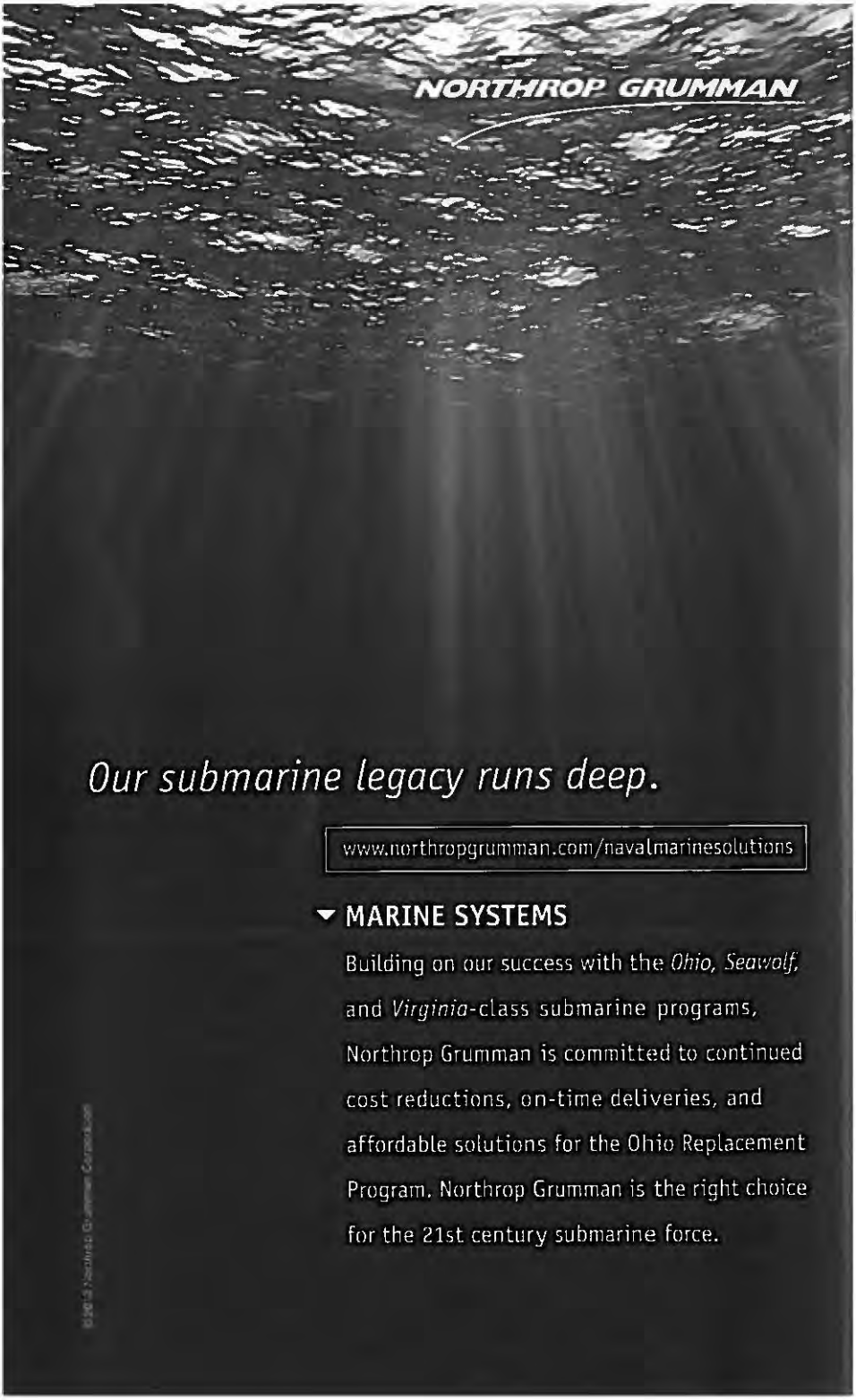
JANUARY 2011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EDITOR'S COMMENTS

Three presentations from the Annual Symposium in October are featured in this issue. Rear Admiral Michael Conner, the Director of Submarine Warfare on the CNO's Staff, presented an overview of the current issues and concerns driving submarine programmatics. He listed four general areas of attention: Nuclear Deterrence, Operating in an Anti-Access Environment, Submarine Force Structure and Coordination of the Undersea Battle Space. His descriptions of the situations, present and future and the challenges to be met across those areas offered a genuinely focused program based on real national security requirements. This is must reading for all in the submarine community.

Rear Admiral Doug McAneny, ComSubPac, presented a report on the status and activities of the operational side of the Submarine Force, using the history of the Submarine Force in the last half of the 20th Century to discuss where we are now and have to expect over the first 50 years of the 21st Century. The third presentation from the Annual Symposium was given by Captain Jim Waters, the former Commanding Officer of USS VIRGINIA (SSN 774). He described the first deployment of VIRGINIA, and the very interesting innovations of that new class in ship control and sensors. Of equal interest to most in the audience was his discussion about mentoring and training his officers to ensure they are on the proper path to eventual command.

The ARTICLES section has nine pieces which cover a wide spectrum of interest plus a longer than usual Submarine News from Around the World section. Two general news parts of that World News of particular interest are the lead item about the UK plans for their defense forces and, near the end, the Chinese plans.

The first article, by RADM Frank Lacroix, concerns the program to build a replacement class of SSBNs to succeed the OHIOs when their useful life is done. The priority of that program is the highest, the cost is also high and payment will come at a time when the Navy's and the Nation's, tolerance for high cost is critical. The entire submarine community, designers, builders and

operators, understand that conjunction in general. Frank Lacroix here points out a specific problem. The next article, by two highly experienced retired submarine Captains now employed by General Dynamics, points the way to payload improvement in our submarines. Long criticized for neglecting weapons and payloads for platforms and sensors, the submarine community has both the will and the means to address the payload issue in a meaningful way. This may be one of the first steps in vital improvements which will go a long way to improving submarine effectiveness.

There are two interesting Royal Navy articles; one policy recommendation and one floorplate experience. In addressing any Royal Navy issues, it is appropriate of what the RN did during the tough days of the Cold War. They built SSNs, really at the expense of the rest of their Navy, and helped us man the ramparts which we submariners knew had to be ready and strong to effect real deterrence. Dr Wells is proposing a defense plan for the UK which is *Maritime Heavy*. It's a tough dose which he is prescribing, but regardless of its acceptance, it should be acknowledged as a worthwhile assessment for a UK *way forward* into the perils of the 21st Century. On the other side of the ledger, we have a view from one of the RN's operators of the building and first operations of one of those very important RN Cold War SSNs. Any of us who have been in the commissioning crew of one of our own submarines can recognize the world he describes.

From a diametrically different direction, our friend VADM Singh of the Indian Navy (see January 2010 THE SUBMARINE REVIEW, recounts his experiences in, and affection for, the Indian Navy's Foxtrot submarines of Soviet origin. From that we have Captain Jim Patton musing about the several useful possible uses for SSBN tubes potentially rendered empty by future Arms Control cuts. Part of that conjecture, of course, recognizes that future cuts in the number of missiles should not lead to a cut in the number of submarines—survivability being an equal consideration to effectiveness .

There's a lot more—enjoy.

Jim Hay
Editor

FROM THE PRESIDENT

2010 was another solid year for the Submarine Force. The Navy commissioned two VIRGINIA Class submarines, USS NEW MEXICO and USS MISSOURI, and all four SSGNs were at sea at the same time. The transition to building two VIRGINIA Class submarines was successful, with the addition of a second submarine in fiscal year 2011 as part of the current Shipbuilding Plan. As of this writing the funding for the second Fiscal Year 2011 submarine is at risk due to the lack of a Fiscal Year 2011 budget, and I would encourage you to advise your congressional representatives of their need to approve the budget that contains the full funding for this submarine as soon as possible.

The Submarine Force leadership saw significant change, with VADM John Richardson now serving as Commander, Submarine Forces, RADM Frank Caldwell serving as Commander, Submarine Force, U.S. Pacific Fleet, and additional submarine leadership in important positions in the Navy and Department of Defense. We were pleased to have VADM Steve Stanley, Principal Deputy Director of Cost Assessment and Program Evaluation (CAPE) for the Office of the Secretary of Defense address the Corporate Benefactors and VADM John Bird, Director of the Navy Staff, address the Annual Symposium. VADM Bill Burke is the Deputy Chief of Naval Operations for Fleet Readiness and Logistics, VADM Joe Leidig is the Deputy for Military Operations, U.S. Africa Command, VADM Scott Van Buskirk is Commander SEVENTH Fleet and VADM Cecil Haney is Deputy Commander U. S. Strategic Command.

I am pleased to serve you all as the President of your Naval Submarine League. In my first four months on the job I have been impressed with the importance of this organization fulfilling its mission as the "Professional Association for Submarine Advocates". The League is on track to complete a profitable year. All services have been provided within budget, and NSL's Corporate Benefactors made significant financial commitments sponsoring this year's events. Additionally, Corporate Benefactors and Guest

Exhibitors supported the Annual Symposium with 22 paid exhibits and a total of 31 exhibitors. Gifts in-kind from Industry members, in conjunction with the Corporate Benefactor program, support much of the League's overhead costs. Their generosity allowed the League to hold attendance costs close to last year's level.

The Annual Symposium was a big success. The League recorded the presentations and they are available for viewing on a loan basis from the NSL office. I ask that you cover the postage. Please mark your calendars for next year's Symposium on 19-20 October 2011 at the Hilton McLean, Tysons Corner, Virginia.

The agenda for the 2-3 February 2011 Corporate Benefactors Recognition Days focused on the challenges to be addressed in a tight fiscal environment and included Admiral Kirk Donald, VADM John Richardson, RADM Mike Connor, RDML Dave Johnson and RDML Terry Benedict as the session speakers. Submarine Force Leadership is focusing on increasing capabilities based on responsibilities, obligations and opportunities within the constraints of resources, platforms and payloads. The presentation slides are available for our readers.

In addition, VADM Stanley presented a broad overview of the resource constraints that will have to be managed while developing a new SSBN, a top priority for the Submarine Force, to the breakfast attendees. Undersecretary of the Navy Bob Work challenged the luncheon audience with the encouragement that the Submarine Force already has the gold standard acquisition program with the Virginia class submarine and that it will have to be matched by the SSBN acquisition program to sustain both lines within decreasing top line resources.

THE SUBMARINE REVIEW will be a Submarine Force resource for disseminating this information to a large audience. Additional opportunities to expand upon the submarine message will be through the Submarine Technology Symposium and Annual Symposium. These are exciting opportunities for the Naval Submarine League to be involved as the Submarine Force develops their approach to meeting these challenges. THE SUBMARINE REVIEW provides you with a forum for discussing

topics of interest to the Submarine Force. Seize the opportunity to express your views on subjects important to undersea warfare.

The Annual Submarine History Seminar, co-sponsored by the Naval Historical Foundation and Naval Submarine League, will be held on 14 April 2011 at a venue to be announced. The topic is ***"The Rise of the Submarine Launched Ballistic Missile"*** and will feature an historical review of increased reliance on submarine launched warheads with a panel assembled by RADM Jerry Holland, USN (Ret).

The Submarine Technology Symposium will be held 17-19 May 2011 at The Johns Hopkins University Applied Physics Laboratory. The theme, ***"Maximizing Capabilities – Technologies to Enhance Submarine Effectiveness and Availability,"*** supports the Submarine Force initiative and promises to make this another outstanding event. The session topics include *Baselining Submarine Technology Gaps, Overcoming Anti Access and Area Denial Challenges, Improving Interoperability and Collaborative Operations, Facilitating Submarine Capability Multipliers and Improving Submarine Availability and OPTEMPO.* Note that the Fleet Requirements session has been refocused. In addition to chairing Session I in defining gaps, Active Duty speakers will give the lead off briefer in each session representing the Fleet perspective followed by four industry responses. The Submarine Technology Symposium will feature speakers including Admiral Kirk Donald, Naval Reactors, the Submarine Force Commanders, and several others. As information is updated it will be available to you on the STS Symposium webpage accessible through the League's webpage, www.navalsubleague.com .

On behalf of all the Naval Submarine League staff we wish you a very Happy, Healthy, Prosperous and Joyful New Year. Please keep military personnel around the world in your prayers. I look forward to visiting with many of you in the near future.

John Padgett
President

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ANNUAL SYMPOSIUM

2010 NAVAL SUBMARINE LEAGUE ANNUAL SYMPOSIUM

UNDERSEA DOMINANCE IN 2040 OVERVIEW OF SUBMARINE PROGRAMS

REMARKS BY RADM CONNOR, USN
Director, Submarine Warfare, Office of the CNO

Fellow submariners and members of the Submarine League, it's great to be here.

I would like to thank the Submarine League for hosting this symposium—an energetic forum that allows us all to talk about where the Submarine Force has been and where we are going.

At lunch I sat with Frank Miller (who was Assistant Secretary of Defense), Sergei Makhovnev (Naval Attaché for Russia), and Chris Groves (the submarine staff officer for the British Embassy) and we talked about topics ranging from Trafalgar Night to nuclear deterrence.

Congratulations to the commanding officers that were recognized today for their outstanding leadership—Mike Stevens, Craig Blakely, and Jim Waters.

And now, I would like to look ahead to 2040. I have four major issues that I want to discuss today and round out this year's symposium.

1. Nuclear Deterrence
2. Operating in an Anti-Access Environment
3. Submarine Force Structure
4. Coordination of the Undersea Battle Space

Nuclear Deterrence in Transition

As a result of the consistent, superior performance of the SSBN force, the Department of Defense has expected us to take on a greater proportion of the strategic deterrence mission in the future. The Nuclear Posture Review is complete and has strongly

re-affirmed the importance of the survivable submarine leg of the triad. Our national leadership clearly understands what former Secretary of Defense James Schlesinger said in an interview last year in the Washington Post [July 11 2009, pA9], "Nuclear weapons are used every day to deter our potential foes and to provide reassurance to the allies to whom we offer protection." I for one, did not fully understand the degree to which countries around the world depend on our nuclear deterrent forces to maintain the peace until I attended an international deterrence conference hosted by STRATCOM earlier this summer and saw how many countries rely heavily on the credibility of the US nuclear capability.

The transition in nuclear deterrence results in fewer weapons overall, but a **higher percentage** of those weapons will be deployed by the Navy.

Against this highly dynamic background, we are developing the plan for the OHIO Replacement SSBN. This SSBN will start construction in 2019, deliver in 2026, and start patrolling in 2029. It is planned to operate until about 2080, so we must equip it with the required capabilities and stealth to pace the threat that will come from the future's more capable submarines, distributed systems, and emerging sensors. I need your help ensuring that we are ready in 2029. We are leveraging everything we have learned in lowering the cost of Virginia SSNs to help ensure we design the Ohio Replacement for affordability—both in acquisition and in life cycle maintenance. We will also design for even better operational availability than the OHIO class.

To lower development costs and leverage the proven reliability of the TRIDENT II (D5) Strategic Weapon System, the OHIO Replacement will *re-host* the same system carried on the OHIO. This weapons system has evolved to an open architecture that will make it easy to adapt over decades. The OHIO Replacement is now a formal program and has moved from strategic systems oversight with the Strategic Systems Program (SSP) to submarine development with Program Executive Office for Submarines (PEO SUBS).

This is a big program with a big budget and, like Ohio, it will draw a lot of scrutiny. We are ready for that scrutiny. This

program received positive comments from Secretaries Gates and Carter for our concerted effort to reach a more affordable service cost position by getting the top level requirements right.

This program is on track, and we are confident as we take the first program of this magnitude to a Defense Acquisition Board Milestone "A" decision.

Next, I would like to discuss "Operations in an Anti-Access Environment."

The Anti-access problem

The president's National Security Strategy—released this past May—and the Cooperative Maritime Strategy for the 21st Century emphasize that deterrence is about more than nuclear weapons.

To credibly deter conventional aggression among competitors requires proportional conventional tools. For the past two decades, the US leaned on ground forces, strike aircraft from our carriers and the Air Force, and Tomahawk cruise missiles to deter potential adversaries by holding them at risk.

A major objective in conventional warfare has now become gaining and maintaining access in a denied area to carry out the mission. Our adversaries understand that success hinges on denying access to our high-end forces.

With their significant level of effort, we face the challenge that when we have access, are we bringing enough tools to the table?

There are two distinct tracks emerging to deny access:

One example uses low-to-medium capability technology to threaten coalition and neutral forces in a region constrained by geographic chokepoints. This is well-suited to the circumstances of their geography. This track invests in defense modestly with less capable platforms that nonetheless still have adequate reach across a body of water like the Arabian Gulf and certainly can complicate operations in the Strait of Hormuz.

Another example uses high tech, cutting edge capability designed to asymmetrically defeat our forces. Countries with the resources and know-how will develop military technology with the sophistication needed to tilt the battle space in their favor. This

type of challenge characterizes the looming threat to regional order and stability that will persist indefinitely.

In particular, anti-access systems are being developed with the purpose of undermining our deterrent influence by denying us access to critical theaters and areas of global interest. Among these anti-access systems are quiet modern submarines that are capable of holding both combatant and support ships at risk with torpedoes or cruise missiles. Putting emphasis on the importance of this submarine role as an element of reducing the influence of other nations in the global commons is becoming more prevalent. Similar things can be done in areas that have geographic advantages such as chokepoints and straits for regional competitors.

Coastal based cruise missiles and ballistic missiles could have significant impact in areas that are vital to the commerce on which many of our partners depend. Taken together, these anti-access systems are intended to constrain the ability of traditional power projection systems to operate against future threats.

In addition to land based systems, competitor surface combatants with the newly increased range and effectiveness of surface-to-surface and surface-to-air missiles are emerging challengers to existing forces.

Undersea platforms, however, are not vulnerable to these anti-access systems. The assured access that we gain through stealth makes our role in naval warfare increasingly valuable.

We are becoming the essential key—that opens the door to let the surface and air forces, with higher volumes of fire power, move in.

While undersea forces are not at risk from emerging anti-access technologies, I am not sure we are doing all that we can to leverage our capability in support of larger naval and national objectives.

We need to fully support the sea control and sea denial missions. For the last twenty years, all of our Nation's wars have involved adversaries with no significant maritime capability. This has meant that we have been able to *skip* the Sea Denial part and get right to work exploiting our Control of the Sea. As a result of this recent experience, we as a Nation have a diminished

appreciation of the criticality of Sea Denial as an essential precursor to our ability to exploit Sea Control.

It is clear that we will not get a *free pass* like this anymore. Sea Denial is back as an essential Navy mission that will need to be done early in any campaign. And what is important for us in this room to recognize is that this Sea Denial mission falls largely on the shoulders of the undersea forces.

Sea Denial includes eliminating the threat from adversary submarines. It includes taking out long-range SAM shooters. It includes sinking Amphibs, interdicting maritime commerce, holding adversary SSBNs at risk, and sealing ports.

In the future, it will have to include defeating adversary UUVs, or denying the adversary the ability to exploit undersea energy resources or other infrastructure.

What are the implications for the role played by submarines in the return of the Navy's Sea Denial for the Navy undersea forces? Well, there are at least two very important consequences that we need to get our heads around.

First, we need to rethink our undersea weapons suite. During the Cold War, when we last thought of undersea forces as blue-water Sea Denial forces, the tactical weapons carried by our submarines were Mk48 torpedoes, Tomahawk land attack missiles, and Harpoon anti-ship missiles. When the Cold War ended, and the Soviet Navy returned to port, our maritime strategy ever since has been focused on the littorals—"From the Sea," "Forward...From the Sea," and most recently our Cooperative Maritime Strategy for the 21st Century. But what weapons are we carrying twenty years later? They are the same! We still carry torpedoes and Tomahawks. Of course, both of these weapons are greatly improved in terms of performance, but they remain basically the same weapons performing the same jobs modeled for the same target set.

As we take this new look at our weapons portfolio we need to include weapons that we need to operate forward, potentially far away from the carrier strike groups, and perform Sea Denial missions against the littoral target set of the future.

What is the best way to attack mini-subs or UUVs? We have had to put together with urgency a program that ensures that we

are properly addressing the rapid proliferation of mini-subs. . . but we also need a longer view.

What about shallow draft, high speed craft that are today every bit as lethal as major combatants during modern Naval history?

For example, we have great capability against high-end warships.

But how do we do against some asymmetric threats like light patrol craft which is a high speed, shallow draft combatant?

Are we doing all we can; or at least all we should to adapt our weapons and concepts of operations to pace this type of threat?

I believe we need to expand our horizons in this area, look at the range of contributions that we can make, and aggressively pursue those that show the most promise.

When you look at our contribution to the land attack problem, it is a combination of capability and strategy.

The influence of anti-access centers of gravity ashore on friendly forces should be minimized. We have a role in precluding attacks on friendly forces.

Our leaders understand that submarines are uniquely suited with a demonstrated capability to operate with impunity in these access-denied areas and have concerns about our ability to conduct deep strike when the hulls on our SSGNs start to reach end of hull life in 2026.

Stretching Virginia class SSNs could help address the potential need for strike payloads. We could take their Tomahawk capability from 12 to 40 TLAMs using the launcher system currently used by SSGN. In the longer term, they could host a new generation of munitions.

While we follow these studies, and lend support to them where appropriate, I want to make sure everyone understands that our big issue is force structure.

While we are happy that we are moving to the delivery of two Virginia class submarines per year, we must also be cognizant of the fact that our most recent 30-year Shipbuilding Plan removed 10 SSNs of the 54 SSNs previously planned (a staggering 20%). We cannot withstand any further reductions in SSN force structure—and really need to work on getting some of those cuts back.

Every SSN removed from service, removes 150 talented Sailors highly skilled at undersea warfare. It means 15 fewer deployments of SSNs operating in forward waters. Their absence will prevent other Naval Forces from gaining access when they need it and will affect the credibility of conventional deterrence.

Again, we need the help of the Submarine League in carrying the message that the Submarine Force does not compete against the rest of the fleet. The Submarine Force is a key enabler for fleet success across the range of missions.

Coordination and Alignment

I'd like to finish with some observations about coordination and alignment.

Today the elements of undersea warfare are scattered across many commands and resource sponsors. However, we need to make sure that the fleet requirements for these capabilities are driven by those who best understand the undersea environment.

For the undersea domain, there are the fundamental skills for exploiting the undersea stealth and ambiguity that are the tools of the trade for submariners. Dealing with uncertain position information in the development of the common undersea picture, is challenging—unless it is where you have always lived.

And we have to remember, before we can succeed at the war-fighting tasks, we have to get the basics right: deconflicting mutual interference, preventing Blue on Blue prosecution, and avoiding fratricide. These are not things that are solved without diligent management. Just as we integrate Tomahawk missile strikes into an Air Tasking Order managed by the Joint Force Air Component Commander, we need to ensure that the various entities developing undersea capabilities, such as UUVs, develop them with the understanding that they must fold into an undersea picture—managed by the Undersea Warfare Commander. And therefore, it is imperative that the Submarine Force establish the control nodes and promulgate the architecture that will enable seamless integration and intelligent autonomy!

If we, the Navy, are to deploy a UUV for extended missions, the Submarine Force, the subject matter experts, should define

what those requirements should be, so that this UUV *with legs* can be effectively integrated into the USW environment.

There are certainly other tools in development which will allow the Undersea Commander to control and integrate the operations and hence the effects of submarines, IUSS, MPRA, and surface ASW forces. We need to start now to ensure we have the concept of operations and the command and control in place to ensure this comes out right. This is our domain. When we implement these tools in the fleet, implementation should be at submarine headquarters in Norfolk, Naples, Yokosuka, and Pearl Harbor.

