); VA uses *ratios* which ensure all the monthly mandatory costs and expenses (as in childcare) of the buyer are calculated so that the buyer will not over-obligate; and ARMs, although allowed, are severely limited in the increase in a given year and the total increase allowed over five.

For oversight, VA has developed the capability to monitor payments so that as soon as the owner misses a payment, communication is initiated to assist, as necessary, to ensure foreclosure will not result.

Recently, VA has initiated a refinance (REFI) program meant to help all the LGY participants take advantage of the present market to adjust their mortgage and payments.

Education

This, of course, is the primary program which comes to mind when the term, *GI Bill* is mentioned. During the period the original education bill was in effect, 7.8 million veterans participated. Since then, there have been several program variations passed by Congress. The one in effect today is the Montgomery GI Bill. It requires the enlistee to decide upon entry; and, if signed up, to pay $100 a month for the first year ($1200 total). Then, within ten years of discharge, he or she can take advantage of the benefit. Today the value of that contract is just over $47,000.

In mid-2008 Congress passed one of the most generous bills since the GI Bill itself. Senator Webb, the junior Senator from Virginia, sponsored a bill based on the original GI Bill, but framed particularly to include the Reserves and National Guard post 9/11. The Bill will become effective 1 August 2009 but, has four features which will make execution (by VA with guidance from OSD) workable but cumbersome. The major components are:

- All service members (having had active duty post 9/11) will be eligible based on the total time on active duty. (There is no *payment* by the participant, as in the Montgomery Bill.) If a person served over 36 months, *active time*, they would be eligible for all benefits; those serving 12 to 24 months would be allowed 60%; and, if at least 24 months but less than 36, the allowed benefit would be 80%. There is allowance for *transferability* to family members under development.
- Tuition will be fully paid for any public college or university; but the maximum allowed in each state is the highest tuition at the most expensive public school in that state (that is, the limit will be somewhat different in each state based on the *highest* tuition.) On the other hand, if the veteran selects a private school, the limit is as above—unless—the school will pay part of the differential (between high allowed and the private school tuition), in which case the government will match the school dollar for dollar.
- Book allowance will be $1,000 / year

- Living expenses will be the amount allowed for an E5 (PO2) with two dependents predicated on the zip code of their home.

Disability Compensation

This is, by far, the largest program (>$40B in 2009). It is also the most visible, most complicated, most reported, and most emotional.

There are two key basic points which should be easy to understand but which prove to be more difficult when adjudicating on an individual basis:

- Any disability, to be eligible for compensation, must have been received or exacerbated (if present prior to service entry), while in the service on active duty.
- The compensation received for that disability or illness is based on the "degree of disability" not necessarily on the presence of it, in and of itself. That "specific degree" will be determined by a physical or mental exam and, if applicable, by measurement in the case of a scar, degree of motion, hearing, vision, etc.

A primary, and the most publicized difficulty in the system is the time presently required to adjudicate a claim. (An individual claim may include several issues such as vision, hearing, back, diseases, etc—the average number of issues per claim is over three—we have seen as many as 40—and each issue must be resolved individually). But, no matter how long it takes to formalize the decision, when done, the claimant receives the retroactive payment back to the *date of claim* or the date the claim was received. And, in most cases, the payment is received monthly for the rest of the life of the veteran. That is, no compensation (money) is *lost*. Further, all disability compensation is tax-free, no matter what the vet's income level might be.

To put the increasing workload in perspective: in 2002, VBA received 576,000 claims; in 2009 they received over 880,000 claims. Of those in 2009 about 25% were from Iraq and Afghanistan veterans; while the majority of claims were re-submittals from veterans who over the years had had claims adjudicated but who

now believed the problem was worse or that there were additional disabilities for which they should be compensated.

Summary (sort of)

The primary goal, in the last few years, has been to serve our newest veterans from the Global War on Terror (GWOT) as fast as possible (as a priority). Simultaneously, we have strived to *reach out* to our older veterans through publications, advertising, and presentations so all America's veterans can take full advantage of the benefits they have earned. There are special programs for *former POWs*; Benefits Delivery at Discharge (BDD) for helping all newly discharged veterans establish their records with the VA and begin receiving disability, if appropriate, immediately; and for those with *presumptives*, the several diseases which have been linked to exposure to Agent Orange during the Viet Nam War. (Two of the primary presumptive diseases are diabetes and prostate cancer—but there are over 15 diseases attributable to Agent Orange.)

Two of the most publicized medical and mental problems upon which we have focused during this last conflict (GWOT) are Post Traumatic Stress Disorder (PTSD) and Traumatic Brain Injury (TBI). The VA and DOD have worked hard to identify personnel with these potential problems. Special screening is done by both OSD and the VA; and every GWOT veteran has been authorized to use the VA hospital system for five years after discharge from active duty. During such visits, screening and further consultation is utilized to ensure we detect the symptoms as soon as possible and conduct necessary treatment.

Opinion

Every American should feel a sense of pride for the work in which the VA is involved, and the professionalism of the organization. There is no better mission and there are no better, no more dedicated and no more emotionally involved people than those at the Department of Veterans Affairs. The Mission, the People and the Veterans served must never be forgotten.

Final Point:

I would like to make one more point to all who might have slogged through this discussion: Every veteran, as he or she departs the service, should take a copy of the medical record to the local VA. In the case of older veterans, if there is something which happened to you while in the service, get it on the record—even if there is not, try to get your record to the VA. In later years, if you need help and are *on the record* at the VA, you stand a good chance of getting medical care in the best system available. I have seen several very sad cases where veterans became ill and, because they had never gotten the record to the VA, the VA was unable to provide assistance in a timely manner. In two cases the veterans died prior to the record being found. In a third case, fortunately, through a Herculean effort by a classmate, the record was retrieved and eligibility for VA assistance established before the veteran died from the disease he had contacted in the service 20 years earlier.■

ARTICLES

THE 0'S AND 1'S OF USW - A DISCUSSION OF COMPUTING IN USW

by Lt. Chris Bernotavicius, USN

Lt. Bernotavicius is a Submarine Officer currently enrolled in the USN Post Graduate School at Monterey, CA. This paper was recommended for publication by RADM Ray Jones, the current PGS USW Chairman.

Abstract

In this paper we examine the historical impact and future potentiality of computers on the art and practice of UnderSea Warfare (USW), with particular emphasis on Submarine Warfare. While a complete history is impractical in this short format, a solid overview of the evolution of the use of computers from their nascent days, to mechanical prototypes and sophisticated modern systems is considered. Aside from considering the tangible benefits of computers, this paper also discusses the increasingly evident challenges that are created by our ever broadening dependence on increasingly complicated systems. The conclusion is inescapable; computers provide not only an avenue to success, but also pose some of our deepest challenges.

Introduction

> "Now if the estimates made in the temple before hostilities indicate victory it is because calculations show one's strength to be superior to that of his enemy; if they indicate defeat, it is because calculations show that one is inferior. With many calculations, one can win; with few one cannot. How much less a chance of victory has one who makes none at all!" [Griffith, 1963]

Though the concept of a submersible vehicle has existed for centuries, the modern use of a submarine as a submerged warship, and a capable weapon is a relatively recent innovation. Early submarines such as TURTLE and HUNLEY were little more than simple diving bells. Powered by hand and armed with only the most

primitive of weapons—they served as little more than harbingers of a new type of warfare. Early innovations in submarines and submarine warfare were mechanical in nature. The development of newer and more efficient mechanical systems led the way for ballasting, ventilation, habitability, and of course weapons and sensors. These changes and improvements transitioned submarines from scientific curiosities to true weapons and warships.

Increasingly computers have played an important part, perhaps even the leading part, in the race to a better and more sophisticated weapon. Today computers dominate not only the day to day operation of the submarine, but also the planning of its missions, the training of its crew, the employment of its sensors, and the design of the boat itself. The submarine has given us a new vantage point from which to ask questions about the nature of our conflicts and their resolutions, and increasingly the answer to these questions is sought via technological means. At the same time computers also pose some of our strongest challenges, indeed they are changing the very notion of how our weapons evolve.

First Computers

Today, when we think of computers our tendency is to imagine screens and graphics, or perhaps a machine that can solve complex computations. In truth, the evolution of computers begins with devices such as a simple abacus. In similar fashion, the first *computers* used in undersea warfare were far from the complicated machines that we utilize today. One of the more useful early computing devices was the Torpedo Data Computer, or TDC. In fact, this device was actually much closer to the abacus than todays machines. Designed to solve the complex geometry problem of torpedo fire control, the TDC was an analog, electromechanical device. The problem of aiming a torpedo at a moving target from a moving submarine was difficult and computationally intensive. One had to take into account the bearing to the target and its speed to calculate its advance, not to mention the torpedo speed and gyro angle, etc. In WWI this problem was addressed with a variety of slide rules [Wikipedia, 2008]. By WWII technical innovation had provided another solution. An analog device, the TDC was primitive in the sense of today's computers, but sophisticated for its time and a real tactical advantage. It accepted inputs on the target

solution from officers in the attack party, and provided an angle solver and an estimated target position. In some sense, it was the first true use of a computer in making tactical decisions. Certainly it was one of the first uses that permitted and aided real time decision making from the submarine.

The Navy's use of computers rapidly progressed beyond simple mechanical devices such as the TDC. The age of the digital computer was upon us and though initial progress was slow, it would eventually come to dominate much of what we do. In former Secretary of the Navy John Lehman's excellent book profiling heroic sailors and Ships, one of the few women detailed is RADM Grace Hopper, whom Lehman calls a "Naval Reformer". [Lehman, 2001] In 1943 the graduate of Yale, and professor at Vassar joined the Navy WAVES where she was promptly assigned to work on programming America's first digital computer—the Mark I. Fifty one feet long, it occupied a massive space and could perform only three additions a second. It was however the coming of an age for both the Navy and the nation. It was initially conceived of as a machine that might rapidly complete complex calculations—such as those involved in laying a minefield. [Lehman, 2001] RADM Hopper went on to work with increasingly complicated and increasingly smaller computers. She served in the Navy until the age of 80. She was perhaps one of the first to question why such devices could not be used for strike planning or navigation. Indeed, it is hard to imagine (perhaps impossible in the case of strike planning) doing any of these tasks without the aid of computers. This early use of computers was focused on a simpler or improved method to complete sophisticated calculations. It addressed problems that were already in existence, perhaps in a new and innovative fashion–but none-the-less they were problems that already existed. Today's computers encompass not only large sophisticated machines shore side, but also a menagerie of such devices on board ships and submarines. From computers as an integral part of many systems such as sonar and fire control, to the desktop computers that are now ubiquitous in the stateroom of every officer—it is clear that computers have come to dominate our technology, and in only 50 years! What is sometimes less clear is that often times the problems they aid with are not even ones that can be conceived of without computer technology.

Operational Planning

Not only have computers come to dominate on board submarines, but also in the planning and analysis of submarine operations. As the US entered WWII, no comprehensive analysis had been done regarding the problem of an extended conflict featuring submarine warfare. Despite the lessons of WWI, namely that submarines can be a decisive advantage, no theory or plan had been developed to cope with this threat. [Meigs, 2002]

Initially the scientists of the National Research Defense Committee focused on such problems as determination of the maximum range of echo-ranging and its environmental dependence, improvements in the problem of tracking a contact based on intermittent bearing and range data, and probability studies focused on devising optimal attack procedures. They also focused on gaining quantitative information about the actual result of attacks and operations. [Meigs, 2002] It is clear that these are the sort of problems at which computers excel. They are both computationally intensive and data dependent. They are also highly dependent on repetition—something that is difficult for humans to do efficiently. Indeed *computer* databases were used, though again of a primitive sort compared to todays fine computers. Initial databases were kept on so-called "Hollerith codes", punch cards based on an automated codes.[Meigs, 2002] This sort of cumbersome and crude data would allow scientists to determine optimal tactics such as convoying and perfect attack patterns for aircraft and surface ships. It also signaled an entire field that would later arise—namely that of computer databases and *data-mining* techniques. Today we expect large repositories of data we desire, whether it be a bibliography and electronic references, a collection of personnel records, or a large accumulation of tactical scenarios. In fact, many of our plans and assumptions rely on large depositories of data.

The ability to maintain large stores of data and conduct complex calculations, and then repeat them many times are the hallmarks of all computers. These are also the sort of abilities that allowed scientists and Naval officers in conjunction to invent the idea of operational analysis and to consider the quantitative optimization of tactics and analysis. In WWII computers also played a key role in cryptography and signals analysis.

Today computers are increasingly shifting operational planning

from shore to sea based platforms—often with real time capabilities. Complicated strike missions can now be completely planned and executed from a submerged platform. What once took hours or days of planning on a mainframe can now be done in a few seconds in the control room of a submarine.

Training

Computers revolutionized USW in another, completely separate fashion—training. Training is perhaps one of the most significant factors in deciding any conflict—tactical or strategic. In order to be useful, training must be realistic, evaluated, and optimal. That is to say, one must train using the highest standards and ideal tactics with constant observations and measurable performance. It is hard to replicate the complexity of a tactical environment in such a setting, and yet the quality of training is completely dependent on it. Early attempts were by and large improvisation...

> "At first thought, a simulated approach and attack might seem too nebulous to have real training value. However the same section of the TDC used to determine enemy course and speed could also generate a complete, realistic problem. To have all the elements for a sonar approach required only the recording of the enemy ship's speed as well as its range and bearing for each minute of the exercise. To introduce the sound bearings realistically, we developed our own device, consisting of my shaving brush and a dynamic microphone. The microphone was plugged into the receptacle in the forward torpedo room that normally received the output from one of our sound heads..." [O'Kane, 1977]

Training rapidly proceeded from an improvisational use of the TDC and a shaving brush to a more complicated use of computer resources. Advanced trainers are particularly important in ASW, where the problems are often long—on the scale of many hours and filled with boredom. Here few problems will be seen by any crew (aircraft or surface) and the tactical behavior must be optimal. As early as 1943 scientists had developed suitcase sized training aids that could be used to simulate attack problems, as well as simulated sonar problems. A drastic improvement over an analog machine

and a shaving brush!

Today modern trainers dominate preparation cycles for crews of all platforms. These can range from mock ups of a sonar space with real time problems, to virtual reality ship control trainers, the flight simulators. Increasingly, trainers feature connectivity that allows personnel working on separate tasks to communicate and interact in a fashion that emulates closer and closer the intricacies of a tactical situation. On board Virginia class submarines, full tactical scenarios can be run right in the control room. These feature sonar, radar, and ESM contacts as well as full use of all tracking systems. In fact the use of a photonics mast (an inherently computerized system) permits computer graphics to simulate visual contacts. That the technology could have evolved to this degree of realism is a testament to the infinite versatility of the modern computer

Acoustic Propagation and Sensors

As previously stated, one of the primary goals for scientists as WWII entered its peak was to quantify the range and capability of acoustic sensors. [Meigs, 2002] Acoustic sensors have proved reliable and enduring due to the strength of sound's ability to travel and persist in water. Developing useful sensors has proved to be dependent on understanding and quantifying the environment. This combines oceanographic study with the need to exploit the power of computing. Early efforts were focused on shore side understanding of acoustic arrays and the basics of underwater acoustic propagation. Later efforts focused on development of optimal acoustic sensors and tactics.

The realization that the ocean environment controls acoustic propagation was profound for the future of sonar. The study of this idea promoted the use of physics, oceanography, and perhaps most importantly computers. The basics of any model of acoustic propagation relies on strong models of the physics of sound propagation in the ocean, but the implementation involves complex calculations and a multitude of repetitions. These are precisely the traits that computers are ideal for and excel at. Shore side acoustic models run on mainframes have evolved into smaller more compact programs that can be run on computers located on a submarine. Today's generation of computers and programs, such as PCIMAT and STDA, can take real time data and provide accurate acoustic

models—or at least as accurate as the data that is provided. The improvement is staggering—from a fundamental concept to a practical and tangible advantage. It is important that we recognize that our ability to compute and maintain this sort of accurate modeling is a real and tangible advantage—as valuable as a new submarine or weapons systems. At the same time these models can lead us down a terrible path. Often times with a machine to tell us the sound propagation paths and intensities we absolve ourselves of the need to educate ourselves on the environment and in situ analysis. The tendency is to believe the computer vice calculate and analyze, to rely on a mean vice the actuality of here and now. How much easier is it to operate a terminal than to learn the environment and the reality of the *here and now*?

The application of computers to sensors has not been limited to sonar. Computers permit ever more complex signal processing, allowing ever smaller signals to be extracted and analyzed from the surrounding noise. Radar, ESM, and MAD are all sensors that exist in their current fashion almost entirely due to computers. The shift from analog systems to digital implementations has allowed incredible advances in capability and size. The smaller, far more powerful sensors that exist today are a tangible product of a few decades of research. WWII saw the advent of radar and ESM, today we have radars capable of detecting periscopes from miles away and ESM suites that can use pattern matching algorithms to classify signals. It is unclear where a limit will be found, (if there is one!) but it is also certain that the path there will be paved with circuit boards.

Modern Advantages

We have seen that the historical impact of computers on USW has been profound, but the impact is not just historical. Advances continue to be made in all of the fields mentioned. Our acoustic models continue to improve and become more sophisticated and closer to real time. Our planning tools have improved and shifted toward sea based, in-situ planning. In the design of our trainers we increasingly take advantage of computing power to provide more realistic, connected, and mission optimal trainers. Today we can train for specific missions with specific anomalies—all while being observed and graded. What is interesting though, is to examine

some of the more modern applications of computers that are not simple derivatives of WWII technology.

Unmanned vehicles are becoming increasingly important in today's tactical environment. They are a platform in which the entire crew has been replaced by a computer. They are able then to enjoy the advantage of small size, maneuverability, and low risk that this arrangement conveys. Early unmanned vehicles were little more than large remote controlled cars, but the evolution has been rapid. Today's vehicles are small, dynamic, and highly autonomous. Capable of entering denied areas without risk to humans, unmanned vehicles are perhaps the future of the Navy. This has promoted research in an incredibly diverse array of fields, such as path finding and optimal search, mechanics and dynamics, control systems, and power systems. Already, today's vehicles display incredible longevity and capability. All of these areas are facilitated and dominated by computer methods. It is clear that to maintain an advantage in unmanned vehicles, the Navy will need to maintain a firm advantage in computing.

The increased power and reliability of computers has permitted their use in more mundane, but no less important applications. Our navigation and ship control systems are increasingly turned over to computers. Today's ships rely on GPS and computer based navigation systems. Our submarines rely on automated depth keeping and steering. These factors work to reduce crew size and permit greater multi-tasking. Even the back-up systems are now more and more reliant on computers. Simple commercial programs such as Excel and Power Point permit clearer presentations and more sophisticated data analysis on the deck plate level. In a fundamental way the nature of day to day work on board a ship is changing. Increasingly, less time is devoted to the mundane tasks of ship control and seamanship, and more is devoted to data analysis and dynamic improvements—at least in concept! It is a hard and constant challenge to avoid simply turning over the elements of seamanship to computers.

Even the construction of our ships is being revolutionized by computers. Previously ships were designed on paper with conventional drafting techniques—and a great deal of actual design was still needed during the construction process. Today computer programs such as CATIA are used as industry standards. These

programs permit three dimensional design and collision analysis on desktop computers. This innovation has streamlined the construction process and permitted greater accuracy and uniformity in the construction process. It is clear that the impact of computers is felt in ways that early pioneers could not imagine.

Modern Challenges

The previous sections have extolled the virtues of computers in almost every facet of USW. It must be noted that the ever increasing prevalence of computers is not without some negatives. As computers become increasingly sophisticated, so does the information that they require—perhaps leading us outside the realm we are accustomed to think in. Today's acoustic models can accurately handle dynamic, littoral environments, but to operate them requires detailed knowledge of oceanography and acoustics. Our tactical decision aids can use probabilistic considerations and optimization techniques to aid in search problems, but the operation of these systems and the interpretation of their output often requires sophisticated understanding of probability and search theory. Modern sonar systems are capable of incredible signal processing and advanced algorithms for analysis and estimation—but these techniques are often outside the scope of our sonar operators training. All of these issues raise concerns with traditional training pipelines. Increasingly a mismatch can be seen between machine capabilities, and machine use. Often operators do not even understand what these systems are capable of—much less how to provide the detailed and sophisticated information they require. Troubleshooting and maintaining these systems is increasingly difficult. Although proposed, the Submarine Force does not even have an IT rating! In an era of increasing networks, expectations for connectivity and strong desire for data to be available from all sensors, for data fusion—it is hard to see how these desires can be fulfilled with our current force structure.