Summary

So, I have discussed four important areas where big changes are underway and we need to take a good lead angle to intercept. By making the right decisions now, we can ensure that in 2040, we will like where we are.

- We will be fielding an effective, affordable nuclear deterrent.
- We will have the perspective and technical agility to pace the threat in an anti-access environment.
- We will have created the required undersea force structure.
- And finally we will have organized ourselves to ensure that our complex spectrum of activities in the undersea domain is well-coordinated and cost-efficiently aligned.

Thank you and I look forward to any questions you may have.

2010 NAVAL SUBMARINE LEAGUE ANNUAL SYMPOSIUM OCTOBER 20, 2010 REMARKS BY RADM DOUG MCANENY, USN COMMANDER SUBMARINE FORCE U.S. PACIFIC FLEET

Good afternoon and Aloha! It is great to be back again for another Symposium.

The Naval Submarine League can always be counted on for a terrific event and as the representative of the Pacific Fleet Submarine Force it is an honor for me to have the opportunity to represent the over 11,000 men and women who support the Force today in the Pacific.

This year's Symposium theme—Undersea Dominance in 2040—provides us all the opportunity to rally around a goal. Our challenge is to sustain what is clear to any maritime power in the world today—the United States Navy is without a doubt the most dominant undersea force in the world today—our challenge—maintain the advantage that supports our *worldwide maritime dominance.*

And what should be clear is: without Undersea Dominance there can be no Maritime Dominance.

My remarks will build on a look back at the journey that got us to where we are today—a review of the post-WWII history of the Submarine Force—the sixty-year history of the force from 1950 forward to today.

While taking you through this period I think you will agree there are some lessons both good and bad that history teaches us which we should bear in mind as we move forward in the next 30 years.

The 30 year period from 1950 to 1980 was a very busy period for the Force—we began this period with no sea based strategic deterrence capability, no nuclear powered submarines and no fixed ocean surveillance systems.

Over the next 3 decades, this capability would be fielded with a vengeance as we raced against the Soviet Union to shape the post-WW II security landscape.

In just 30 years we would build 87 nuclear attack submarines

- We would build 41 nuclear ballistic missile submarines—affectionately referred to as the *41 for Freedom.*

- We would launch the world's most formidable ballistic missile submarine USS OHIO (SSBN 726)—now serving the United States Navy as a guided missile submarine equipped with over 100 tomahawk cruise missiles.

- The underwater SOSUS network responsible for tracking and alerting US forces of adversary submarines would be fielded with listening posts around the world.

- The Navy would end this period with more nuclear submarines than diesel electric submarines.

- At our peak the Force consisted of over a hundred and forty submarines.

We also suffered the loss of two of our nuclear submarines USS THRESHER and USS SCORPION. In the wake of these losses would come brutally honest assessments that would change submarine construction and maintenance—the result—improved safety.

Finally, in spite of two significant wars our Navy didn't lose sight of the need to build for the future.

The next 30 years, which brings us to today, was punctuated by significant change also. **(Figure 1)**

- In the early eighties the Trident submarine class would begin strategic deterrent patrols from a new base in the Pacific Northwest—Bangor. Later, a base in Kings Bay, Georgia would host the remainder of the Trident force.
- The Navy would decommission its last diesel electric attack submarine opting instead for the mobility and endurance of nuclear powered attack submarines.
- Construction of the SEAWOLF Class, a follow on to the Sturgeon Class, would be halted at 3 ships. The SEAWOLF Class was considered a "Cold War" relic—it's too bad we weren't able to predict at the time what the *emerging China* would look like in 2010 when the decision to stop construction was made. There is a cruel irony in this decision—as you will likely learn from VADM John Bird tomorrow—the number of MK 48 ADCAP torpedoes available in the SEVENTH Fleet AOR on a day-to-day basis is of significant interest to planners. I'd like

to remind you that the SEAWOLF Class submarine can carry two and a half times the number of heavyweight torpedoes carried by a VIRGINA Class submarine or LOS ANGELES Class submarine. Potential firepower is a game changer and it should never be forgotten that it is in demand today just like it was in the "Cold War".

- In fact, this recognition drove a decision to convert 4 of our OHIO Class SSBNs to SSGNs with a significant gain in available firepower—and added flexibility to the warfighter—just in the nick of time to allow the Navy to face the emerging BMD mission.
- As you can see from the slide, in the second thirty years submarine force structure would fall from nearly 140 submarines to 68 today—a decline of over 50 per cent.

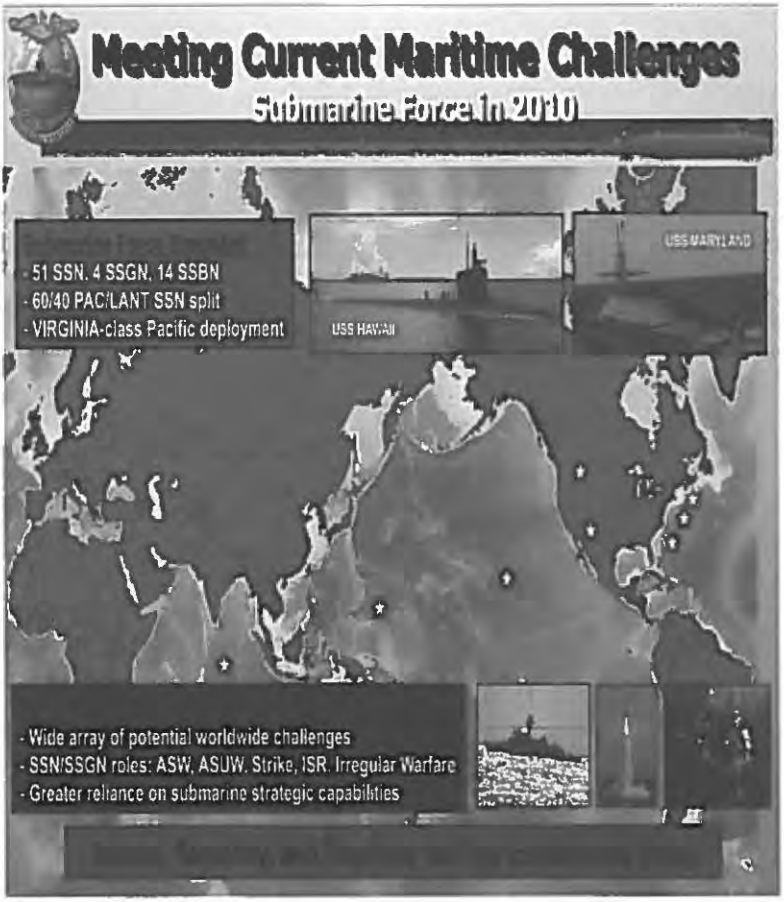

Figure 1

USS HAWAII arriving in Apra Harbor, Guam on first VA-class WESTPAC deployment

Lower images:
USS CHICAGO image of Chilean warship during RIMPAC exercise
TLAM test launch
SDV operations with USS HAWAII

So where does that leave us and what is needed to sustain today's dominant position? As was the case over the last 60 years—our Force is in high demand today.

- The ISR platform of choice in every theater and every corner of the planet—we are meeting only half of the worldwide Combatant Commander demand.
- Our attack submarine force has mastered shallow water littoral operations—our versatile platforms, many designed to counter Cold War threats, have been retooled with sensor suites—
    - Patriot radars
    - Night Owl infrared systems
    - Low cost conformal arrays
    - Combat systems optimized for high contact density operations
- We are optimized to take the fight into the littoral—and we are an adaptive force!
- Every day our ballistic missile submarine force has 5 survivable boats at sea. These submarines represent the survivable leg of the strategic triad—with their Trident II D-5 missile system their value to the nation's defense and the defense of our allies is indisputable. This success breeds success and put the Force in terrific position as we move forward with the OHIO Replacement Program.
- Finally, we have taken the fight to extremist elements that would like to harm or threaten our way of life—or those of our allies. Teamed with our NSW partners, we are supporting operations against extremist elements operating in the PACOM and CENTCOM AORs.

The REGULUS I had severe inherent shortcomings. A launching submarine had to surface and sit dead in the water, the guidance method was very susceptible to electronic jamming, and the missile itself flew at subsonic speeds, making interception relatively easy. In 1960, REGULUS I was no longer used on carriers (it had never been popular, being regarded as a competitor

to manned aircraft), but the Submarine Force had increased to five ships. However, at that time the UGM-27 POLARIS SLBM (Submarine-Launched Ballistic Missile) system became operational, which rendered the REGULUS completely obsolete.

In 1963, shortly before retirement, the REGULUS I was redesignated in the RGM-6 series as follows:

Old Designation	New Designation
SSM-N-8	**RGM-6A**
SSM-N-8a	**RGM-6B**
KDU-1	**BQM-6C**

The last REGULUS submarine was retired in 1964, and many missiles were converted into BQM-6C targets afterwards. In total, about 500 Regulus I missiles of all types were built.

As we focus now on the Undersea Dominance in 2040—where must we focus our attention to maintain our preeminent position as the world's most dominant maritime power? (**Figure 2**)

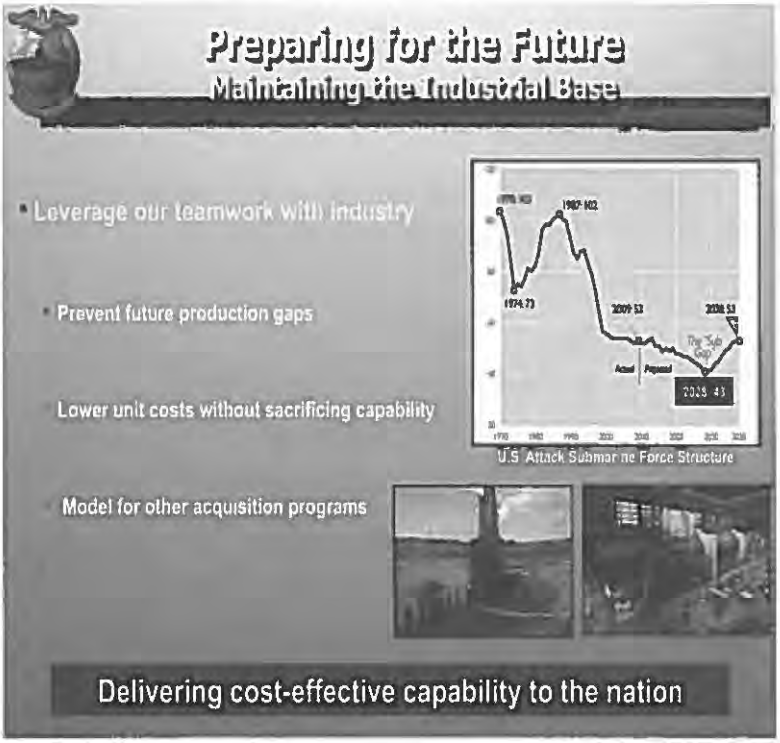

Figure 2

Graph from Heritage Foundation backgrounder, Feb 2010: "Submarine Arms Race in the Pacific: The Chinese Challenge to U.S. Undersea Supremacy"

The Shrinking U.S. Attack Submarine Fleet
In 2009, the U.S. had 53 attack submarines in its fleet. By 2028, that number is projected to drop to 41—a decline of nearly 23 percent—creating a "sub gap" in which the fleet falls below recommended levels.
Sources: U.S. Navy, "Active Ship Force Levels 1917–Present," at *http://www.history.navy.mil/branches/org9-4.htm#1986 (December 18, 2009), and Ronald O'Rourke, "Navy Attack* Submarine Procurement: Background and Issues for Congress," Congressional Research Service *Report for Congress, May 20, 2009, p. 9, Table 3, at http://assets opencrs com/rpts/RL32418_20090520.pdf (July 25, 2009).*

Note: Graph says force shrinks to 41, but N87 data has revised this to 43.
- Decommissioning ceremony on USS LOS ANGELES, 23 Jan 2010
- Image of PCU CALIFORNIA, Sep 2010

- I'd like to begin with something I mentioned earlier the SEAWOLF Class submarine—a class of three ships.
- In addition to the obvious problems of a three ship class—challenging logistics support, building an experienced cadre to operate and maintain these submarines, and per unit costs I think we need to remember one thing.
- SEAWOLF is extremely relevant in today's maritime environment—but we can do a better job of delivering capability to the Nation at a reduced cost.
- The Submarine Force has advantages that position us well for the future—we have shipbuilders willing to work with us to drive out cost—we have a dedicated acquisition corps working exhaustively to ensure our Submarine Force capability meets tomorrow's needs.
- We listen to criticism and move out to meet cost targets in a resource constrained environment. In fact, just recently Secretary Gates cited the Ohio Replacement Program as a model in which "the Pentagon is trimming requirements without sacrificing capability." A lesson we learned well as we drove costs down on the way to a two per year VIRGINIA Class submarine build rate.
- We are using the same experience to ensure sensors, weapons, and combat systems needed to keep our submarines fit to fight are delivered in the same manner—in today's uncertain fiscal environment we can ill afford to *strike out* with anything delivered to our submarines in the name of improved combat effectiveness.

As we prepare for the future, *adaptability* must be "the coin of the realm." Our ability to *adapt* is proven. One need look no further than USS LOS ANGELES—a 33 year old submarine built to fight in the COLD WAR—yet on her final deployment successful in meeting a broad range of threats that weren't even considered by planners when the ship was designed. **(Figure 3)**

- Stealth will always be in demand—it transcends any threat—because of our inherent stealth—the threat of nuclear conflict or conventional war will be drastically reduced for our Nation and our allies well into this century.
- I enjoy listening to the so-called pundits who say we don't need a strong navy because there hasn't been large scale maritime conflict since the end of World War 2—no kidding? I wonder why? If you don't think muscular maritime forces are a must to balance power and prevent coercion then you haven't been paying attention to what our allies in the western pacific are up to in the face of China's naval buildup.
- As Vice Admiral Sir Jeremy Blackham and Mr. Gwin Prins a professor at the London School of Economics recently articulated in their article Why Things Don't Just Happen—Silent Principles of National Security *Presence is the prerequisite for the silent deterrent message that naval forces alone can articulate.* A poised force is the prerequisite for pre-emptive action. It is also a prerequisite for surprise. The ships needed to fulfill these missions must have endurance, versatility, role-adaptability and number and be cheaper. The ability to mass and surge a force demands numbers. Numbers are also essential for replaceability. If you cannot afford to lose a ship, you cannot afford to use it. Presence is therefore the indispensible prerequisite for deterrence.

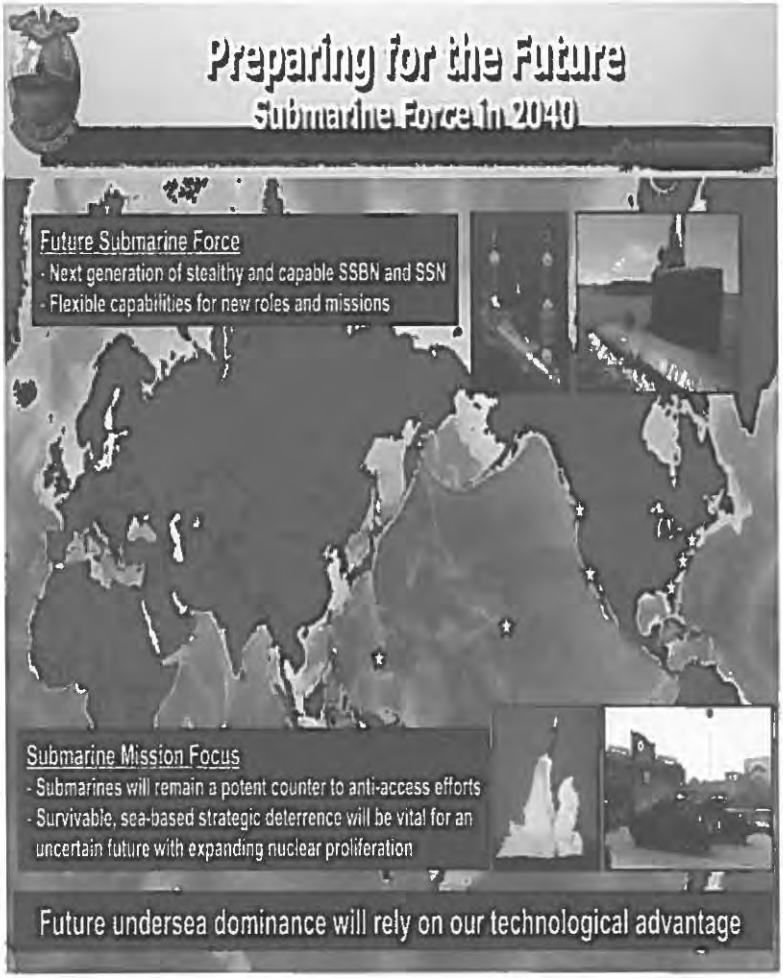

Figure 3

- Proposed modular tube concepts for VA-class
- USS HAWAII transiting Tokyo Bay
- DPRK military parade in Oct 2010, new MRBM

Figure 4

USS CHARLOTTE Crew

Figure 5

NAV and DCA on USS SANTA FE, Jan 2010
USS ALABAMA returning from deterrent patrol, 29 Sep 2010
USS TUCSON returning to Pearl Harbor from WESTPAC deployment, 8 Oct 2010

Finally, I've spent a lot of my time talking about hardware but make no mistake about it—it's really about the people in our Submarine Force.

I've had the great good fortune to have worked for some of the giants of our Navy over the last 30 plus years. I always took note of the compliments paid to the Force by non-submariners—our CNO Admiral Gary Roughead is a great example of what I am talking about. He appreciates the capability we bring to bear for our Navy and our Nation each and every day—and has been one of our biggest fans.

We aren't taking our foot off the gas though. We are working hard each and every day to develop the next generation of submariners.

Today's Force still attracts our best and brightest (**Figure 4**). You'll have a chance over the next couple of days to meet many of them as they provide some insight into deployed operations, and the state of the Force. I know you will enjoy what they have to say.

We are dominant today and will be into the future. The lesson of the past has been to invest in technology, adapt, modernize, and maintain our industrial base. Despite many challenges, our Force is strong. Our Sailors are national assets and are our legacy. They are history's best and brightest. I count on you all to maintain our edge. Push the pace of technological advancement and submarine construction, but most importantly get the word out. Our mission matters! We are ever present and ready to answer the call at any time.

Admiral Mies thanks again for inviting me to speak this year.

2010 NAVAL SUBMARINE LEAGUE ANNUAL SYMPOSIUM OCTOBER 20, 2010

REMARKS BY CAPTAIN JIM WATERS, USN
Former Commanding Officer, USS VIRGINIA (SSN 774)

Good afternoon and thank you Admiral Mies, Admiral Padgett, and the Naval Submarine League for the invitation to speak today. I am honored and humbled to be included in the list of presenters at this important gathering of Submarine Force leadership and supporters. As a former Commanding Officer it is certainly refreshing to have someone interested in my perspective again! Nothing is quite like the first day at your new job following Command at Sea to make you realize that you really aren't as interesting or funny or even as handsome as you thought during the previous few years. As I look back over the brief six months since I relinquished Command of VIRGINIA I realize how much I truly miss it. The people most of all...for it was the honor of my life to lead the Sailors of VIRGINIA. Together we brought this most lethal combination of stealth, firepower, and sustainable mobility from the dry dock at Electric Boat, through 75,000 miles of testing, evaluations, examinations, and training, culminating in a 37,000 mile journey to the far reaches of the world and back in direct support of our nation's defense during the first full length deployment for the class. After that experience, there is nowhere I would not go with those men in that ship! As you may have guessed I am extremely proud of my VIRGINIA crew and excited to talk about what they accomplished as well as the promise I see in this new class.

I will center my perspectives on three principal points based on my experience in Command of VIRGINIA. First, I will share as much as I can about my deployment and what we did to be truly ready. Second, I will discuss key VIRGINIA Class enhancements and built-in flexibility that I see as particularly exciting. Third, I

will talk a little bit about how I developed my Officers for future leadership.

VIRGINIA deployed on 15 Oct 2009 and conducted operations across a broad spectrum of environments and mission tasking in support of both European Command and Africa Command. As the ship got underway on a typically cold, wet, and windy fall day in Groton, there was great excitement onboard. We were finally through the rigors of pre-deployment training and assessment and looked out on the grey Atlantic knowing we carried 120 days of food to ensure we could dwell in some of the most challenging environments on the planet. My crew knew the number *120* but I don't think it was until I put it in terms of *food till February* that they really understood how long we could be at sea. As it turned out we conducted a 75 day underway that included an appropriate mix of unique and routine days and finally wound down with a port visit in Rota Spain over the New Year holiday that included its own special challenge for VIRGINIA. Because of the holiday the entire Spanish Navy was in port and our assigned berth, was revealed to me by the pilot as wedged deep in the basin between an Amphibious Assault ship and the Aircraft Carrier with about 30 ft to spare at either end. We obviously made it safely, albeit slowly, into our berth, but it certainly gave me pause as that ski jump was apparently hanging over our bow.

Following this welcome break, the action quickly picked up as we began the transition across the extremes of the 6th fleet Area of Responsibility (AOR) moving from EUCOM to AFRICOM support. In fact the very day we got underway from Spain we passed through the Strait of Gibraltar. On our route through the Med we conducted a brief stop in the vicinity of Naples and a port visit in Souda Bay, Crete before executing our southbound Suez Canal transit. While the Med presents many unique challenges, I do not highlight the chokepoints we transited as a claim to anything unique for VIRGINIA. I mention them as a reminder of just what is required to get there and to point out that our Submarine Force routinely makes the difficult route. As a way of emphasizing this point, I am firmly convinced that one of the most challenging events of the entire deployment (from the Arctic to the Equator) was the transit through the southern end of the Red Sea

including the straight of Bab el Mandeb. This transit was safe and secure, but required the highest level of planning, supervision, and skill to ensure that our margins to safety were satisfactory on all sides. Another thing clearly on my mind as we moved south was the fact that we surely had to come this way again in order to get home.

Following our arrival on the other side of the world, we conducted a brief port visit in Fujairah, UAE before conducting operations in support of AFRICA Command. While certainly not a garden spot, this port provided us with some of our most unique liberty experiences, including a view from the world's tallest building, the Burj Dubai.

Our mission time challenged us to think in new ways about how a submarine can be employed as it involved us in some of the latest tasking developed in our continuing national priorities. We not only found ourselves on the far side of the world but dealing with 180 degree changes from our first missions in support of EUCOM. Through it all the ship and the crew adapted to our new environment and just kept working. At the conclusion of our time in the Indian Ocean, satisfied that we had made a direct contribution to combating some of our nations biggest direct threats, we made our way back through the knothole that is the transit from the Southern Red Sea to the Strait of Gibraltar, stopping along the way in the beautiful port of Aksaz Turkey.

The odyssey was long, but very satisfying. The ship sustained 37000 miles at an 86% OPTEMPO while taking some of the harshest environmental treatment dished out. I could not speak more highly of how well this ship held up. In all of that time we pulled in only one time due to a material issue...Fujairah to replace a photonics mast. Just a few days following the deployment Mr. Steve Rogers of Naval Reactors visited the ship eager to know how her various systems, both forward and aft, had held up. I found that over and over again, I simply said "it just worked." "No issues?" he would ask about each system we discuss and I would reply "No issues, it just worked."

Looking back I realize that one of the principal reasons that the crew was able to transition this ship from a new construction mentality to deployed success was our mantra that *everything*

leads to deployment. Every test, operation, transit, and inspection was entered from the perspective that it would help prepare us to deploy. Yes, it was important to test VIRGINIA, but the only test that would really matter, the seminal event in her young life, would be successful operations at the far side of the world. As you would expect for the lead ship in a new class, VIRGINIA executed a large portion of the Operational Evaluation used by the Navy to ensure that what it bought really did what they expected it to do. We *kicked the tires* throughout months of tactical scenarios that approximated real world threat conditions as closely as possible. Everything from more than 50 torpedo shots against unaugmented 688's and Arleigh Burke destroyers, to ISR in a tiny box with the Coast Guard alerted to our presence, to mine hunting in shallow water. The Navy gained valuable data to validate their purchase, and we on VIRGINIA appreciated that, but we looked at those events as pre-deployment training. Even our long transits into Groton became pre-deployment training as we used the inbound track whenever time allowed to operate in shallow water frequented by trawlers and the merchant traffic moving in and out of New York surfacing within sight of land. Throughout it all we tracked our many lessons and folded them back into our operational plans to do things better, within a consistent lifecycle of plan, train, execute, evaluate, and revise.

The other major resource that we leveraged, as you might expect, was the talent of our Schoolhouse, Naval Submarine School. We engaged early and often with the team there, modifying our plans and updating our individual and team skills based on their feedback. Our Officers particularly benefitted from the advice and counsel of Subschool's *greybeard* Capt. Steve Gabriel. This concept of consistent senior experience, as I have also seen in Pearl Harbor with Capt. Glen Neiderhauser, has proven invaluable to deployers across the board. Because VIRGINIA has the unique ability to accurately simulate a challenging tactical environment, including the visual world, we worked with the Subschool team to conduct all of our formal Pre-Deployment attack center training (Intermediate and Advanced) on the ship. This proved to be a huge enabler of success as we were able to refine our processes and communications under the

actual conditions we would see on deployment. I can clearly remember standing at the back of control while deployed and reflecting on how accurate the training had been. Those days in the trainer when we said to ourselves, "great training, but there is no way things would happen this fast" were proven false as we saw first hand in theater.

Recognizing that every day on deployment requires the entire team to be focused with an understanding of their personal roll in maintaining the ship safe, I felt confident that our team had it right as we prepared to depart. At the back of my mind, however, a key question kept nagging at me: "How will I know if we began to slide toward complacency, if our standards slowly decline?" After all, some of our least glorious moments as a force have happened just when we thought a deployment couldn't go any better. My XO, COB, Department Heads, and I put our heads together to discuss this question on several occasions. These discussions in themselves, shared with the rest of the wardroom and the Chief's Quarters contributed toward a heightened sensitivity to the issue, but that was not enough. With the COB's lead we put in place a series of checks that every day had nuclear trained chiefs watching operations forward and forward chiefs watching operations aft and reporting their findings to me and the COB directly. Having the Engineering Department Master Chief (EDMC) listen in on the sonar operator net certainly gave me solid feedback on the state of formal communications there. We attacked individual problems when they occurred giving the entire team the clear message that standards would remain high even if I could not personally be far from control. I also took input on the crew's state of readiness from my Corpsman and Culinary Specialist Chiefs who did not routinely stand watch and were well positioned to see the affects of the long grind of operations on the crew.

Overall, VIRGINIA's deployment should abolish any thought that this new class is somehow fragile or unready. I will gladly stand our deployed readiness against any other ship in the fleet. Through our diverse missions, comparable in length to other contemporary deployments, I believe that VIRGINIA proved that the new class is ready for full length deployments and has laid the

groundwork for a class that will be supporting our nation well past 2040.

Along the way I have come to know and truly appreciate several of the changes that were implemented in the design of the VIRGINIA. I am convinced that these enhancements combined with the solid base of our experience in the Los Angles and Seawolf classes give us absolute superiority over our known threats today and into the future. I will start with one of my favorite topics: Photonics...For a moment, picture yourself as the Commanding Officer of a Los Angles class submarine (not difficult for some in the audience). You are conducting vital Intelligence, Surveillance, and Reconnaissance tasking in an area frequented by fishing trawlers and other small craft in proximity to a major shipping lane. It is an overcast moonless night and you hear an increase in noise over the open mic indicating that tensions are rising in control. The OOD has just taken the scope from the JOOD and is discussing various contacts. He begins talking about raising #1 scope to use IR. Like any CO worth his Command at Sea star, you proceed to control to get the real picture of what is going on. Clearly not satisfied you get on the scope and immediately see the problem. I am sure that the seasoned submarine warriors recognize the immediate danger and would take the necessary action to keep the ship safe. Clearly there are also additional options such as IR on the #1 scope, but that takes time. Playing the same scenario on VIRGINIA, the team and I see it immediately in control. If we think the lights are confusing the situation the scope operator would simply turn off the overlay. If I want to know the range exactly (we already know it is close) it is a simple click of the trigger. This visual information is available to the operator all the time on either of our two mission scopes and available to me in my stateroom and the wardroom via our video network. Without a complete breakdown of fundamental principles and extreme complicating circumstances, I submit that it would not be possible to generate this ugly nighttime situation at periscope depth on a VIRGINIA class submarine. Too many people know...too much information is available. Because of this nighttime capability my personal experience on deployment was a

sense of relief whenever it got dark for I knew that we literally owned the night.

While I have demonstrated the good of photonics, the bad is the size and unique design of the sensor head, and the ugly is that the resolution of the color camera can not match an optical scope for finding very small contacts. Can it be done safely? I think so when prudently operated, or my deployment would not have been possible. Is improvement needed? Absolutely, and one new version is already deployed to the WESTPAC on USS HAWAII! Is photonics as clear as an optical scope during the day? No! I like photonics, but not because I think the system is perfect, in fact it is downright complicated to use properly. I like photonics for many reasons too complicated to discuss here, but the most important reason is that when my crew and I were sent to sea with this system, I was able to trust their lives to its performance...how could I think anything else? Let me be clear to those in this audience who have anything to do with fielding Photonics or its successors, it is absolutely the right path to pursue for our future, but it needs to get better.

An important benefit of our night vision is the fact that the control room remains consistently lit day or night. Anyone that has ever attempted any evolution in a control room rigged for black will appreciate that handy feature. Within this control room the watch leader is surrounded by the information he needs to make decisions. Sweeping around him is everything from Sonar, to ship control, to fire control, photonics, and navigation. This layout allowed me and my Officers of the Deck to more rapidly absorb and integrate available data and turn it into action.

Another enabler of mission success was the new ship control system built into VIRGINIA. I certainly won't bore anyone with the exciting details of the quad-redundant fly-by-wire setup. I will focus on what it means for the operator...and that is simply more mission time with the scope safely and securely up. The system was able to maintain the ship's 7800 tons precisely where it needed to be and allowed for operator input or complete control when necessary. While difficult to quantify, I can say that we were able to maintain the ship at PD longer in heavier seas with more consistency than my past experience with other classes of ship.

VIRGINIA was designed from the ground up to consistently operate in automatic ship control. Normally this consists of keypad automatic where the pilot would simply type in the depth on a touch screen popup keypad and the ship would do the rest. When seas were heavier we found that the semi-automatic mode of *Auto joystick* worked best as the pilot could instantly override ordered depth with the joystick control driving the bow planes to dive or rise while the automatic system maintained angle with the stern planes. Releasing the stick allowed the fine controls of the automatic system to settle the ship out. Radical maneuvers at high speed worked best with a combination of manual and automatic control with the planes and rudder split between the Pilot and Co-Pilot.

Having two DOOW equivalent Pilots on watch and no planesmen presented VIRGINIA with an interesting challenge. Given the fact that Navigation division has one billeted CPO, the ANAV, consider your watchbill with two DOOWs at all times. With no COW qualification on which to cut their teeth, careful planning and an aggressive qualification program is necessary. Sometimes it even requires the Sonar Chief, Fire Control Chief, and/or Radio Chief to stand the watch.

Looking to the future for a class of ship intended to carry the load well beyond 2040 there are many changes, improvements, and redesigns coming. I am sure Capt. Jabaley will have all the details for us next, but what of VIRGINIA and her early sister ships? The fact that there will be threats in the future that we don't see today just like many of today's threats were unseen in 1980 makes flexibility the name of the game and that game needs space, which is difficult to come by on a submarine. Fortunately, VIRGINIA is particularly well suited to meet the demands of a flexible future requiring expanded mission rolls, new weapons, and yet to be designed remote sensors.

The torpedo room itself is designed for flexibility. It was built to hold ADCAP Heavyweight torpedoes and Tomahawk cruise missiles in cradles that can themselves be off loaded, completely emptying the room, a space large enough that we actually mustered the entire crew there a few times early in my tour. This space opens a world of possibilities for things yet to be imagined

such as remote sensor command and support modules in keeping with Admiral Donnelly's call for submarines to be the hub of distributed/netted sensors. The cradles can also be redesigned to hold future ordinance or remote sensors and must only fit the basic footprint in the torpedo room. Additionally, I think we will eventually look to the lock out trunk for more than SOF operations. It is capable of deploying and recovering a 9-man Special Operations team with all of their gear and the ship is designed to hover indefinitely at periscope depth to support these operations. In that trunk I see a huge floodable volume that can be controlled from inside a ship, which can operate at low or no speed. Just imagine what we can do with that! Along the lines of extra space, the VIRGINIA class mission configurable mast bay provides options for the future. We currently use it for mission specific sensors or improved photonics systems, but the future will tell another story for this bay I am sure. I challenge the industry leaders in the room to think creatively about this flexible space built into the class as you work to meet the inevitable design requirements of the future.

To this point I have spoken extensively about the ship and what it can do, but it is only a true threat to our enemies because of the crew that operates it. The Submarine Force leadership that preceded me on this stage highlighted the fact that our sailors are the most important reason for our undersea dominance...a true National Treasure. I couldn't agree more with that sentiment and wish to give you one CO's perspective on how a portion of this treasure was developed on VIRGINIA. I have always believed in my heart that one of my primary goals or legacies in command was to prepare my Officers for future leadership. It was an entering argument as I took Command. With deployment clearly in mind we worked to ensure that all of VIRGINIA's Officers maximized their tactical experience. With appropriate experience and depth would come the opportunity to give them more challenging real world experience. Leveraging the improved situational awareness of the VIRGINIA control room, I provided each of my Department Heads and both XOs the opportunity to serve as approach officer for the vast majority of our torpedo shots. Importantly, most of these were not scripted, but were

tactically challenging engagements with topflight, unaugmented opponents. I was always there to oversee the operation in backup, but it was their approach. When satisfied with the experience of my Department Heads I was able to give each of my XOs frequent time on the bridge while piloting. My Division Officers were taught the art and science of operational planning, required to demonstrate that skill to receive their Dolphins, and then relied upon to initiate and own the plans for our many operations. This approach led to a wardroom of individuals who understood risk management and to a good extent the responsibilities of those above them in the chain of command. It also resulted in three Command qualified Department Heads, and Division Officers with extensive OOD experience prior to deployment. This allowed us to further leverage their broadened experience and advanced qualification to give each of my Department Heads, time as Command Duty Officer and several Division Officers time as OOD during our Africa Command mission.

Giving each of VIRGINIA's Officers increased authority and autonomy while coaching them to success and holding them accountable, when they screwed up, helped to build the team that got this first of the class deployment done right. More importantly though, is the breadth of real world experience and inherent initiative that these Officers will bring to the next level as they move on in their careers. I believe that, in general, we must resist the temptation to remove authority and autonomy from all of our Officers when faced with problems. We should not be afraid to hold individual Officers accountable for poor performance and avoid spending time trying to *band-aid* bad situations at the detriment of entire crews. Our Navy's heritage of independent Command at Sea and our WWII submarine experience scream out for us to allow aggressive and creative Officers to lead the way, provide training and guidance to those who will take it on board, and leave behind those who refuse to meet the standard.

In conclusion, it is my hope that each of you not only gained a better understanding of what the crew of VIRGINIA accomplished and what the ship itself can do, but got a glimpse of what it took to get to the far side of the world and back. If you leave here with a sense that the future of our Submarine Force is brighter because

we have built a great submarine, are working to make it even better, and manned it with a great team of United States Submarine Sailors, then I have accomplished my mission today.

Thank you...and God Bless America!

Save These Dates

Annual History Seminar
14 April 2011

DC Area Submarine Birthday Ball
9 April 2011

Submarine Technology Symposium
17-19 May 2011

Annual Symposium
19-20 October 2011

NAVAL DEFENSE SOLUTIONS
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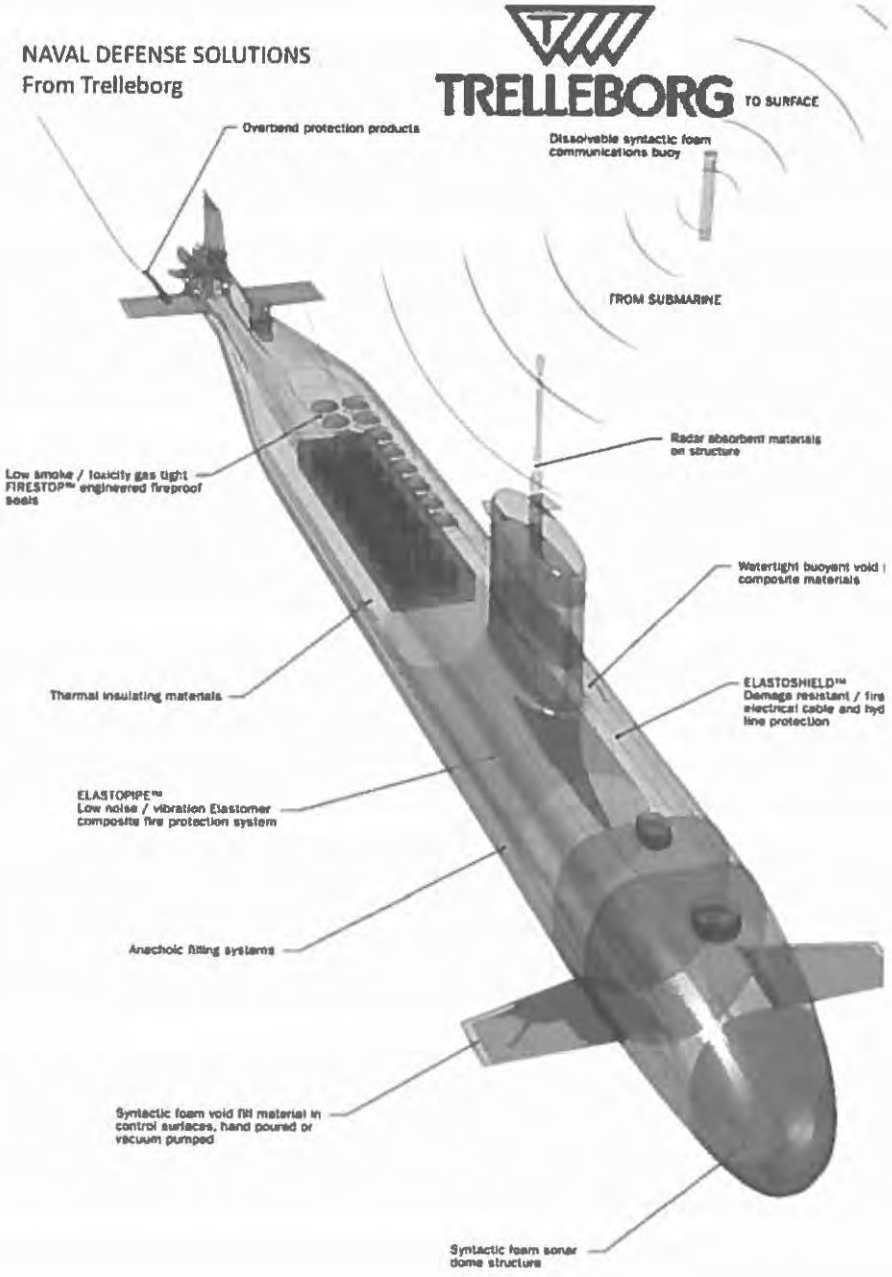

ARTICLES

THE SSBN(X) AND DEFENSE BUDGET IMPERATIVES: CONSIDERING THE IMPACT OF COST ON ESTABLISHING REQUIREMENTS

by RADM Frank Lacroix, USN(Ret)

RADM (Ret) Frank Lacroix was the Director for Force Structure Resources and Assessments (J-8) on the Joint Staff and the Deputy Director for Operations in the Office of the Navy Comptroller.

Despite last minute Office of the Secretary of Defense (OSD) efforts to trim costs, the SSBN(X) submarine, the follow-on to today's Ohio class ballistic missile submarine that is due to enter service in 2028, may still be the costliest submarine in U.S. history. First estimates had the lead boat in the anticipated class of 12 SSBN(X) submarines costing as much as $13 billion to research, develop, and manufacture, subsequent boats in the class were projected as costly as $7 billion apiece to procure. At that cost, given the United States' current and anticipated budget environment, funding issues likely could dog the program throughout its design and construction, particularly if a solid case has not been made that the right submarine is being built and built well. [1]

The Navy and the Department of Defense (DOD) have long been aware of this new submarine's high price tag. The Navy's 30-year (FY2011-2040) shipbuilding plan noted years ago that, "recapitalizing the SSBN program will impact the Navy in the mid-term as significant resources are allocated to the SSBN(X) recapitalization program . . . (T)hese ships require significant resource commitment and their cost will impact the Navy's ability to procure other shipbuilding requirements during the period when they are procured. . ."

And the Secretary of Defense acknowledged that "the Department proposes spending $6 billion in research and development over the next few years -for a projected buy of 12 subs at $7 billion apiece. Current requirements call for a submarine with the size and payload of a boomer and the quieting of an attack sub" and that "the new ballistic missile submarine alone would begin to eat up the lion's share of the Navy's shipbuilding budget."[2]

The staggering unit cost quoted for the SSBN(X) signals that, at least in the submarine's earliest phase, the DOD, the Joint Staff and the Navy may need to revisit a critical lesson that policymakers learned in earlier submarine programs, particularly during the transition from the Seawolf to the Virginia program: when establishing the operational *requirements* for a new submarine, *cost* and specifically *total ownership cost* (TOC) are the most important considerations.[3]

Using Cost to Define Requirements

While a seemingly straightforward notion, TOC has not always successfully been considered during a program's design phase.[4] With TOC as an overriding concern, a new submarine design's through-life cost becomes the ultimate design criterion instead of other factors, such as maintenance ease and access. As we learned on the Virginia-class program, using such other criteria to drive the design did not always translate to lowest through-life cost.

Minimizing developmental risk also plays an important part in controlling the TOC of a new submarine program. Consider the Ohio class. Before those boats were built, the Navy's Strategic Systems Program Office (SSPO) did its homework and made two influential decisions. First, it decided to incorporate the *state of the art* technology into the boats. This simple but wise decision eliminated excessive technology and system development risk from the design and construction phases of the program. Nonetheless, the U.S. Navy put to sea a submarine that incorporated the best technology then available, one that was arguably the most capable submarine of its day.

Second, the SSPO decided to focus to sustainability and operational *availability*. With the Ohio class, SSPO shifted the *41*

for Freedom paradigm of operating from tenders worldwide to relying on fewer *available* submarines that operated from the continental United States. The lesson here is that the number of ships at sea matters, and *operational availability* ultimately affects both deterrent survivability and required force level. Because this consideration remains important in today's economic and operational environments, this type of thinking and *doing the math* should continue.[5]

In contrast, the Seawolf program was launched in the 1980s with a more aggressive technology insertion approach resulting from Group Tango's efforts. As we know, this approach pushed the *state of the art* and proved both more costly and more challenging to execute.

Another important cost control tool is *the operational requirement* reality check. As Defense Secretary Gates might have been implying in his Navy League talk, DOD acquisition programs have routinely *raised the requirement bar.* In the case of the Submarine Force this means that acoustic signature design requirements have generally held out the most challenging radiated noise levels as the *objective* quieting levels for new submarines.

This highlights another aspect of the cost-benefit challenge that the Navy faces in creating a 40-year design for the SSBN(X). That is, should the U.S necessarily assume that a new platform would need this degree of quieting to be successful during its design lifetime? Answering *yes* to this question implies that the United States will face as aggressive and acoustically challenging an adversary for the next 60 years as it faced during the Cold War. Answering *no* means that we are willing to take some risk in this area or that there might be a less expensive means to address the posited threat.

In either case, the new submarine's program managers face a cost-benefit tradeoff that requires them to ask several first-principle questions including: Why we are designing a 40 year-submarine? And, why are our SSBNs not simply spin-offs or branches of an efficient SSN production line? That is, building an SSBN variant as required.[6]

That approach would likely not require enormous RDTE investments to assure future operational efficacy in contrast to developing new submarine concepts as we do now.[7] With SSBN(X) we seem to be committing ourselves to a unique strategic ship class in a day when its requirement is being questioned and appears to be waning. Indeed, we might even be buying in excess of eventual launcher need under arms control agreements.

Concept Coherence

Each submarine concept evaluated for efficacy in an analysis of alternatives (AoA) must be balanced from both *naval architecture* and *military capability viewpoints.* This means that each concept must be both balanced and internally coherent. *Balance* as used here refers to a basic submarine design consideration. Once platform characteristics and capabilities are defined, from a naval architecture viewpoint each concept should be neither arrangement nor weight limited. Naturally, from a military capability viewpoint each concept should have the right balance of capabilities. Taken together, the simultaneous optimization of military capability and *naval architecture* aspects is the nexus I refer to here as concept *coherence.* Naturally, upsetting the balance after a concept is set is likely to be problematic.

Embracing Low-Risk Designs

In this economic environment a new submarine preferably involves low developmental risk. Despite other appealing priorities, a guiding policy will be to leverage recent shipbuilding process improvements to constrain both near-term (design/construction) risk and cost. This implies that tradeoffs must be made in terms of capability as well. As on the Ohio class, for SSBN(X) *better* and *best* are the enemies of good enough in terms of capability. In designing the submarine, judgment will need to be coupled with restraint.

Likewise, sound judgment will be called for regarding margin and flexible volume investments, inasmuch as operational availability and low TOC will be key features of the SSBN(X). In practical terms this means insisting on high-availability, low-

maintenance solutions and resisting the traditional impulse to invest in measures to *improve* technologies which have proven to be of poor-availability. It also means avoiding investments at the margin that involve significant cost.[8] In the current environment where the future role of strategic weapons is being debated, wisdom would militate against such investments, especially if they will not make a significant difference if the ship might later be used in another role.

It will also be important to reevaluate the paths to *margin* employment. Recall that four *Ohio*-class boats have been converted to SSGNs. The role of strategic weapons in the world is evolving and their place in our military arsenal is slowly being redefined. That redefinition is incomplete, but it is clear that the most basic assumptions of nuclear deterrence are also being challenged. Changes to Cold War strategic retaliation doctrine may well result in continued lowering of nuclear force level requirements and alert conditions.[9]

In this regard, it is notable that a slew of improved conventional capabilities–including the follow-on to the Tomahawk, the hypersonic cruise missile, and low-observable, SSBN-convertible ISR packages–are on the near horizon. As those assets come on line, it is more likely that the new submarine's internal volume will be eventually sought as flexible space for such conventional payloads. This makes it all the more important that the SSBN(X) design avoid a solely "high-end" strategic submarine framework and not be coupled with missile tube design margins tied to future strategic missile payloads, as was the case with prior strategic submarines. Rather, during the early phases of the program policymakers need to think through designs that offer low-cost ways to convert the submarines to conventional use.