Computers also have the potential to narrow our view point instead of broadening it. Today it is inconceivable that a presentation not be given on power point, that our data not be collated in Excel. The potential exists that our officer core will be reduced to middle managers and technocrats, losing our edge as tacticians and leaders. It is increasingly cumbersome to maintain a lead in training

in both fields. Today's officers need not only understand all of the systems and the increasingly complex theory that underlies them, but also the overriding tactical needs. It is possible, that as computers become ever more complex and the systems ever more dynamic, that these two goals will prove incompatible.

Conclusion

In this paper we have surveyed some of the incredible historical impacts that computers have had on the art and practice of USW. It is clear that computers have proved to be the revolutionary catalyst for many of our technologies and ideas. It is also clear that many of the contemporary advances are being driven by more sophisticated and smaller processors. Some of the most dynamic technologies and growing fields like, unmanned vehicles, ship design, and navigation, are dominated by these advances. At the same time computers pose a bold challenge for our personnel with regard to training and operation. The ever more evident mismatch between capability and use should prove an alarming warning that we are loosing an edge. The short time frame in which computers have been in use and become dominant should also provide a warning. How much longer can we expect the Navy to resemble its traditional image? The only thing that is clear is that continued research and training in computational fields must be a crucial and leading component of the Navy's future.

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SUBMARINES IN EARLY U.S. NAVAL INSTITUTE PROCEEDINGS PART I

by Mr. John Merrill

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Introduction

From 1874, Naval Institute Proceedings, the journal of the Naval Institute, has provided an independent window dedicated to Navy matters with articles from military professionals and civilian experts. Through the years and especially after the Navy's April 1900 purchase of HOLLAND submarine, commentaries directed to submarines have appeared in the Proceedings. A bibliography of submarine pieces in the Proceedings from 1903 to 1992 reveals more than 200 hundred articles most with the word submarine in the title.[1,2] The intention here is to take another look at some of the early essays. In some instances, the authors became persons of note in the years ahead. Historical honesty admits that each essay appearing in the Proceedings contributed to having a record of the Navy's submarine history.

Perusal of articles, pre-World War II, with an eye toward forethought of submarines and their future comes up a bit short. Submarine technology receives reasonable attention and discussion, but attention to the use of submarines beyond the battle group is sparse. Broad acceptance of the submarine in some quarters appears to have been slow.

Possibly one of the most striking areas regarding the perception of the submarine in the post World War I period is the lack of a broad recognition of the huge success of the German U-boat in World War I in almost depriving England of oil and food with submarine commerce raiding. Perhaps the strong but failed effort

in the early 1920s to outlaw submarines internationally was a result of the U-boat success. But it seems rare to find consideration of submarine commerce raiding from pro or con viewpoints during the decades between the world wars.

An underlying theme in submarine-related writing in the pre-and post-WWI period is a recurring and broad interest in moving forward with development of a true fleet type submarine. By 1912, the repeated goals always included greater range and endurance, higher speed, and better sea keeping ability. A surface speed of 21 knots and a periscope capability at least 30 feet below the surface were desired.

A passage of twenty years saw the Portsmouth Naval Shipyard commissioning of DOLPHIN (V-7) in 1932 when, "...the V-7 was actually the first of the fleet-type submarines to be designed for what would later be called patrol operations." Additionally as, "...the Navy designed V-7 was approved, this submarine can be seen in retrospect, as the progenitor of the famous U. S. submarines of World War II..."[3]

Considering the nine V-class submarines, "As it turned out, the V-1 design marked the last attempt in the US Navy to achieve a true fleet submarine capable of operating with the battleship squadrons. Emphasis was already shifting to other concepts, but the name "fleet submarine" had become so firmly imbedded that it continued to be used for the next twenty-five years as a synonym for a large submarine."[4]

Military Value and Tactics of Modern Submarines Proceedings
December 12, 1912
Chester W. Nimitz Lieutenant USN

During the first part of his career Nimitz (Passed Midshipman Annapolis Class 1905, Ensign USN 1907 and Fleet Admiral 1944), had significant assignments with the new and burgeoning Navy Submarine Force beginning in 1909. Prior to submarine duty, his early selection to command the destroyer DECATUR as a 22-year old newly minted ensign also portended an interesting career.

In the spring of 1912, after consecutive tours as Commanding Officer on submarines PLUNGER (A-1), SNAPPER (C-5) and

NARWHAL (D-1), Nimitz was invited to address the Naval War College on the subject of submarines. This was an unusual honor for a 27-year old lieutenant. On June 20, 1912, he delivered his lecture, "Defensive and Offensive Tactics of Submarines." The lecture was classified confidential. This article is the unclassified and expanded version of the War College paper.

When Nimitz wrote the essay, the Navy had only twelve years' experience with submarines. His experience of more than three years commanding submarines is reflected in his writing by the clarity, confidence and technical understanding of the underwater craft. It could be construed that the Proceedings readership gained much from this seventeen-page paper about submarines.

As a proponent of the submarine, his paper included establishing the ability of the submarine to meet the standards of military value communication, mobility, invulnerability and offensive strength. A line of technical reasoning was presented to support the ability of the submarine to meet military needs. Fourteen figures of detailed engineering drawings of a submersible and a submarine were included along with other drawings.

His approach to submarine tactics divided the capabilities into three categories: harbor defense, coast defense, and sea-keeping offensive submarines. This part of the paper included recommendations for submarine disposition on both coasts along with a need for more submarines. A Nimitz biographer, E. B. Potter, observed that at that time, Nimitz along with other naval officers did not recognize the potential of submarines to capitalize on their ability to be commerce raiders. "Like most naval officers of time, he saw the submarine as a defender of harbors and coasts and as auxiliary to the fleet."[5]

At the time of writing his paper, Nimitz was on assignment to supervise the building of Diesel engines for a Navy tanker, MAUMEE, at the New London Ship and Engine Building Company, Groton, Connecticut. In his paper he made a strong case for the use of Diesel engines in submarines. He discussed the positive attributes of the Diesel (vs. gasoline) and included reliability, ease of repair, reduced fuel costs, safety, and removal of the effects of gasoline odor. He furthered his knowledge of Diesels in 1913 when he was sent to study at Diesel engineering plants in Germany and Belgium.

Nimitz's association with the Navy's growing submarine community continued. In 1918, he was awarded a Letter of Commendation for meritorious service as Chief of Staff to the Commander of U.S. Atlantic Submarine Fleet. In late 1918, he reported to the Office of the Chief of Naval Operation, and as a lieutenant commander was given duty as Senior Member of the recently formed Board for the Standardization of Submarine Design.

Starting in 1913, the British constructed steam driven on-the-surface submarines to reach a speed of 23.5 knots. Six of the eighteen steam submarines were lost due to accidents. In 1917, the General Board of the US Navy favored the use of steam for high-speed propulsion of submarines. Standardization Board members Captain Thomas C. Hart and Nimitz were strongly against submarine steam propulsion and were successful in insuring that future fleet boats would not have steam propulsion.[6]

In the following years until mid-1931, his assignments included command of Submarine Division 14, based at Pearl Harbor, and later command of Submarine Division 20. By 1931, his heavily submarine-oriented duty assignments covered a fair part of 22 years. His 1912 paper in the Proceedings with its clear grasp of what submarines are about was also a strong indicator of the direction of his future career.

Rear Admiral Nimitz was designated Commander in Chief, Pacific Fleet and Pacific Ocean Areas (CincPac) in December 1941, an assignment that he held throughout the war. Battleship losses at Pearl Harbor and the small number of aircraft carrier resources limited options for carrying the war to the enemy at sea and ashore at that time. Pre-war plans for submarines emphasized the submarine as a scouting force for the fleet to ambush a carrier, cruiser, or battleship.

Soon after taking command, Nimitz deployed his submarines in a proactive role of *unrestricted warfare* against the Japanese merchant fleet. The intention of this action was to distract the Japanese and slow down their offensive. Submarines available in the early stage of the war were hampered by reliability and torpedo problems and, in some situations a somewhat passive approach to engagement. By mid-1943, newer submarines, better torpedo performance, and an aggressive stance turned the tide. U.S. subs

not only destroyed the transports Japan needed to survive, they also sank a greater tonnage of Japanese warships than carrier aviation, land-based aircraft, surface warships, or any other allied forces.[7]

The newer fleet submarines available to Nimitz as CincPac were vastly different than the 1912 submarines available at the time of his early paper. The submarine's ability to meet the standards of military value, communication, mobility, invulnerability and offensive strength, were on display during the WWII Pacific war years. Submarines and comments related to their tactical use in his 1912 Naval Institute paper were not amiss from how the improved submarines of the 1943 era operated in the Pacific. *Guerre de course* (commerce war) was not an option for consideration by Nimitz in 1912.

The Submarine and the Future Proceedings Jan-Feb 1916
Ensign V. N. Bieg, USN

About the middle of World War I, Ensign Beig looks to the future with a submersible in place of a submarine as an offensive weapon used against the battleship. A recommendation is made to consider developing not an improved submarine but a heavily armored submersible to overcome the deficiencies of the submarine. "The present type of submarine must change or rather give way to a new development which is capable of competing on equal terms with the battleship or its modification."[8]

The new submersible, optimized for surface running and offering no provision for diving, is proffered as the design goal. As a surface craft, the submersible's reduction in overall weight requirement would allow the use of enhanced heavy armor to provide significant protection in close to the enemy battleship encounters. "No dependence within torpedo and gun range would be placed on invisibility, reliance being placed solely on invulnerability."[9]

The presentation of this novel way to provide at sea battleship interdiction demonstrates the Proceedings interest in bringing different concepts for the readership to consider.

The Fleet Submarine Proceedings Nov.-Dec. 1916
Lieutenant (JG) F. A. Daubin, USN

Admiral Daubin graduated from the U. S. Naval Academy in the class of 1909. He became one of the U. S. Navy's most experienced submariners. From 1942-44, as ComSubLant in New London, he was directly responsible for the organization and training of the submarine forces that made so great a contribution to the winning of the war in the Pacific.

In view of the success of the German submarines in sinking 487 vessels by February 1916 after 18 months of war, it is interesting to note that the author reasons that the primary role of the submarine must be to destroy or aid in destroying the enemy's fighting ships while the secondary role might be that of a commerce destroyer.

"If we decide that the role of the submarine in our future wars will be that of a commerce destroyer, a guerilla of the seas, or that it shall be used strictly as a second line of defense, then we could be assured of some success by copying the best class of the foreign submarine, the 800-ton boat with a surface speed of 15-17 knots; submerged speed as high as possible and ability to remain at sea for three weeks would be required."[10]

Four years later in June 1920, S-1 (SS105), the first of a new United States class of 51 submarines was launched. The design was a compromise between a coastal defense boat and a full-ledged fleet submarine. Most of the submarines built in the United States prior to the S-1 were of lesser tonnage and shorter in length than Daubin suggested. The S boats' surface and below surface speeds were marginally faster and met the tonnage requirement. This was not a fleet boat. Interest in Daubin's comments regarding fleet submarines was substantially quoted in the New York Times.

The Fleet Submarine Proceedings Nov.-Dec. 1916
Lieutenant R. S. Edwards* USN

In the same Proceedings issue as Daubin's article under the heading *Discussion*, Lt. R. S. Edwards, a submarine officer and later an admiral, lauded Daubin. "To Lieutenant's Daubin's well

*Admiral Edwards was the submarine officer who coined hte phrase "the silent service" referring to the underwater branch to which he belonged. He served during a large part of World War II as Vice Chief of Naval Operations.

considered plea for larger submarines I would add the no small advantage of better living conditions on the larger boat...I think more such articles would be welcomed by those who have had no submarine experience to help them form an opinion on the two (submarine) types—the large and the small: but we must know what the argument is about and I suggest that now is the time for the designers to tell us what the fleet submarine will be when it is built."[11]

The Ideal Submarine Proceedings Nov.-Dec. 1916
Professional Notes, Submarines
Scientific American January 13, 1917

With an objective point of view, clear and technical comment by the magazine concurs with the best current Navy opinion regarding submarines and the future at that time. An appropriate quote provides the setting. "A few of our naval men and, alas, the majority of our Congressmen, are still clinging to the belief in the efficiency of mosquito craft. They believe that a host of 500-ton coast-defense boats of moderate speed and small sea-going power would afford a better defense than a smaller number of boats, twice their size, of greater speed, of wide range of action, of great powers of offense, and capable of going out with the main fleet to tackle the enemy a thousand miles from shore..."[12]

The article cited Naval Constructor Emory S. Land's recent testimony before the 1916 House Committee on Naval Affairs, based on his experiences at sea that the ideal boat for the Navy would be one between 750 and 950 tons and 225 to 250 feet in length. Estimated surface speed of from 17 to 19 knots and a submerged goal of 14 knots were mentioned. Additional comment included the success of the German 800-ton submarines and the predominance of comparable submarines of that tonnage in the navies of Austria, England and France. At the time of the House meetings, Russia and Japan were constructing 800-ton submarines. Italy abandoned the 400-to 500-ton type and was building only boats of from 750 to 950 tons.

The Argument for the Submarine Proceedings, October 1919
Professional Notes: Naval Policy
Scientific American, September 6, 1919

This pro-submarine essay acknowledges a previous view held by the magazine that was against the future construction of submarines. Piracy against merchant shipping was the primary basis of the anti-submarine position. A secondary aspect was "supposed tactical inefficiency when employed in legitimate operations against enemy warships."[13]

Scientific American's earlier recommendation for international outlawing of submarines brought protests from naval officers, especially from Britain, and a new review of the future of submarines. Additional post-WWI facts about the use of submarines modified the magazine's attitude, particularly in regard to the efficiency of submarines as warships. This new point of view came from an Allied Service publication that cited German submarines as accounting for more warship losses than any other agency. This information provided a new view of the submarine's efficiency as a weapon. Submarines accounted for almost one-third of total losses. Mines were second to submarines, with one-fifth of the warship losses. Germany, with 114 WW I mine layer submarines contributed to the losses from mines.[14]

Regarding strategy, the essay observed the successful and effective strategic submarine support of the blockade of the North Sea north and south exits. This took place after the early war loss of the three British destroyers ABOUKIR, CRESSY, and HOGUE by a single submarine in a single attack and quickly brought an end to using a surface ship to close or blockade off the enemy coasts to keep the German Fleet in harbors.[15]

A further acknowledgment of the military value of the submarine was made of its value as a scout. A United States Navy admiral, "who spent the period of the war in Europe and was intimately associated with the naval operations, draws our attention to the demonstrated efficiency of the submarine as a scout, particularly developed during the operations of the war."[16] That the stealth of the submarine makes it less vulnerable to detection and allows ease of observation or blockade was a further note. A closing comment regarding the international outlawing of submarines emphasized the difficulty of the vast oversight resources that

would be required to assure compliance to such a law.

Cruise of the American Unter-Seeboot 111
Proceedings March 1957
Admiral F. A. Daubin U.S. Navy (Retired)

In this paper written after his retirement from the Navy in 1948, the Admiral recalls his participation in the post-Armistice German reparations when six U-boats were allotted to the United States. In 1919, Admiral Daubin (as a Lt. Commander) brought the U-111 from Harwich, England to the United States. Naval engineers and submarine specialists and civilian shipbuilders carefully examined the U-boats' capabilities to learn everything they could about German submarine construction. As a result, the following years were sometimes referred to as the *German Years*.

German U-boat engineering influenced the post war US submarine designs into the 1940s, including Diesel engines, trim pumps, air compressors, and low-pressure blowers for emptying main ballast tanks, and periscopes. US submarine designs differed from the German in areas that included arrangements for torpedo handling, habitability requirements such as berthing, recreation space, and cold storage.[18] This post-war period also witnessed further Navy effort to develop its own submarine construction and design capabilities and break the monopoly of private submarine builders. This began earlier in 1914 and 1915 with submarine construction at the Puget Sound and Portsmouth, New Hampshire, Navy Yards.[19]

After the War, a submarine section was established in the office of the Chief of Naval Operations. Lt. Cmdr. Daubin became the assistant to the section captain, Chief of Section. In the submarine section, there was awareness of the limits of submarines in meeting the requirements to be a dynamic part of the battle fleet. One item considered were submarines cruising at the end of a towline. The Diesel engines and other features of the proven German submarines led to pursuing a request to obtain a German submarine as war reparation. Normal channels were not used. Shortly after discussions with Secretary of the Treasury William McAdoo there was a Presidential approval of the request for six German submarines.

In his 1948 remembrance, Daubin noted that in the chitchat of the Navy Department in 1919 "Submarines were not in the picture

of the future." A prescient quote in the essay by the Submarine Section Captain summarizes a view of the status of the submarine and the direction needed to pursue for future acceptance. "Well if they are not outlawed by international agreement," he commented, "they will be but a berth for adventuresome officers wanting an early command, unless submarines become sea-going and reliable enough to accompany the fleet. For as long as they cruise part of time at the after end of a tow line, the fleet will not consider their destructive power in war."

Thirteen years later, in June 1932, the previously mentioned DOLPHIN was commissioned. It was a large vessel, a fleet submarine with high endurance and speed to support the battle fleet or independently range up to 16,000 miles at 7 knots.

Submarine Capabilities and Limitations Proceedings August 1925

Lieutenant Wilder D. Baker,* U.S. Navy

An early quote in Baker's essay makes a point that even after twenty-four years of U.S. Navy submarines "it was not until after the World War (I), that much thought was given to their [submarines'] capabilities as, prior to then, no one ever heard of much else than their limitations. During the war, submarines made a name for themselves, not enviable but well known and thoroughly feared."[19] From the time of the initial purchase of HOLLAND until the Armistice signing in early November 1918, the US Navy commissioned 80 submarines. It is somewhat difficult to grasp how there would be a lack of awareness. However, such a lack could be restrictive with regard to identity and fiscal support for the needs of the submarine community to increase the submarines standing in the naval service at large.

Baker's writing reaches out to the Navy community and brings the current status of the submarine, then to the attention of those outside the submarine community in a logical way, and addressing

*On February 7, 1942 the Commander in Chief, Atlantic Fleet, established the Atlantic Fleet Antisubmarine Warfare Unit in Boston, with Captain (later Rear Admiral) W.D. Baker, in charge, to plan anti-U-Boat patrol and detection activities on the Atlantic including related research and development.

how the submarine would function in a patrolling, screening, or scouting Navy assignment.

A recent 2007 chronicle of the Battle for Japan 1944-45 provides a relevant comment for Baker's 1925 essay. In February 1944, the U.S. Navy's submarine operational textbook Current Doctrine was extensively rewritten. "Doctrine's foreword asserted grudgingly: 'during probable long periods before fleet action occurs, submarines may usefully be employed in the following tasks: (a) Patrol (including commerce destruction) (b) Scouting (c) Screening...' Full acceptance of the effectiveness of commerce destruction as a powerful submarine capability in the Pacific began in earnest in 1944."[20] Acceptance can be elusive.

Baker's essay, a mid-1920 perspective, creates awareness for the Navy with regard to the operational roles of the submarine. His eight-page paper has a submarine operational viewpoint highlighting the underwater vessel's capabilities and limitations. In some instances, he uses detailed technical operational considerations to make the reader understand the demands of having a vessel operate in three dimensions in a wartime scenario.

After establishing the necessary engineering complexity of the submarine and the requirement to operate both on the surface and below, Baker comments "All these things have contributed to make a new type of ship which the service at large understands but vaguely." His goal is to have the submarine better understood. In particular, he stresses the importance of improving the crew's living and working conditions as a significant goal in designing a submarine, noting, "...the submarine crowded, shorthanded, with consequent hard watches, poorly ventilated and tremendously active in a seaway" to support his design comment. [21]

End Comment

Assessing submarine historical documents is demanding from the limited viewpoint of a current reader due to a lack of knowledge of the context under which the articles were written. A 21st Century reader may lack an adequate perspective of the technical, fiscal, political and other factors at play during the writing, in some cases almost 100 years ago. However, the original thoughts, ideas and recommendations by those who were bold enough to present their ideas are well worth consideration.

Noting wrong or incorrect judgments made in the past brings to mind the present. Today, the question of what is missing in regard to current thinking and planning and what unnoticed problems or directions to explore might be neglected not by choice but perhaps by lack of oversight, initiative, and creativity. Comments have been made that progress may be encouraged by overcoming conventional wisdom and bureaucratic obstacles.

Rear Admiral William S. Sims, President of the Naval War College, made observations appropriate to the above paragraph in his speech to the Naval War College 1921 graduates. The speech appeared in the March 1922 Proceedings with the title "Military Conservatism." In his paper, the admiral points out the dangers of military conservatism and strongly supports the important need for Navy leaders to counter conservatism with intellectual honesty and logical thinking to eliminate or at least minimize the impact of conservatism on the Navy's future.■

ENDNOTES

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THE BLACK PIG AND THE RED BANNER FLEET

by CAPT Dan Conley, RN(Ret)

Editor's Note: A version of this article appeared recently in the Royal Navy's Naval Review.

Introduction

During the 1980s periodically the Soviet Navy deployed significant numbers of submarines into the Atlantic to probe the West's anti-submarine capability. This article describes one Royal Navy submarine's part in meeting the threat of Soviet nuclear submarines deployed in the seas to the west of the UK.

HMS VALIANT – The "Black Pig"

Commissioned in 1966, HMS VALIANT was the first nuclear submarine of all British design. Whilst it had many commendable design features, the Valiant Class of SSNs suffered from very congested engine room spaces which were very difficult to access and maintain. Being first-of-class also brought its own problems and VALIANT was all too often affected by serious engineering defects. Exceedingly challenging to maintain in a sound operational state, she became known as the *Black Pig*.

Successions of her engineering teams held few fond memories of their time onboard her: there were too many long hours in harbour labouring in exceedingly cramped, hot conditions to repair yet another broken bit of machinery; too often there were frustrations experienced from program change caused by a major defect. And there were many instances of personal courage and sacrifice. Whilst at sea during her first commission a fire was detected in the machinery spaces. The propulsion plant was quickly shut down and the Engineer Officer, dressed in his pajamas, immediately raced into the affected compartment with a hand-held extinguisher successfully tackling the flames, preventing the fire becoming serious.

During her second commission whilst in the Mediterranean shadowing a Soviet nuclear submarine, a seawater pipe burst and a flood alarm activated. The submarine was rapidly surfaced and

with the reactor shut down the diesel generators were started to provide power and very limited propulsion capability. The noise of these evolutions alerted the Soviet which was observed to be rapidly closing in what appeared to be in an aggressive posture and accordingly a nearby US destroyer was called in to ward it off. It was only years later that it was established that the Russian submarine had no hostile intent and indeed its Commanding Officer, sighting smoke pouring from VALIANT's conning tower, thought she was in trouble and was closing to offer assistance. The smoke was in fact the exhaust from the diesel generators.

I commanded the *Black Pig* during the final two years of her third commission (1984 – 1986) and like most of her commanding officers, experienced a wide spectrum of engineering problems. For example my diary entry on the 24th February 1986, records in the deep Atlantic the separate incidents of quite a serious flood arising from the failure of a fully pressurized sea-water pipe, a major steam-leak in the engine room and a temporary loss of propulsion. Yet when the boat was at sea and the propulsion plant behaving itself, her crews could quite correctly be very proud of their notable operational achievements such as in 1967 the first Royal Navy submarine continuous dived passage from the Far East to the UK, operations under the Arctic pack ice in 1981 and very active participation in the Falklands War. For my part, during 1985 I took the *Black Pig* on two anti-Soviet patrols to the west of the UK where some success was achieved in hunting out submarines of the Red Banner Fleet.

Prior to my command of VALIANT, I had served on USN exchange on the staff of COMSUBDEVRON Twelve (1981 - 1983). I owe much of the operational success we achieved to two New London colleagues; Captain Jim Patton USN for his tactical incisiveness and astute mentoring and Dr Bill Browning, Applied Mathematics, for developing the analytical tools required to undertake successful approaches exclusively using towed array data.

Valiant's Spring 1985 Patrol

In the spring of 1985 the *Black Pig* was directed to patrol the Shetlands/Faroes Gap. We did not have to wait long before receiving intelligence of a south bound *Victor I* SSN which, fitted

with special detection equipment, was of specific intelligence interest particularly when it reached the waters to the west of the UK. The hunt was on and after a few hours we made detection on the Soviet at long range and closure occurred to a comfortable trailing position on his quarter. Early the following morning we manoeuvred in close to achieve an accurate tracking solution before opening to a less stressful shadowing range. The close approach had the particular satisfaction of converting a faint line on a sonar display into a firm aural contact emitting a range of machinery and other noises. Besides the intelligence gained, being close to the opposition gave all the crew a real buzz.

However, after a second close approach was conducted some 24 hours later, now to the west of the UK the *Victor's* mode of operation changed dramatically from steady transit to a patrolling, searching posture characterized by frequent manoeuvres. The latter were to very much test the nerves and mettle of our sonar and control-room teams and it proved very difficult to maintain the tactical upperhand. There was more than one phase of anxiety and avoidance of a potential counter-detection situation.

Meanwhile the towed-array fitted frigate HMS CLEOPATRA had been closing from Iceland-Faroes Gap patrol areas and we were directed to hand over contact to her. This we did on the third day of contact and range was opened to a stand-off position. However, it became evident that CLEOPATRA was experiencing problems maintaining contact and we closed the *Victor's* last known position to re-establish where he was. Less than 18 hours after breaking off contact we were back behind the Soviet submarine which had resumed his transit to the south-west. Additionally we reported firm contact upon a second submarine, classified as probably a homeward bound Soviet *Yankee* Class SSBN tracking north. However, no one seemed to bother about this new contact. Five days after making initial contact, the *Black Pig* pulled off from the Soviet as it was clear he had resumed passage south for the Mediterranean.

Heading back towards the Shetlands Faroes Gap our next task was to intercept a southbound *Victor II* SSN. Within a couple of days this new *Victor* had been detected and trailing station on her quarter was achieved, with occasional close range intelligence gathering passes being conducted. This submarine proved to be a

straight forward transitter of limited intelligence value and when it reached the west of Ireland the decision was made to break-off contact. However, shortly after contact faded instructions were received to pass the Soviet's positional details via a slot communications buoy message to a RAF *Nimrod* on route from the Azores to Scotland. At that time RN slot buoys had a reputation for poor reliability and furthermore our positional data on the Soviet was somewhat stale. However, best estimates were put onto the buoy. A few hours later, a message was received indicating that the buoy transmissions had been detected by the *Nimrod*. But even better, immediate contact had been gained upon the *Victor* when the aircraft set up its first sonobuoy barrier.

Having broken off from the second *Victor*, the next day heading back to the Rockall Trough mid morning we encountered an outward bound ECHO II cruise missile submarine. Exceedingly noisy and of primitive, hazardous design, it was doing about 11 knots in a south-west direction and appeared to be heading across the Atlantic. We speculated that it could have been trailing its coat in response to US deployment of Cruise Missiles into Europe. A short trail was conducted with one very easy close approach. The crew found it interesting to listen to the very loud whines and thumps of machinery in this ageing submarine of the Red Banner Fleet and as we broke off to enjoy a hearty lunch could only but surmise that conditions onboard this very rudimentary nuclear submarine would be pretty tough.

Meanwhile over two weeks into the patrol the crew had well and truly settled an operating pattern which involved often being in close proximity to Soviet submarines. The routine of life onboard was interspersed by plenty of movies, eagerly awaited soccer results on Saturday evenings and short church services in the wardroom on Sundays where some crew members were tempted to come along by the prospect of a glass of sherry and nibbles afterwards. I split the command function with the Executive Officer, but sleep was light owing to awareness of the frequent ranging manoeuvres and one ear cocked to the stream of sonar reports emanating from the soundroom adjacent to my cabin. I tended to conduct the close approaches in the very early hours of the morning on the premise that the Soviet crews would be at a lower state of alertness at that time.

The final detection of the patrol was a homeward bound VICTOR III coming back from the Mediterranean. At the time the VICTOR III SSN was arguably the most capable operational Russian ASW platform and as we had developed a serious noise problem we did not want to push our luck and, therefore, marked him from a reasonable range. Nevertheless, heading for the bright lights of Murmansk, he was not hanging around and keeping station on him exclusively using towed array data was very testing involving high speed sprints out of contact interspersed by periods at slow speed to reacquire him and re-establish his position. After two days of trailing and one close pass, in deteriorating sonar conditions contact was broken and with no more likely contacts we were directed to head back to base in Faslane in the Clyde.

The Summer 1985 Patrol

Two months later VALIANT was at sea in the North West Approaches taking part in a somewhat mundane sonar trial to the west of UK when a Soviet submarine build-up in the NE Atlantic became evident. In view of the potential threat posed to the on-patrol UK SSBN, we were directed to proceed at best speed to Faslane to pick up a towed array and then to return to patrol areas to the west of UK to support the detection and location of the Red submarines. Meanwhile HMS CHURCHILL operating in the same areas had made contact with and was trailing a Victor class SSN.

Underway with the towed array attached after a quick turn-around, the *Black Pig* proceeded on a fast transit to areas where the activity appeared most intense. CHURCHILL had been withdrawn from the operation and the trail was rapidly going cold. However, a few hours after submerging we made contact with a Victor Class SSN and proceeded to close him to get into a comfortable trailing range. He turned out to be our old adversary, the special fit unit of the previous patrol returning from the Mediterranean. Frequently manoeuvring, in a patrolling, searching mode the Russian was again a difficult contact but one good intelligence gathering close approach was achieved.

On the morning of the fourth day a second submarine of much quieter characteristics was detected in company of the VICTOR and we took up station behind both. However, in the early evening warning instrumentation indicated a potentially significant problem

with the propulsion system. The previous occasion this type of warning had occurred presaged detection of a serious defect and a subsequent limping back to harbour with much reduced power. Shutting down of the nuclear plant was going to be necessary to investigate the problem.

With the reactor shut down, the trail was continued in battery power, maybe a first for a nuclear submarine but speed was constrained to five knots and the battery endurance was very limited. It was a tense time as the engineers made their investigations. However, as the investigating team emerged from aft, the news was good as the warning was evidently a false alarm. Having dropped back to a prudent range, the relatively noisy re-commissioning of the plant took place and within an hour of the plant being *scrammed*, the *Black Pig* was back in the trail with full power available.

Overnight both submarines were followed as they headed for the Shetland/ Faroes Gap but by lunch-time the following day strong Soviet surface ship sonar transmissions had been detected to the south-west, classified as emitting from an *Udaloy* class destroyer. There was multiple ship noise on the sonar transmission bearings albeit there was no intelligence to support the presence of a Russian surface ship force.

As sunset approached, still in the company of the two Russian submarines, at periscope depth I sighted the UDALOY on the horizon together with the masts of several other ships. It was assessed there were three or four Russian auxiliaries escorted by two or three destroyers heading north-east probably simulating a NATO reinforcement convoy. Right ahead of the force we went deep and headed for its northern flank where the VICTOR was tracking, in the process keeping out of the way of the approaching UDALOY. As the convoy passed, we crossed to the southern flank and on turning to parallel the most southern ship a high bearing rate submarine contact, suspected as the quiet second submarine, was detected very close to the ship. It was evident that the Russian submarines were carrying out exercise attacks on the convoy and our sonar and control room teams had a real challenge in maintaining the overall tactical picture. Meanwhile in the air the Soviets were carrying out simulated air attacks on the ships whilst Soviet anti-submarine aircraft played the part of their NATO counterparts.

After this bit of excitement the next day of the patrol, a Sunday, was to prove a bit quieter but, continuing to shadow the convoy in the morning we sighted two Soviet auxiliaries and one escorting Kotlin Class destroyer. Sunday lunch was interrupted by the VICTOR being detected going deep and at speed crossing ahead at close range, shaping up for another foray upon the convoy. During the afternoon a probable diesel submarine was detected at close range astern of the convoy and a good tracking solution achieved on him.

A day or so later now in areas to the north of the Shetland Islands, it became evident that the Soviet exercise activity was dying down and the convoy had dispersed. We had lost contact upon the two SSNs although had detected two new distant Soviet nuclear submarines to the north but these were not priority. Accordingly we returned to the west of UK to search for any submarine which might be still be lurking undetected off the North-West approaches, particularly quiet diesel types.

Whilst conducting search of the Rockall Trough area, a report was received of two homeward bound Delta Class SSBNs, transitting approximately 24 hours apart. Therefore, having moved to a position to make detection and interception, in due course the first of the DELTAs was detected at long range. A close approach and short trail were achieved but having confirmed that the DELTA was firmly heading home we hauled off and decided to forego his consort and continued searching south, albeit the second DELTA was detected at range to the north-west later on the same day. There was discussion onboard what the British public would have thought of all the nuclear weapons firepower onboard the two DELTAS only a couple of hundred miles off the UK's shores.

A day later we moved to areas off the north west of Scotland in an attempt to intercept an outbound VICTOR II SSN which appeared to be heading for the Mediterranean but which could have been tasked to carry out anti-SSBN operations. On this occasion the outcome was less than successful and the VICTOR was assessed to have slipped past transiting in shallower and more noisy water. We did eventually detect him but disappointingly he was well past heading south although clearly he had not dallied on the way.

The patrol was to end on a better note with the very long range detection, closure and a successful intelligence gathering approach

to a homeward bound CHARLIE II Class missile submarine coming back from the Mediterranean. Intercept over, we headed home having been at sea just over three weeks.

EPILOGUE

I was to experience one more Soviet submarine encounter in the *Black Pig* whilst participating in a NATO submarine versus submarine exercise in the Ionian Sea – exercise Dogfish. In the Blue role throughout, in error we had received an op order copy which contained all the tracks and way-points of the Orange submarines. Thus it was all too easy nailing the opposition. However, for us the exercise was somewhat a sideshow as we were determined to detect a VICTOR II, which was known to be in the Mediterranean and had been trailed for a while by USS DALLAS but contact had been lost with it for several days. We guessed that the NATO exercise might well be of interest to it. Sure enough a little time into the exercise we had made a couple periods of brief contact with what we had classified and reported as the VICTOR.

During the final phase of the exercise we conducted a successful approach against the Italian Submarine GUGLIELMO MARCONI which towards the end of the serial was at periscope depth about two miles to the north of us. We were also at the same depth in contact with a USN P3 when suddenly a high bearing rate submarine contact was detected about four miles to the south, tracking aft and emitting classic Russian SSN characteristics. As it was after sunset, we were very hamstrung in taking rapid action with the control room totally darkened and the need to pass locating details of the Soviet to the aircraft – not very easily as we were confined to simple NATO word codes. The tactical situation was also confused by a high density of merchant shipping and a lot of biological noise in the vicinity.

When it appeared that the aircraft had got the message, we went deep to close the Russian but on leaving periscope depth lost passive sonar contact, albeit quickly detected a series of Soviet SSN medium range sonar transmissions coming from his direction. These were followed by brief bursts of Soviet underwater telephone communications which made me speculate that he was possibly exercising with either a warship or submarine which we had not detected or else he had decided to join in. Certainly life was

confusing as surrounding us was a great cacophony of noise with a vocal Italian submarine chatting away on the under-water telephone, an aircraft dropping numerous active sonobuoys all over the place and a Soviet submarine which appeared to want to be part of the action.

The reaction of headquarters on receiving our submarine detection report in due course was quite positive. The acoustic analysis people were less complimentary claiming that we could have been much prompter in detecting the Soviet Submarine's active sonar transmissions.

The *Black Pig* shortly afterwards entered Rosyth Dockyard for her third and final overhaul. Unfortunately this probably proved to be an overhaul too far and against a background of the end of the Cold War and a number of engineering problems incurring prolonged repairs, during her fourth commission she experienced few operational opportunities and was de-commissioned early.■

USS TOPEKA DEPLOYMENT

by CDR Marc Stern, USN

Commander Stern presented this Deployment Brief to the Naval Submarine League's Annual Symposium on October 23, 2008.

Good afternoon ladies and gentlemen. Thank you for the privilege and the honor of allowing me to speak to you today.

TOPEKA has had a good year, highlighted by a Western Pacific deployment completed last April. The ship has had many successes and while I take some personal pride in each, I do feel it important to give credit, where credit is due. Sir Isaac Newton said, "If I see further, it is because I stand on the shoulders of giants." I've heard that quote several times before in talks such as this; typically the point being made is that the speaker or writer, after achieving some amount of success in some particular endeavor, gives credit to those who contributed to developing, teaching and mentoring them, allowing them to go on to success. On one hand, I will be no different. I will certainly tell you that while in command, whatever success I have had certainly is owed to the great leaders who I have been fortunate to learn from throughout my career—the many inspirational commanding officers I was lucky to work for as well as many other great Submarine Force leaders, ranging from enlisted instructors in the various schools I've attended all the way up to the flag officers who have shaped the Submarine Enterprise throughout the years. As a matter of fact, the next speaker, Admiral Hilardes, was Engineer on GURNARD when I reported aboard as a young ensign for my first submarine assignment. The positive impact he had on my development as a leader is something that I'm sure I draw from even today as a Commanding Officer. However, today I would like to focus on another set of giants, whose *strong shoulders* have truly enabled TOPEKA's success—my extraordinary crew. Like every parent that thinks their kids are the smartest and most beautiful and most handsome in the world, I'm sure every

CO thinks he has a particularly great wardroom and crew. In some sense they would each be right—we all have fantastic crews of well-trained hard-working Sailors that do amazing things every day to maintain and operate our great submarines. But, I can't speak for all of them, so instead I will spend the next few minutes discussing some of the things my great team of *giants* have done in making TOPEKA successful.

As you know, it's all about the deployment. The rest of our time back in homeport is spent preparing the ship and the crew for the next deployment. The crew worked hard during the various training events we conducted prior to WESTPAC. That hard work and preparation often paid off while we were actually forward deployed when on many occasions, I thought to myself, "Good thing we did that in the trainer or in our training!". It wasn't always easy, either. For example, at one point we were scheduled to get underway to get some practice tracking submarines against one of the other boats in the Squadron acting as our target. When an emergent material problem caused us to be stuck in port that week instead of underway honing our tracking skills, we decided to make the best of a frustrating situation and use the On Board Trainer (or, *OBT*) mode of our sonar system to get the practice we needed. This system worked great injecting real looking and sounding contacts into the sonar system and allowed us to accomplish some good quality training. Nothing is as good as the real thing, but this was a reasonable substitute. My guys took it seriously and made the best of it—they even manned all the watches in their underway coveralls so that if you were to have stepped into the Control Room from other parts of the ship, which at that time had the industrial feel of a submarine deeply involved in a maintenance period, you would have not only felt like you were watching an actual submarine underway, but you would have also been convinced that we were really tracking an adversary.

Something else memorable and worth mentioning about my pre-deployment training was having the privilege of a *grey beard* – a retired senior submarine officer – oversee our Attack Center training for one whole week. The credibility, wisdom, and technical savvy Captain Oliver provided were invaluable. One of the scenarios we did during that week seemed a bit odd—it wasn't the *usual* scenario I was used to seeing in the countless Attack Centers

I had previously done throughout the years. But, we did the scenario, collected our lessons learned when complete, and moved on to the next training event. Imagine my surprise, when months later while conducting real-world operations we were faced with nearly that very same situation. That operation went extremely well for us and I am sure that no small part of our success was due to Squadron Eleven's, Submarine Learning Center's and Captain Oliver's relevant, realistic and somewhat *prescient* training scenario.

As we prepared to leave for Westpac, I was told that Admiral McAneny's mantra was that you needed to be able to fight-hurt while deployed. In other words, you couldn't always expect to pull into port to fix material problems, sometimes you needed to figure out how to stay at sea, work around the problem, and continue carrying out your assigned mission. My crew took that direction to heart. While the list of innovative, safe and effective ways in which my guys did this is long, I would like to highlight just one as an example:

> As we transited across the Pacific toward Westpac, the pipes for the system that provides depth indication for my Control Room became heavily fouled with sea growth, causing the indication to become extremely sluggish. We tried the usual remedies such as blowing the lines with air and cleaning the installed strainers, but nothing seemed to help. We had no reliable indication of depth and I knew going to periscope depth without broaching would be extremely challenging, if not impossible. Stealth being the hallmark of submarine operations—I knew that just wouldn't do. Knowing we had to somehow figure it out and *fight-hurt*, my guys came up with a great solution. We have a totally independent piping system, also connected to the sea, for the use of my 3" Launchers down in the Countermeasures space just forward of the Crew's Mess. We removed our master shallow-water depth gauge from the ship control panel, up in the Control Room, and re-connected it to a valve down in the Countermeasures space. We then rigged bright lights and a video camera mounted upside down facing the depth gage and connected it using a really long cable to a flat panel LCD display which we mounted over the ship control panel, back

up in the Control Room. This arrangement allowed us to safely and effectively conduct periscope depth operations over the next three months, including during sensitive operations. Some of my guys took the Admiral's direction directly to heart. After six hours of watch, looking up at that screen mounted so far up on the panel, the helmsmen would sometimes get sore necks—I guess they were truly and literally *fighting-hurt*!

Like many in this room, I have sailed in seas all around the world during all the seasons of the year. But, I must say, I have rarely seen weather as consistently bad as during this deployment. It seemed like we operated in the same general region as one typhoon or another for most of the six months. And, for a submariner, high sea states are more than just a nuisance leading to upset stomachs. Operating in high seas is particularly challenging for the ship control party to stay at periscope depth without broaching the ship and maintaining our stealth, and my guys did a great job of doing this for weeks at time in sea states that make my stomach turn just thinking back to those difficult times. I think their success is particularly commendable given our work-around depth indication as well as the ship's depth control system also being in reduced status—resulting in that system, which can sometimes help with depth control during particularly challenging situations, being only available for limited use.