Conclusions

The proposition here is straightforward. In a constrained economic environment, the lesson of the Virginia program should be applied on SSBN(X) and future new submarines. A cost cap should be applied (and important policy guidance to constrain costs should be given) before alternative concepts are developed.

In the case of the SSBN(X), this could have been done by the Navy or OSD; or preferably by agreement of both.

Having missed this opportunity, it is important to remember that the SSBN/SSGN platform is basically a truck carrying strategic or conventional capabilities. With this in mind, wariness must accompany any *Mercedes or Cadillac* acquisition solutions. This means avoiding the temptation to push the *state of the art* in any high technology area. It also implies tempering any rush to high RDTE investment in areas other than those that would underwrite the ship's operational availability and lower its TOC. And it suggests the importance of lessons learned from VIRGINIA and the SSGN concerning open architecture and flexible volume.

Fiscal realities are now constraining the SSBN(X) program. Times *have* changed, because of the SSBN(X)'s unconstrained birth and the future impact on other programs, the DOD is now *compelled* to impose a unit cost cap (e.g., about $5 billion in 2010 dollars) on the submarine.[10]

Unfortunately, after the fact, this has the disadvantage of potentially upsetting design balance and risking the preferred concept's coherence as each capability is selectively reexamined, altered or eliminated.[11] The SSBN(X) program is now faced with the reality of affordability as ***the*** priority program requirement; it also faces the challenge of avoiding a piecemealed, directed and sub optimized SSBN(X) design.

Whatever the final design, the SSBN(X) program must yield high operational availability. One approach to this is to examine technologies from the viewpoint of sustainability and decisively shed those that are *losers* or likely costly in the future. Luckily, the Los Angeles, Seawolf, Ohio and Virginia class experiences can provide insights in this area. They will also highlight the most effective sustainment processes.

Lastly, as was the case with the Ohio class, acquiring the SSBN(X) means sorting through a complex coupling of strategic and submarine concerns. While some issues are more straightforward than others, once the ship is under construction, Navy and shipyard SSBN(X) program managers will have a final difficult challenge: shackling the requirements while nonetheless delivering

a capable submarine with *maximum* operational availability at *minimum* TOC.

ENDNOTES

1. The first Ohio-class boat entered service in 1981, the last in 1997. The Ohio-class submarines will have been in service about 40 years when they begin leaving service by the second decade of the twenty-first century. The Navy wants to procure the first SSBN(X) in 2019 and have it enter service in 2028. While many ship specifics remain unclear, the SSBN(X) is planned to have a life-of-ship reactor core and could remain in operation until about 2080 or 40 years after class delivery. Planning at this point also indicates that 12 ships will replace the 14 Ohio-class boats. CRS R41129 and the Ron O'Rourke discussion in the July 2010 edition of THE SUBMARINE REVIEW provide informative back ground reading on the SSBN(X).
2. Navy League Sea-Air-Space Exposition May 3, 2010, in the same speech, Secretary Gates went on to say that "we have to accept some realities. American taxpayers and the Congress are rightfully worried about the deficit. At the same time, the Department of Defense's track record as a steward of taxpayer dollars leaves much to be desired."
3. If the quoted acquisition cost is for the preferred ship in the recently completed Analysis of Alternatives, it is unlikely that those alternatives were "cost-constrained" before concept formulation. According to Navy sources, the SSBN(X) has been under preliminary design for about a year, and I assume that the AOA recommendation is being designed.
4. TOC or total ownership cost is the combination of design, acquisition, O&S (operating and support, i.e. sustainment) and disposal costs for the ship.
5. See discussions of the Ohio-class program in Friedman: *U.S. Submarines since 1945*, and Polmar and Moore: *Cold War Submarines*.
6. This is not to imply that this would always be a simple and straightforward task, but the point here is that it is likely to be less expensive to do this than design, produce and support an entirely new class of submarine.
7. This proposal is neither outrageous nor implausible. Consider that the first U.S. SSBN, USS George Washington, was the result of a missile compartment inserted into a bisected attack submarine. The George Washington was provided advanced acoustic quieting measures. In retrospect then, if this policy would have been in effect when Ohio was built, the Ohio class would be a derivative of the Los Angeles class, perhaps with further quieting, and we would now as a matter of policy be looking at a (lower cost?) Virginia derivative for the SSBN(X) role.

8. For example, historically the Submarine Force has favored a larger missile tube than initially required to accommodate the as yet undeveloped (and larger) "next generation strategic missile." Now, the SSBN(X) is planned to deploy with the D-5 missile. See *Inside the Navy*, 20 September 2010.
9. Naturally the SSBN(X) Analysis of Alternatives could not have anticipated any particular "nuclear zero" progression or end point conditions. As Secretary Gates noted however, "We must rethink what and how we buy, this will mean among other things: A Submarine Force with expanded roles that is prepared to conduct more missions deep inside an enemy's battle network. We will also have to increase submarine strike capability and look at smaller and unmanned underwater platforms".
10. This is not an arbitrary number; it is about the Selected Acquisition Report (SAR) cost of a mid-1990s Ohio-class ship escalated to 2010. Interestingly, it is also about the inflated differential between the SSN 688 and Trident cost at the time added to the cost of the Virginia today. See also the New York Times, 15 September, 2010: "Pentagon changes rules to cut cost of weapons." Naturally a cost cap will force both a serious reevaluation and prioritization of requirements; but most importantly, as in the case of the Virginia Program, it will provide a clear management team objective.
    See also Defense Daily 30 September, 2010: by September 30 2010, Ashton Carter reported that, the Navy had cut the cost of the SSBN(X) by 16% with a goal of a 27% reduction."
11. The opportunity for design incoherence does exist if indeed a hunt and peck approach is implied by Undersecretary of Defense Carter when he stated, "But just to be specific, there are three or four major design drivers of the cost of the submarine. And for each of those, one has to look at what the tradeoff is for each of them between extra capability and cost and decide at which point in the design one has gotten most of the capability without paying most of the maximum cost.

SUBMARINE PAYLOAD EXPERIMENTATION AND DEVELOPMENT
CAPITALIZING ON SUBMARINE STRENGTHS TO ADDRESS NEW WARFARE CHALLENGES

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Operational experimentation is vital to developing the capabilities needed to maintain undersea warfare as an area of enduring U.S. military advantage.

The Submarine Force would benefit from a systematic approach to operational experimentation, especially in the area of large payload tubes. The Ohio-class SSGN broke the tyranny of the 21-inch tube, but the Submarine Force has not used it to experiment with payloads that exploit the volume and large ocean interface those ships provide. In order to take full advantage of our investment in future Block III Virginia-class ships configured with large bow payload tubes or the access submarines can provide to politically sensitive or militarily denied areas, we must have new payloads.

The 2010 Quadrennial Defense Review (QDR)[1] highlights several focus areas for the Defense Department in the years ahead. Among them are ongoing Irregular Warfare (IW) threats, and anti-access / area denial (A2AD) systems that can hold traditional U.S. power projection forces at risk. Both challenges are likely to become more difficult because globalization has accelerated the proliferation of advanced weapons technologies, even to unsophisticated and non-state adversaries.[2] The submarine already has some unique capabilities to counter those threats, and available

technologies can enhance these capabilities for 21st century warfare.

A well-defined submarine payload development and experimentation process is increasingly important to test vehicles, tactics, concepts of operation, robustness and the supportability of technologies needed to address 21st century warfare requirements. As an example, an agile irregular warfare (IW) threat led by terrorists in Iraq and Afghanistan has challenged U.S. forces in those countries and elsewhere, and forced the Navy to increase submarine Special Operations Forces (SOF) support requirements. That makes IW and SOF support fertile ground for experimentation, especially for submarine-launched, high-endurance unmanned surveillance vehicles and improved SOF mobility systems. A more rigorous experimentation program might require each deploying submarine to launch and operate an unmanned surveillance vehicle as part of its mission. This approach would significantly increase the empirical data available to operators and system developers, which would be invaluable in refining these capabilities.

At the same time, evolving A2AD challenges require attention. The Air-Sea Battle[3] and other emerging warfare concepts propose using submarines in expanded mission sets, and they will require new payloads to excel in those missions. Operations against a peer competitor with a sophisticated A2AD capability will require submarines to play an expanded role in ISR, seabed reconnaissance, and most importantly, strike missions during power projection operations. This latter requirement highlights the submarine's limited magazine and may be what motivated the 2010 QDR to direct a Navy study to develop options for increasing Virginia-class SSN strike capacity.[4]

The redesign of the Virginia-class submarine bow, to save $40 million per ship, enabled the Navy to replace the 12 vertical launch system tubes with two large, SSGN-like payload tubes. As an additional benefit, this spiral development will not increase their strike capacity, but will significantly increase payload flexibility. Specifically, future Block III Virginia-class ships can carry and deploy payloads much larger than 21-inches in diameter and can share payloads with SSGN. The first ship with large

diameter bow tubes will not enter the fleet for several years, but the four operational SSGNs, each with a dedicated experimentation tube, are available now to develop new payloads and operational concepts.

In his April 2009 Submarine Review article[5] Dr. Owen Coté asserted that to be relevant, future U.S. forces would have to address IW and wars over the commons, and meet two characteristics common to both conflicts. The first is the need to decrease dependence on local bases, and second is the need to defeat high value mobile targets. To achieve this second capability, U.S. forces will require ubiquitous and persistent, multi-spectral intelligence, surveillance, and reconnaissance (ISR) and equally ubiquitous and persistent time critical, precision fires. These aggregate capabilities do not exist today, and even such elements that do exist would not survive in denied areas. However, Dr. Coté proposed an SSGN experimentation process using off-the-shelf technology that could help develop the capabilities that would be essential to future combat operations.

Several payloads meet this *off-the-shelf* requirement, including the Standard Missile in a strike role, the Army Tactical *Missile* System (*ATACMS*) and the AIM-9X Sidewinder.[6] The AIM-9X was designed as an air-to-air missile, but tests have shown it can be launched vertically in a Tomahawk cruise missile capsule and acquire aircraft in flight. If adapted to undersea launch, it could protect submarines and SOF from helicopters and other low flying aircraft—especially when those forces are most exposed during the ingress or egress phase of their operations. Further, the AIM-9X may also be employable against small surface craft.

The Multiple All-Up-Round Canister (MAC) currently used aboard SSGN, or an adapted version could carry these missiles, but they would be even more attractive if they did not require modification for undersea launch. Two potential methods for doing that are under development. One would employ an encapsulation technique that could support immediate or delayed launch, allowing the submarine to clear datum before missile motor ignition. A second concept under development uses the missile motor exhaust gas, or a gas generator, to pierce the water above the launcher. This water-piercing concept allows unmodi-

fied missiles to fly through a gas plume and across the water-air interface.[7]

While these missiles would add significantly to submarine capability, not all of them require large payload tubes. However, other payloads, including prompt global strike weapons, would require more volume than current 21-inch vertical launch system tubes provide.[8] Even at missile diameters up to 40-inches, Ohio-class SSGNs and Virginia-class Block III submarines could still carry multiple weapons in a single large payload tube. These and other weapons under development could service time critical targets in both IW and A2AD conflicts including road mobile weapons launchers. In addition, these ballistic or hypersonic-glide[9] weapons would be far more survivable than subsonic cruise missiles against modern integrated air defense systems.

Moving beyond weapons, large tubes could carry many other payloads including Unmanned Aerial Vehicles (UAV), Unmanned Undersea Vehicles (UUV), nano-communications satellites, high bandwidth antenna, and SOF delivery vehicles. Submarines have already launched and controlled small UAVs such as Buster[10] that requires surfacing and launch from the top of the sail, or the Switchblade[11] UAV launched via the trash disposal unit. However, while useful in some scenarios, these vehicles lack endurance. Longer-range vehicles such as the Scan Eagle[13] UAV could significantly expand a submarine's ISR coverage—a concept proposed by the Submarine Future Studies Group in 1998 and approved by the Submarine Force leadership. These larger, more sophisticated UAVs should be packaged for launch from the large submarine payload tubes aboard SSGN and Block III Virginia-class ships. The UAVs could launch across the water-air interface in capsules similar to the kinetic payloads described above. Alternatively, middle-ware devices such as the developmental universal launch and recovery arm[14] could provide that function.

Another useful non-kinetic payload is a submarine-launched UAV serving as a decoy or carrying other electronic warfare payloads. Such vehicles could create false targets, stimulate enemy defenses, and generally degrade his situational awareness. Specifically, they could cause adversaries to energize defensive radars and reveal their position. This in turn would allow targeting

from other submarine launched ISR assets, and engagement with submarine launched prompt precision fires. This concept does **not** mean to suggest that submarines can do it all. However, if future A2AD challenges make it untenable for other forces to operate nearby, submarines may have to create openings in an adversary's defensive perimeter by blinding enemy sensors and degrading integrated air defense systems to improve the survivability of follow-on forces with greater strike capacity.[15]

Other systems required for IW or major combat operations could be adapted to submarine launch as well. The 2010 QDR guidance to exploit advantages in subsurface operations[16] by developing UUV systems capable of a wider range of tasks, is likely to lead to larger diameter, higher endurance vehicles that existing SSN launch systems cannot accommodate. Given the QDR and recent CNO emphasis in the UUV area, they are likely to become the first submarine payload that requires a large SSGN or Block III Virginia payload tube. Further afield, the Army's Space and Missile Defense Command—Army Forces Strategic Command laboratory has developed nano-satellites capable of serving as communication links.[16] Submarines could launch them or air-breathing relay vehicles to restore some level of communication after attacks on U.S. space assets that are likely to accompany future conflicts. Large payload tubes could also house very high data rate antennas too large for a submarine sail. Together, these payloads could improve situational awareness across a range of missions for U.S. and allied forces.

SOF support Swimmer Delivery Vehicles (SDV) and other small manned vehicles could be stored and deployed from large submarine payload tubes. SDV transport, deployment and recovery are long-standing Submarine Force capabilities. However, the ability to house these vehicles within the ship's payload tubes provides added vehicle protection, reduced risk to SOF personnel and enhanced operational capabilities. Specifically, it would reduce the number of divers required to support SDV launch and recovery—an option SOF personnel would welcome. Moreover, the lack of a dry deck shelter (currently used to house these vehicles) eliminates submarine speed restrictions and helps

maintain operational security, as the nature of its mission would not be obvious to observers during port egress.

In a recent speech, the Secretary of Defense called for "...A Submarine Force with expanded roles that is prepared to conduct more missions deep inside an enemy's battle network. We will also have to increase submarine strike capability and look at smaller and unmanned underwater platforms."[17] That is tall order, but history suggests the U.S. Submarine Force can meet these new challenges as it has done in the past. After World War II for example, the Submarine Force developed nuclear propulsion, acoustic quieting, and submarine launched strategic weapons—all new technologies that became mainstays of undersea warfare. Those achievements resulted from a strategic competition with a peer competitor: an impetus that does not exist today. However, the proliferation of dangerous technologies, the potential for a new undersea competition, and anti-access strategies that threaten U.S. power projection forces should be impetus enough to develop new capabilities and maintain our lead in undersea warfare. To that end, the Submarine Force would benefit from a funded, systematic process for proposing, prioritizing and developing new payloads.

ENDNOTES

1. U.S. Department of Defense Quadrennial Defense Review Report. Washington, DC 2010. http://www.defense.gov/QDR/images/QDR_as_of_12Feb10_1000.pdf (accessed 8 March 2010) p.9
2. Ibid p. 9
3. Ibid p. 32 "The Air Force and Navy together are developing a new joint air-sea battle concept for defeating adversaries across the range of military operations, including adversaries equipped with sophisticated anti-access and area denial capabilities."
4. Ibid p. 32
5. Coté, Owen Dr. "An agenda for Submarine Force Experimentation" Submarine Review, April 2009.
6. "Raytheon-led Littoral Warfare Weapons Team Demonstrates Successful Underwater Launch" Raytheon Corp. http://raytheon.mediaroom.com/index.php?s=43&item=1381&pagetemplate=release (accessed on 9 March 2010)
7. Navy Test Advanced Sub Missile Launcher. http://newwars.wordpress.com/2010/04/18/navy-tests-advanced-sub-missile-launcher/ (accessed 28 June 2010)

8. The Prompt Global Strike Mission Needs Statement (MNS) and Initial Capabilities Document (ICD) identify the war fighter's need for a capability to strike globally, precisely, and rapidly, with kinetic effects, against high-payoff, time-sensitive targets in a single or multi-theater environment, when US and Allied forces have no permanent military presence or only limited infrastructure in a region, regardless of anti-access threats. www.dtic.mil/descriptivesum/Y2009/AirForce/0604856F.pdf (accessed 10 April 2010)
9. Hypersonic-glide weapons use small wings to develop lift that converts descent velocity into lateral translation that increases range while frustrating defense systems because the weapon deviates from a pure ballistic trajectory.
10. Mission Technologies (MiTex) Inc. www.mitex-sa.com/pro_buster.html (accessed 10 April 2010)
11. Aero Vironment: www.avinc.com/uas/adc/switchblade/ (accessed 8 March 2010)
12. Boeing: www.boeing.com/defense-space/military/scaneagle/index.html (accessed 10 April 2010)
13. Moseman, Andrew. "Four Challenges for the Navy as More Drones Go Underwater", Popular Mechanics, December 2008. www.popularmechanics.com/technology/military_law/4294104.html (accessed 8 March 2010)
14. Jan van Tol et al. The AirSea Battle – A Point-of-Departure Operational Concept, Center for Strategic & Budgetary Assessments, May 2010, http://www.csbaonline.org/4Publications/PubLibrary/R.20100518.Air_Sea_Battle_A_.pdf (accessed 21 May 2010)
15. U.S. Department of Defense. Quadrennial Defense Review Report. Washington DC 2010. http://www.defense.gov/QDR/images/QDR_as_of_12Feb10_1000.pdf (accessed 8 March 2010) p. 33
16. Cummings, John. Army Nanosatellite Program Receives First Units 29 April 2009, www.army.mil/-news/2009/04/29/20327-army-nanosatellite-program-receives-first-units/ (accessed 10 April 2010)
17. Gates, Robert M. Remarks delivered at the Navy League Sea Air & Space Exposition 3 May 2010, http://www.defense.gov/Speeches/Speech.aspx?SpeechID=1460 (accessed 15 June 2010)

THE SURVIVABILITY OF THE ROYAL NAVY AND A NEW ENLIGHTENED BRITISH DEFENSE STRATEGY

by Dr. Anthony R. Wells

Dr. Anthony Wells is the only living person to have worked for British Intelligence, served in the Royal Navy and the United States Navy as a British citizen, and worked for US Intelligence and the Unites States Navy as a US citizen. Dr. Wells was educated at Durham University, King's College, London, and the London School of Economics. He received his Naval training at the Royal Naval College Dartmouth. He is the Chief Executive Officer of TKC International LLC, and has been in the national security and intelligence business for well over forty years. Dr. Wells was trained in the 1960s by several mentors who were key operatives in World War Two, including Sir Harry Hinsley, the great Bletchley Park Enigma code breaker. Dr. Wells is a Life Member of the Submarine League, and worked with the late Vice Admiral J. Guy Reynolds on several projects.

The objective of this article is to demonstrate that the survivability of the Royal Navy as a serious world class fighting force, and a new enlightened British defense strategy coexist in ways that serve the long term security interests of the United Kingdom.

The bitter fact is that the Royal Navy has been decimated: A very small, outstanding surface force, a great Submarine squadron (but that is all – a squadron), and a strike force that may or may not materialize in the shape of the new carriers. The amphibious force and the Royal Marines brigade are again excellent, but small in size and limited in resources. The outlook is even bleaker because of the economic climate and the simple lack of funds—there is no money. Something has to give. This article seeks to show that out of very bad things can emerge very good things.

Now is the Royal Navy's moment in time—sink or swim, best foot forward, or die on the vine and wither to an inconsequential force that cannot project power anywhere with any kind of long term credibility.

The UK is spread too thinly across too many operational domains. As a result, the UK is in great danger of executing none of them as well as when the UK was better resourced. This less than adequate across-the-board performance is not because of people. The UK's Forces are made up of high performance professionals. Their ability, motivation, and dedication are never in doubt. The UK's Achilles heel is that it is spread too thinly. It does not have the resource base to continue to perform in all those domains that predicate its Force Structure, its acquisition strategy, and its investment in R&D, as well as maintaining good personnel, training, and retention policies. The indications that the UK's defense posture may hemorrhage are clear. Such indications are no longer wrapped up in the analysis of what should drive the UK's strategic doctrine, or Staff College analysis of fighting the next wars, or examining the balance between the future demands of conventional and irregular warfare. The key point is that the UK simply cannot afford the luxury of trying to do things for which it does not, and will not, have the resources.

What is the answer? Let the UK be capable of executing a much more limited range of warfare domains that are both within its current and projected resource limits, and which are in keeping with the UK's most critical national interests. Failing to achieve in an environment of a fiscally strained and struggling industrial base is not a recipe for military success for a nation with such an incredible military heritage as the UK. The answer is to specialize in those areas where there is the greatest security return for the investment made.

During this century successive British governments will be faced with hard decisions about how to secure and protect the UK's vital interests in various geographic areas. The likelihood is that the UK will have to provide capabilities to cover the land, air, sea, and space interfaces. The key question is what is the best total force structure to meet the land-air-sea-space domains within the projected fiscal limits? A Joint approach to a tri service Force

structure runs a great risk that it will devolve into a traditional break-out of what each Service says it must have in order to continue doing business in ways with which it is most familiar. Each Service may have to sacrifice some sacred cows, but the key single Service focus will remain very influential despite the apparent desire to remain Joint and cooperative. The reason for this lies in the nature of organizations protecting their survival and operating within a bureaucratic structure. The willingness to step aside and take a very deep strategic breath is less likely.

Defense of the UK home base at a strategic level has rested firmly with the national deterrent in the shape of the ballistic missile submarine force. The UK has to decide whether other credible threats present reasons to maintain additional ground and air forces for the protection of the home base. The compelling evidence is that the UK's vital security interests are overseas. The dilemma is that the UK neither wishes, nor can afford, elaborate overseas permanent bases other than those that are shared with the United States. The residual bases at places such as Akrotiri in Cyprus, Gibraltar, Diego Garcia, Ascension Island, and the Falkland Islands facility, together with the various reciprocity agreements with the United States, are of a much lower order than the historic bases that the UK possessed at such locations as Singapore, Hong Kong, Malta, and Bahrain.

The analysis of twenty first century vital UK national interests, the defense of the homeland issue, the overseas basing situation, and the nature of the land-air-sea-space warfare domains in the future lead to one clear conclusion—namely that British Force structure has to be *expeditionary* and *maritime* in nature. The Royal Navy by its very nature becomes the centerpiece of that expeditionary force structure, within which are encapsulated the land, air and space domains. In essence, such a Force structure is seaborne.

The next question that such a conclusion predicates is what are the key characteristics of such a maritime expeditionary Force structure? Flexibility is critical. However, force structures tend to evolve in very inflexible ways over time, driven by programs, technologies and industrial base concerns. Creating and maintaining flexibility in the Force Structure will be an absolute key

requirement. The Force structure cannot be constrained by base issues and geography. This implies sea based systems that have a logistical tail that will sustain a forward deployed expeditionary maritime force to deal with a range of contingencies. The latter include guaranteeing UK access to vital areas that are essential to its economic survival, deterring and preventing other nations from pursuing anti-access policies, littoral access for ground and air forces from the sea to those land areas where the UK wishes to use influence, and a wide range of other activities, missions, and political-military goals such as security force assistance, protecting UK citizens and their interests, humanitarian relief, evacuations of UK citizens, and at the higher-end, amphibious operations that involve direct forcible entry and sustainment from the sea of land and air operations. In all these areas—space and intelligence, surveillance and reconnaissance play very critical roles. The Space-ISR components will be critical in forward deployed expeditionary maritime operations at whatever level and whatever the mission. Survivability against emerging counter access systems and technologies will make the ISR mission highly critical and fully integrated into expeditionary operations.