Not only were the seas rough, but on most days haze, rain and fog limited visibility to no more than a few thousand yards and at times it was near zero.

Like most WESTPAC deployers we operated in very shallow water during significant portions of our deployment. To put how really shallow it was into perspective, we spent weeks at a time in water significantly shallower than my ship is long. While submarine operations by definition incur some risk, just by their very nature, we take precautions to ensure the ship is kept safe—especially so when we do things like transit into shallow water. In one particular case, our mission had us attempting a transit of a new, unexplored part of the area in which we were operating, in what we knew would be extremely shallow water. We took additional precautions, and we were able to keep the ship safe.

However, no nautical chart is perfectly accurate, and indeed we ended up coming across a spot in which the chart listed water deep enough to transit through. But, it actually turned out to be too shallow, and when we received yellow and then red soundings our pre-deployment training and the outstanding response by my watch team enabled us to conduct a sharp turn and head back into deeper water—just like we had practiced so many times before. The only casualty out of that event was my already thinning hair getting a little bit thinner!

Submarines operate in the littorals and the challenges associated with being in that environment are not terribly new or particularly interesting by themselves. However, combined with the horrible weather and the fact that we operated in some areas with little Submarine Force experience, the challenge of operating in close proximity to literally thousands of contacts in only a several week period was particularly keen. Considering the shallow water we were in, the 10 to 20 or more contacts surrounding our ship at times within just a few thousand yards, with visibility that made it hard to hold more than just a few of them visually, it was extremely challenging and again, my team of giants performed superbly. Additionally, we often had to cross though, or even operate for periods of time in, busy merchant transit lanes. Automatic Identification System (or *AIS*) provided great information on most of the merchants and was a fantastic tool for helping us to drive to avoid them. I also quickly learned that many of the fishermen and trawlers also operate inside the merchant transit lanes—profit motive dictates that they go where the fish are. One thing that added to the challenge, however, was that the merchants, who lose money when they slow down, would maintain their speed, and just drive around the fishing vessels with small course changes—something I just hadn't really thought about before. I learned that lesson the hard way when on one occasion, we detected a merchant on AIS at long range, but with a very narrow angle on the bow— in other words he was heading right at us—and, at high speed. No problem, however; at that range it would be easy, even at the slow speeds we travel at periscope depth, to drive off of his track and maintain a nice comfortably long range as he would pass us by. But, it seemed every time we turned to drive off of his track, the merchant would turn to point virtually right at us—and getting

closer and closer by the minute. Eventually, it dawned on me that the merchant was dodging fishermen, many of which I just couldn't see at that range. Finally, we went deep—not very deep of course, remember, we were in extremely shallow water as it was, and we drove fast to stay clear of the approaching ship. Again, my crew acted just as they had been trained and kept the ship safe.

While deployed, TOPEKA and other units of the Pacific Fleet, including the KITTY HAWK Strike Group, took part in a major combined Japanese and U.S. Navy exercise called ANNUALEX. The exercise was a great opportunity to operate with the ships and submarines of one of our closest partners in the region.

The crew worked hard on the deployment, so it was always nice to be able to unwind and enjoy liberty in the wonderful countries we had the good fortune to visit. Port visits included Yokosuka, Okinawa, and Sasebo, Guam, Subic Bay, and a brief stop in Pearl Harbor. Always mindful of how critically important it was to be good ambassadors in representing our country while on liberty, the crew again performed superbly and the visits were conducted without incident in every case.

TOPEKA was among the first ships to conduct a port visit to the Philippines in a number of years and it proved to be a great time for the crew. Combining inexpensive food and drink with tropical paradise-like weather made for great liberty. As a matter of fact, the crew had such a good time at a local beach club that we were invited to leave a sign on one of the doors to mark the visit for all eternity.

Like all deployers, the crew was anxious to participate in community relations (or, *COMREL*) projects whenever possible—events in which a ship's crew goes out into the city we are visiting and does some sort of work project—for example, cleaning and painting a church, repairing the roof on a medical clinic, or in this particular case, conducting minor repairs to the playground equipment at a Japanese orphanage in Yokosuka, Japan, as well as just giving the kids some much-needed attention. I'm not sure who got more out of those interactions—the Japanese orphans or my crew. It always impressed me and warmed my heart when each time we began arranging for a community relations event, we found we had many more volunteers than the project could logistically handle.

Bad weather isn't the only unfortunate thing about leaving for deployment in October. The crew missed being at home with their loved ones for holidays such as Thanksgiving, Christmas, and New Years. But, the cooks prepared fantastic meals on those days that I'm sure would put some 5-star restaurants to shame, the wives sent bags full of goodies to decorate the ship in the theme of each holiday, and the crew made the best of each occasion. While we all missed our families, the crew's camaraderie and esprit d'corps was impressive and each one of those days was a memorable occasion in which we all managed to have some fun.

After returning from the deployment, TOPEKA recently conducted the majority of the submarine midshipmen operations for the Pacific Fleet. Over about a five week period, the crew showed over 560 Naval Academy and ROTC Midshipmen what submarines were all about. While the routine of surfacing, transiting into port to conduct the personnel transfer and then diving later in the same day, every day, including most weekend days, for all those weeks began to feel like ground-hog day, the crew rose to the occasion. That routine is particularly tough on the crew, so you can only imagine my pride, when even near the end of that time, after all those difficult days, I still would read feedback from almost every single midshipman offering lavish praise on the crew for their contagiously positive attitude and impressive professionalism.

Shortly after taking command a little over a year ago, we went north to participate in an exercise with the Canadians and to enjoy several days of liberty in Victoria, British Columbia. Following the port visit, I was lucky enough to get to do in command something I had never had the good fortune to do previously in my career: TOPEKA was assigned to conduct a Service Weapons Test and a Sinking Exercise (or SINKEX) in which the ship shoots real (non-exercise) torpedoes with actual explosive warheads installed. We were originally scheduled to participate in the SINKEX of the ex-HMCS HURON, but the surface ship gunfire and aircraft bombing proved too lethal, too quickly, and she sank before we had our chance to shoot, scheduled for later in the day. Fortunately, a contingency plan was in place and we successfully shot two MK-48 ADCAPs—one against a target buoy and the other against a decommissioned diesel submarine, the ex-USS SAILFISH. It was a testament to the crew that the SINKEX was conducted flawlessly,

and even the most junior guy on board could not help but beam with excitement and pride as we could hear, and feel, the loud thud as the torpedo did it's job and then we listened solemnly on sonar as SAILFISH sank into the depths.

When we were first told we would be sinking the SAILFISH, some quick research revealed that this SAILFISH, SS 572, was the second warship to bear the name. The first SAILFISH, however, had a particularly interesting history, which I couldn't help but read as well. Originally built and commissioned as the SQUALUS, which infamously sunk and was later raised, she was repaired and re-commissioned as SAILFISH and went on to conduct 12 World War Two patrols. During our WESTPAC much later in the year, the SINKEX we had conducted was far from my mind, but later on WESTPAC while conducting operations in many of the very same waters that the first SAILFISH conducted her wartime missions over 65 years earlier, I couldn't help but remember the words I'd read describing the "tremendous seas in the midst of typhoons", "the mountainous sea state" and the "dreadful visibility." Here we were in the same places, enduring the same terrible weather conditions! It gave me a comforting sense of continuity and a connection with our proud past. I'm sure that while to men like Lockwood, Gilmore and Fluckey our flat panel computer displays on the CONN might look foreign and somewhat unrecognizable, I'm equally sure however, that they would immediately recognize the same professionalism, the same courage and the same tenacity in my crew of giants that they saw in their men so long ago.

Thank you again for this opportunity to speak and I look forward to answering any questions you might have during my remaining time.■

DESIGNING AMERICA'S SUBMARINES
A CULTURE OF INNOVATION AT ELECTRIC BOAT

by Mr. Patrick Bevins and
CAPT Karl Hasslinger, USN(Ret)

Mr. Patrick Bevins has 35 years experience in submarine operations and design, and is currently the Program Lead for future submarine rolls and missions at General Dynamics Electric Boat. CAPT Karl Hasslinger, USN(Ret) is a former attack submarine commander who is now the Director of Washington Operations for General Dynamics Electric Boat.

The Virginia-Class submarine is the first warship designed completely on computers, and the first U.S. Navy ship designed for post-Cold War security challenges. For General Dynamics Electric Boat, the lead design yard, VIRGINIA represents the culmination of more than a century of submarine innovation. The legacy of innovation that helped Electric Boat to deliver the Navy's first submarine, the Navy's first welded-hull submarine, the Navy's first nuclear submarine and the Navy's first ballistic missile submarine remains firmly imbedded in the culture at Electric Boat, and will help ensure U.S. dominance in undersea warfare for decades to come.

A History of Submarine Design and Innovation Leadership

In 1952 Captain Hyman Rickover approached Electric Boat with his vision for a nuclear powered submarine after another shipyard told him it was impossible. Having built the Navy's first submarine in 1900 and many more during two World Wars, Electric Boat enthusiastically accepted the challenge. When USS NAUTILUS went to sea in 1955 it was the world's only real submarine, possessing unprecedented submerged endurance even while operating at high speed. It was a technological marvel that immediately supplanted all anti-submarine warfare platforms, tactics and weapons.

In the years after NAUTILUS the Navy engaged in what can only be described as an era of heady experimentation. It built nuclear submarines with new hull forms, propulsion plants, sensors and even new mission capabilities in rapid succession. While the Submarine Force was still experimenting with NAUTILUS, Electric Boat inserted a large missile section into a follow-on SSN already under construction and created the world's first SSBN. Armed with 16 intercontinental ballistic missiles carrying nuclear warheads, USS GEORGE WASHINGTON was by far the most powerful ship afloat. Once underway, it was nearly impossible to locate, making the SSBN the most survivable leg of the U.S. strategic triad—a distinction that endures today.

At the other end of the mission spectrum Electric Boat designed and built the tiny Submarine NR-1, the world's first nuclear powered research submarine. Her small but powerful reactor freed her from the endurance restrictions that batteries imposed on conventional submersibles. She carried no weapons, but for decades she crawled along the seabed conducting valuable search and recovery, oceanographic research missions and the installation and maintenance of underwater equipment.

Throughout the Cold War, Electric Boat designed and built numerous follow-on attack and ballistic missile submarines. Most were members of large classes, but some were unique efforts to experiment with new capabilities. Ships such as TULLIBEE, NARWHAL, LIPSCOMB and TRITON were prototypes that pioneered new sonar arrays, passive ranging capabilities, propulsion systems and machinery quieting techniques that today's submariners take for granted.

Overall, of 19 U.S. nuclear submarine classes, Electric Boat designed and built 15 of them. Of note, the recently commissioned USS HAWAII (SSN 776) has the distinction of being the 100th nuclear powered submarine built by General Dynamics Electric Boat. HAWAII is also the third ship of the Virginia class. While significantly more capable than NAUTILUS, this class shares a proud heritage of design innovation.

Electric Boat, or EB as it is known among its employees, didn't have a monopoly on good ideas. But there is a unique innovative spirit at EB that is based in the company's culture. For more than a century, EB designs have set trends or shifted paradigms—

perhaps not an unexpected outcome for a company formed by a group of people who had confidence in a small submersible vessel that was little more than a curiosity to naval officers at the time.

Culture and Organization Matter - Management consultants often say that culture trumps strategy, meaning that an organization is more likely to go where its culture guides it than where management directs. Without a culture of free thinking, an organization won't produce innovative designs or solutions just because it is directed to do so. EB has endured because innovation and creativity are valued and remain a way of life as part of the company's inherent culture. Between 1952 and 1963 the Navy invested heavily in submarine designs, averaging almost two new or modified designs per year. But, when the Polaris program design was completed, the pace slowed and a now-larger EB found itself looking for more work. In response, management created the Advanced Engineering and Program Development department to focus on new submarine concepts as well as commercial applications the company's skilled workforce could pursue. The new department comprised engineers of various disciplines, naval architects, operations analysis personnel and even a financial analyst, all led by an engineering program manager.

The department's first submarine effort was the Undersea Long-range Missile System (ULMS) study that eventually produced the OHIO class SSBN. Commercial ideas included nuclear power plants encapsulated in submarine-like hulls and operated on the seabed to avoid land based safety and security problems. Another commercial application was the design of nuclear powered submarine tankers to ship oil from Alaska to the east coast via polar routes. While economically feasible, it would have taken tremendous capital and the project didn't gain momentum as fast as the competing Alaska pipeline.

In the late 1960s the Advanced Engineering and Program Development department morphed into the Concept Formulation or CONFORM (accent on the first syllable) group. The term *concept formulation* came from a stage of defense program development introduced by then Defense Secretary Robert McNamara and his systems analysis experts. However, unlike the dictionary definition of conform, the CONFORM group at EB has

been responsible for some of the company's most revolutionary and non-conforming submarine and undersea warfare concepts.

CONFORM—The earliest CONFORM efforts focused on attack submarine improvements including greater speed, acoustic isolation of machinery, external weapons, alternative control surface configurations like the X-stern, and the elimination of the fairwater structure to reduce drag and noise. While some of these innovations weren't used, in each case EB personnel increased their understanding of esoteric disciplines vital to good submarine designs such as acoustic quieting, shock mitigation and hydrodynamics. Other studies included Dry Deck Shelters and Swimmer Delivery Vehicles, improved propulsion machinery performance and vertical launch systems for cruise missiles.

Coincident with its design work, CONFORM developed tools and processes that supported its enduring success. Among them are publications listing ship characteristics and power requirements for various hull configurations. These are useful references for naval architects assessing early concepts for new designs. Also, CONFORM developed a design process that extends beyond a single innovation and mandates a whole-ship integration review. Working with the Navy, CONFORM developed a software program, called SUBCODE that allows new ideas to be evaluated quickly but also thoroughly for their overall effects on a submarine's characteristics and operating parameters. These design tools and processes provide EB and Navy decision makers with a high degree of technical credibility and confidence in the results.

Among its many new ship designs CONFORM evaluated new hull forms and other innovations to increase submarine payload capacity. This effort in particular led to some of the most unusual designs. In the mid 1990s an elliptical hull form was evaluated. *Flat-Fish* as it was referred to, provided more useful payload space at reduced navigational draft however it had several disadvantages that kept the idea on hold.

Other non-traditional concepts included a very large payload module that would be towed behind an attack submarine to a forward location. Once in position it would take station on the seabed where it would wait for firing commands. Towed modules could break the relationship between submarine size and payload

capacity. They could increase submarine payload capacity by an order of magnitude and could even be deployed by legacy ships that make-up the majority of the submarine fleet. One early concept was a strike module that carried over 250 Tomahawk cruise missiles. Later concepts looked at tandem tows of smaller modules that would be dropped off at different locations to enhance their survivability. Concepts like this could change traditional deployment timelines by providing Combatant Commanders with a stealthy, survivable, high volume fire capability that could strike immediately and from close-in positions with no risk to operators. There would be no delay waiting for traditional platforms to take station in launch baskets. And adversaries would not have time to shelter or relocate high value personnel or systems, further enhancing the effectiveness of the strike. The advent of the SSGN however has temporarily reduced the value of such concepts due to its significant payload capacity.

During the late 1990s CONFORM supported a major Submarine Force effort to look at extending a submarine's sensor reach. Deployed or *leave-behind* sensors placed on the seabed, and sensor packages carried by unmanned aerial and undersea vehicles were all evaluated for compatibility with submarine designs. Studies concluded that submarines using off-board payloads can monitor and influence significantly greater areas than any planned improvement to traditional hull or mast mounted sensors.

Software Development Is a Key Aspect of 21st Century Designs

When the Cold War ended abruptly, the Seawolf attack submarine program was cancelled just as it was moving into production. The Navy wanted a smaller, more affordable submarine that could operate in the world's littoral areas where conflict was presumed to be more likely. In response, EB designed the Virginia class attack submarine with multi-mission capability but optimized for littoral warfare. And while Virginia represents a leap forward in undersea warfare capability, EB pioneered innovative design and construction processes that are themselves worthy of discussion.

Perhaps the most revolutionary aspect of VIRGINIA's design was the decision to eliminate a mockup. In the past, EB would build full scale wooden mockups so engineers and designers could visualize sections of the ship and installed systems. With VIR-

GINIA, this visualization is done electronically. The Electronic Visualization System (EVS) allowed engineers, equipment suppliers, builders, maintenance personnel and Navy representatives to work collaboratively and update the overall design. This state-of-the-art system provided not only visualization, but also tools to ensure equipment movement didn't interfere with structures and allowed for the safe passage of personnel. The EVS software enhanced EB's design capability and reduced labor hours required to complete it, not to mention the cost avoided by not having to build or maintain mockups. By the end of the Virginia class design process, the drafting table and t-square had been replaced by a computer screen and a mouse.

Another important advance in VIRGINIA's design was enhanced automation supporting crew reduction. Sailors are expensive: crew size dictates messing and berthing arrangements as well as equipment capacities for making fresh water, storing and cooking food and even air conditioning. Also, the crew occupies space that could otherwise increase payload capacity. Moreover, personnel costs are a major factor in today's Navy. For all these reasons crew reduction is a worthy goal that makes advances in automation essential.

EB stepped up to this challenge and proposed aggressive but reasoned crew reductions, with automated ship control being the best example. The traditional submarine ship control party included a Diving Officer of the Watch, Chief of the Watch, Helmsman, Planesman, and Lee Helmsman. On Virginia class submarines those positions were consolidated into a two-man team: Pilot and Co-Pilot. This change broke a 100-year paradigm where the ship's control surfaces were directly controlled by mechanical linkages and/or hydraulic actuators in the hands of crew members. On Virginia, they are controlled by computers or a joystick, but in each case commands are sent to control surface actuators electronically in a fly-by-wire system. Just like modern aircraft and the space shuttle, the system required tremendous reliability and much improved visualization systems so that two men could stay abreast of the ship's status and operate systems formerly controlled by five. In order to develop these systems, EB had to move into another new technology area: software development.

EB's software development group now manages multiple

programs related to the development, refinement and maintenance of computer code that supports automated ship control systems on OHIO class ballistic missile submarines, guided missile submarines and Virginia attack submarines. Its internally developed software code also contributes to design systems, weapons and payload handling, the integration of wireless technologies in submarine systems, vehicle monitoring and control systems, non-tactical data processing and simulation systems. Software development is a natural follow-on that has allowed EB to keep pace in an information-based world.

Construction Process Improvements—In addition to improved submarine design methods, EB has continued to pioneer modular construction processes that reduce labor hours and drive out cost. Highly automated material storage, retrieval, cutting, coating, movement and welding systems have made its Quonset Point facility a world class, state-of-the-art manufacturing complex. Submarine hull cylinders now leave Quonset Point in excess of 90 percent complete—including major foundations, heavy equipment, piping, wiring and even lighting systems. These process enhancements are still ongoing and are helping to further reduce construction time. Whereas early ships of the Virginia class were assembled from 10 hull sections, today they are assembled from only four sections as large as 1,800 tons. This process improvement not only reduced labor hours at the building yard, but also contributed significantly to reducing planned construction time from more than 100 months originally, towards a goal of 60 months.

A highly successful capability that resulted from new modular construction techniques was the Command-and-Control Off-Hull Assembly and Test Site (COATS). Located in the shipyard in Groton, Connecticut, this facility allows each new ship's command and control module—the control room with all its combat systems—to be assembled and tested outside the ship, while other construction activities are taking place. This permits an entirely new sequence of construction events. Previously, command and control systems were completed in the latter part of the construction sequence, often making them the controlling path for sea trials. Now, command and control systems are tested early, allowing time to identify and correct deficiencies without impacting schedules. It

also allows crewmembers to train on the actual system their ship will go to sea with—it's not a simulator. A refresh prior to sea trials ensures the ship has the latest software updates. As a result of this process, commissioning crews go to sea so skilled in the operation of the ship that VIRGINIA and HAWAII have conducted real-world missions during what was supposed to be a shakedown period.

DARPA Hard Projects— In the first years of the 21st century CONFORM provided innovative solutions to some technically challenging problems posed by the Defense Advanced Research Programs Agency or DARPA. DARPA prides itself on taking on only the most challenging problems, those it considers *DARPA-Hard*. Under the Tango Bravo program DARPA challenged participants to identify technology barriers (thus the acronym Tango Bravo) to reducing the displacement, and thereby cost, of nuclear submarines. CONFORM responded in true fashion and developed two ship designs that replaced higher cost systems with innovative alternatives. Specifically, EB identified several aspects of current submarine designs as cost drivers including the sonar sphere, mechanical drive line components, the torpedo room, and manning. DARPA embraced EB's concepts and funded follow-on studies to develop external weapons, shaft-less propulsion, and a large bow sonar array in place of the current sonar sphere.

Leveraging the Tango Bravo work, EB proposed radical changes to the Virginia class submarine bow arrangement for Block III and follow-on ships. The new bow has a Large Aperture Bow array in place of the traditional sonar sphere. Now, instead of the sonar sphere and twelve vertical launch tubes (VLS), there will be two larger Vertical Payload Tubes (VPTs) similar to those in OHIO class ships. The VPT arrangement breaks the tyranny of the 21 inch torpedo tube or VLS tube as the only ocean interface on an attack submarine. With that change, new payloads developed for SSGN can be exploited by Block III and later Virginia class attack submarines, enhancing their relevance to combatant commanders. Potential payloads include large, high-endurance unmanned undersea vehicles, unmanned aerial vehicles, special operations support vehicles, a range of strike weapons and ocean engineering apparatus. The sequence of conceptualization, studies, engineering

and design work leading to funded at-sea hardware, or "*concepts to capabilities*" is an EB hallmark.

Into the Future—Throughout the company, designers and engineers combine creativity with rigorous analysis and engineering discipline to enhance submarine design, construction and lifecycle support capabilities. Shipbuilders continue to refine every aspect of the construction process, while engineers and designers are working on far-reaching programs such as the DARPA sponsored shaft-less propulsion system, and conceptual studies for a follow-on ballistic missile submarine to replace OHIO class ships when they retire.

Other undersea warfare technologies and operational concepts are being studied as well, including very-high-speed vehicles based on supercavitation phenomenon. Supercavitation has enabled small vehicles like torpedoes to travel at hundreds of knots underwater. With DARPA sponsorship, EB is now looking at using similar technology to propel other undersea vehicles. Hundreds of concepts for future submarines and other undersea warfare systems line the walls of the CONFORM *War Room* at EB. This gallery contains everything from electric toilets with no plumbing to submarine launched satellites and radically different hull forms. When the Navy calls for a new submarine or spiral improvements to existing ships, there will be no lack of ideas.

EB continues its focus on undersea warfare innovation and its relentless drive for quality and more efficient design-build processes. At the heart of its undersea warfare innovation effort is the small but powerful CONFORM organization that serves as an idea incubator for follow-on programs. The company leadership has continued to invest in overhead functions like CONFORM and also in identifying and recruiting the right people across the company and providing them with an environment that values creativity over conformity. Innovation has flourished at Electric Boat because it is an enduring part of the company's culture. It is a place where talented individuals are challenged by difficult problems, and can contribute to ensuring that the U.S. Navy maintains its pre-eminence in Undersea Warfare.■

REFLECTIONS ON A BYGONE ERA

by Rear Admiral Maurice H. Rindskopf, USN(Ret)

The deactivation of DSRV-1 (MYSTIC) on 1 October 2008 is a time for me to reflect on my involvement with this program over a considerable period of time.

It is well documented that the two DSRVs were the product of a heart-rending study on submarine safety which commenced after April 1963 when THRESHER (SS593) sank off Portsmouth, NH during her builder's trials. I was on duty in Washington in the Office of Naval Intelligence when I received orders as Commander Submarine Squadron TWO in New London shortly after the sinking. I reported to New London on 21 June 1963 during the early stages of the search for the remains of THRESHER using such assets as the Navy had at that time, led by the bathyscaphe TRIESTE.

In 1963, a command reorganization took effect in New London which made me Flotilla Commander which included not only Submarine Squadron TWO, but also Squadrons EIGHT and TEN and Submarine Development TWO under which THRESHER search was being prosecuted.

Arrival of DSRV-2

In June 1964, on short notice, I was ordered to Submarine Flotilla EIGHT in Naples, Italy where our only submarine rescue capability resided in the assigned Submarine Rescue Vessel. Thus, I had knowledge of progress in the SubSafety studies then ongoing.

We can fast forward to 1969 when I established the Office of the Deep Submergence Program Coordinator in the Pentagon (Op03U, later changed to Op23). There I became the sponsor for all deep-diving submersibles including the DSRVs, which were then under construction by the Lockheed Missiles and Space Company in Sunnyvale, California.

Arrival of colors

RADM Rindskopf giving a speech

In May 1971, DSRV-2 was flown from Sunnyvale to San Diego to the Lockheed Ocean Laboratory where it was prepared for its official launching. My wife, Sylvia, was invited to christen DSRV-2 and I to be the commissioning speaker. The accompanying photographs show her traditional smashing of the bottle of champagne, not on the tender plastic nose but rather on a one-inch pipe affixed for the purpose (not an easy target). Elmer Wheaton, Lockheed Vice President, is an interested observer.

The commissioning crew of AVALON comprised:
OIC LT Frederick Merrick
AOIC Steven Rush
COB Bob Grogan
Crew Merle Vogle, Corky
Palmer, Barney Bakara

Sylvia Rindskopf breaking the traditional bottle

My remarks have not been preserved, but I am sure I commenced with THRESHER sinking, then described the exhaustive SubSafety study which included recommendations for the construction of the two 5,000 foot capable rescue craft. I must have concluded with the fervent hope that these two craft would never have to be utilized in a full-fledged emergency, but that they would remain on call 24/7, as they say today. Indeed, that is what transpired, even though the DRSVs each made more than 1,000 dives and participated in many realistic rescue exercises with U.S. and foreign submarines around the world.

Sometime after my retirement in 1972, a proposal was made that DSRV-1 would be named for RADM Walter N. (Buck) Dietzen who was then Commander Submarine Flotilla Five in San Diego; and DSRV-2 named for me. Fortuitously, this did not come to pass, and MYSTIC, a whaling port near New London; and AVALON, a major tourist attraction on Catalina Island in California were selected.

Perhaps AVALON and MYSTIC received more publicity in 1984 than at any time before or after in their entire careers. They were featured in Tom Clancy's first and most famous novel Hunt for Red October. They were transported to the scene by USS DALLAS (SSN700) and PIGEON, one of two catamaran Submarine Rescue Ships. They transferred Clancy's hero, CIA operative Jack Ryan, to RED OCTOBER and removed all her enlisted personnel prior to the defection of the Soviet submarine. Later AVALON helped engineer the sinking of PATRICK HENRY (SSBN599) to simulate the destruction of RED OCTOBER. In a discussion with Clancy shortly after the book was published, he asserted that the DSRV could land and mate with the Soviet submarine as easily as with a U.S. submarine. If that were in fact true, it is unfortunate that the Russian Navy never sought assistance from the Norfolk Rescue Command when KURSK went to the bottom. MYSTIC might have saved the day.

AVALON was deactivated in 2000 and used as a source of spare parts for MYSTIC over the rest of her service. Together, they were a part of my legacy during my 34 years in the Navy.■

Presentation to the first OIC (still unnamed) of a ship's clock

Elmer Wheaton, Vice president Lockheed Missiles and Space Company, presenting Mrs. Rindskopf with a handsome punch bowl as I watch closely

THE SUBMARINE COMMUNITY

RECOLLECTIONS OF AN AFTER BATTERY RAT

by Mr. Bob 'Dex' Armstrong

Editor's Note: Mr. Armstrong is a well known teller of sea stories, especially among readers of submarine-specific web sites. This particular piece was recommended by a senior submarine sailor with long experience in listening to sea stories, both old & new.

I was one of the lads who rode REQUIN in the twilight of her career. She was a sweetheart, and those of us who were fortunate enough to be assigned to her and serve under Ed Frothingham were damn lucky. Captain Frothingham was a very special naval officer, an exceptional leader of men and a sailor's sailor in every sense of the term. He instilled in all of us a sense of duty and pride that we have carried down through all these years. We were 'his boys'... We knew it and it gave us something other lads who served on other boats missed. It was a helluva good feeling to know you had that kind of a commander.

Where do I begin? It was a long time ago... Over thirty years. I was a nineteen year old lad... Green... About as green as they came. In those days, old sub sailors would say,

"Hell kid, I've wrung more saltwater out of my socks than you've seen!"

That about says it.

It was 1960 and there I was, standing on Pier 22, Norfolk, in the shadow of 'Mother Onion' (USS Orion AS-18, our tender or mother ship). I had been assigned to T-Division on Orion to await the return of my boat, then deployed in the Med. T-Division was sort of an orphanage for bluejackets in transit. We were billeted in a forward berthing compartment. It was a pig pen. It smelled like an iguana cage. Any lad who spent time waiting for his boat stuck in the squadron's T-Division had a lousy introduction to Submarine Squadron Six.

In those days you weren't allowed to have civilian clothes aboard a naval ship. Outside the gate of Destroyer/Submarine Piers

(D&S piers) ran a street called Hampton Boulevard... A sort of neon Baghdad. They had places called locker clubs. You rented a locker and there you stowed your civvies. Hampton Blvd. was lined with locker clubs, naval tailors and bars... Beer joints like Lovey's, Crazy Kat...The Victory Grill ... The Big "O"... Bell's ... Looters' Terrace. We, the lads of SUBRON SIX, hung out at Bell's. The barmaids were Dixie and Tiger. The single guys set up shop in Bell's when the boat was in port. It had a well worn pool table and a very unique collection of painted ladies who catered to every temptation that an immature lad could ever desire.

It was great to get word that my boat was coming in. I spent a couple of hours wandering around on the pier, watching the Elizabeth River Channel for the REQUIN. Late in the day, I saw her for the first time. My new home was a three hundred eleven foot beauty. She slid into the outboard nest and put her lines over. Crew members yelled to wives and children. Lads from the tender hustled fresh milk and fruit over the gangway to smiling crew members topside. There was a lot of yelling, wisecracking and activity. I reported aboard and immediately got lost in the shuffle. Nobody gave a damn about some 19 year old kid with a sea bag.

The first fellows I met were Larry Dyshart, Rick Katzamyer and the leading seaman, Adriane Stuke. I didn't know it at the time, but 'Stukey' would be one of my two closest mates during the years I rode REQUIN. Stuke was 100% red blooded American wild man... He worked hard, played hard and attracted good looking women like a magnet. The two of us gave the skipper and wardroom more gray hair than any other two apes in the crew. Our antics became legend. If we had spent more time in productive development and less in monkey business, Ed Frothingham would have slept a helluva lot better. If they had a Phi Beta Kappa for class clowns, Stuke and I would have nailed it down flat. Over the years we got involved in every knot-head prank and foolish stunt that took place on the ship.

Being a submariner is serious business. They make that very clear early on. There is no place on duty for error or a cut-up. You foul up and you're gone... It is that simple. We were good at what we did. Ed Frothingham and Mr. Frame made damn sure we did our jobs. Pride comes from professional performance... The hallmark of the Submarine Force. Ed Frothingham made us sharp.

He wouldn't tolerate a slack crew but he allowed a level of latitude that made us a high morale crew. We pushed him past his limit on several occasions and when we did, he set our hip-pockets on fire. Anyone who ever got in the Old Man's doghouse never forgot it. He could pour molten lava on you in a heartbeat.

Some more about the smiles later.

I was originally assigned to mess cooking. There was no disciplinary stigma attached to being a mess cook... If you were not yet a qualified submarine sailor and you were E-3 or below, you mess cooked... It was that simple. Non-rated, non-qualified men were worthless creatures incapable of standing an independent watch. In the spectrum of humanity, non-quals were positioned at the absolute lower end of the pecking order, along with single cell forms of life found on the first two pages of high school biology books. I mess cooked with Stuke. It was like being an understudy for the Flying Walendas! Survival was based on being able to duck insults while sinking verbal harpoons in vulnerable crewmembers. Stuke knew 'em all. He had seen them in the Med. You pull enough liberty with any crew and it doesn't take long to know everyone's soft spots.

"Pipe down, Rhodenhieser an' for chrissakes get off it!! Tell the boys about the dream girl you ran around with in Spain... The one who had warts on her eyelids and smoked cigars!"

Stuke was the master... Try to one-up the magnificent one and nine times out of ten he handed you back your fanny on a silver platter.

There was an art to mess cooking. It was similar to lion taming... Drop your whip and the animals ate you.

It was simple. You set up for the meal, served the meal and cleaned up and washed the dishes... And between times you were the cook's step'n-fetch-it. You also had to make the tossed salad.

To produce the salad, you had to first figure out how many clowns would show up for the meal. If you guessed wrong and had excessive leftovers, the cooks took delight in raking you over the coals. If you were short, the last diners would hound you to make more, while announcing to anyone willing to listen what worthless bastards you were.

One night Stuke and I realized we wouldn't make it. The animals were hitting the salad heavy and we wouldn't make it past the third

sitting. The lads being relieved wouldn't get salad unless we dropped down into the cool room and broke out more.

All of a sudden the great Stuke stands up and waves a five dollar bill.

"Who got it?? Five bucks to the sonuvabitch who finds the toenail!"

Then he went on to explain how he'd thrown this toenail in the salad as sort of a contest to liven things up. It sounded nuts, but everyone knew that Stuke was crazy enough to have pulled a screwball stunt like that so immediately, everyone lost interest in the salad. It worked like a champ.

Stuke sung Ray Charles. He knew every song Ray ever came up with. When he wasn't telling some sea story, usually an eight-foot lie gift-wrapped for rookies, he was singing.

REQUIN was packed with honest-to-God liars. Truth took such a beating on the boat that most of us got where we wouldn't have recognized it if it bit us on the butt.

Someone would tell something... Not to be outdone, some other animal would trump his tale with some instantly fabricated, properly embellished hokum... Then one of the master liars would hit us with a load of gold plated horse manure and take the cake. Bobby Ray Knight was the undisputed king of BS. When he entered the after battery crews mess, no amateur was safe.

One morning, this new kid was talking about this nice young lady he had dated in high school who had a leg brace. It was all about the difficulty he had getting her in and out of a VW. In comes someone from the forward torpedo room who goes into a song-and-dance about this barmaid he knew with a glass eye and wooden leg. Then Bobby Ray comes in from the forward engine room. He drew a cup of coffee and broke in...

"Hell, that's nothing. I knew this gal back home in Texas... She was missing a hand... As I recall, it got bit off by a wolf, but that doesn't matter. In any case, they whittled her this wooden hand and made her these fingers out of chicken bones. They connected the chicken bones with fishing line run up her sleeve, and by moving her arm she could work those chicken bones. Woman got so damn good at it, she could deal cards and change spark plugs!"

No one on the boat was in Bobby Ray's league. That man could throw a pork chop past a wolf.

Another master liar was the cook, Rodney A. Johnson, known affectionately as 'The Rat' or 'Rat' Johnson. If you got anything on anyone in the crew, you told Rat. Rat in turn would nail the poor unsuspecting devil right in the middle of a meal.

"Hey Jack, why don't you tell the boys about the WAVE Officer who chewed you out for winking at her? Understand she got you right between the running lights ... Must've been a picture... A big ox like you standing there saying 'Yes ma'am, Yes ma'am..."

Rat was unmerciful ... He was like a circling shark. A little blood in the water and he was in for the kill.

We loved Rat. He had to be one of the best cooks in the Navy. All submarine cooks were good but the Rat was exceptional. I wish I had a nickel for every night I could smell cinnamon rolls cooking up in the conn... A four hour mid-watch wasn't half bad when Rat was night baker. Rat was famous for his night rations.

The other cooks would throw out a couple of loaves of bread and some cold cuts (if you were out a long time, the cold cuts got this kind of Robin Hood green furry stuff growing on it. The cooks cut it off under the assumption that surgical elimination cured everything)... And Navy mayonnaise. For those of you who have never had the pleasure of eating Navy mayonnaise, let me describe it for you. It came in a tin can with no label. Printed on the top of the can was something like ... 'Dressing, salad, mayonnaise type II mod 6 unit of issue one, each.' Holy catfish, the stuff was from another planet! Once the can was opened and air hit it, the damn stuff vulcanized. No kidding. That stuff formed a scab-like scum you had to lance with a knife if you wanted to put it on a sandwich.

Most good memories that submarine sailors carry with them concern the times spent laughing in the mess deck. It was the gathering place.. The dining establishment... The movie house... The club house... The card parlor... The training facility, and the primary assembly point for major collective ass-chewings.

One major butt-munching comes to mind. We had been out a long time and had developed a severe case of galloping boredom. It had reached a point where a lot of us could actually feel our toenails growing... It was that boring. Saw this movie *The Vikings*, and halfway through the movie, we started calling the principal characters by the names of the officers up forward. The Old Man became Ragnar, the grizzled old leader... The Exec became Einar,

and so on. During the movie, we outdid each other with Viking nonsense. After the film, the relief watch came forward... They had turned their foul weather gear inside out so that the brown hairy lining was on the outside, and they had stapled stupid looking cardboard horns on their caps. The appropriate laughs were obtained and then the idea took on a life of its own... Everyone started putting on a fake Scandinavian accent... Talking what passed for 'Viking talk' and giving the Odin salute to everyone passing fore and aft. Everyone outdid everyone else. Some clown made an aluminum fish and suspended it above the gyro repeater in the control room.

By the time the wardroom had figured out just what in the hell was going on, the whole thing was completely out of hand. It all came to 'all stop' when Ragnar, alias Ed Frothingham found the port and starboard lookouts wearing cardboard horns.

We got assembled and were treated to a very strongly worded discourse on naval decorum, discipline and collective stupidity. Frothingham, normally a very quiet and private man, gave a near volcanic performance and lectured us in pirate parrot terms. We got out of the Viking business damn near as fast as we got into it.

I hope I don't convey the impression that REQUIN was some sort of a seagoing clown act, far from it. We earned what they paid us... At times we earned a helluva lot more than they paid us.

(Editor's note from Cathy Armstrong, the 20 year old conned into typing this epic: the REQUIN was a seagoing clown act...)

They called it Cold War service. It sure was cold at times... And wet. REQUIN had the rattiest collection of foul weather gear ever found in North America. It all looked like it came out of a Goodwill dumpster. At times our bridge looked like a hobo convention. My watch officers were 'Jim Buck' (Lt. James Buckner) and 'Noel K' (Lt. Noel K. Schilling). Both were ex-raghats. Buck had been a submarine corpsman who was selected for the Naval Academy... Graduated and married a Navy nurse... A redheaded sweetheart. Noel K. was a mustang in every sense of the word. If you could think of it, hell, he'd done it. He had forgotten more about diesel boats than most of us would ever know. I spent many hours on the bridge with these gentlemen. Most of the time it was cold, wet or some combination of both. I respected both officers... We all did.

That needs to be said at this point. REQUIN had a damn fine wardroom. Our skippers, Ed Frothingham and Ed Frame (after serving as exec.) were tops. We would have gone hopscotching through hell with either one of them.

Mr. Gibbons was our next exec. He was hard to figure out at first. It took us time to recognize that this man had wall-to-wall intellectual curiosity, and a knowledge of wildlife, particularly birds, that made him a kind of Marlin Perkins to the crew.
My favorite Mr. Gibbons story goes like this:

> It was a beautiful day. I was hanging out of the starboard lookout hole and my opposite number, Tim Conaty, was hanging out of the other one. Tim was, and remains, one of the closest friends I have ever had. He made third class petty officer well before I did and rode my back about it like an angel from hell. He would even make me acknowledge the weight of his superior leadership position and kiss his ring before he would pass up a cup of coffee to me, his old pal, still standing mid-winter topside watches when he was touring below decks. Conaty was a big fake... One of the most brilliant and gentlemanly individuals ever to serve aboard REQUIN... He worked at attempting to be as obnoxious as his contemporary crewman. When he put on his barnacle-encrusted sonuvabitch act, it was funny as hell. We didn't have a set of Encyclopedia Britannica, we had Arthur Leo 'Tim' Conaty. He was our resident '*Mr. Wizard*. He settled arguments, arbitrated ecclesiastical controversies, and explained natural phenomenon. Most of us were dumber than a box of rocks when it came to most subjects other than sports, automobiles, and females. Conaty was our secret weapon... If the wardroom slipped you a hot potato, you could adopt an outward appearance of pensive concentration and go find Tim. If Conaty couldn't give you the answer, it was either a national security issue or BS... One or the other. The wardroom had Gibbons, and we had Conaty, the after battery resident wise man.

Back to Gibbons. There we were manning the bridge, Dex Armstrong, Tim Conaty, and Mr. Gibbons. All of a sudden Mr. Gibbons points to about 015 and yells,

"Look at that! Do you see it? A Wilsons' Petrel!"

I didn't see a damn thing but ocean... Much less Wilson and whatever in hell a Petrel was. My first thought was, this is some kind of joke... Either that or Tim and I are trapped on the bridge with a gahdam commissioned lunatic. We soon learned that a Wilsons' Petrel was a sea bird and Mr. Gibbons was not only a master bird watcher but one of a handful of folks who would have recognized that this particular Petrel was way north of where he or she was supposed to be, and the only man on REQUIN who gave a damn.

In the months to come, Mr. Gibbons became one of the most beloved officers in the wardroom. Lads would drop below after a watch and sit in the crews mess drinking coffee and discussing cloud formations or sea turtles... Or peculiarities of nature like the Sargasso Sea. Nobody ever got bored standing watch with the man most affectionately known as *The Bird Man*.