One key conclusion from the analysis of operations is that the UK will not have the resources for second order power projection of land forces beyond the first order maritime expeditionary land elements on board amphibious warfare and transport ships. Working with other nations will be paramount in this context. The traditional alliance with the United States must prevail along with growing relationships with other nations as part of the international maritime community. Traditional low intensity operations such as counter terrorism, counter piracy, counter drug and the plethora of tasks to inhibit the illicit transport of weapons, explosives, WMD materials and human trafficking will all continue with this force structure.

The next key question that falls out from this analysis is how to do this. What must be done?

An overriding conclusion is that the single linchpin of an expeditionary warfare maritime strategy is the Royal Navy. All else must devolve down to the support of this single strategy—influenced on and from the sea, with a global capability to provide

and sustain conventional maritime and irregular operations. This does not mean that the Army and Royal Air Force are relegated as poor relations. What it means is that both these services must subject themselves to massive organizational soul searching to find the right balance of economically viable forces to help sustain this new strategy, and within the fiscal constraints laid down by the government. It is not a question of winners and losers, but how to refine what forces will be needed and those that are no longer relevant for the new strategy.

The twenty first century has witnessed already the emergence of global security issues that are not like the twentieth century's continental type strategy that required large standing armies and air forces. Emerging global resource and economic issues are overlain with asymmetric and irregular threats across a very broad spectrum, and at the same time witnessing the emergence of a powerful China. Existing rogue states also challenge the normal international order. The sea is the international commons that connects all these varying and vying interests and potential problems, and pose serious threats to the UK's vital national interests. The maritime axes, or confluences of economic and threat challenges, are virtually global in disposition, not completely, but they exist and are emerging in almost all major sea and ocean areas. The Mid East, South East Asia, and East Asia are prominent, and other troublesome areas loom on the horizon. The UK cannot become an inconsequential player in this environment and should now create a maritime force and programs that support this new Strategic Vision.

The substance is not about the recent reemergence of old challenges—piracy, arms and human trafficking, drug and gun running, the movements of materials associated with WMD, the use of the sea for terrorist related activities, and so on—there is little new under the sun in the ways in which the sea has been used as the conduit for these and many other forms of non conventional violence and illegalities—the Royal Navy was the instrument for eradicating the slave trade and pirates. The substance has to be about threats to the vital national interests of the UK, and by association, its most trusted friends and allies who, because of economic and cultural globalization, are joined at the hip with the

UK in collective self interest. There is nothing new here—just a variant on a very old theme. So what is the substance? What are these vital national self interests if the UK is void of a future threat of invasion, or of the old world balance of power and territorial issues that caused centuries of European based conflict?

For most educated laymen the answers are not that difficult to discern, and should not therefore be oblivious to those who must make hard defense decisions in the UK between now and into 2011. Budget pressures will not permit delay.

The global commons is about resources and production at all levels of economic activity, whether in high technology, or in the simplest agricultural economies, and their ownership, acquisition, security, transportation, and the associated economic and cultural well being of all the member nations of the world. The challenges to the stability and growth of this global economic environment are considerable. The UK is a trading nation, an island, and one totally dependent on imports and exports for its life blood. The sea is the common factor that joins these economic interests with other nations. The air and space are important, but they do not predicate the UK's ultimate well being. The sea is the means to the UK's economic ends. The UK trade and resource numbers for the present and the foreseeable future all support this key statement. Without maritime power the UK has no means to influence and safeguard its critical economic and political national self interests. The means by which to influence from the sea are legion. The UK must accept that its ability to contribute to land campaigns, within the context of its military past, will be seriously curtailed. Military influence on the land will come from the sea in the form of Special Operations Forces operations, security force assistance, and short low intensity operations using Marines, SOF and a very much smaller traditional military cadre, with a logistics tail that is sea based and supplied.

What then must be done to implement the expeditionary maritime strategy to meet the emerging threats of the twenty first century?

The UK's Navy should expand significantly all the principal maritime warfare domains—surface, air, subsurface, amphibious warfare, land attack from the ocean, ISR, special operations, mine

and counter mine, maritime space operations and communications, together with the ability to respond to national contingencies in short order, and maintain the national strategic deterrent. All these elements must be joined in the pursuit of alliance building, multi lateral operations, and forging security relationships through security force assistance and multi national training and exercises. This is the simply stated backbone of a new maritime strategic vision.

The top down break down of this strategy then says—what does the Royal Navy need to fulfill the above, and what can we afford? There is one key going in assumption to this question – the government, the Ministry of Defense and Parliament accept that massive cuts will be necessary in the British Army and the Royal Air Force. Not simple cuts in programs and planned procurements, but cuts that shift irrevocably the strategic balance to an expeditionary maritime force based exclusively on the Royal Navy, with the Army and the Royal Air Force playing roles ***solely in those domains that support the global deployment of maritime power.*** The latter does not envisage major land campaigns or sustained land based air operations. Gone will be the days of a British Army that is deployed for an Iraq type operation, or an Air Force with home based squadrons. Army and Air components will have to be tailored to and subordinate to maritime operations. The latter operations will stop short of any major deployment of land forces, except Marines, Special Forces, and small Army and Marine units that support highly specialized land operations—SOF operations, Security Force Assistance, support to UK personnel overseas, and short shock type operations based on highly specialized Special Forces and Royal Marines. Amphibious lift and logistic support for the latter will be necessary. The main thrust of this maritime strategy will be the global maritime ability to project surface, naval air, and subsurface forces to cover the spectrum of sea based conventional maritime and irregular operations—there will be no Army sustained deployments and no Air Force that conducts any air operations other than in support of maritime operations and logistics support through air lift. All the other current Army and Air Force roles and capabilities disappear.

The current order of battle of the Royal Navy is a pale reflection of its former self. The force strength is not only low, the capabilities and balance of the force is out of kilter with emerging threats, and the operational tempo required for forward deployed maritime expeditionary warfare. The analysis that follows is predicated on the perceived needs of a new Royal Navy that has the flexibility, force strength, operational capabilities, manpower, logistics train, and deployment schedule to meet a wide range of conventional and asymmetric threats, while deterring potential threats, and providing security force assistance in a multi national environment.

The Royal Navy currently has two light carriers of 20,000 tonnes that are aging and deploy the GR3 Harrier that is rapidly becoming dated for future missions. There is no organic in-flight refueling from these platforms. Range, endurance, and on station time are limited in a world that increasingly requires carriers to be at significant stand off ranges from anti carrier ballistic missiles and in order to complicate the tracking and targeting parameters of the newer, quieter, and more flexible non nuclear and nuclear submarine threats. The three amphibious warships and four dock landing ships are very fine vessels and represent a significant baseline for growth of an expanded expeditionary force that can embark a very much larger Marine Force than the current elements of the Third Commando Brigade analyzed below. These seven units are bedrock for the future. The surface force is small, and as most will agree, does not reflect the emerging threat needs. Why is this? The six type 45 Destroyers, one type 42 Batch 2 destroyer, the 4 type 42 Batch 3 destroyers, the 4 type 22 frigates, the 13 type 23 frigates, the 8 fine mine counter measures vessels, and the assorted thirteen patrol boats are outmoded with the exception of the mine counter measures vessels and the missions associated with the patrol boats. The type 45 and type 42 destroyers, and the type 22 and 23 frigates are relics from Cold War requirements and thinking. They are about defense and not offense. They are heavily air defense oriented in an age when the spectrum of air attacks will be so varied that none of the missile systems will be relevant. Naval warfare is about offense. The current destroyer and frigate force has little offensive punch at ranges, precision accuracy, and

with fire power, especially volume fires (both anti surface and land attack), that will make a difference. Long range guns with precision rounds will change this environment, together with smaller caliber guns that also have precision rounds for dealing with a myriad of asymmetric threats. As the emerging sea-air interface in East Asia is demonstrating in most analyses, and in real world operations, the United States Pacific Fleet is facing a challenge to blend its carrier air power with its surface and subsurface forces in innovative and unique ways. However, the key is capability. The UK's new maritime expeditionary force must pack a punch rather than have roles that look very much like defending the platform. This is not to minimize defense. Clearly being able to defend the ship is critical. The question is what is the best means of defense? Given the emerging threats there is little doubt that the best means of defense is attack. Key components in sustaining the latter are ISR and Information Warfare. Within this new strategy and force level the UK must invest in and develop all the ISR tools that make the integration of shipboard organic sensors and the data seamless with non-organic ISR platforms and their sensor data. Situational awareness, data sharing at the national, theater and tactical systems levels is absolutely essential. The Royal Navy's expeditionary force will need to have real time satellite and high altitude stealth persistent UAV feeds while also integrating local tactical feeds from multiple off board sources, together with organic data. The cyber warfare domain is part of a much wider Information Warfare domain. The current UK submarine force of four planned Astute Class (three currently building), six Trafalgar class nuclear powered attack submarines (SSNs) and the four Vanguard class ballistic missile submarines (SSBNs) is outstanding. The problem is numbers. Whatever the quality, and there is no question that the Astute class is outstanding, the key point is that a submarine can only be in one place at a time, and a small force is also limited by deployment cycle issues. The submarine with its stealth, covertness, and ability to operate clandestinely with extraordinary persistent presence, is an invaluable asset within the UK total defense posture. The UK simply needs to build more. The number is at least double the current force strength, with an SSN force of about twenty

platforms. In addition to tactical tomahawk and torpedoes the UK submarine force needs a third kinetic weapon that will provide precision volume fires way beyond the capabilities of previous subsurface to surface tactical weapons. A platform is only as good as the weapons it fires and the targets it can destroy. Tomahawk and torpedoes do not meet all the coming threat needs – a third kinetic weapon is required together with much greater information connectivity for UK submarines. Success will rest on information dominance and information flow. This new maritime expeditionary force will require logistics and sustainment. The current four fleet tankers, four replenishment ships, one aviation training ship, one forward repair ship will have to be significantly enhanced. At sea, forward deployed logistics support will entail the full spectrum of support activity, including repair docks, hospital ships, and commercial vessels configured for support that includes the aid to civil power missions and security force assistance. Such ships should be able to generate and supply electric power from off shore and coordinate aid, disaster relief, and multi national training support. The new UK expeditionary warfare strategy will be free of all foreign bases and over flight rights issues.

The Royal Marines, together with select elements of the British Army, will form the core of the new maritime sea-land force embarked in a significant amphibious force. There will be a heavy emphasis on Special Forces for quick reaction, high tempo operations, where rotary wing and seaborne lift will be critical. Safe insertion, withdrawal and sustainment will be critical, with air support from the new UK carriers. The best of the best of the British Army units will form the core of the conventional units, providing the ground support elements for sustaining operations that are not Special Forces oriented. Such UK forces are likely to operate only in a multi national environment, in security force assistance and in a well defined set of UK—only credible scenarios where UK interests and citizens require protection. The final size of this force will be driven by the defined total expeditionary warfare force capability that the UK can afford, driven in the final analysis by the size of the amphibious transport capability, the size of the home base training reserve, back up reserve forces, and personnel in the leave, training, and staff

cycles in the UK home base centers. The Third Commando Brigade will become the key element on which to build an expanded force, together with the Special Air Service, the parachute Regiment and selective British Army units with the requisite combat records and traditions for recruitment and retention. The Commando unit model of approximately 690 persons per commando has served well, and may well continue to serve as a good model. Armored support and logistics are critical elements and will have to be balanced in a fine away to ensure that the new expeditionary warfare force is not lacking in an essential capability. The ability to transport armor on a regular basis, globally, will be a necessary capability for instance, together with very specialized Special Forces units, such as the special boat service, and other UK clandestine forces.

Within the above framework the Royal Air Force is reconfigured to meet the total air needs of the UK's expeditionary warfare strategy. Anything that is not relevant for this requirement has to leave the UK force level, including staff functions and logistics. In order to support maritime expeditionary warfare the Royal Air Force will have to recruit and train to support the new carrier navy flying the Joint Strike Fighter, and or the F-18 and its several variants, and provide extensive rotary wing support for the amphibious ships and replenishment ships. In addition the Royal Air Force should have responsibility for the provision and manning of key space and airborne (manned and unmanned) ISR platforms and sensors, but only those that are capable of supporting forward deployed maritime operations, free of bases. The Royal Air Force should assume responsibility for cyber and information operations, tasked to provide persistent information dominance, and work with the US in the Royal Air Force's historic relationship with US space systems, and their organizations and commands.

The UK Intelligence Community should reconfigure itself to address the demands of a forward deployed expeditionary warfare force, where information dominance on a 24/7 basis will be critical for staying ahead of the threat and anticipating force deployments, presence in key areas and guarding against a wide variety of threats to the new force. As stated earlier, attack in the

modern cyber and information worlds will be the best form of defense. Coming second in the information age will not work. Integration of the intelligence requirements of this new force within the classic UK agency structure and culture may need changes of information sharing, coordination and cooperation that go beyond the improvements made as a result of 911. Connectivity and communications become critical and the Air Force's role of ISR tsar will demand resolution of emerging connectivity problems, particularly in bandwidth management and security.

There are emerging techniques that may be game changers over time to the color and complexity of expeditionary warfare. Various capabilities may impact the sensor, communications and information domains in ways that will require the UK to stay ahead with its US ally, to ensure that systems are not attacked in ways that are outside the current electronic warfare domains and traditional communications intelligence realms. The UK should therefore invest heavily in ISR, cyber warfare, and the overall information dominance domain.

The above is a strategic vision for a expeditionary maritime strategy—it means massive pruning of the Army and Air Force, followed by a complete revitalization of the Royal Navy and its industrial base—the shipyards, the naval weapons and aircraft manufacturers, helicopters, and so on. Army and Air Force contractors will have to accept this huge change—there is no alternative because there are no funds for the alternatives. It will mean massive personnel changes, and the Royal Navy will have to keep in its ranks enough personnel for probably longer periods of service to implement this new strategy. Parts of the Royal Air Force will become the new maritime Air Force, to support projected maritime power from the sea. The Army, with the exception of the Special Forces, other units that will enhance the capabilities of the existing Third Commando Brigade of the Royal Marines to an agreed land force structure level that is transportable and sustainable from the sea, and key logistics regiments, will downsize significantly, a sad event, but necessary from all perspectives, strategic and financial.

Britain's strategic deterrent posture should remain intact because with the absence of all other forms of defense—the Army

and the traditional Air Force will have gone—the long term guarantee for the UK of national survival will remain with the national strategic deterrent—the Strategic Submarine Force.

The above maritime expeditionary warfare strategy is a rational answer for the long term security needs of the United Kingdom, radical change based on a vision totally in keeping with the long term 21st century interests of the United Kingdom.

Let the UK make this great change, implement this vision, and go forward based on its historic strategic roots—a maritime strategy based on the enduring core strength of the Royal Navy, together with the great traditions and capabilities of the Army and Royal Air Force, the UK's industrial base, and its global economic and security interests.

Editor's Note: Readers may wish to study the first item in Submarine News from Around the World in this issue for the British Government's current approach to their defense needs.

FROM BARROW TO BEAR ISLAND

by CAPT. Dan Conley, RN(Ret)

This article describes one SSN's early years from build to operational patrol. It will be of particular interest to those readers who have stood by a ship in construction.

Editor's note: Dan Conley is a retired RN Captain who was the RN representative at SUBDEVRON TWELVE in the early '80s and who later commanded the SSNs HMS COURAGEOUS and VALIANT.

The Build

On a dull, overcast spring day in April 1978. HMS SPARTAN, the second to last SSN of the SWIFTSURE Class, took to the water at Vickers Shipyard Barrow-in-Furness in the NW of England. She was launched by the submarine's sponsor Lady Emily Lygo, a charming Floridian, wife of Vice Chief of Defence Staff Sir Raymond Lygo. As the traditional bottle of champagne broke against the hull, SPARTAN started a slow passage down the way. As she slid into the murky waters of the Walney Channel she left behind HMS SPLENDID still in the early stages of construction.

I joined SPARTAN in September 1978, and after a quick handover from the temporary XO, the responsibility of a second in command was mine. As I surveyed my rather stark office surroundings in a draughty, temporary building, my immediate concern was that contractors sea trials were only five months away and there was much to be done in preparing the submarine for sea. Pressing problems included lack of any executive branch officers other than myself - the Royal Navy Submarine Force was going through a period of significant expansion and there were simply no qualified officers of this specialisation to fill key appointments other than being available a few weeks before proceeding to sea.

Indeed the Captain did not join until after the trim drive in the yard basin had occurred in early December. Meanwhile there was the challenge of keeping virtually a full complement of seamen occupied who were well and truly engrossing themselves in the dubious delights of Barrow. This rather austere Victorian industrial town had the compensation of bordering on the beautiful and rugged countryside of the Lake District, albeit few of the crew took advantage of the rural delights.

At the time Vickers was under national ownership, as were the majority of Britain's shipyards. Including the gun manufacturing facility and engineering works, there was a total workforce of about 13,000, a far cry from the 5,000 people in the current set-up. Whilst there was no significant industrial strife whilst I was in Barrow, this era marked the lame duck years of Prime Minister Jim Callaghan's Labour government and was a time of very weak management within British industry. Therefore, on occasions one got the impression that the workforce dictated their own terms to the management and many inefficient practices and examples of over-manning were evident. That said, many of the senior management were legendary in terms of their ability to build and deliver nuclear submarines and they exuded a great degree of pride and confidence that they would produce a first rate ship for the Royal Navy.

As an aside, in 1986 the Government sold the Barrow facilities to the managers and workforce for $160 million, with the Cammell Laird yard in Merseyside thrown in. For those who invested in the new company - VSEL, this proved to be an exceedingly good investment as in 1995 GEC-Marconi bought the company at a price tag of $1,360 million.

There was excellent cooperation and indeed often friendship between the shipyard managers and the ships staff who had assumed responsibility for the nuclear plant and watertight integrity. Meanwhile the Naval Overseer organisation ensured that our aspirations in terms of unauthorised improvements to the submarine were kept within reason. That said, we prided myself in the number of modifications which were achieved to meet the aim of ensuring the submarine's fittings and accommodation areas were to the best of standards.

As the trim dive date approached, my imperative was to ensure that when the submarine submerged in the fitting out basin it did not replicate one of its predecessors by ending up bow down in the shipyard mud. Consequently, because they appeared unsound, I ignored the naval architect's trim calculations. Instead I simply rang around other vessels of the class and got hold of their in trim draft mark readings. On the assumption that the Ship-builder had built the submarine roughly the same size as the others of the class it was not rocket science to make an adjustment for stores and water density and put on a very acceptable and safe trim for the basin dive, which in event was completed without incident. However, unfortunately the naval architect concerned stuck to theory in applying the final solid ballast adjustments to the submarine.

Contractors Sea Trials

Late February 1979 saw us gingerly move out of the dock system into the open sea but the thrill of "Getting Underway in Nuclear Power" was tempered by the Captain declaring on arrival on the bridge that his children had mumps and that he had feared that he had also contracted the illness. As we passed by the light carrier HMS INVINCIBLE fitting out, her bow, which had been damaged as she was moved into the entrance dock, reminded us of the perils of this evolution at a time before the entry was significantly improved for the Trident submarines. A shipyard joker had painted a large sign above the damage indicating the remedial work was going to be undertaken by the local auto bodywork repair company. In event SPARTAN's departure and return were achieved without serious incident.

On the maiden dive in the sheltered waters of the Clyde, it proved difficult to get the submarine under water as she evidently was too lightly ballasted. A weekend in the submarine base at Faslane followed with a number of shipyard workers undertaking the miserable task in driving rain of securing tons of ballast under the casing: the theoretical calculations were disposed of to the classified waste.

Proceeding back to sea for crew safety training prior to pro-gressing the sea trials, a serious problem soon emerged in that

many members of the crew had become ill with violent stomach-ache and dizziness. Fortunately the symptoms, although very unpleasant, were short-lived, and the cause was determined as contamination in part of the fresh water system. Meanwhile the embarked shipyard personnel, who could be up to 40 in number, had established themselves in the weapons compartment, nicknamed the *casbah* owing to the amount of coloured material separating their temporary bunks. Fitted out with a film projector and other comforts, the *casbah* was their sanctuary and was even out of bounds to the Work-Up Staff.

Cleared by the Work-Up Staff to proceed with the trials, the next aim was to undertake machinery tests in the Irish Sea working up to full power dived. These were achieved travelling up and down the deep bottom feature known as Beaufort's Dyke which is situated across the Ireland-Scotland ferry route. This relatively deep patch of water is about 30 miles long but is just over two miles wide and was where over two million tons of WW2 explosives were dumped shortly after the war. This equates to over 30,000 tons of ordnance per square mile. Thus working up to 30 knots, executing a Williamson turn at either end of the trench with a rather green crew, was challenging as at times we were at maximum speed only about 400 feet from the seabed. However, for the duration of these trials the Captain was safely ashore, having been landed suffering from mumps, and I had temporary command for which I was paid a shilling a day by Vickers. Of note on reaching the 30 knots, a fifty pence was successfully balanced on its edge on the wardroom table: fitted with pump jet propulsion there was virtually no vibration.

The remainder of the sea trials were completed very successfully and the first deep dive to maximum safe depth was undertaken without too many doors jamming owing to hull compression. Meanwhile we enjoyed the finest of cuisine as the Shipbuilder was paying for all the food. Amazingly the Faslane base supply department was not to be defeated by LOGREQS which included such delicacies as frogs' legs, lobsters and Alaskan king crab to support epicurean adventures for the crew. It was all a bit of a game to see how far the shipbuilders could be pushed, including charging them corkage on their own beer and wine,

proceeds going towards the Ships Company commissioning dance. US readers might raise an eyebrow by the prospect of shipbuilders having access to alcohol at sea but this was never an issue of concern and in event very little was actually consumed.

Return to the Shipyard and Commissioning

Returning to the shipyard in early April, the normal three-month post sea trials fit out was extended by two months for SPARTAN to be incorporated with external protective fittings to enable her to undertake the designated role of a target submarine. The latter meant SPARTAN was destined to spend significant periods of time at the Royal Navy BUTEC and USN AUTEC ranges having a variety of practice and test torpedoes fired against her, sometimes in a hit mode. AUTEC trials were very much welcomed by the crew because they inevitably included port visits to Florida. For my part the high point of the target role was a 28 knot run down the AUTEC range which demonstrated that the Tigerfish ASW torpedo with only an eight knot advantage could achieve a hit, albeit we incurred only a glancing blow which caused no damage.

On a fresh, sunny September morning, the commissioning ceremony took place in a shipyard berth where a pavilion and stand had been set up. There was a substantial gathering of crew families, the shipyard staff, local dignitaries and other guests with the shipyard band providing jaunty musical accompaniment. The commissioning berth and everything around it had been spruced up and painted including only the jetty facing starboard side of the submarine, making it at least 5.5 coats of external paint since the initial build phase. At the start of the proceedings the Ships Company marched on to take position in front of the stand. Very memorably, the standard of marching was absolutely outstanding.

Several crew members of the previous HMS SPARTAN attended the occasion: their Vickers built Bellona Class light cruiser had been sunk off Anzio in January 1944, by a guided bomb. It was very much a humbling experience to meet these stalwarts, several of whom had been severely wounded during the attack and needless to say they were delighted to be our guests and over the moon to be given a tour of a nuclear submarine. We were

also honoured that Lady Lygo was able to attend and indeed she was to maintain a strong interest in the submarine during its succeeding commissions.