Then there was 'Big Joe DiGiacomo'. He came aboard as the engineering officer. Rumor had it, he taught electronics at the Naval Academy. On duty he had the reputation of being a hard ass... Very exacting, and hell on nomenclature and proper phraseology. I once entered the control room and announced that one and two-way trash was lined up in the passageway aft and requested permission to, "...pop the sail door and drop shitcans."

After two or three minutes of having hell rained down on me there was no doubt that in the future I would say,
"Sir, request permission to put a man on deck to dump one and two-way trash."

Big Joe made a meal out of damn near everyone in the first month. A lot of the monkey business dried up with the arrival of Mr. D... I took my qualification walk through with the Italian terror. The only question he failed to ask was Mrs. Frothingham's maiden name and shoe size. My fear is that some day I will die and go to hell and have to re-qualify under Mr. D.

But every now and then, Mr. DiGiacomo would throw the cooks out and take over the galley. He would put us all to work cooking an Italian meal. Damn we had fun... Up to that point I had never known that cigar ashes were an important ingredient in Italian cooking.

Mr. D. was a fine officer and he knew it.

Using proper terminology was important for a number of reasons. We had this officer named Hollis Holthouse... He was as clean cut as Don Winslow of the Navy. The animals called him, *Holly Whorehouse*... It didn't fit. He tried hard but always came up shy of ringing the bell and getting a Kewpie doll. I heard somewhere that he left the navy and became some kind of off-the-wall minister. Anyway, one night we were snorkeling and running the fresh water vaps (Badger stills) in the forward engine room. It was hotter than the hubs of hell when you were making battery water. Holthouse was handling the dive, under instruction. The skipper was standing in the control room. Holthouse hit the *press to talk* button on the 21 MC and made an inquiry relative to current conditions in the forward engine room... This voice comes back in a strong Texas accent,

"Sir, it's hotter'n two mice having sex in a wool sock."

The Captain shook his head. Bobby Ray would never understand or appreciate the concept of naval decorum. He once announced that his luck was SO bad, that if he had been Jayne Mansfield's baby, she would have bottle fed him.

Everyone loved the big ugly sonuvabitch.

There was another memorable character on REQUIN... The *body snatcher* or Fritz *the leprechaun* Badertcher. He was a hard worker... Most electricians were—don't ask me why. It may have been an aberration confined strictly to our boat.

Fritz was another one of our band of misguided deck apes. Most nonsense originated and matured in the deck force—not that idle hands were the devils workshop, far from it. By its very nature, the deck force became the institutional repository of the youngest and most spirited lads on board. Chipping and painting is not a cerebral exercise. You could handle 90% of it with less than two and a half brain cells totally engaged. In Brazil they have monkeys doing more interesting work than slopping zinc chromate on inanimate objects.

Stuke was the leading seaman. The Chief of the Boat (not Truman, he was great) was a little sonuvabitch with a cobra tattooed halfway up his arm. He came off an aircraft carrier and spent a disproportionate amount of his time telling us how gahdam clever naval air sailors were. We all felt that we had no desire to be a part of anything that Drifty thought was clever.

Whenever Drifty went below we would *float-test* one or two chipping hammers and paint scrapers. We never found one that could maintain buoyancy. Stuke and I may very well be the world's greatest authorities on topside equipment flotation. The bottom of the slip between piers 22 and 23, Des Sub Piers Norfolk is covered with the residue of numerous experiments. Drifty never could figure out where all the tools were going. Alcohol, tattoo ink and living on carriers had damaged his capacity to figure out anything more complex than tying his shoes. I sure as hell hope that the statute of limitations has run out on wanton destruction and intentional misplacement of government property. If not, Stuke and I will have to set up housekeeping in Latin America.

Fritz Badertcher couldn't swim. When you get qualified there is a tradition that says that you can't pin Dolphins on a dry shirt. Fritz announced to the world's largest collection of major league liars that he couldn't swim. We never figured he might be telling the truth. I'm not sure that anyone in ship's company had been close enough to the truth in a couple of years, to recognize it. Fritz hit the water and damn near set up housekeeping with several hundred missing chipping hammers.

Conaty made third class. In the caste system of subsurface society he had been vested with authority and placed in a position of responsibility. It didn't seem to prevent him from stealing a blanket off some poor sleeping sonuvabitch when he came off watch, or painting the atmosphere blue with unprintable invective whenever the below decks watch vented number 2 sanitary inboard without warning him. He was still the same old Conaty most of the time with occasional trips to the land of drunken power fantasies. Whenever Tim would get three sheets to the wind he would announce that he was a *petty officer of the line* and denounce his former mates as occupying a rung of the social scale well below his recent elevation. We loved it. There was only one Conaty.

Non-rated lads stood topside watch. It was a lot like being the gate keeper at a lunatic asylum... Especially late at night when the local cab companies delivered drunks. Only other drunks find drunks amusing. Want to have fun? Try herding a drunk from the quarterdeck of a diesel boat to the after battery hatch and getting him below. Half the time you end up fishing the poor fool out of the water.

On nice nights, topside watch wasn't half bad. You checked the lines every 15 minutes and wrote 'All lines secure, moored as before' in a log that had ten million coffee cup rings on the cover. Between entries you played hopscotch between salvage air connection plates or shot pier rats with a pellet gun... Or you could listen to Norfolk late night radio brought to you by an endless number of flea bag establishments willing to sell sailors the entire known world for no down payment and easy monthly installments... A form of indentured servitude that replaced the company store for owning souls.

If you were lucky enough to pull the 4 to 8, you got to watch the sunrise over Craney island and catch the Krispie Kreme doughnut delivery. Controlling ten boxes of fresh doughnuts had a proportional effect on one's immediate popularity.

There was another submarine in our division, the USS Cutlass (SS-478). While standing topside watch one night, Stuke made an interesting discovery. The Cutlass, like all subs, had her name painted on her stern in 6 to 8 inch white letters. With minimal effort the "L" in Cutlass could be converted to an "E", changing the name to 'CUTEASS'. It took 'em the better part of a week to discover the conversion and all of three seconds to assign the blame.

At sea we usually wound up on the receiving end of some weird game dreamed up by the perverted antisubmarine wizards. We called it ping time. To add some kind of diabolical interest, naval air and destroyer forces dumped things called PDCs on us... Practice depth charges. Little hand grenade-like devices thought up by some underemployed simpleton whose goal in life was to interrupt folk's sleep. You never got used to the fool things. Just when you were drifting off, some idiot would park a load of the racket makers on your underwater roof. Being at the bottom end of the naval chain allowed us to over simplify everything... A distinct advantage in naval service.

We operated with a naval air unit out of Bermuda, VP 45 known as Polly's boys. They were good if the amount of noise they made when we were trying to get some sleep is any indication. Very good.

When we were on the surface, Stuke, Conaty and I were lookouts and on the dive, planesmen. We rotated every hour and twenty minutes using the helm as our base. We were called *section*

three. We were good. They used us on battle stations.

REQUIN had a fiberglass sail held together by a couple of thousand Monel metal bolts. This gave us a high bridge. *High* being one helluva relative term when compared to battleships, aircraft carriers and the Cape May ferry. It never seemed too damn high in heavy weather.

The bridge had only one piece of equipment... The TBT (Target Bearing Transmitter). A device used to transmit information on ships or shore locations below to anyone interested in that kind of information. At times it held a portable signal light for visual communication... The light could be dismounted and taken below. The worthy grand keeper of the signal light was a second class signalman named Stokes. Stokes owned a bosun's pipe and could pipe all the calls. I never figured them out. Only Noah, Admiral Lord Nelson, and about a handful of retired tin can sailors gave a damn about bosun pipes. Well, Stokes had this xenon searchlight. It was one of the brightest things on the planet... It could throw a light beam all the way to the horizon or cook the eyes out of any P2V pilot who happened to sneak up on you at night.

Oh, and we had another use for the searchlight...

When we would come in from sea, the married guys would invariably con the single guys into standing duty the first night in. We always had a battery charge scheduled that night. All the officers went ashore and left Lt. Noel K. Schilling with the charge. At times, one of our girls would come down and we would take off for a little half-hour of commingling bliss in the back seat of some shipmate's car in the parking lot. We would mount the searchlight in the bridge socket and flash the car if the lad was needed aboard. The searchlight was appropriately named the *Lucy Light* after a rather amorous third class dental tech who bestowed her favors rather liberally among lonely E-3s a long way from home.

We carried four types of torpedoes: 14's, 16's, 27's, and 37's. We would fire the rascals and have to surface, then go find the fool things and recover them. Recovering a floating torpedo is a tricky operation. You would come alongside of the one ton monster, put a swimmer over the side to wrestle with the beast while the deck apes rigged the torpedo loading boom. The poor devil in the water had to place a stainless steel recovery band around the torpedo. You have to picture one ton of steel fish bobbing around in the swells

and some raghat trying to slip a metal ring on it... It was like trying to put a garter belt on a raging wet rhino.

Capt. Frothingham and some other officer invented a recovery net... They built the contraption on the Orion. It worked great... It revolutionized picking up fish. We named it the 'Requin Recovery Net'... I left the ship and never knew what ever happened to the net. It had to be the most wonderful labor saving device ever built by the hand of man. It put our wardroom right up there with Leonardo Di Vinci and Edison.

When we loaded for sea we looked like some kind of buccaneer ship. There was no place to store chow for more than about a week, so we packed food everywhere. Cases of canned goods... Beans, peas, etc., were stacked up two, and at times three layers deep in the passageway. You damn near had to be a lizard to get in and out of the lower bunks. Potatoes were brought on board in bags and either stored in bench lockers in the after battery crews mess or packed in the showers... By the time they opened the showers, the potatoes would be long gone.

Flour and sugar were stored outboard the engines in both the forward and after engine rooms... Port side. Outboard the two starboard engines, you had twenty pound cans of coffee. Going into the yards, you stored coffee everywhere... Up to, and including the skippers hip pockets. Coffee was the medium of exchange in the yards... Par value was directly tied to the coffee bean. Non-scheduled work was accomplished by a primitive form of barter called *Cumshaw*. In the world of Cumshaw, a twenty-pound can of Navy coffee trumps everything. I never really understood why, but in the yards, everything cost coffee...

Most of the chow was stored in the passageways of the crews after-berthing compartment in the after battery. Since the lower rated animals were usually the ones tagged for loading the stores, they knew where all the good stuff was located. Since I was an After Battery Rat... Who lived in Hogan's Alley, I used to make certain that a case of peanut butter and a box of crackers found its way over in that direction. At night someone would whisper,

"Anyone near any Vienna Sausage?"..."I'll toss you a can of peaches for some Peter Pan."

We were a Peter Pan boat. Oh, it's true, we carried a few Skippy eaters, but they were a distinct minority. Skippy eaters were treated

like subversive, non-believing heathens. Peter Pan eaters were the good guys. We won all peanut butter elections and the cooks knew that bringing Skippy on board could lead to physical violence. It was like talking during a Rocky and Bullwinkle cartoon... Tongue removal could result. Vigilantes ruled the after battery. You either rode with the good guys or became a Skippy eater.

Rocky and Bullwinkle were the patron saints of mess cooks. Bad mouth either the squirrel or the moose, and weird and exotic things began showing up in your mashed potatoes. One of the cardinal rules of underwater courtesy and etiquette states that he who aggravates a mess cook or cook should not be surprised to find iguana droppings in his soup. The after battery was a jungle.

Speaking of coffee, in the crew's mess we had two contraptions that could give you a hard time... The coffee urn and the garbage ejector (the GDU, garbage disposal unit).

First the coffee urn... It stood outside of the galley. It had a gravity drain to number two sanitary tank. The drain line had a gate valve and a kick-throw between the urn and the tank. Failure to completely close these two valves on blowing sanitary tanks, allowed the wonderful contents of number two sanitary to percolate up into the urn and make its unique contribution to the taste of REQUIN coffee.

I learned to drink coffee aboard REQUIN. Every cup had a hydraulic oil slick floating on it... For years I wondered why in the hell non-navy coffee didn't taste like boiled Yugoslavian Army socks and come with rainbow colors floating around in it.

The garbage ejector... You have to understand our solid waste disposal problem. When REQUIN was down... Running submerged, trash, garbage and junk collected. Straight garbage got packed in weighted bags... Nylon bags that fit into tapered stainless steel cans called sharpshooter buckets. These buckets formed garbage into bagged slugs that could be forced to sea using 225 lb. ship service air. We weighted the bags so that they went directly to the bottom and did not give away our position.

Failure to properly secure the muzzle door to the GDU would allow sea water to come shooting out of the inner vent. Nothing could interrupt the evening movie any faster than the unique sound of high pressure water hitting our return ventilation line in the overhead. All leaks had classifications... This was a *Cow Pissing on*

a Flat Rock leak.

Diesel submarines leak. Only Hollywood diesel boats don't leak. One of the rudest awakenings you get in the Sub Force is finding out that movies lie. There isn't a whole helluva lot of romance and adventure in the world of a submarine qualified E-3, but you make great friends... The best shipmates in the fleet.

You must understand griping... Constructive, creative griping, not to be confused with counter-productive whining. This may seem weird, but we maintained high morale by inventing unique ways to gripe. No one could take a mole hill and build an Alpine range any faster than the After Battery Rats.

Once we were overrun with roaches. It got so bad that eventually they had to fumigate the boat. Everyone made roach cracks. We used to knock before opening the bread locker so they could run and hide. We used to tell people to be considerate since the light could hurt their eyes... We used to announce that REQUIN had the kind of raisin bread that, if you didn't like raisins, you could shake it and all of the raisins would get up and run away.

We got other strange critters that were cannibals. We used to yell,

"Trade you two blind ones for one with no teeth."

We raised complaining to the level of fine art...

Standing bridge watch (lookout) in heavy weather could make time drag. When you are cold or wet, or a combination thereof, hours seem to drag on. It really feels good to hear your relief request permission to come up... You would give him your binoculars and tell him about any contacts you held and anything radar held over the horizon. A smart lad would have checked the PPI scope in the conn before coming up and would already have a clear picture of what contacts we were working. Once you had performed all the mandated rituals, the deck officer would grant you permission to lay below. You would drop down, make your way through the conn, pay your respects to the lads standing watch in the control room and move aft to the crews mess to draw a cup of hot coffee.

If your foul-weather gear was wet, you would draw three cups of coffee (one for the throttleman, oiler and yourself) and make your way aft to the forward engine room. You would remove your wet gear and spread it out on the engine covers to dry... Then visit

with the engineman until the heat from the two Fairbanks 1600HP diesels knocked the chill out of you.

Bobby Ray, John O'Neil and Dutch Vanderheiden usually were on watch and we'd tell some sea stories and catch up on the scuttlebutt.

After a while, you'd take the dirty cups back to the messdeck and go hunt up an empty bunk to crawl into. You see, unlike the officers and rated men, non-rated men hotsacked... You didn't have your own assigned bunk. You just found an empty one and stole a couple of blankets off of other guys who were sleeping, and crawled in. If it was cold, the engines drew a draft through the boat every time someone went topside through the conning tower hatch (known as the pneumonia hole). We would crawl into our bunks fully clothed, boots and all. I used to pull a watch cap down over my ears and eyes. All things considered, sleeping wasn't half bad on REQUIN.

Our call sign was *ROCKET WOLF* and our call letters were NYEC. I can't think of what value this would have for anyone, but it goes to show that the training sticks with you. You never forget.

It's funny what you remember. If you were moored on the starboard side of pier 22 in the forward nest, you could shoot beer cans out of the after signal ejector and put them on the boat deck of the ORION. I would not like to go into detail where this specific knowledge was gained.

Most submariners have a bunch of tales of thrilling moments. Captain Frothingham kept our thrilling moments to a minimum. He was not an advocate of the unexpected.

We hit the Yorktown ammo pier once and bit a large chunk of lumber out of it. We sledge-hammered the wood out of the bullnose, replaced the paint and reduced the incident to a laughable memory.

Once USS KING (DLG-1) hit us with an ASROC-assisted homing torpedo. It busted through a hull flange, shearing the bolts of the forward signal ejector. We took some water in the forward torpedo room. Considering the operating instructions that Captain Frothingham had to follow, we were as restricted as a duck taped to a shotgun muzzle. We all knew that given an equal playing field, our wardroom could out-think the surface navy every time. They were good. REQUIN was better... We held our own.

We were *Dungaree Navy*. In simple terms that means we had no uniform of the day. In port or at sea, it was all the same... Dungarees. We lived in dungarees. At sea, water... Fresh water, was precious. This was the pre-nuclear Navy. Living was rough... Air wasn't that great. If you were down for any length of time, it got so bad it wouldn't support combustion... At times you couldn't light a smoke. C02 built up. You absorbed it with lithium hydroxide.

Air got foul... Cooking odors... Bilge stench... Sanitary inboard vent air... And 80 men missing regular showers, combined to create a pretty ripe atmosphere. It didn't take a high I.Q. to figure out why they called them pig boats. About REQUIN... She was three hundred eleven feet six inches long... Powered by four 1600HP Fairbanks Morse diesel engines connected to 500 KW generators by direct drive aft of each engine. The generators supplied power to a pair of Westinghouse motors or the batteries. We had 252 tons of batteries (126 in the forward well; 126 aft.) Each cell weighed a ton... MLA 77A Exide wet lead acid. (You qualify under Mr. D. and you never forgot. It is weird what rattles around in your head after thirty years... Give Mr. D credit. I missed two questions on final qualification. I didn't know that Yarway made the levelometer gauges for the sanitary tanks and that the muzzle roller in the torpedo tubes was phenolic... The rest were bronze. I never forgot.)

REQUIN was a working boat. The nuclear subs had long ago become the focal point of the public's interest. The glamor associated with subsea service had been transferred to the nukes. Our boats were associated with the past.

We were assigned duty like target for anti-submarine elements and cat and mouse games with navy air. We called it ping time. No glamour, just long hours... Days of boring work. But, we did it... And we did it well. What pride we had we got from the association with good men, a great wardroom and a good boat... Teamwork, and a unique light-hearted way of getting the job done.

The Old Man was good. He was quiet... He didn't say much. If he called you by name it felt good... That might sound funny, but he wasn't given to the small talk that the crew engaged in.

He was from New England... He had no middle name. His name was listed as Edward (NMN) Frothingham. What the hell was NMN? No middle name... Navy abbreviated everything. He only had eight fingers—he had lost two in a helo-transfer. We were told

that he was damn sensitive about the subject, so we'd stay off the topic. Outside of hearing, he was known as *Eight Fingers*. Once when I was standing watch we had a helo-transfer. Capt. Frothingham and Jim Buck were on the bridge. The Old Man turned to the lookouts and said,

"Gentlemen, put your hands in your pockets!"

We didn't laugh.

I said he was good. He was a true seaman... He had a million evasion tricks up both sleeves. He perfected the airless surface, a little ditty that involved a rapid angle change allowing the boat to broach and fall back, trapping air in the forward tanks. It drove the cooks nuts.

I vividly recall our introduction to Captain Frothingham...

When we went to sea, we drew sea print films... 16mm movies. They constituted most of out entertainment... Stuke made up the difference. We had two projectors (ANQB Navy projectors) but, only one cinemascope lens. The raghats had one projector and the wardroom had the other. Prior to Frothingham's arrival, we had an unwritten gentleman's agreement with the wardroom... We would alternate nights with the cinemascope lens.

One night, in accordance with the existing agreement, we were well into the first reel of the film we were showing, when Quesada (the wardroom steward—we called him 'Q') showed up and said,

"Zee Captain, he want zee lens."

"Go tell him, it isn't the officers' turn."

Q shoved off and went forward... We continued to watch the film. In a minute, he turned up again...

"Capt'n serious ... He no fooling ... He want to have lens."

We sent him forward again to have the exec explain the standing arrangement to the skipper.

Shortly after Q left, someone yelled,

"ATTENTION ON DECK!!"

And there was the Old Man in all of his radiant glory. He lit us up like a pinball machine, and when he left we knew damn well that if he sent word for anything in the future it would go forward or we would be hanging by our toes. It was very clear... Absolutely clear.

We had a cook... His name was Custer. He never got used to the crews' monkey business. When he was baking a cake one night we

started carrying a 3 to 5 degree down angle. When he pulled his cake out of the oven, one side was about five inches higher than the other. Everyone was in on the gag and had a great time making comments to the effect that it was the weirdest gahdam cake they had ever seen.

Another time, the poor devil baked bread during a time when we dove and while snorkeling, pulled a vacuum in the boat. His bread came out like a dozen black bricks. He went nuts... We rolled on the deck laughing!

Custer made hamburgers one night. While he was cooking them, we kept pulling the electric breaker to the grill. Custer was the only guy in the crew who had no idea that he was about to serve damn near raw hamburgers to the crew. When he did, everyone started mooing like a cattle herd and yelling,

"Mine's not dead... It's still moving!"

Then we started singing the theme song from the Rawhide TV show. Custer often wondered if we were all a little light in the brains department. We loved it... You could always get him to hit a number five dry fly.

Being at sea wasn't that bad... Especially riding the surface. Some of my finest memories are of nights standing watch on the bridge.

Summer nights were great. The boat would knife along and sea water would rise up along the tank tops, slip away aft and cascade off, leaving millions of twinkling phosphorescent stars winking back at you in the wake. It doesn't get any better than that.

Every now and then porpoise would play in the bow wave... Coffee always tasted better on nights like that... If you could get a visitor to the bridge and assume your watch long enough to allow you to drop down to the 0-2 level and catch a smoke, it sure made life worth living.

You can't stand bridge watches with someone and not get to know them. I've never met any of Tim's family but I have always felt that I knew them... And I could tell stories on Stuke the entire night. You get close when you wear Dolphins.

We didn't do anything like you see in the movies ... Or pull any rabbits out of magical hats. We did the routine work of peacetime submarine assignments. Most of us were young fellows still in the wild oat-sewing stage of life... Hootin' holler, bark at the moon,

lads. We took our slice of life right out of the middle.

Today diesel boat sailors have been relegated to a place on the chart of the development of man, down around the point previously occupied by Cro-Magnon primates. REQUIN is a neanderthal now... A living naval fossil. Time moves on... Technology renders perfectly serviceable things obsolete. Obsolescence takes hold and you are history.

REQUIN is like a racehorse that has been put out to stud. Maybe some lad in Pittsburgh will visit the old girl and it will ignite his spirit of adventure. Adventure lives in all boys... Maybe he will go to New London and then find himself standing on pier 22 at Des Sub Piers in Norfolk, waiting for his new boat. If she were half the boat REQUIN was, he'd spend a lifetime looking back and knowing the best times in his life were punching holes in the ocean on her.■


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THE TRUE ORIGIN OF THE NAME "TACAMO"

by CAPT Thomas F. Watkins, USN(Ret)

The story I am about to tell covers a period 40 to more than 60 years ago. As of this date the principal participant has died, and I, the youngest participant, am 82 years old and of marginal health. So the story had best be told by me today or the truth may never be known. Therefore, for what it's worth ....

BACKGROUND

It was a tense period for our nation during the Cold War with the Soviet Union, with special concern with what President Kennedy called *The Missile Gap*. With the highest national priority, the Navy's Special Project Office (SPO) was formed, headed by Admiral "Red" Rayborn, to conceive, develop, build, and deploy a nuclear retaliation force of 41 nuclear submarines (each with two complete crews) and 16 Polaris missiles that could be fired submerged on orders from the President of the United States. As the backbone of the nation's deterrent force, these submarines were to be stationed on patrol in many unknown locations somewhere beneath the Seven Seas.

The importance of the program was felt keenly by SPO personnel. In those days it was the custom in Washington for all service personnel to wear civilian clothes to work. Yet, as a reflection of pride for the extremely high national priority of SPO, we all wore our uniforms to work—only on weekends were civilian clothes worn. (All hands were very conscious of that priority, so Saturday work was normal routine ... and often Sundays as well).

I was a member of SPO. I was therefore a small part of a magnificent team, who put their hearts and souls into creating one of the finest and most dedicated Military/Civil Service organizations our government has ever produced: *Special Projects Office*. It was quartered in the old Munitions Building on Constitution Avenue, and completely dedicated to its mission of highest national priority. Within SPO, this LCDR had the distinct honor of working for a remarkable officer, Captain Dave Veazey, as his one and only communications assistant.

Communications, of course, enjoyed a small but vital position in the huge POLARIS Technical Engineering Division, which was responsible for designing and producing the submarines and their missile armament. It was headed by RADM Levering Smith, CAPT Veazey's direct boss.

The fact was, of course, that the entire mission of our 41 submarines depended on our ability to reach them with a *firing message* while deep in the ocean and far from home. It was Captain Dave Veazey's Command Control Communications Branch, that was charged with developing the system(s) that would guarantee receipt of the President's orders by all deployed submarines—even with the USA under attack.

There were many, many R&D ideas under development in an attempt to determine the best mix of communications systems that would provide the redundancy necessary to assure message delivery, even after the US sustained a nuclear attack. Several of the various systems made use of powerful low frequency radio signals sent from huge shore based antennas, and one even involved an aircraft dropping an explosive device far at sea emitting a series of coded detonations.

So it was a natural to try combining these two ideas such as installing a very low frequency (VLF) transmitter in a navy patrol aircraft. It would fly over distant seas and transmit VLF signals to submerged submarines by use of an extremely long wire antenna towed behind the aircraft.

The idea, of course, was to get the transmitter closer to the submarine operating areas thereby increasing the signal strength needed to penetrate deeper into the salt water. Development of this system was assigned by SPO to the Bureau of Aeronautics (BUAIR). This project eventually acquired the name TACAMO.

Well, that's the background of the VLF transmitter flown to sea by an aircraft. But how does the name TACAMO get in there? A bit of history is necessary to understand how this all relates:

A FLASHBACK

Dick Whiteside and I were classmates in the USNA class of 1949 but that was just for starters. We were together again in 1951 attending Submarine School. We remained close friends, and it was our good fortune that duty assignments had us together several

more times over our naval careers. And, as luck would have it, my submarine even relieved his submarine in a Sixth Fleet deployment to the Mediterranean—we were each XO of different subs.

So it was in Gibraltar that we sat in his wardroom transferring pertinent deployment information. As usual we swapped a few sea stories and that included our experiences as XO. One of Dick's many ideas was this extra large stamp he had made up, with which to imprint a piece of incoming mail, thus directing some action officer to Take Charge And March Off—in other words take full responsibility for whatever action was necessary, and get on with it. In large red capital letters the stamp simply said: TACAMO.

To those of us who spent some years as USNA midshipmen, the order *Take Charge and March Off* is familiar. We used to march a lot, often in sections to and from class—there was but a singular curriculum back then, which made it feasible to do so. The order may be less familiar today, as the diverse USNA curriculum has precluded sections marching to class for many years.

THE EVENT THAT COINED *TACAMO*

One of my many responsibilities for Captain Veazey was to keep Milestone Charts showing sequential progress and plans of our numerous Communications R&D Projects.

We had lots of them—at one time running a R&D Communications budget as large as twenty million dollars a year.

At this particular time—timeframe 1962—I was having difficulty in laying out any meaningful development schedule for our VLF aircraft project that had recently been assigned to BUAIR. I had called them frequently but they apparently had our project low on their priority list. In the absence of Captain Veazey, who happened to be in the hospital at the time, I was making our periodic status report to Admiral Smith and told him the BUAIR project was languishing.

I was ordered to return immediately to his office, together with the action officer in BUAIR responsible for the project. In short order Admiral Smith's office featured two BUAIR Commanders, plus this Lieutenant Commander, all lined up at attention before his desk and suffering the penetrating glare of ADM Smith. I had the distinct impression that the casual civilian attire of the Commanders was not making a favorable impression on Admiral Smith.

After some unsatisfactory answers to his questions, Admiral Smith read the riot act to the two rather dejected BUAIR reps, and left no doubt that the priority for the project was to be moved to the top of the list. Then he asked them, "What's the name of this project anyway?"

There followed a long silence with the two BUAIR Commanders looking even more uncomfortable—the project had never been assigned a name.

Finally I broke the spell with: "How about TACAMO, Admiral?" ADM Smith shifted his gaze to me and asked: "What's a TACAMO?" I told him that it was short for the command "TAKE CHARGE AND MARCH OFF!" "Perfect! Make it so!" said the Admiral, and immediately told the two BUAIR Commanders that they'd better get hopping ... and now!

And with that TACAMO became a new SPO/BUAIR high priority R&D project. The name was applied that day by Admiral Levering Smith in his office; and TACAMO went on to become one of our R&D projects that actually became operational in the world of POLARIS Command Control Communications.

I have heard several amusing, and incorrect, explanations of TACAMO's origin, including the honoring of an obscure American Indian Tribe—so obscure that no one has ever found record of it. But the story I have related above speaks for itself.

As for me, I quickly called my friend Dick Whiteside to confess I'd used his creation without his OK. All I can say is that it was lucky for me that Dick was a good friend of mine.

There you have it.■

THE BATTLE OF THE ATLANTIC, 1939-1945

WHY THE U-BOAT CAMPAIGN FAILED, Pt. II of III

by VADM James A. Sagerholm, USN(Ret.)

VADM Sagerholm is a retired submarine officer. He commanded USS KAMEHAMEHA (SSBN642) and was Deputy Director of Naval Intelligence. As a Flag Officer he served as Commander, South Atlantic Force and as Commander, Naval Education and Training.

In Part I, VADM Sagerholm set the stage for the actual operations of the Battle of the Atlantic, and the big picture strategic question posed by the title. He outlined the background for the force structure, and tactics, both sides had at the start of the War in September of 1939. He also noted the advantages and disadvantages of that force structure, the production problems inherent in starting a complex construction program after a significant hiatus, and the practical difficulties of resource allocation between services in the face of a national leadership lacking a sufficiently sophisticated overall program for achieving its wartime goals.

Two questions at the start of Part I are based on World War I German experience and form a major point in getting to the answer posed by the title. Admiral Sagerholm asked why Kaiser Wilhelm failed to recognize the lesson of history when, in the lead-up to WWI, he built his High Seas Fleet to be second only to Britain's. He also asked why the WWI experience of early success and near victory in the submarine war, followed by total defeat, was repeated in WWII; given that Germany "...arguably possessed the most experienced submariners of any navy in the world."

Dönitz was firmly wedded to the idea of employing group tactics as the means to defeat the convoy system. In the winter of 1938-1939, he had conducted an open ocean exercise in the Atlantic for the purpose of testing the concept, including command and control, locating convoys, and bringing U-boats to the convoy

for group attack. Analysis of the exercise convinced him that group tactics could be decisively successful. However, numbers assumed critical importance, and it was from the analysis of this exercise that his requirement for 300 submarines was derived.[28]

When forced to commence the submarine anti-shipping campaign with but 22 boats on 3 September 1939, Dönitz resolved nevertheless to try group tactics at the first opportunity. To this end, he assembled in October 1939 a group of six U-boats under the tactical command of Senior Officer Sixth U-Boat Flotilla in U-37, with the intent to have the group operate at the convergence point for shipping entering the Straits of Gibraltar. U-40 was late getting to sea and, while traveling the shorter route through the English Channel, struck a mine and was lost. Two other boats, U-42 and U-45, were lost to destroyer attacks while passing west of Ireland. The remaining three encountered a convoy west of Portugal and attacked. Three to four ships were estimated to have been sunk, but in the attack, one of the U-boats expended all of its torpedoes and had to return home. The last two boats then proceeded to separate patrol areas for independent operations, ending any attempt at group tactics.[29]

The first wolf-pack operation had hardly been an outstanding success, and showed that numbers were indeed necessary in order to account for losses that might occur as well as to provide a broader coverage of the ocean to facilitate locating convoys. The operation also confirmed the infeasibility of trying to exercise tactical control from one of the boats in the group.

The officer in tactical command had necessarily to be surfaced, and thus had to stand off at a distance from the action, making his ability to control the attack nearly nil. A second attempt in early November produced results similar to the first attempt; Dönitz therefore reverted to ordering independent operations until sufficient numbers of boats were available. It would be another eight months before wolf-pack operations were again attempted.[30]

Dönitz chose to extrapolate the tenuous results achieved with just a few boats into the conviction that group tactics had been verified as the key to successfully countering the convoy system. He resolved the question of controlling the group's concentration against a convoy, once located, by determining that he could do so by radio from his headquarters ashore, using sighting reports from

U-boats as well as intelligence obtained from the German code-breaking group, B-dienst. Once the boats were assembled in attack positions, each boat was released to act independently, the success or failure of the attacks being determined by the skill and dash exercised by the individual skipper. Following the action, Dönitz required each commanding officer to submit an after-action report to him personally and in detail. To one accustomed to submarine operations where silence is the key to initial surprise and ultimate survival, the numerous broadcasts required of the U-boats appears to have been a ready formula for their loss, but Dönitz maintained that the use of short code signals denied the enemy any precise direction finding ability, and thus he argued that his requirements posed little risk to his boats.[31] This was just one of several erroneous assumptions made by Admiral Dönitz regarding the ability of Allied forces to locate his submarines.

One of the consequences of convoying by the Allies was the removal of ships from most of the ocean, the ships now being concentrated in the convoys. This significantly increased the difficulty of locating ships to attack in the broad reaches of the ocean. One course available to the U-boats was to gather at or near points of convergence of sea routes where convoys or ships had to transit in order to arrive at a given destination, points such as the Straits of Gibraltar or the area just northwest of Ireland. This approach worked well in the early years of the war when the British anti-submarine resources were still thinly stretched. During one episode in September 1940, while operating between Rockall Bank and the North Channel, the U-boat aces Prien, Kretschmer, Schepke, and Bleichrodt sank nineteen ships and damaged three others, in action lasting less than a week.[32] However, the Allies were of course aware of this vulnerability, and when forces became available later in the war, the concentration of surface and air coverage at such points was increased, forcing the relocation of U-boats to the west in the open Atlantic. Under these conditions, instead of random searches by individual U-boats, an alternative was devised wherein the U-boats extended a line across an area of the ocean where a convoy bound for Britain from America was expected to pass, based upon information provided by B-dienst. When a boat sighted a convoy, an immediate report was made to headquarters, and boats in the area were vectored to the location

reported. The success of this approach depended heavily upon sea and weather conditions. A convoy might or might not be sighted as it passed through the U-boat line. The bridge of a surfaced boat was less than twenty feet above the waterline, allowing a field of vision of less than ten miles in radius on a clear day, and much reduced in poor weather or rough seas. Germany was slow in developing radar, so passive sonar was the only sensor available for detecting a convoy, and although German passive sonar was excellent, sonar performance depended on water salinity, water temperature layers, and sea state, all of which affected sound transmission in the sea.[33]

A related factor affecting the ability of U-boats to intercept convoys was the work being done by the Allied signals intelligence analysts. When the Allied code-breakers intercepted and decoded orders to the U-boats, the convoy commodore was advised to change to a new course specified in the message without any reference as to why.[34] While this may seem to be a relatively straight-forward process wherein the intercepted message is decoded, analyzed for its effect on a convoy, and then suitable warning given to the convoy commander, in reality the process was far more complicated and subject to a number of variables, not the least of which was the ability of the decoders to actually break the message in all its parts in a sufficiently short period of time to be useful, usually less than 48 hours, and having done so, for the analysts to understand properly its import. The Allied system for decryption of intercepted transmissions was known as Ultra, which was part of the broader area of signals intelligence (sigint) that comprised any use of intercepted electro-magnetic emissions made by the enemy. Ultra was the product initially of a group of cryptanalysts working in Britain at Bletchley Park, an estate in the countryside near Oxford. There, in near total isolation from the rest of the world, mathematicians and electronics experts worked together in the effort to unravel the mystery of the German Enigma machine, the device used by the Germans to encode and decode their encrypted messages. Employing a system of three (later four) rotors containing letters and numbers in different sequences, rotating in accordance with a series of settings that changed either at random intervals or at regular times, depending on the user, and thus creating millions of possible combinations for any letter or number to be encoded, the system was deemed to be unbreakable

by the German cryptology community. However, unknown to the Germans, an Enigma machine had been recovered from a U-boat before it sank, together with some of the code books. With these as a start, as well as the invaluable assistance of three young Polish engineers who had escaped from Europe with significant information regarding the system, a primitive computer using vacuum tubes was built to run the vast number of combinations to be tested that ultimately led to decryption of messages using the Enigma system. While Ultra was of considerable aid in countering the U-boat threat, it was but one of several aids derived from sigint, one being traffic analysis, which is the statistical analysis of transmissions to determine patterns from which information may be deduced; another being high-frequency direction-finding, HF/DF, of which more later.[35]

At one point in the Battle of the Atlantic, the Germans added a fourth rotor to the Enigma machine, which totally denied the Allies the ability to decode Enigma traffic, a situation that lasted for some four months until the combined efforts of the cryptanalysts at Bletchley Park and at the National Cash Register plant in Dayton, Ohio worked out the algorithms needed to once again read the German messages. In the employment of Ultra, extreme care had to be taken in making use of the information so as to avoid revealing to the Germans what was being accomplished. As it was, Dönitz several times questioned his signals intelligence agency, B-dienst, as to whether the Allies were breaking the Enigma messages, his suspicions aroused by convoys seemingly disappearing from projected routes after his boats had been advised of intercept points to take. He was assured that the millions of combinations possible in Enigma encoding made it impossible to decode their messages. And so it would have been but for the building of the primitive computers that were able to run the necessary thousands of computations that were needed to break the codes. Having been so confidently assured by B-dienst of the security of messages to the U-boats, Dönitz and his staff concluded that the cause of convoy re-routing was the locating of U-boats by very long-range airborne radar combined with deductive analysis by the British based on information provided them by French underground intelligence networks. His own B-dienst was breaking British reports of U-boat locations being broadcast to the convoys and

hunter-killer groups at sea in the Atlantic, and were a source of information for the U-boat command of which the British were unaware, but B-dienst never accepted the possibility that the British ability to identify U-boat locations was the result of decoding German message traffic. So the game of cat and mouse switched back and forth throughout the war, and at the time of the writing of his memoirs in 1957, Dönitz was still "not certain whether or not the enemy did succeed in breaking our ciphers during the war."[36]

A third method for locating convoys was aerial reconnaissance, a method that intuitively offered the most efficient means with its relatively rapid coverage of large areas of the ocean. However, there was no naval air arm, so any air reconnaissance required the cooperation of the Luftwaffe. When Dönitz approached Reichsmarschall Hermann Göring following the fall of France, Göring refused to provide any assistance, citing the needs of the Luftwaffe in the ongoing battle to subdue Britain by air attacks. Dönitz then took his request to Hitler who, on 7 January 1941, ordered Air Group 40 in Bordeaux to be placed under command of the navy. However, the Fw200 aircraft that comprised Air Group 40, although considered long range by the Luftwaffe, did not have the range needed to cover the western Atlantic, and were therefore restricted to sweeps over the Bay of Biscay to the Straits of Gibraltar and as far north as the North Channel above Scotland. Although the Fw200s eventually provided successful reconnaissance in the Gibraltar area, the shipping entering the Mediterranean was mostly of smaller tonnage than the ships headed for Britain. Furthermore, the supplies going to Britain were the prime target, but the Fw200, being a converted domestic airliner, simply was unable to effectively operate in the much more hostile environment of the north, hostile both from enemy aircraft and from weather conditions at those latitudes. By the end of 1941, therefore, Dönitz concluded that Air Group 40, despite the efforts of the aircrews, was not equipped to answer the needs of the U-boat service. The problem of locating convoys in the open ocean, once the shipping convergence points were denied to the Germans, remained a problem for the rest of the war. Dönitz concluded that the "problem could only be solved by the acquisition of more boats," but it was not until 1943 that he had even a force of 100 boats, let alone the 300 that he had identified as needed, and by 1943, the tide of battle

in the Atlantic had turned against the U-boats.[37]

From the very outset of its restoration in 1935, the U-boat arm was never given the recognition it deserved as a critical element in Germany's war against first Britain, and then against Britain and the United States. Hitler and his generals, together with Reichsmarschall Göring, were *continental* in their focus, and failed to appreciate that the winning of the war required the defeat of Britain, which in turn required that Britain be denied the means to wage war. The effects of this were felt throughout the war, and included difficulty in competing for materials and personnel for U-boat construction and maintenance, lack of air support, redirection of U-boats from the Atlantic to the Mediterranean in support of the Africa Korps, a similar redirection to Norway during the invasion by Germany, and the lack of sufficient priority for the development of countermeasures to offset Allied innovations in anti-submarine warfare.[38]

The relationship between Grand Admiral Erich Raeder and Admiral Dönitz was initially marked by a conflict as to the course a rejuvenated navy should take. Raeder had been head of the navy since 1928, and steered it through the turbulent times of the Weimar Republic, and on into the rise and takeover of the country by the National Socialists led by Adolf Hitler. Raeder had been impressed by Hitler's ability to out-negotiate and bluff the British and French. He therefore accepted Hitler's word that there would be no war for at least a decade, and set the date of 1948 for completion of the navy's reconstruction. Subsequently, at Hitler's direction, the completion date was moved up to 1944, a move that should have alerted Raeder that Hitler's intentions were such that he expected to have war earlier than he had previously indicated to his generals and admirals. Raeder's goal was the creation of a balanced fleet of battleships, aircraft carriers, cruisers, destroyers, and submarines, a fleet capable of open ocean operations in the Atlantic. Dönitz, who had been appointed by Raeder to the post of Senior Officer, U-boats in 1935, saw the future of the German Navy primarily as a commerce destroyer using submarines as the principal force. The disagreement on the future of the navy had the unfortunate effect of delaying the submarine building program. Once war started, however, Raeder had been persuaded of the need for a strong U-boat force. He scrapped the balanced force plan and

argued for increased production and support of the submarine force, but he failed to convince Hitler, who evidently never grasped the importance of the U-boat campaign to the overall war effort. It was at this time that Raeder, as commander-in-chief of the navy, should have pressed Hitler and Göring for the creation of a joint Atlantic command to coordinate air and sea assets in the campaign to stop or significantly reduce the flow of war materials and food to Britain. Such a command would have been especially useful when the need for aerial reconnaissance was critical to the success of wolf-pack tactics. Both Raeder and Dönitz saw Hitler as being so deeply committed to land warfare that his understanding of *Weltmacht* in a Mahanian sense was hopelessly warped. Although Raeder had trouble from time to time with what he viewed as Dönitz's excessive ego and stubbornness, he nevertheless also appreciated the latter's abilities and expertise in submarine warfare, and continued to support him and the U-boat arm until Raeder's retirement in 1943.[39] Nevertheless, Raeder's pre-war faith in Hitler's ability to avoid war through negotiations had led Raeder to accept Hitler's assurances that there would be time to complete the navy's building plan before any war might be expected. As a result, when war actually erupted in 1939, the navy in general, and the U-boat force in particular, were well below the numbers calculated as needed to attain the goal of destroying British shipping to the extent necessary to bring about Britain's defeat.