Commissioning ceremony over, the challenge then was to get the VIPs onboard for a tour and glass of champagne. The well-built wife of Barrow's Mayor proved a bottle-neck in getting down the access hatch until threatened by the Mayor with use of the torpedo loading gear to get her onboard. A very successful Ships Company dance in the Town Hall finished the day, but for a number of the crew who had married Barrow girls, who characteristically were not inclined to move out of the town, it was a sad end of an era and their main aspiration was to return to another building boat as soon as possible.

The seemingly interminable leaving parties over and the final unofficial improvements levered out of the Shipbuilder, SPARTAN left her birthplace for the final time for workup in Faslane. She had cost about $320M to build in today's money. Sadly, not for the want of enthusiasm and effort, we did not excel in the subsequent safety or operational workup phases, albeit we were assessed as *Satisfactory* in both. Unfortunately the operational workup serials were mainly geared up towards fighting our own or allied forces and were not a good precursor for the forthcoming deployments against Soviet submarine opposition.

Although during the workup and post commissioning trials, there were few technical problems, I have one enduring memory of a defect on the anchor system. Some years prior whilst sonar officer of the first-of-class SWIFTSURE, I witnessed a severe problem on recovering its anchor. As the final shackle (or shot, as it is called in the US Navy) had been heaved in, the cable came off the anchor windlass and totally ran out to the cable locker clench. Getting the anchor in then involved the difficult and very prolonged evolution of getting the weight of the ship off the cable and securing the cable back onto the drum. After many frustrations in trying to get the last half shackle in, eventually this was only achieved by breaking the cable and stowing the half shackle below. This was a very difficult task in the wet, cramped conditions of the SSN's anchor windlass compartment. It was concluded that whilst the cable locker was adequate in capacity on

initial use, as mud deposits built up on the cable, it became too small for stowage of the designed eight or so shackles.

Based upon this experience I attempted without success to persuade the overseeing authorities to have half a shackle removed from SPARTAN's cable outfit. Sure enough during the workup, on anchoring off the port of Rothesay in the Clyde, we endured a repeat performance of SWIFTSURE'S travails. I had to be prevailed upon not to truck the offending half shackle to the design department in Bath.

On Operational Patrol

SPARTAN undertook her first operational patrol in the Spring of 1980. Despite the passage of thirty years, details of events which occurred during this patrol are not releasable, but hopefully they will be de-classified before the key participants have "crossed the bar". Nevertheless a brief account of her second patrol is related in the book *We Come Unseen*, author Jim Ring, published in 2001. There follows a summary of my recollections of happenings during this operation which occurred in February 1981.

This patrol commenced with the detection of a homeward bound Victor Class SSN to the NW of the UK. After a period of loss of contact as he passed through the difficult sonar conditions of the Iceland-Faroes Gap, we re-located him in the South Norwegian Sea and thereafter maintained a loose trail on towed array data.

When about 100 miles south of Bear Island, in the early morning hours, hull array contact was achieved on the Soviet which had stopped transitting and was observed manoeuvring around a certain area. We closed to about three miles to the east of the Victor's search locus and watched as events unfurled. Soon there was great excitement in the control room as a Delta Class Soviet SSBN was detected heading on a south-westerly track. We maintained a prudent range observing the SSN manoeuvring round the SSBN conducting very evidently ineffective delousing manoeuvres. In the late afternoon the SSN headed south-east and faded shortly thereafter having completed his sanitising manoeu-

vres. Meanwhile we established trail on the port quarter of the SSBN as it headed NW at a speed of about 5 knots. There was a great buzz throughout the boat with the appreciation that we had just undertaken a very unique piece of intelligence gathering of a Soviet SSN sanitising a deploying Delta SSBN. I retired for an early evening meal before relieving the Captain for a stint as Duty Command.

On returning to the control room and receiving handover, there was disappointment that contact had been lost on the DELTA. However, after a couple of hours searching to the north-west, contact was regained. Just before midnight confusion existed in the sound-room regarding the bearing of the DELTA, whether we were on its port or starboard quarter. Then it became clear that we were holding two distinctly different sets of contact characteristics on different bearings. We were now behind not one but two DELTA Class SSBNs which were about 10 miles apart heading deep into the Greenland Sea towards the marginal ice zone. A second report went to the Captain that we had additional company.

We maintained trail on the two SSBNs as they headed into the Greenland Sea for the next day. On the second evening of the trail as we approached the Greenland Sea Oceanic Front a marked rise in sea noise was detected ahead but of course there was no shipping around. Meanwhile the sea-water temperature had dropped and ice or frost was beginning to form on exposed internal surfaces of the pressure hull. Owing to the absence of a navigational fix for several days, not very detailed navigational charts, lack of knowledge where the ice edge started, and appreciating that HQ had no idea where we were, we were somewhat venturing into the unknown. However, not fitted with SAT-COM, we had no secure method of radioing for extra waterspace and approaching the edge of our allocated areas we had to break off trail and headed south away from the marginal ice zone.

A few days later, when back south in the middle of the Norwegian Sea we made contact with a homeward bound CHARLIE II SSGN and trailed it for some time before pulling back and returning to base. For me it was the end of my time in SPARTAN and my journey from build to operational patrol. SPARTAN was

to go onto several very successful operational patrols and took an active part in the Falklands War.

Epilogue

SPARTAN's decommissioning service took place in Faslane in January 2006. The following is an extract from a local newspaper report:

> *The service complete, the stage is handed over to Admiral Sir Raymond Lygo KCB, to inspect the Ship's Company and say a few words of his own. SPARTAN was named and launched at the Vickers yard in Barrow-in-Furness by Lady Emily Lygo, and since his wife's death in September 2004 the Admiral has taken a close interest in SPARTAN during her final 17 months in service.*
>
> *Looking ruefully at the leaden skies and the rain spattering off the quay, Admiral Lygo acknowledges that "we've all had just about enough of this", and keeps his speech short. He pays tribute to the men who have served on board SPARTAN, and who will be scattered to the four winds of Royal Navy service in a few minutes' time, and then the white ensign is lowered from SPARTAN'S flagstaff, and with a poignant "Three cheers for HMS SPARTAN", the senior Navy figures leave the scene, the band strikes up for the last time and the Ship's Company is finally given permission to disperse.*

FOXTROT NOSTALGIA

by Vice Admiral (Ret.) Arun Kumar Singh,
PVSM, AVSM, NM, ADC
Indian Navy

Indian Navy (IN) Submarine VAGLI (commissioned on 10 August 1974), the last of the Foxtrots (Project 641i) was decommissioned on 09 December 2010, after 36 glorious years of service to the nation and the Navy. Indeed INS Vagli was the seventh of the eight Foxtrots to be commissioned at Riga (formerly in the erstwhile USSR and presently in Latvia), and her decommissioning marked the end of an era, which started on 08 December 1967, with the commissioning of INS KALVARI, India's first submarine, also at Riga. During the next 43 years, the Foxtrots trained generations of Indian submariners, who then went on to man the next generation of conventional submarines; viz. the German Shishumar (Type 1500 or SSK), the Russian Sindhughosh (Kilo) class and our first nuclear submarine, the Russian Charlie class SSGN, INS CHAKRA. Indeed, even after the induction of the Kilos and SSKs, the Foxtrot remained the 'Basic' Submarine for training all submariners (Basic course, PCO'Q' and CO'Q') for another decade.

The great thing about the Foxtrot was its simplicity of design, based on the reliable Second World War German type 21 submarines (In 1995, I saw a Type 21, a submarine monument in Germany, and it bore an uncanny resemblance to the Foxtrots). The Foxtrot was absolutely reliable, and all its initial teething problems had been resolved in the Soviet Navy, which deployed it in large numbers, on long-range missions, before the advent of nuclear submarines. While it was not basically a *training sub*, the Foxtrot, did forgive some mistakes, which in other more advanced subs could have been disastrous. I would like to recount a few anecdotes about these legendary boats.

In 1970, IN Submarine KARANJ, whilst dived at periscope depth, suffered an unfortunate collision with the 1700 ton destroyer, the *original* INS RANJIT. The ship had to be towed back to harbour, whilst the sub made it back under own power, and was *as good as new* in a few months after a new fin was constructed, in time for KARANJ to take part in the Indo-Pak war of 1971. Incidentally, I later served on KARANJ as a Navigator and EXO, and discovered that the reconstructed bridge was not exactly aligned fore and aft. A similar incident involving INS VELA and the 5000 ton destroyer, the *new* INS Rana occurred at sea in 1989, with somewhat similar results. Once again the robust VELA made it back to port under own power. Many years later, when commanding the *new* 5000 ton destroyer, INS Ranjit, I remember mentioning these incidents to my OOWs, so that they would realize the serious consequences of colliding with a Foxtrot.

There are a few humorous anecdotes too. The crew designate of a yet-to-be commissioned Foxtrot, was undergoing work up on INS KURSURA in 1974, prior to departing for Riga, when the CO designated suggested, perhaps in a lighter vein, to the CO INS KURSURA, that they attempt an urgent dive while going astern! When this proposal was rightly turned down, the response was that the first dive of the newly commissioned Foxtrot would be with sternway on. This particular Foxtrot did not do a stern first dive, post commissioning, but many still remembered the precommissioning promise. When the sub entered Mumbai, after a three month passage around the Cape of Good Hope, the CO smartly saluted the Captain SM 9 "Reporting the safe arrival of IN Submarine-sir!" The Captain SM, aware of the earlier anecdote said "Thank God!"

WHAT IF WE HAD TOO MANY TUBES & TOO FEW MISSILES

by CAPT Jim Patton, USN(Ret)

Captain Patton is a retired submarine officer who is a frequent contributor to THE SUBMARINE REVIEW.

Background

As the world continues to pursue the admittedly noble goal of eliminating nuclear weapons, it appears apparent that the prudent policy of the United States will be to retain *some*, as a deterrent, as long as others exist. It is also apparent that the most secure and most reliable location for these weapons is in the launch tubes of the *Ohio* class SSBNs or their successors. A potential developing problem, however, is that as one START[1] treaty follows another, with ever smaller mandated warhead inventories, that a decision might be forced to either drop below a force level of 12-14 SSBNs, or send these platforms to sea with empty or permanently disabled tubes – an illogical and politically unsustainable option. Since the suggestion that such empty tubes be filled with non-nuclear land attack *Tomahawk* missiles, such as on our four SSGNs was effectively nixed by Congress, other options must be considered to employ these otherwise empty tubes in ways that also support the best interests of the United States.

Discussion

Both of the above options are disagreeable for one reason or another, but arguably the most disagreeable is to reduce the force level of the weapons *system* below the *fiducial level* of platforms that assures adequate coverage of existing and potential *missions* in spite of a credible worst case situation of unplanned platform non-availability, be it anywhere across the spectrum from a material failure through extensive planned maintenance to loss by enemy action. Arguably, that fiducial level is the minimum of twelve hulls presently planned, so the very real probability is to someday have too many tubes and too few missiles.

We appear to be recovering from the vernacular of the post-Hiroshima world of General Curtis LeMay and others wherein the word *strategic* (very familiar to the likes of Clausewitz and Mahan) was prostituted to equate to *nuclear*. In fact, particularly in this era of almost sinfully small CEPs[2], it is becoming very apparent that the word strategic is most properly used to describe the target, and not the weapon or weapon system. Tangentially, as somewhat a corollary to this, when even the detonation of a sub-kiloton nuclear *device* deep in some hole or cave is universally viewed as a strategic *event*, there is not, and never has been, anything such as a *tactical* nuclear weapon.

To be capable of exerting great influence on events ashore (an alternative and not too shabby way of describing *strategic*) across a much broader spectrum of situations other than Armageddon, it would be helpful if a platform could do other than quickly export many kilograms of plutonium vast distances. For example, its been shown that the kinetic energy (KE) of something of the mass of the *throw weight* of a modern SLBM[3] impacting the earth at the multi-Mach number that reentry vehicles possess deposits, thanks to the $KE = \frac{1}{2} MV^2$ of classical physics[4], energy the equivalent of thousands of tons of high explosive (HE), and would create a very wide, very deep crater—very close to the *aim point* due to the above mentioned almost sinful CEPs (and with no fission products drifting about to complicate the geopolitical issues). After all, it was an event of this kind which some claim killed all the dinosaurs. So, even though Congress, as mentioned above, has reportedly rejected the idea of a *mixed loadout* of nuclear/non-nuclear offensive weapons on an SSBN, there could be future considerations for such as a KE payload on existing boosters (HE payloads don't make sense, since above about Mach 3, there is more energy deposited by the mass of an object than by the detonation of an equal mass of HE). It would be an interesting addition to the military portfolio of the President of the United States if he were able to put his finger on any spot on the globe, and inside of an hour, there would be a large hole at that very location.

There is another school of thought that maintains that any serious future conflict will involve a *space war* in that the

intelligence, communications and navigation satellites of the adversaries will be attacked. After each entity's means of doing this are consumed or suppressed, there will be a great advantage gained by the side that most rapidly repopulates these constellations which have become almost indispensable in modern warfare. If each deployed SSBN had some *launch to orbit* intel, comms and nav satellites in what would otherwise be empty tubes, the winning of this race would be assured.

Much work has been done in many quarters to support the concept of a *lightsat* family, where most of the existing capabilities of navigation, intelligence and communications satellites could be packaged in much smaller form factors (perhaps trading off on-orbit lifetime), possibly enabling something with the enormous *throw weight* capability of a D5-like booster to deploy more than one satellite per launch, a capability that would significantly improve the flexibility and effectiveness of a *constellation repopulation* effort.

In many out-year war games that investigated the subtleties of a *space war* against one another's vital space assets, the interesting concept of *antipodal nodes* was discussed at length—the antipodal node of a given spot being a point defined by a spot having the same latitude, but transposed north to south or vice versa, and having a longitude displaced by 180°—in other words, a point literally on the other side of the world. The reason antipodal nodes were of interest is that when something is launched to orbit, orbital mechanics dictate that some 30-45 minutes later it must pass directly over its launch point's antipodal node—a nice place to be sitting with an ASAT[5] capability if one wants to limit an adversary's capability to place things in orbit. All antipodal nodes for launch sites on the Eurasian land mass lie between South America and Australia, and for the continental United States, lie in the Indian Ocean (potentially strategic places to be controlled by the US or its allies in the event of a potential *space war* and subsequent satellite constellation repopulation). However, since the launch site from an SSBN can be virtually anywhere in the world's oceans, and it is not known until the launch itself, it follows that, unlike land-based sites such as Canaveral or Vandenberg, the location of its antipodal node is also unknown

until launch. One option an SSBN could have would be to launch from a site whose antipodal node is in Kansas or Ayers Rock in Australia.

Conclusions

It has been a major accomplishment to have brought the world's inventory of nuclear weapons from many 10's of thousands to *merely* several thousands in the space of two decades. It is clear that the leadership of the globe's major powers intend to reduce this number even further—perhaps asymptotically approaching zero sometime this century. During this effort, however, the concept of credible deterrence which saw us through the Cold War must remain strong—in some form. If not MAD[6], which promised both sides in a conflict utter and complete devastation of their social fabric, it must clearly present a situation where things of great value (perhaps leadership itself) to an aggressor are kept under real and relatively immediate risk by non-nuclear means while at the same time the command, control and preciseness of these deterrence systems are virtually invulnerable to outside interference or degradation.

The primary platform to cover this enormous transformation of the geopolitical equation is almost certainly the present and successor fleets of SSBNs, of numbers adequate to provide surety, and carrying a payload mix which constantly evolves to match and meet the dynamics of the global situation and international laws and treaties.

ENDNOTES

1. Strategic Arms Limitation Treaty
2. 2. Circular Error Probability – the radius of a circle centered on a "target within which half the weapons released are statistically expected to fall.
3. Submarine-Launched Ballistic Missile
4. Kinetic energy equals ½ the mass times the velocity squared.
5. Anti-Satellite.
6. Mutually Assured Destruction.

JAPAN PARTY
RANGOON, MARCH 1944
A STORY OF SURVIVAL

by C. "Mike" Carmody, ENC(SS)(DV) (Ret)USN
Crewmember of USS PAMPANITO (SS383)

Colonel Saito and Major Surgana, Japanese Army Engineering Corps, were two builders of the most notorious railroad ever constructed under monstrous and primitive conditions. This 265 mile rail link ran through the jungles and mountains of Thailand, Burma. The labor was supplied by 61,000 impressed allied prisoners of war and 250,000 Asian coolies. After two years, the death toll suffered by the laborers was astronomical. The final death toll was 16,000 allied prisoners and 90,000 Asians. They had perished from malnutrition, disease, and savage atrocities.

Colonel Saito held in his hand a message from Tokyo, ordering him to send 10,000 of his ablest Allied POW's to Japan. They were to work the mines and munitions factories.

From Camp Tamarkan on the River Kwai, the first segment of 2,250 men was selected. They were known as the *Japan Party*. Lt. Yamada, a Japanese officer, led them 900 miles south to Saigon.

When they arrived at Saigon, no ship's captain would accept the responsibility of carrying such a large human cargo into harms way. Lt. Yamada spent two months trying to acquire passage for the prisoners but was unsuccessful. He and the prisoners were ordered back to Camp Tamarkan.

Two days after their arrival at Camp Tamarkan they were ordered to move south along the Malayan Peninsula. This time their destination was the island port of Singapore 1,400 miles away. Passage had been guaranteed on two passenger cargo ships.

The prisoners were packed into old, run down iron cattle cars. After two weeks of rail travel, under appalling conditions the *Japan Party* arrived at Singapore on September 4th. Thirty-two men had perished during the trip. The remaining 2,218 men were divided into two groups and placed in the ships cargo holds. The cargo holds offered no ventilation or proper sanitary facilities. The

two *Hell Ships* as they were known, were part of a 16 ship convoy, plus destroyer escorts.

On the morning of September 5, 1944 the ships slipped their moorings and got underway. Seven days later, on September 12th two U.S. Submarines, USS PAMPANITO (SS383) and USS SEA LION II (SS315), torpedoed the two cargo ships.

The following stories were from interviews with survivors and recorded aboard the USS PAMPANITO. They related the prisoner atrocities during captivity and how it felt to be torpedoed and survive being in the water for five days.

At 0200 hours, September 12, 1944, the Japanese cargo ship, RAKUYO MARU, took torpedo hits to the bow and her amidships. The survivors later recalled the torpedo hits sounded like dull thuds, causing the ship to violently shake and forcing the bow to plunge down. A large wave swept over the bow, washing many men overboard and injuring numerous others. POW's Bill Cray and Harry Weigand said it was a frightening experience. They said the Japanese crew went completely berserk after being torpedoed. The Japanese took all lifeboats and rafts and kept the prisoners at bay threatening them with guns.

The prisoners began throwing overboard anything that would float. Loose lumber, furniture and heavy hatch planks were some of the items thrown overboard. The falling debris killed many men in the water.

About an hour after the attack the prisoners in the water observed the ship settling very slowly. In fact she took 12 hours to sink. Hundreds of men made their way back aboard the sinking ship. Prisoners Sam Whiley and Andy Nobbs said they went to the ship's galley eating and drinking everything in sight. Many men filled their canteens with water and made packages of food.

Prisoners Arthur Wright and Frank Lawrence made it back aboard one hour before the ship sank. They found new dry clothes, cigarettes and assorted cans of fish. Prisoner Cliff Farlow described the RAKUYO MARU as sinking very slowly by the bow. He said the ship made a lot of hissing air noises with a lot of foaming bubbles. The dangerous suction that usually accompanies a sinking ship wasn't that bad.

Inhumanity at Sea

POW Max Cambell related a heart-wrenching scene. He said just after the RAKUYO MARU sank a Japanese naval frigate and small freighter appeared. They proceeded to rescue only the Japanese survivors. The frigate's seamen threatened the POW's with small arms, keeping them away from the ships. Some were shot.

The POW's had taken over the empty rafts and damaged life boats. They watched in shock and horror as the ships departed. No POW's were known to have been rescued by the Japanese. Approximately 1,100 were lost to the sea.

Approximately 150 miles away and twenty hours after the RAKYUO MARU sinking, USS PAMPANITO moved in to attack the convoy. At 2200 hours, 12 September 1944, PAMPANITO fired nine torpedoes at the convoy. Seven found their targets. Unknown to PAMPANITO's crew, one of the four ships struck was the KACHIDOKI MARU, a large ocean liner hell ship. She received three torpedo hits. Post war records revealed she sank within 20 minutes.

PAMPANITO evaded shellfire from the destroyer escorts, but received a damaging near miss from an aircraft bomb. By dawn, the following day, PAMPANITO had caught up to the remaining ships of convoy, approximately 150 miles from the first attack. She submerged ahead of the approaching ships. As the convoy came within range, PAMPANITO fired a spread of three torpedoes, timing one hit. Sonar reported hearing noises of a ship breaking up.

The entire day, PAMPANITO received a vicious and relentless depth charge attack from the escorts. By night, she surfaced and continued to patrol south along the China coast. On the fifth day, she was back in the area where the RAKUYO MARU had been attacked.

It was late afternoon when PAMPANITO came upon a large crude oil debris field, littered with flotsam and human bodies. The lookouts spotted groups of men, covered with oil, floating on makeshift rafts. It soon became apparent these men were allied survivors from the sunken hell ship. Rescue operations immedi-

ately began. A radio broadcast was sent to any submarines, within range, to assist in the rescue.

Three submarines came to assist PAMPANITO, that day. 73 survivors were rescued by PAMPANITO and another 86 by assisting submarines. The rescued survivors were taken to Siapan. Seven died en route and were buried at sea. The remaining 152 were delivered to the Army's 148th General Hospital, Siapan.

The rescued survivors reported there was another hell ship. Her name was the KACHIDOKI MARU. This was one of the ships sunk by PAMPANITO just before midnight, 12 September 1944. It was further learned the KACHADOKI MARU had approximately 1,000 allied POW's and more than 1,000 civilians and wounded Japanese soldiers on board. The mystery was what happened to all those people?

Admiral Nimitz, Commander in Chief, U.S. Pacific Fleet, later greeted the survivors at Pearl Harbor. He said the convoy attack was one of the war's greatest sea disasters in history. He also said the hell ships could have received permission to sail unmolested. However, the Japanese greed to ship war material prevailed.

Information provided by POW's proved beyond a doubt that atrocities were being committed. A warning was sent to Japan stating atrocities were a war crime and would be dealt with by the military courts. Unknown to military intelligence, the POW's provided the locations of several large steel bridges crossing the River Kwai.

The mystery of the KACHIDOKI MARU is revealed

Five days after the hostilities ended an advanced Marine scouting party liberated emaciated allied prisoners at a prison camp in Northern Japan. The prisoners reported they were the survivors from the KACHIDOKI MARU, torpedoed in September 1944. They identified their group as the *Japan Party*.

The following post war statements were from the Prisoners of War themselves, thus clearing the mystery of the KACHIDOKI MARU's sinking. Many of the prisoners recalled they couldn't help notice the large brass ship's bell, engraved with the name SS President Harrison, when they boarded her in Singapore. At that time, of course, these English and Australian prisoners had no way

of knowing the KACHIDOKI MARU was a captured American vessel.

POW's Ray Stack and Ralph Clifton, revealed what happened to the people on board the KACHIDOKI MARU after PAMPANITO sank her. They reported the KIBIBI MARU, a 20,000-ton whale factory ship, had taken aboard all the survivors from the convoy's sunken ships. They verified three torpedoes had struck the KACHIDOKI MARU and she swiftly sank. They said, after the sinking, a small freighter and two CHIDORIS arrived the next morning from Hianan Island to begin rescue operations. A Chidori is a Japanese patrol boat that carries many depth charges. All the survivors were transferred to the whale ship. It took on more than one thousand civilians, three hundred Japanese naval personnel from the sunken destroyer and frigate, and 656 allied prisoners of war. It was estimated more than 350 POW's, all the wounded Japanese soldiers, and hundreds of civilians, perished when the KACHIDOKI MARU sank. The whale ship left Sangi Harbor, located on the east coast of Hainan, with her human cargo, on September 15, 1944. It arrived safely in Japan on September 28, 1944.

When the 656 prisoners of war disembarked in Japan, they were disgracefully exhibited to the crowds that had lined the streets of Yokohoma. They were made to march in bare feet and rag like clothing. It took an entire day to reach their destination, a prison camp located outside Yokohoma known as Kawasaki.

Prisoners Roger Curtis and Henry Sherwood said they experienced more hardships during the winter of 1944. It was one of Japan's coldest winters ever recorded. Twenty men of the *Japan Party* died from starvation and freezing cold. At night, temperatures decreased to agonizing numbers. The dead were laid in rows because the frozen earth prevented them from being buried. The need for extra clothing was critical. The dead were stripped and their clothing used by the surviving prisoners. The insensitivity to the dignity of the dead was unthinkable, but there was no other choice. Survival was the utmost of importance. The prisoners knew they had to keep from freezing. Every scrap of clothing helped them live on.

In January 1945, the Kawasaki Camp and nearby town were completely destroyed by incendiary bombs dropped from allied B29 bombers. The prisoners were moved to another prison camp, several hundred miles away, in the city of Aomori, located in Northern Honshu. They were put to work in a munitions factory adjacent to the camp.

One month before the hostilities ended the B29's bombed Aomori and the munitions factory. The area was completely leveled. Unfortunately, the prison camp received several direct hits, resulting in the deaths of 30 more prisoners. The prison guards fled during the bombings and the prisoners were left to fend for themselves. They had nowhere to go, so they made makeshift shelters from the rubble.

On 7 September 1945, five days after the war with Japan ceased; the men heard motorized vehicles approaching their shelters. It was an advanced U.S. Marine scouting party. The Marines couldn't believe the ragged skeleton-like men they had encountered. The prisoners informed the Marines they were the 606 sole survivors of a group known as the *Japan Party*. The Marines gave the men rations and instructed them to stay put, because war had ended. Within hours, more food and medical supplies were air dropped. A few days later, the survivors were air lifted to the USS RESCUE, a hospital ship stationed off shore.

Of the original 2,250 *Japan Party* prisoners, only 758 survived. This included 152 prisoners rescued by American submarines and 606 liberated by U.S. Marines.

Admiral Lockwood, Commander Submarine Force, Pacific Fleet, later said the submarine actions during September 1944 were the most successful coordinated submarine attacks of the Pacific War to date. Damage inflicted on the Japanese Merchant Marine was awesome. It involved the sinking of four tankers, five freighters, two ocean liners, four warships, and four probable. War ships sunk were the UNYO, an Escort Carrier, SHIKINAMI, a new destroyer, HARADO, a minelayer, and an unknown frigate. Special accolades were given to PAMPANITO (SS383) and her crew, for the daring attacks and the unique rescue operations of allied prisoners of war.

Footnote

The railroad bridge locations supplied by the POW's aided in many being destroyed. The most important and largest bridge was #277. On 13 February 1945, two low level bombers, each armed with two radio controlled 800-pound bombs, destroyed the bridge's four massive concrete support columns with surgical precision. The entire four span steel bridge collapsed into the River Kwai, denying use of the railroad.

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DEGAUSSING POLICY DURING WWII: SUCCESSFUL OPERATIONS AND PROPOSALS FOR MODIFICATION, PART II OF II

by Victor S. Alpher, Ph.D.[1]

Dedicated in Memory of Ralph A. Alpher, Ph.D. (1921-2007), Naval Ordinance Laboratory (1940-1944), Johns Hopkins APL (1944-1955).

Dr. Alpher is an independent research consultant based in Austin, Texas. He is an elected member of the Society of Sigma Xi (Scientific Research Society). He has a long and distinguished career as a researcher and practitioner in psychological assessment and neuropsychology. He has published widely, including a number of recent works in Military History and the History of Science.

> "The *BARB* spent a day outside the Golden Gate for test-depth dives and 5-inch gun training. Another day at a degaussing pier in San Francisco made her less sensitive to magnetic mines or torpedoes—a real joy to contemplate. Having shaken off her magnetism overnight, she would return to Mare Island the next morning." (A rare mention of degaussing in a wartime memoir; *Thunder Below* by Admiral E.B. Fluckey, University of Illinois Press, 1992, p. 299.)

Abstract

Part I of this series of two articles examined the reasons for generation of Degaussing Policy (DP) by the Chief of Naval Operations and its effects throughout the Fleet, Merchant Marine, and the Army's surface vessels. In late 1942 through 1943 proposals were made for modification of DP in ways that would substantially affect its success. Proposals and analyses are discussed. Ultimately, the Chief of Naval Operations rejected all such major proposals at the end of 1943. Advancements in degaussing today assure its importance to future naval operations.

Degaussing Policy and the Submarine Service[2]

In a memorandum dated 19 September 1940 from the U.S.S. AUGUSTA, Flagship of the United States Asiatic Fleet, at Tsingtao, China, Commander-in-Chief Admiral Thomas Hart discussed the installation of degaussing equipment on vessels of the Asiatic Fleet. In order of priority, he placed *submarines* first, followed by cruisers and then destroyers. He stated at the time, that "the following general order of priority best meets the needs of the Fleet and should be followed in so far as circumstances permit."[3] Moored enemy magnetic mines could threaten submarines at depths of 300 fathoms (1800 feet).

As Degaussing Policy (DP) was developed, submarines did not routinely receive degaussing coils, but were regularly subjected to *flashing* to counter acquired magnetization (described in detail in the first paper of this series). However, by late 1941 and early 1942, the Chief of the Bureau of Ordnance, W.H.P. Blandy, and the Chief of Naval Operations, F.J. Horne—Acting, were still recommending that degaussing coils be installed on submarines *as long as this did not result in a delay in the completion of the vessel.*[4,5]

Degaussing Policy Under Scrutiny

By 1943, however, the extent of DP was being questioned—not by the operations in the Fleet, but by the central agencies guiding its implementation.[6] It was already known that the degaussing program of the U.S. and its Allies was vastly superior to the Axis.

Why tamper with success? Cost-containment seems to be the motivating force—almost routine in some organizations. For example, to save costs, there were only two experimental live tests of the Mark 14 torpedo in 1926—a clearly bad decision.[7] Yet, in other areas of new development, cost-containment was explicitly eschewed during the early war period in favor of speedy development and implementation. One of the clearest examples is the development of the Proximity Fuze under Dr. Merle Tuve.[8] This was a Navy *"Section T"* contract to the Department of Terrestrial Magnetism of the Carnegie Foundation, as were many

ordnance development contracts. They would later be adapted as needed for Army and Army Air Force use during the war.

In a lengthy study entitled "Value of Deperming"[9] Dr. H.M. Mott-Smith of BuOrd concluded that the most cost-effective deperming stations were those close to the continental U.S. and not forward stations. He believed that Degaussing Officers were most effectively assigned to these facilities. Aside from materials, each Deperming Station required the following personnel *per shift* covering a 24 hour schedule:

1. One Officer (usually a Lieutenant [j.g.])
2. Two Physicists
3. Three Petty Officers
4. Twenty Seamen
5. Five cooks, Mess Attendants, Firemen, Guards, etc.
6. Thirty One Total Personnel

Mott-Smith proposed that a reduction in the building and maintenance of forward stations would be more cost-effective because little change appeared necessary once the many vessels were in operational status. However, the existing policy of six-month intervals for deperming *necessitated* forward deployment of deperming installations and deperming barges. Return to the continental U.S. was costly, impractical, and inefficient. It was proposed that minesweepers be outfitted to perform flashing in forward areas.

BuOrd and BuShips Challenge the DP Directive

A joint letter, marked CONFIDENTIAL, from BuShips and BuOrd to the Vice Chief of Naval Operations, is dated 16 August 1943—Subject: General Degaussing Policy.[10] This significant document, six pages long, is over the signatures of H.G. Rickover, C.L. Tyler, A.H. Van Keuren, and W.H.P. Blandy, and may represent the single most important coordinated work of these bureaus during the War—both of which had heavy responsibility for executing Degaussing Policy. Together the Bureaus recommended significant change in DP.

This document is also quite significant in that it also reveals standards for the criteria used for determining what ships received *no coils, M-coils, or MFQ coils*, at a minimum. No coils were installed in "[v]essels which normally operated in unswept, mineable waters," Wooden vessels with beams less than 20' received no coils, and wood-hulled vessels with beams greater than 20' received M-coils. Steel-hulled ships with less than 15' beams received no coils, those with beams of 15' to 30' received M coils, and those with beams greater than 30' received MFQ coil setups. For "Major Combatant Vessels, and Special Auxiliaries" (all of which were steel-hulled), vessels with beams equal to or less than 62' received M-Coils, and those with beams greater than 62' were fitted with MFQ Coil arrangements.

They also recommended that degaussing by flashing be used "in lieu of coils" on vessels that policy then required M-coils only, as well as vessels employing no coils. This would be promulgated for vessels operating in areas where the vertical component of the earth's magnetic field *varied by no more than .11 gauss*, and these vessels would be prohibited from operating outside the specified area unless facilities for *reflashing* the vessel for the new latitude were available. Elimination of the M-coils would result in cost and material savings.

However, these changes would require magnetic ranging facilities such that vessels would be checked at a minimum of every *two months* instead of the current six. There would be a need for *more* forward Degaussing Stations, not less. Also, such vessels would not be permitted to operate outside of areas where course accuracy greater than plus or minus 3 degrees was necessary (i.e., following marked channels), and therefore, a gyro compass rather than a magnetic one would be sufficient. However, elimination of coils on a class of ships that had previously had them would have predictable *negative* effects on morale and efficiency.

Table 1 (January 15, 1942) shows a cost analysis *for each type of degaussing installation*. It examines data on Weight, Cost and Time of Installation.[11] The four basic types of coiling setups were designated Mark I (M-coil), Mark II (M & A [athwartship] coils), Mark III (M, F, & Q coils), Mark III Mod I (M,F, & Q coils, distributed) and Mark IV (M,F,Q, & A coils). This analysis was

made just at the time of the introduction of the German 4 milligauss mine. Revision of DP was not seriously considered again until early 1943.

TABLE I — Comparative Data on Weight, Cost, and Time of Installation

Class	Mark I			Mark II			Mark III			Mark III Mod.1			Mark IV		
	Weight Thousands of Pounds	Cost Thousands of Dollars	Time Weeks*	Weight Thousands of Pounds	Cost Thousands of Dollars	Time Weeks*	Weight Thousands of Pounds	Cost Thousands of Dollars	Time Weeks*	Weight Thousands of Pounds	Cost Thousands of Dollars	Time Weeks*	Weight Thousands of Pounds	Cost Thousands of Dollars	Time Weeks*
Battleships BB57 Class	25	43	4	47	81	6	58	99	5	58	104	6	80	137	7
Aircraft Carrier CV9 Class	41	60	4	61	89	6	97	136	5	97	141	6	117.5	168	7
Battle Cruisers CB1 Class	44	68	4	60	100	6	75	115	5	75	120	6	91	155	7
Cruisers CA58 Class	38+	56	4	51+	80	6	61	93	5	61+	95	6	73+	115	7
Cruisers CL55 Class	32+	47	4	43+	67	6	52	78	5	52+	81	6	63+	100	7
Destroyers 2100 Tons	10.5	15	2	15	18	4	14	29	3	16	21	4	20.5	38	5
Destroyers 1600 Tons	8	13	2	12	28	4	12	17	3	13	20	4	16.5	35	5
Destroyers 1100 Tons	6.5	12	2	10	27	4	11	16	3	11.5	18	4	14.5	33	5
Submarines SS212 Class	7	12	3	Installation of A Coil Impractical			15	24	6	15	28	6	Installation of A Coil Impractical		
Auxiliary Typical	20	30	3	33	43	5	37	43	4	38	45	4	51	58	5
Minesweepers AM2 Class	5	8	2	7	14	3	6.5	14	3	7	16	3	9	20	4
Tugs AT Class	4	7	2	6	12.5	3	6.3	12.5	3	6.8	14	3	8.8	17	4
Sub Chasers PC Class	3.5	5	2	5	8.8	3	5.4	8.8	3	5.8	10	3	7.4	12	4
Harbor Tugs YT Class	2.2	3.5	2	3.2	7	3	3.9	7	3	4.1	7.3	3	5.5	9	4

*These times are the minimum which can be expected and do not allow for unforeseen delays in procurement of material and installation, and are contingent on advance planning. Longer time should be allowed when possible.
+Based on calculated weights.

Table 1. Table from Letter from BuShips and BuOrd to the Vice Chief of Naval Operations. This shows data on the Weight, Cost, and Time of Installation of Degaussing Facilities on seagoing vessels from Battleships and Aircraft Carriers to Harbor Tugs as of January 15, 1943. Note that for submarines, data for installation of Athwartship (A) Coils are not reported, as these were considered "impractical" NARA NND 803073 14 October 2004.

The Chiefs of BuShips and BuOrd wrote to the Vice Chief of Naval Operations, suggesting changes in Degaussing Policy for Naval Auxiliaries, U.S. Army Vessels, Coast Guard Vessels, and Panama Canal Vessels, in a CONFIDENTIAL JOINT LETTER dated 17 March 1943.[12] They stated that DP *over-protected* smaller vessels and should be reduced.

Degaussing Versus Minesweeping

Another important analysis appears in late 1942 archives of the BuShips and BuOrd correspondence in the National Archives. "REPORT NO. 9—Mine Countermeasures – Proper Relationship of Degaussing to Magnetic Minesweeping" is marked SECRET and is also *numbered*, both of which are designations signifying its intelligence importance and potential controversiality.[13] This report is a thorough analysis of the results of minesweeping by both the British and U.S. forces, seen in the context of the massive degaussing effort. The most revealing part of this report is the cost analysis, which was summarized:

> "These curves [graphs included] show that without degaussing a mine of about 50 mg. [milligauss] sensitivity would be most effective. With any reasonable amount of degaussing, the most effective mine is a sensitive mine of about 5 mg. sensitivity. This is just half of the value for the E.R. [Effectiveness Ratio; E.R. = Target Width/Sweep Width] for 50 mg. mines and no degaussing. In other words, degaussing has reduced the effectiveness of enemy magnetic mines by a factor of ½. This is what we have bought for $128,000,000."

It is concluded that by *doubling* the minesweeping program, the same effect could be attained. Unfortunately, the conclusion is based only on merchant ships lost, including Liberty ships—at the time of the analysis, a total of 2550 ships having an average beam of 52.5 feet. With new ships being degaussed during construction, the degaussing program overall "contemplates the coiling of about 2400 of these vessels." This would mean M-coils only, except for ships with beams greater than 62 feet, which would receive

additionally F and Q coils. The final conclusions of this report are summarized thus:

(a) Degaussing has resulted in a twofold increase in the safety of our merchant marine against magnetic mines.
(b) Effective results could be obtained by increasing minesweeping at two-thirds the cost of degaussing. This favorable situation of minesweeping cost to degaussing cost is only valid, however, if we do not over-protect [sic] ourselves against magnetic mines.
(c) Our sweeper needs are calculated on the hypothesis that we should carry our countermeasures *only to the point where the mine is as effective as a torpedo* (emphasis added by author; there is no mention of the origin of this criterion).

On 14 April 1943, J.L. Doob, of the Bureau of Ships, produced a Rough Draft of a position paper on Degaussing Policy. The data used for his analysis were those for Liberty Ships. He considered the potential losses of discontinuing degaussing to be quite acceptable – additional losses of 1 ship per month at the end of 3 months and 2 ships per month at the end of 6 months (Atlantic), and comparable losses in the Pacific at 3 and 6 months. These statistics were based on an assumption that in the Atlantic, the enemy would be laying 500 mines per month, and in the Pacific, 300. However, he nonetheless concluded that discontinuation of the degaussing program currently in effect was inadvisable; because of the startup cost, time lost, and casualties incurred over the year's delay in *reintroducing* degaussing, should enemy mining activity increase. Also sweepers in use as patrol vessels would have to be recalled in favor of increased minesweeping. This would almost certainly be detected and investigated by the enemy. The conclusion: current DP was sound.[14]

Mine Warfare Operational Research Report OpNav 30M-C, No. 27, Discussion of Degaussing Policy is dated 14 June 1943.[15] Report No. 27, CONFIDENTIAL, appears over the signatures of F. Bitter, Commander, USNR and Officer in Charge of the Mine

Warfare Operational Research Group, and of L.S. Fiske, Captain, USN and Assistant Director, Base Maintenance Division. This report comes to different conclusions regarding the possible losses in the Atlantic and Pacific to the Liberty Ship fleet, again founded on base rates of 500 mines per month laid in the Atlantic and 300 per month laid in the Pacific. Losses due to curtailing the Degaussing Policy with respect to Liberty ships in the Atlantic was estimated at 0.8 ships per month in the first 3 months, and 1.5 ships per month at the end of 6 months, 2.8 ships per month at the end of a year, increasing slowing to 13. In the Pacific, additional ship losses were estimated at 0.6 per month in the first 3 months, but only 1 ship at the end of 6 months, 2 ships per month at the end of a year, increasing slowly to 8.

Who, however, would want assignment to Liberty Ship with no degaussing coils? Perhaps only with an increase in the existing system of hazard pay. For surviving a torpedo attack or air-to-sea bomb, for example, merchantmen received increased pay (this applied to the Murmansk run according to Lt. Col. C.J. Lyons; personal communication, January 5, 2010). The M-coils given all Liberty ships were important psychologically as well as strategically.

Arguments Against Modification of DP

Degaussing reduced the magnetic field around a ship by a factor of about *three*, rendering German magnetic torpedoes and mines much less effective. Curtailment of degaussing would necessitate the minesweeping of new areas. Any increase in the amount of minesweeping would surely be noticed by the enemy and analyzed—and if it led to an increase in mining, many vessels would be lost during the ensuing year of re-implementing degaussing, flashing, and other components of DP.

Finally, and most important, this report makes, for the first time, a more *detailed* examination of the effect of degaussing *on morale*—and I believe the weight of evidence is that this is the factor that eventually prevailed. For example, it was concluded that personnel on ships without degaussing facilities would become lax in their duties, knowing that new ships were *not* even being degaussed! Of course, some personnel would attempt to

compensate for the lack of degaussing protection—in potentially unproductive ways—such as increase in visual observation to the detriment of other assignments.

Some small landing craft would also lose degaussing protection. Coastal areas were frequently mined. Such a measure would leave combat troops vulnerable when assaulting new areas, such as when Marines were transported to new islands in the Pacific, and Army Rangers attacked the Atlantic Wall in Normandy on D-Day. It was concluded that although minesweeping was the most effective component of magnetic-mine countermeasures, "total losses in the event of a magnetic mine blitz would be several times as large if we gave up degaussing."

The CNO Closes the Door on Changes in DP

The CNO appears to have brought any considerations of altering policy – except to *increase* the effectiveness of minesweeping and the effectiveness of degaussing of minesweepers – to an end, after receiving much information from the various sources mentioned here, and possibly others. A Confidential Memorandum dated 13 December 1943 from the Office of the CNO with extensive Atlantic and Pacific Fleet distribution reveals these final conclusions.[16]

Figure 1 shows the Submarine Tender Orion on September, 1944, off the coast of Saipan. This photograph illustrates the effects of Degaussing Policy—from the essential degaussed tender, to the subs depermed at advanced bases. Without these interlocking units of iron, steel, sailors, and copper, submarines could not have sunk 5,320,094 million tons of enemy shipping in the Pacific. The majority of these losses were to merchant shipping, crippling the Empire of Japan.[17]

Figure 1. Photograph of the Submarine Tender Orion with seven submarines being protected and outfitted, taken off of Saipan in September, 1944. From Theodore Roscoe's *United States Submarine Operations During World War II*, United States Naval Institute, 1949.

Figure 2. Photograph of Ralph A. Alpher, taken during the period of time (ca. 1944) he was working for the Bureau of Ordnance and studying physics in night school at The George Washington University, where he received his M.S. in 1945 and Ph.D. in 1948. Much of his work in the 1940-43 period involved theoretical and applied studies of degaussing and magnetic airborne detection, as well as the production of related Operational and Technical Manuals. He became a world-reknowned cosmologist for his work on nucleosynthesis and the Big Bang theory, culminating in award of the 2005 National Medal of Science (selection by the National Science Foundation). Beginning 1 August 1944 through mid-1955 he worked on a variety of naval contracts at the Applied Physics Laboratory at Johns Hopkins University, while simultaneously being involved in a number of significant research projects in astrophysics.

Final Words as a New Era Dawns on Degaussing

One rarely sees extensive discussions of technology, although DP was and is an essential dimension of Naval warfare.[18,19] A testament to the enduring value of degaussing is that many WWII vessels served in later conflicts in Korea as well as Vietnam.

In July, 2008, the first high-temperature ceramic superconductors were installed in the USS HIGGINS to perform degaussing. On April 1, 2009, the *Higgins* successfully passed through the U.S. Navy Magnetic Silencing Range at San Diego. This new method is more energy-efficient than copper and lighter in weight. A bright new era in the history of degaussing technology has commenced.[20]

Acknowledgments

My father, Ralph A. Alpher, Ph.D. provided the greatest inspiration to my research into the technology of World War II. His long-term colleague, Robert C. Herman, Ph.D. who also worked on *Section T* Navy contracts provided me much guidance during my career.

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Finally, I wish to thank the Editor of THE SUBMARINE REVIEW, Captain James Hay (U.S.N.-Retired), who encouraged me to organize a larger amount of material into the present two-part series. Kristin Bernacchi, Assistant Editor, has helped to make each paper better in appearance, organization, and accuracy.

References

Note: References declassified by the National Archives and Records Administration (NARA) follow each item with the date declassified.