German technology did not live up to its reputation when it came to support of the U-boat campaign. Torpedo detonators were not properly tested and resulted in numerous failures in the first two years of the war. The German electronics experts lagged behind the Allies throughout the war in the development of radar, and showed a poor understanding of the use of microwave radar, claiming that it was impossible to use frequencies in that range, yet U-boats were being attacked in pitch darkness by aircraft appearing seemingly from nowhere. It was not until a British bomber carrying centimetric radar was recovered in Holland that the German scientists were confronted with hard evidence that such radar not only existed, it was capable of discerning small objects at ranges deemed impossible by the Germans. Initially, the U-boats were provided a radar detection device named Metox, that being the French company that manufactured it. The system came with a primitive makeshift

antenna consisting of a wooden cross with a wire stretched around it, connected to a cable that led down through the bridge hatch into the conning tower, an arrangement that had to be rigged every time the boat surfaced, and unrigged whenever the boat submerged. The crude antenna was limited to detections at such short range that when the device emitted the radar detection signal, the source of the signal was so close that the boat had to crash dive, but first the antenna and cable had to be stowed below, a clumsy and dangerous arrangement. Eventually, the boats were fitted with circular metal antennae that were much more sensitive and were permanently mounted on the bridge.[40]

Later innovations that looked promising on the drawing board did not meet expectations. One such was the anti-escort acoustic torpedo that was designed to home on the screw noise of destroyers and other smaller escorts. While these torpedoes initially were successful, the Allies quickly devised acoustic countermeasures that decoyed the torpedo, rendering it harmless. However, the early success of the acoustic torpedoes, together with the new circular antennae and a new radar detector named Wanze, instilled a false sense of confidence in the boats so equipped. Wanze detected the same low to medium frequency radars as Metox but at much greater ranges from the emitter, allowing adequate time for evasion. Boats also now had their own radar for use against night attacks by aircraft and for night surface attacks against convoys. This new-found confidence was short-lived, however, when a night wolf-pack attack against a convoy was thwarted by the sudden and undetected attack of aircraft appearing out of nowhere in the pitch-black night. No Wanze warning had been given, and the low altitude approach by the aircraft was not seen on radar until the aircraft was bearing in on the boats. It was evident that aircraft were using radar of a frequency not detectable by the Wanze, the higher frequency centimetric radar.[41]

Even the much touted Type XXI and Type XXIII boats that were introduced near the end of the war, while indeed capable of high underwater speeds attributed to their hull design and their greatly increased battery power, were found to be sloppily constructed, and experienced hull cracks and joint leaks when subjected to shock tests.[42]

Although B-dienst continued to provide information on convoy

routes, the ability of the U-boat force to exploit the information was increasingly impeded by the continual Allied innovations in technology, tactics, and types of forces.

It is important to recognize that the convoy system was the foundation upon which the Allied anti-submarine effort rested. The convoy system provided a structure that fully was in consonance with the primary objective of the Allies in the Battle of the Atlantic, namely, the arrival intact of ships and their cargoes at whatever destination was intended, be it North Africa or Britain or Murmansk. There were several ways to accomplish the mission of getting the cargoes to where they were needed. One way was to avoid the threat by selective routing of the convoys based upon knowledge of the location of the U-boats; another was to attack the U-boats when they approached a convoy, ideally before the boats could attack and in the process either destroy them or repulse them. In practice, both methods were used.

The first method required intelligence as to the location and intentions of boats at sea, intelligence obtained from the Ultra process previously described. Any transmissions from the boats that provided detection opportunities for HF/DF were more valuable in a real-time sense. HF/DF was a system where individual stations intercepted the same signal but at different locations, thereby obtaining a set of bearings of the signal which, when plotted on a chart, intersected at or near the location of the transmitter. It was the combination of Ultra and HF/DF that enabled Allied convoys to be redirected so as to avoid U-boats. It was also the installation of HF/DF on escorts and escort carriers that allowed a rapid reaction of a convoy's protective force to strike at the U-boats before the latter could reach their intended attack position.[43] Despite the growing evidence of the effectiveness of HF/DF in countering the U-boat threat, Dönitz doggedly clung to the notion that the accuracy of the bearings was so poor that HF/DF mounted no significant threat to his force. In addition, he asserted that the use of "spurt" transmissions denied the direction finders the ability to determine a bearing or even to detect the transmission.[44] By the autumn of 1944, U-boat captains had no such illusions about HF/DF, and "were generally averse—and rightly so—to using their radios and were apt to give up after one or two abortive attempts to pass a message; in fact, the more cautious of them made no attempt

at all."[45]

In neither OKM nor in the U-boat command was there a well-developed and realistic strategy for the employment of the ships and submarines of the Kriegsmarine in the event of war with Britain and France, the most likely adversaries of Germany.

Raeder and OKM were seized with the potential problem of breaking a British blockade, the same problem the German Navy faced in World War I. In the latter instance, the German High Sea Fleet had been unsuccessful as an opponent of the Royal Navy, and although it claimed a tactical victory at the battle of Jutland, it failed in its strategic objective of breaking the British blockade. Hence, it had resorted to a counter-strategy of submarine warfare against British shipping, a course that eventually led to the entry of America into the war, with the consequent defeat of Germany. Hampering OKM in its planning was the Hitler postulate that Britain would maintain a *benevolent neutrality* if a war on the continent were to occur. Nevertheless, Raeder's strategic vision called for a German Navy capable of operating in the open reaches of the Atlantic, a navy consisting of 365 ships by 1944, including six battleships, four aircraft carriers, twelve heavy cruisers, and 233 U-boats, a balanced fleet that would in his eyes be capable of successfully challenging the Royal Navy.[46]

Raeder's vision of challenging Britain on the high seas constituted a strategic disconnect with the grand strategy of Nazi Germany. It was a maritime strategy at odds with Hitler's policy of avoiding war with Britain, and did not support Hitler's continental goals of German territorial expansion to the south and east. Furthermore, it disregarded Germany's geographical position that found movement by sea to the Atlantic impeded by the natural barrier of the British Isles. Raeder recognized the need for making the most effective use of his forces by hitting the enemy's most vulnerable points, and he further saw the need for joint operations with the army and the Luftwaffe.[47] In the event, however, Raeder failed to attain his fleet due to the early onset of war with Britain; failed to economize the use of his limited numbers by concentrating the U-boat force on striking Britain's most critical sea lines, its transport of oil from the Persian Gulf and the Caribbean; and failed to have established a joint air-sea command for coordination of Luftwaffe assets with naval assets. It should be noted that Hitler

was not consistent in formulating naval policy, approving on the one hand the expansion of the fleet and insisting that it be *second to none*, while on the other hand committing top priority to the army and air force in support of his continental ambitions of expansion.[48] The inability of Hitler to understand the role of sea power in a comprehensive grand strategy was critical to the outcome of the Battle of the Atlantic and of the war. The Battle of the Atlantic should have been seen as a necessary part of the overall schema for winning the war, since so long as Britain remained as an opponent, the war could not be won.

The strategy adopted by Dönitz was not in consonance with Raeder's original plans, calling as it did for a navy dominated by the U-boat force, nor was it more than an adaptation of the World War I U-boat war against commerce, the only innovation being the use of wolf-packs, a tactic that required large numbers of U-boats in order to be implemented properly. As it was, Dönitz had less than one-tenth of the ocean-going boats he needed when hostilities commenced, but neither he nor OKM made any strategic or tactical adjustment to accommodate his lack of numbers, despite Raeder's previous acknowledgement of the need to maximize the effectiveness of forces inferior in numbers.[49]

In the period between the world wars, the international naval community had accepted the British claim that ASDIC, the acronym used for shipborne underwater sound listening devices, had attained the capability to locate and track submarines such that the threat of the latter had been nullified. However, when put to the test once hostilities commenced, the claim was found to be excessively exaggerated, and the locating and tracking of a submarine maneuvering to avoid being tracked proved to be a daunting task, requiring a high degree of skill by the operator together with a fair amount of luck. Maximum detection range was usually about 2000 yards, or one nautical mile, well within the range of torpedoes. When depth charges were dropped, the explosions obviously blocked out any other sounds, a condition that lasted long enough to cause contact to be lost. This disadvantage was overcome by the development of search tactics involving at least two cooperating escorts, one of whom maintained a position at the last known location while the other(s) conducted an expanding square sweep that moved away from the target datum and

covered the possible escape routes of a slow moving submarine. If the submarine elected to stay in the reverberation area, the stationary escort was in position to regain contact when the noise level subsided sufficiently. The later development of the *hedgehog* ahead-thrown small charge launcher allowed an escort to fire fourteen projectiles simultaneously in a circular pattern with a diameter of a hundred yards or so at a distance of several hundred yards ahead of the escort. The charges detonated only on contact with the hull of the submarine, thus indicating the range and direction of travel of the submarine as well as considerably reducing the sound interference with the sonar.[50]

Augmenting the development of weapons and improvements in sonar was the formation of the Anti-Submarine Warfare Operations Research Group (ASWORG) in April 1942, comprised of civilian scientists and naval officers working together to address such problems as the most effective tactics to regain contact, the most efficient use of aircraft in covering a convoy, and similar problems encountered by the forces fighting the U-boats. Working at sea with the ships and aircraft of the Tenth Fleet in the North Atlantic and the Fourth Fleet in southern waters, ASWORG determined for example that three destroyers searching in line abreast were more than three times as effective as a single destroyer. They developed box searches and the expanding square search for regaining contact. Aircraft search speed, altitude and patterns for most effective coverage of an ocean area were developed.[51] These were but several of the contributions made by this group to the Battle of the Atlantic. By contrast, neither OKM nor Admiral Dönitz attempted the use of similar talent in Germany.

A major contribution of Anglo-American technology was radar, both shipborne and airborne. Invented in Britain before World War II, with improvements by American engineers, radar was installed on Navy vessels in 1942, providing a search radius at least five times farther than lookouts could provide in clear weather, and radar had the added advantage of *seeing* through areas of low visibility. The addition of radar to aircraft was especially of value in covering large areas of ocean in sweeps by the long-range land-based B-24 Liberators and B-17s assigned by the Army Air Force to ASW patrols over the North Atlantic, as well as the growing fleet of Navy patrol aircraft. Again, this example of inter-service

cooperation stands in marked contrast to the refusal of Göring to assist the U-boat force in its campaign. As has already been noted, the eventual use of centimetric radar by aircraft proved to be especially effective in permitting the aircraft to surprise a boat on the surface, usually with the resultant loss of the boat.[52]

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28. Ibid., 32-33.
29. Günter Hessler, Alfred Hoschatt, and Jürgen Rohwer, *German Naval History: The U-Boat War in the Atlantic, 1939-1945*, Facsimile edition (London: HMSO, 1989), 1:10-11.
30. Ibid., 12.
31. Dönitz, *Memoirs*, 60-64.
32. Blair, *The Hunters, 1939-1942*, 193-195.
33. Dönitz, *Memoirs*, 135-136.
34. W. J. R. Gardner, *Decoding History: The Battle of the Atlantic and Ultra* (Annapolis, MD: Naval Institute Press, 1999), 28-30.
35. Ibid., 124-138.
36. Dönitz, *Memoirs*, 324-325.
37. Ibid., 137-141; 144.
38. Ibid., 117; 152.
39. Bird, *Raeder*, 132-140.
40. Jak Mallman Showell, *The U-Boat Century: German Submarine Warfare 1906-2006* (Annapolis, MD: Naval Institute Press, 2006), 95.
41. Ibid., 96.
42. Blair, *The Hunters*, x-xi.
43. Gardner, Decoding History, 124-138.
44. Dönitz, *Memoirs*, 63; 143. "Spurt" was the sending of a signal so rapidly that it took only a second or two to complete the transmission. Nevertheless, DF stations were able to triangulate with accuracy sufficient to locate the sender. See Gardner, 124-128.
45. Hessler, *German Naval History*, 3: 93.
46. Bird, *Raeder*, 116-117.
47. Ibid., 114-118.
48. Ibid.
49. Ibid., 62-65.
50. Samuel Eliot Morison, The Two-Ocean War: A Short History of the United States Navy in the Second World War (New York: Galahad Books, 1963), 123-124.
51. Ibid., 125-126.
52. Ibid., 128.

BOOK REVIEWS

OUR GOOD NAME
A COMPANY'S FIGHT TO DEFEND ITS HONOR AND GET THE TRUTH TOLD ABOUT ABU GHRAIB
J. PHILLIP LONDON

Published by Regnery Publishing Inc, Washington DC 2008
ISBN 978-1-59698-539-1

Reviewed by Ms. Katherine Hutton and
Captain Vernon Hutton, USN(Ret)

A picture is worth a thousand words. In this day and age that picture can reach millions. When that picture conveys an incredible image, especially one that portrays wrongdoing, instant judge and jury effects can literally kill an innocent. And where that judgment fits an agenda, unscrupulous people take advantage. Our Good Name is a story of determined grit and perseverance in the face of sensationalism and accusations run amuck. Jack London, a Naval Aviator, led a company whose culture he developed to align closely with the culture and ethos of the military. They were drawn into a scandal of huge proportion because of an alleged but unfounded link thanks to mischievous people who abused the power of the press.

It is a story of a man and his company and how they stuck to their principles. They set out to fight the misleading and biased attacks. They spent extraordinary time and resources to present the facts and their story. The book demonstrates just how powerful getting a story before the truth can lead to demands that have wrecked careers.

Within this book London illustrates the magnitude of defending innocence against an American cultural phenomenon known as freedom of the press. He shows how the business model of journalism and the information age combine to present a force as powerful as the US military but in its own backyard.

For a company challenged by allegations of misconduct, CACI provides a firm sense of the resolve and steps necessary to present

one's side of the story. London also provides a crisis management model. But mostly London shines as an example of a leader and his company driven by principled creed and how they can survive a sensational onslaught and maintain their dignity and reputation.

If I find any flaw in the book, it is that unanswered questions remain. Of the more egregious examples of unaccountable journalism, this book shows behavior by a Senior Fellow at Brookings that goes unchecked. No accountability for false allegations and no corrections when presented with facts were acknowledged. The book also illustrates a couple of lawsuits that abuse civil litigation to pursue agendas of different matters. Additionally the book details a major newspaper with professional accountability lapses.

This is a good reference book for those looking at crisis management, whether for planning purposes or immediately upon entering a public relations nightmare. Any company should use this book as a reference for its crisis planning. The book provides plenty of reasons to imbed a culture of doing the right thing, a principled-based leadership style as a matter of course.■

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HIDE AND SEEK: THE UNTOLD STORY OF COLD WAR NAVAL ESPIONAGE

Published by John Wiley and Sons, Inc., Hoboken, NJ.
ISBN 978-0-471-78530-9

Reviewed by Jim Patton, Naval Submarine League

First, a great deal of credit is due to the determination and courage of authors Alexandre Sheldon-Duplaix and the late Captain Peter A. Huchthausen, USN (Ret) for undertaking such a massive effort as to document the broad sweep of naval espionage from the later days of World War II through the present day. Sadly, in many respects it may have proved to be *a bridge too far.*

As a participant in a small part of *some* of the Cold War goings-on, I noted that in their telling of a few of their *untold stories*, the authors were very close to what is remembered as truth. However, in others that I feel qualified to have opinions on, they were far off the mark. This dichotomy detracted from the credibility of their description of other events portrayed of which I had no knowledge.

What also served to sour the book for me as a reputable source of factual information were (in spite of 33 pages of some 697 detailed reference sources, implying a work of scholarly precision) many obvious factual, technical errors and editing gaffes which included, for example, mentioning the Manhattan Project facilities at Oak Ridge, *Georgia* (sic); the statements that both Germany and Japan were very close to having nuclear weapons because they possessed a significant amount of uranium oxide; referring (on the same page) to the Navy's PB4Y as both the *Mercator* and the *Privateer*; and describing a ship's voyage from the Mediterranean to the Black Sea as through the Sea of Marmara and *then* the Dardanelles.

The book, at some times, takes on a bit of a *National Enquirer* tone such as when stating (wink, wink) that USS SCORPION (SSN 589) was lost in the Atlantic in May 1968 "...following an explosion", and also alluding that a Sturgeon-class SSN might have been involved in the loss of the Soviet Golf-class SSG K-129 in the

Spring of 1968. To add factual insult to factual injury, the US submarine allegedly involved was further implied to be the Skate-class USS SWORDFISH (SSN 579).

In all fairness, the book has a valid purpose in exposing the completely uninitiated to the extent of not commonly known Cold War events of the last half of the 20th century with the hope that it would stimulate their further inquiry into some of the many other event-specific sources available. Also, by far the best and thoroughly engaging parts of the book—even justifying reading by the *cognoscenti*—were the several chapters documenting the personal exploits and experiences of CAPT Huchthausen himself during his many tours as an intelligence expert and attaché—including Moscow duty as a senior officer during *interesting times*. It would appear that he might have had enough material there to warrant a book of narrower focus, but broader impact, on just those matters. I wish he had.■

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Loc: Edgewater Hotel, Laughlin, NV
POC: Ken Owen E-mail: kenowen1@cox.net

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POC: R.E. "Twig" Armstrong, 15 Duckworth Road, Hebron, NH 03241
Phone: 603-744-2078 E-mail: uss_guardfish@metrocast.net
Web Site: http://www.guardfish.org

USS JAMES MADISON SSBN-627 Jul 8-12, 2009 Silverdale, WA
Loc: Silverdale Beach Hotel, Silverdale, WA
POC: Fred Huwe Phone: 888 890-0623 E-mail: fchuwe@cheqnet.net
Web Site: http://www.ussjamesmadison627.com

USS BOSTON CA-69, CAG 1, SSN-703 Jul 9-12, 2009 Cleveland, OH
POC: Art Hebert P.O. Box 816, Amherst, NH
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The growth and success the Naval Submarine League has experienced has been made possible by the support of its generous members and Corporate Benefactors. The annual appeal to the membership has usually been forwarded with the Symposium mailing. This year the League has initiated a more personal means of soliciting the membership for contributions to support League initiatives and to meet increased operating costs. The President is sending personal letters to each member requesting their participation in this annual appeal and so far it has doubled the receipts we have received in any previous year. We hope to challenge every member to participate in this opportunity to participate in a once-a-year tax-deductible program to underwrite the League activities. We will report the results quarterly in the Review. The following listing reflects contributions received by the League from 1 January through 24 March 2009.

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THE SUBMARINE REVIEW is a quarterly publication of the Naval Submarine League. It is a forum for discussion of submarine matters, be they of past, present or future aspects of the ships, weapons and men who train and carry out undersea warfare. It is the intention of the **REVIEW** to reflect not only the views of Naval Submarine League members but of all who are interested in submarining.

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 CD will be of significant assistance. Content, timing and originality of thought are of first importance in the selection of articles for the **REVIEW**.

A stipend of up to $200.00 will be paid for each major article published. For shorter Reflections, Sea Stories, etc., $100.00 is usual. Book reviewers are awarded $52.00, which is that special figure to honor the U.S. submarines lost during World War II. Annually, three articles are selected for special recognition and an additional honorarium of up to $400.00 will be awarded to the authors. **Articles accepted for publication in the REVIEW become the property of the Naval Submarine League.** The views expressed by the authors are their own and are not to be construed to be those of the Naval Submarine League. In those instances where the NSL has taken and published an official position or view, specific reference to that fact will accompany the article.

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