1. Dr. Victor S. Alpher may be contacted through http://www.ralphalpher.com
2. Early in the war, installation of degaussing coils on all submarines, an unrealistic ideal, was seriously considered and rejected in favor of flashing,

which would allow a more rapid enlargement of the submarine service (see OP-1536, Degaussing Station Instructions: Degaussing of Submarines, for a comprehensive treatment of flashing.)
3. CONFIDENTIAL memorandum dated 19 September 1940 from The Commander-in-Chief, U.S. Asiatic Fleet to The Commandant, Navy Yard, Cavito, P.I. Subject: Degaussing Equipment—Installation of on Vessels of the Asiatic Fleet. NARA NND 755028, 12 October 2004.
4. CONFIDENTIAL Memorandum 30 December 1941 from Chief, BuOrd to CNO, Subject: Protection of Submarines from Magnetic Mines (BuShips-BuOrd joint conf. ltr. C-SS/S81-6(3660 S81-1(17) of Dec. 23, 1941, to OpNav), NARA NND 803073 14 October 2004.
5. CONFIDENTIAL Memorandum from CNO to Chiefs, BuShips and BuOrd, Subject: Degaussing-Protection of Submarines from Magnetic Mines, NARA NND 803073 14 October 2004.
6. CONFIDENTIAL MEMORANDUM FOR FILE dated 12 April 1943, BUREAU OF SHIPS. Subject: NC Liberty Vessels (EC2-S-01) – Effect of Discontinuing Degaussing on, NARA 907051 14 October 2004.
CONFIDENTIAL memorandum dated 19 May 1943, Office of the Chief of Naval Operations, Washington, D.C. From The Vice Chief of Naval Operations to the Chief of the Bureau of Ordnance-Subject: Proposed Curtailment of Degaussing Facilities. NARA NND 907041 14 October 2004.
7. Alpher, V.S. (2010). Torpedo Exploder Mechanisms of World War II: A New Perspective. The Submarine Review, April, 2010, 83-105.
8. Baldwin, R.B. (1980). The Deadly Fuze. San Francisco: Presidio Press.
9. Mott-Smith, Dr. H.M. CONFIDENTIAL Memorandum to Lt. Commander D.W. Ver Planck, USNR, Subject: Economics of Deperming, dated 13 May 1943. NARA NND 907051, 14 October 2004.
10. Unlike most memoranda, this document is marked JOINT LETTER. It is in the Bureau of Ordnance (Record Group 81) files and its heading is NAVY DEPARTMENT, BUREAU OF SHIPS, Washington, D.C., although its reference code is BuOrd S81-1(17)(Re6d). It is marked CONFIDENTIAL and addressed to the Vice Chief of Naval Operations from both Bureaus. NARA NND 907051, and NND 803073, 14 October 2004.
11. CONFIDENTIAL Memorandum from the Bureau of Ships and the Bureau of Ordnance to the Chief of Naval Operations, 14 January 1942 (BUSHIPS No. C-S81-6(3660) and BUORD No. S81-1(17), SUBJECT: Degaussing of Naval Vessels, General Policy. NARA NND 802093 14 October 2004.
12. CONFIDENTIAL MEMORANDUM, from H.C. Train, Assistant Chief of Staff, Pacific Fleet, PACIFIC FLEET CONFIDENTIAL LETTER NO. 8CL-42,26 dated 26 January 1942. This memorandum disseminated information directly from BuOrd, NARA NND 083073 14 October 2004. The same information was disseminated to the Atlantic Fleet in a CONFIDENTIAL MEMORANDUM dated 1 January 1942 from the Commander in Chief, U.S. Atlantic Fleet, NARA NND 803073 14 October 2004.
13. Mine Warfare Operational Research Group (Op-30M5c). REPORT NO. 9. Mine Countermeasures – Proper Relationship of Degaussing to Magnetic

Minesweeping. 17 November 1942. SECRET. Copy No. 13. NND 907051 14 October 2004.
14. CONFIDENTIAL ROUGH DRAFT, Discussion of Degaussing Policy, Bureau of Ships, 14 April 1943. NARA NND 907051 14 October 2004.
15. CONFIDENTIAL REPORT, Discussion of Degaussing Policy, Mine Warfare Operational research Report, OpNav 30M-C, No. 27, 14 June 1943, NARA NND 907051, 14 October 2004.
16. CONFIDENTIAL, NAVY DEPARTMENT, OFFICE OF THE CHIEF OF NAVAL OPERATIONS, 13 DEC 1943. Subject: Recommendations Regarding Magnetic Minesweeping in Relation to Present Degaussing Policy. NARA NND 907051 14 October 2004.
17. Roscoe, Theodore. (1949). United States Submarine Operations in World War II. Annapolis, MD: United States Naval Institute.
18. Rössler, Eberhard. (1981). The U-Boat. The Evolution and Technical History of German Submarines (trans. by Harold Erenberg from the German). Annapolis: Naval Institute Press, p. 9.
19. The recollection of degaussing at the head of the second part of this series is quite unusual. Due to considerations of space, this aspect of the story of degaussing could not be explored in depth. The interpretive value of personal recollections is discussed in Michael Sturma, "U.S. Submarine Patrol Reports during World War II: Historical Evidence and Literary Flair," *The Journal of Military History*, 74(2), 475-490, 2010.
20. See "High Temperature Superconducting Degaussing for Ships," in www.onr.navy.mil, 20 April 2009, retrieved 12 June 2010. See also "ONR Demonstrates New Counter-Mine Technology for Ships," in www.physorg.com/new159370781.html 18 April 2009. Retrieved 8 June 2010. The superconducting ceramic was developed by the Office of Naval Research and the Naval Surface Warfare Center Carderrock Division (Philadelphia, PA). The high-temperature superconductor (HTS) opens up many potential applications of degaussing to naval architecture. 77% of Naval vessel casualties from 1950 to 2009 were caused by magnetic mines, including many sailor fatalities and injuries. This includes critical damage to three modern warships during Persian Gulf Conflicts.

A BRIEF HISTORY OF SUBMARINE RADIO COMMUNICATION

By Edward Monroe-Jones, LCDR, USNR(Ret), Ph.D.
Capt. Robert Baker, USN (Ret.)

Dr. Monroe Jones is an Industrial Psychologist consulting in Organizational Development and Labor Relations. He is also the Director of the Submarine Research Center in Bangor, Washington. He qualified in Submarines twice: as an enlisted man on STERLET and as an Officer on SIRAGO. He is a frequent contributor to THE SUBMARINE REVIEW.

Captain Baker served as a Radioman in four submarines making RMC(SS) in THEODORE ROOSEVELT before being commissioned as an LDO. He continued in submarine communications billets along with a seven-year tour at the White House. As a Captain he commanded NAVCOMSTA Puget Sound and NAVCAMSEASTPAC. He retired after forty years of service.

The latter half of the 20th Century was a technological race between competing hardware and software companies in computers and tele-communications. The Navy kept up with the pace of instant communications and applied the research to Cold War demands.

As vacuum tubes gave way to transistors in the 1960s and finally to micro-chip circuits in the 1970s and 80s the use of Morse Code in submarines dwindled. In the mid 1960s, CW was largely replaced by radio tele-type. The cryptographically secure JASON system used the KW-37 machine. Submarine shore to ship communication called Fox was transmitted six times over a twelve-hour period. A submarine could rise to periscope depth and

copy the Fox transmission for that day at any of the scheduled transmissions. Submarine Fox was transmitted from the ComSub-Pac transmitter at Pearl Harbor to boats operating in the Pacific and ComSubLant at Norfolk sent its Fox messages to boats in the Atlantic.

Submarine VLF reception was best achieved by a trailing antenna, although multi and single loop antennas were also mounted on American submarines. The trailing antenna was a single strand copper wire in a myelin insulating sheath wound onto a reel. At the bitter end of the antenna wire was a steel weight, which kept the antenna taut and acted as its ground. The very low frequency loop was formed by the antenna wire and the steel grounding weight, which radiated RF waves through the sea and to receptors on the submarine's hull. The reel was kept in a trunk housed in the sail and accessible from the control room. When ready to receive, the trunk was opened and the wire was extended by threading it through an orifice in the trunk. American submarines normally carried three spools of antenna. This redundancy reflected the delicate nature of the antenna. If the diving officer used too large a down angle the ship's screws rose about the center of gravity and parted the trailing antenna. In addition, fishing boats and their rigs occasionally parted the wire. Splicing kits were also kept on submarines and could be used when an antenna was damaged in a recovery. Submarines using this type of antenna continue to experience similar difficulties.

Radiomen in submarines were normally assigned to encrypt and decrypt messages up to and including *Secret*. *Top Secret* was normally reserved for officers who crammed themselves into the small radio space to do their work. Neither officers nor radiomen liked the idea and it was inevitable that radiomen would sometimes decrypt incoming *Top Secret* messages. This came to the Navy's attention and modifications were made. Tommy Robinson recalls, "Back in the early 1960s someone in a high pay grade decided that submarines should have their own crypto rooms. Radiomen performed the majority of crypto operations, but occasionally an "Officer Eyes Only" message would require an officer's attention; normally the communications or operations officer. But the orders came down and during overhaul of USS

NAUTILUS (SSN-571) in 1964 we radiomen became proud owners of a crypto room. Physical space was limited in our submarine, especially in radio. Our radio space, located on the starboard side of the control room, was a narrow passageway with transmitters and other equipment against the pressure hull and two CW stations and receivers inboard. A few feet of space inside the room, just forward of the entry door from control, was partitioned and a heavy, metal vault door installed. The result was a metal closet about the size of the officers' head. As I recall, our crypto room contained a safe for registered publications, a chair and KLB-47 crypto machine for encrypting and decrypting messages. A skinny person could just manage to squeeze into the chair with his knees knocking against the machine. The vault door had to be shut and locked from inside the vault. Sea trials followed completion of the overhaul at NSY, Portsmouth, New Hampshire, and we were happy to be at sea. As NAUTILUS submerged beyond 200 feet depth and the pressure hull contracted, our crypto vault door jammed shut, not to be opened until the boat ascended into shallower water less than 200 feet. Although we were aware of the problem, we failed to mention it to any officer. The first time our crypto vault was used by an officer, he emerged after a lengthy stay to remark how stuffy it was in there. Apparently, he thought the problem was of his own making. It took a few self-doubting officers before one reported the problem to the Executive Officer. We radiomen remained silent on the issue."[1]

Fox and all two-way submarine communication were encrypted into five letter code groups. The length of transmissions and frequency of them was kept constant by the insertion of a parallel running tape that interspersed nonsense words or publicly released news, whichever best filled the time equalization need.

In Japan during the 1960s, VLF frequency transmissions from American communication facilities continued to use CW. The transmitter was of German Telefunken make that used a rotary generator AC power output. Whereas three-element vacuum tube power output produced a sharp character, the Telefunken produced a character trailing edge that smeared into the next character. Copying the blurred transmission was difficult and resulted in

much ship-board anxiety as encrypted messages were riddled with spurious letters.

When tele-type communication replaced CW, radiomen had to learn the new equipment and procedures quickly. Often, this meant on-the-job training and it was natural that a few mistakes might be made, even by seasoned personnel. Most were of little consequence; such as the following: Submarine scheduled broadcasts were transmitted every two hours and the period of silence between the broadcasts was partially filled with repeated Victors. This was for tuning purposes and the dit-dit-dit-dah was familiar to all submarine radio operators. Of course, the transmission was by tape, which contained holes and slits for the automatic equipment. A radioman inserted the tape backwards and the resulting transmission was an endless stream of Bakers; dah-dit-dit-dit. Radiomen aboard submarines at sea immediately visualized the mistake and chuckled at the prospect of some poor shore-based lad who would shortly be one stripe lighter.

Submarines depended more and more on teleprinter circuits and communications finally became computerized in both receiving and transmitting. Accordingly, the rate of Radioman lost its meaning and was dropped from the Navy's list of ratings. It eventually became a specialty of the electronic technician rate.

During the early 1960s, the Navy hastily developed an air-to-submarine communication concept. Rear Admiral Bernard Roeder explained the concept to Lieutenant Jerry O. Tuttle. He ended his explanation by ordering the Lieutenant to, "Take charge and move out." Accordingly, the project became known as TACAMO, an acronym carrying the Admiral's intent. Essentially, the concept was an integration of a continuous airborne VLF transmitter, housed in a variety of KC-130 Hercules aircraft, and a deep submergence VLF receiver in American submarines. An aircraft could be alerted to send a VLF *trigger* message to a deeply submerged boat, which could then rise to a more shallow depth for specific missile launch instructions. Both the aircraft and submarine trailed very long external antennas. In the Pacific the aircraft were stationed at Barber's Point, Oahu and on Guam. This system remained in effect until other communication options and the nature of the Cold War diminished the importance of the

project.[2] It was, in part, augmented in the late 1970s and early 1980s by the introduction of Seafarer, originally called Sanguine. The project called for an enormous ELF transmitter that would cost more than $23.7 million dollars. It was to be installed under Lake Michigan. Environmentalists succeeded in killing the bill, but the project was retained and later built at two other locations, Clam Lake, Wisconsin and Republic, Michigan, a separation of 148 miles. The two simultaneously keyed transmitters used a signal in the 40-80 Hertz range. The giant ELF transmitters were deactivated when the Cold War ended and the need for a *bell ringer* transmission was no longer needed. The concept was replaced by another R&D project called NAVSTAR. This concept involved the imposition of communication capability in existing intelligence satellites.[3]

In 1998 the Defense Advanced Research Projects Agency (DARPA) sponsored an extensive and objective study of future submarine concepts. The DARPA report stressed the need for improved connectivity—the ability to communicate effectively. As a result, the Virginia class submarines, then on the drawing boards, were to be equipped with the latest VLF long-range radio wave reception at operational depths and speeds.[4]

VLF and LF broadcasts operate in a frequency range from 14 to 60 kiloHertz. They are transmitted from six high-powered VLF multi-channel sites and seven LF multi-channel sites located world wide. Messages received from ComSubPac and ComSubLant make up the Integrated Submarine Automated Broadcast Processor System which emits a super-encrypted continuous signal. This sequence of messages normally lasts two hours. Signal clarity has been maintained by expanding the band-width using multiple, simultaneous, fiber-optic conductors. The system is called Clarinet Verdin. This description of the shore-to-ship/ship-to-shore transmission methodology is abbreviated and the actual process is more complicated. Submarines at sea have at their disposal satellite assisted communication called Submarine Satellite Information Exchange System or SSIXS. This program provides UHF SATCOM broadcasts formed by the SSIXS computer operators at each of the submarine broadcasting stations. The Navy FLTSAT, satellite system, has been replaced by the

MILSATCOM or military satellite communication system, but its service remains the same. Navy communication systems with their attendant computers and satellites require information transfer and processing that are quick, reliable, easy to manipulate, and automated. The amount of technical support for such a system and its attendant cost is staggering when compared to the relatively simple system used in the Second World War.[5]

The radio space in a modern Fast Attack or FBM submarine consists of several computers linked to satellites. Some boats still retain a teletype machine, but gone are the days of Morse Code.

For all practical purposes the difficulties of submarine radio transmission and receipt are currently such that the submarine must act as an independent body accepting information from shore installations on a schedule and transmitting information as needed on a very infrequent basis.

The journal, SUBMARINE REVIEW carried the following, "The U.S. currently has superior connectivity with its deployed submarines and this connectivity will get even better as recently approved developments are introduced to the fleet. However, as our experience in the area of submarine quieting has demonstrated, those faint noises heard in our baffles are potential adversaries, with far more to gain from an operational sense, improving *their* connectivity."[6]

ENDNOTES

1. Interview with CWO Tommy Robinson, (Ret.), July, 2009
2. Jamie Bisher, TACAMO – *The Survivability Finger on the Trigger*. Submarine Review, January 2008, p83, 84
3. Norman Polmar and K. J. Moore, *Cold War Submarines, The Design and Construction of U.S. and Soviet Submarines*, Dulles, Virginia, Brassey's Inc., 2004. p. 316, 317
4. D. Douglas Dalgleish and Larry Schweikart, *Trident*, Southern Illinois University Press, Edwardsville, Illinois, 1984, p. 99, 100, 263, 266
5. http://www.fas.org/man/dod-101/navy/docs/semp/part07.htm and http://www.fas.org/man/dod-101/navy/docs/semp/part07.htm
6. James Patton, Capt., USN (Ret.), *Maintaining the Submarine Connectivity Advantage*, THE SUBMARINE REVIEW, July, 2009, p. 98

SUBMARINE NEWS FROM AROUND THE WORLD

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From the October Issue

UNITED KINGDOM - The Future of the Royal Navy

In mid-October 2010, the United Kingdom published two documents that will provide basis for the direction of the British Armed Forces and the Royal Navy (RN) for the next decade and beyond. These two documents, the National Security Strategy (NSS) A Strong Britain in an Age of Uncertainty and the Strategic Defence and Security Review (SDSR) Securing Britain in an Age of Uncertainty, can be viewed in their entirety on AMI's website or as downloadable documents.

The SDSR will reduce the overall defense budget to £33.8B (US$53.3B) – a cut of 8% from the previous fiscal year. The defense budget is expected to remain at about that level over the following three fiscal years:

- 2012-2013: £34.4B (US$54.2B)
- 2013-2014: £34.1B (US$53.7B)
- 2014-2015: £33.5B (US$52.5B)

Reductions in forces and accompanying personnel costs will help fill some of the gaps in procurement funding needed to provide for the remaining Astute class submarines, Trident submarine replacement and Type 26 surface combatants. The real problem will be containing the pattern of cost growth and schedule delays that have troubled most RN procurement programs in recent history. The available budget will leave little room for cost growth or schedule slips over the next 4 years and beyond.

The SDSRs specific impact on the active forces of the RN:

- 5,000 personnel to be reduced through 2015
- Carrier HMS ARK ROYAL (R 07) will be decommissioned immediately

- Decommissioning of either the carrier HMS ILLUSTRIOUS (R 06) or the helicopter carrier HMS OCEAN (L 12). The decision as to which will be taken out of service will be made following a short study for cost effectiveness.
- All Harrier aircraft will also be retired. The carrier/helicopter carrier/Harrier decision will leave the RN without an active attack carrier for 10 years
- Decommissioning of one Albion class landing platform dock (LPD)
- Decommissioning of four frigates (probably the four remaining Broadsword class (Type 22 Batch 3).
- Decommissioning of one of four Bay class dock landing ships (LSD)
- Rationalize the RN base infrastructure ashore.
- Surface combatant force level to be set at 19 ships
  6 Daring (Type 45) class destroyers
  13 Duke (Type 23) class frigates (commissioned from 1991 through 2002, replacement beginning around 2023)
- Submarine Force level of seven attack submarines, transitioning from a force of six Trafalgar and one Swiftsure to seven new-construction Astute class by 2020
- Maintain a nuclear deterrence reducing launch tubes per submarine from 12 to eight and total warheads from a force of 48 to 40
- All 14 Hunt and Sandown MCMVs will be maintained and replaced by multi-purpose hulls beginning around 2020
- Maintain the resupply and refueling fleet with a replacement program
- Maintain the six strategic transport vessels (Hurst RO/RO ships)

Significant naval construction programs that are being framed around the NSS and SDSR are:

- Continue developing the Future Ballistic Missile Submarine (SSBN) to replace the four Vanguard class. Main Gate approval is now scheduled for 2016. At least three submarines will probably be built to maintain a continuous deterrent, although the total warhead requirement has dropped to 40 from 48. Launch tubes will also be reduced from the current 12 per unit to only eight in the replacement units.
- Completion of the six Type 45 class destroyers (program underway)
- Continue development of the Type 26 surface combatant to replace the Duke (Type 23) class frigates as well as offering the new design to international customers
- Build seven Astute class submarines to replace the single Swiftsure and six Trafalgar class (program underway)
- Continue with the construction of both Queen Elizabeth class aircraft carriers. The first unit (HMS QUEEN ELIZABETH) will enter service in 2016 and then put in an extended readiness status when the second unit enters service in 2019. The first unit will operate helicopters only for the three years it is in active service and will essentially fulfill an amphibious role if reactivated. The second unit, HMS PRINCE OF WALES, will be fitted with a catapult to fly the Conventional Take-Off and Landing (CTOL) variant of the Joint Strike Fighter
- Replace 12 MCMVs with a new multi-purpose vessel that will also be capable of offshore patrol, hydrographic research etc.
- Procurement of a future replenishment ship scaled to meet the new fleet requirements (replacement for MARS)

Looking at the future of the RN post SDSR, there appears to be a strong government commitment to a multi-purpose navy with a continued strategic role. Investments in the Future SSBN, Astute class submarines, Queen Elizabeth class aircraft carriers, Type 26 surface combatants, multi-purpose offshore patrol vessel (OPV) and support ships (formerly MARS) highlight the balanced portfolio of future British naval programs.

However, many of the planned future programs will likely be scaled back even further in response to continuing fiscal pressures. For example, the SSBN program realistically will not contain more than three units, one aircraft carrier will essentially be transformed into an amphibious ship and the number of Type 26 surface combatants, OPVs and support ships funded and built are expected to be less than currently planned.

Further, significant reductions in general purpose surface combatants and expeditionary ships also signal a future Royal Navy less able to respond to a variety of global contingency missions than in the past, particularly if those requirements arise simultaneously in different geographic areas.

The future Royal Navy will also be severely constrained in its ability to execute naval operations at the naval task group or force level. Nor will the RN have a viable fixed wing aviation force at sea for much of the next 10 years.

Finally, the future general purpose force structure appears to confirm that the Royal Navy will continue to meet its global commitments with *singleton* or small task unit force structures in all but the most exceptional circumstances.

PAKISTAN – Supply Line Shift, Navy Looks Toward China

As of October 2010, AMI continues to receive information concerning future procurements for the Pakistani Navy (PN). With the sea service close to completing its Sword class frigate (four units) and Agosta 90B submarine (three units) programs, the PN is ready to move forward with its next step in its modernization effort.

Pakistan continues to express its interest in the acquisition of four new large ASW surface combatants as well as a new class of submarines from China. Indications are that Pakistan is beginning to rely on Beijing more and more for its naval and air force requirements due to affordability, finance initiatives and fewer political hurdles. The failure to close a new submarine deal with European suppliers is apparently pushing the Pakistanis to seriously consider Chinese-built submarines as well as new frigates to follow the Sword class.

In public circles, the Pakistani Naval Chief (Admiral Norman Bashir) has expressed interest in Chinese systems due to the lower price, flexible payment options and most importantly, lack of political conditions on naval equipment sales. Admiral Bashir has stated publicly that China is much more flexible in its arms deals when compared to other suppliers.

Although Pakistan continues to receive used equipment from the US such as P-3 aircraft and Oliver Hazard Perry class frigates, the country is clearly beginning to move toward another strategy of new platform buys from China.

This not surprisingly follows on the success of the Sword class frigate program, which Pakistani naval officers and crew have publically stated are "great ships".

Pakistan admits that Chinese designs are inferior to their western counterparts in some respects but as China has demonstrated the willingness to custom build ships to Pakistan's requirements, this makes them an attractive supplier compared to other shipbuilders who have not proved so flexible.

Pakistan is considering four ASW frigates (possibly the type 054 class Jiangkai I) and up to eight Yuan class submarines or the newer Chinese design launched in October.

In addition to new frigates and submarines, Pakistan is also considering the procurement of the Chinese HQ-16 (Russian SA-N-12/Grizzly) surface-to-air missile (SAM) to replace the FM-90s currently on the new Sword class frigates and the LY-60 SAMs on the ex-British Type 21 frigates still remaining in service.

With the commissioning of the third Sword class frigate and the completion of the Agosta 90B in 2008, Pakistan could complete negotiations with China at any time in regards to the frigates, submarines or both.

GREECE

Shipyard, Submarines and Frigates

In July 2020, AMI reported information regarding the potential sale of Hellenic Shipyards (HSY) as well as details of Greek naval programs that are scheduled to take place over the next several years.

The original terms of the sale of HSY from March 2010 included:

- Hellenic Navy (HN) accepts the first type 214 class submarine that was initially refused. Although the HN would accept the submarine, AMIs source indicates that it would likely then be sold (asking price €300M/US$388.8M) to a client known to the owner of CMN. The French yard CMN is a 30% stakeholder in Abu Dhabi Mar (ADM).
- The Greek Government waives the penalty for the delay in delivery of the type 214s, amounting to €100M (US$129.6M)
- The Greek Government negotiates with the European Union (EU) to cancel the fine it levied on HSY for what was called *illegal competition*.
- Greek Government to provide €2B (US$2.59B) in new orders for HSY for the new construction corvettes
- Possible shift of construction of an optional Commandante class corvette (a current UAE Navy program) to HSY from Abu Dhabi Shipbuilding (ADSB) in order to increase the order book of the Greek shipyard.

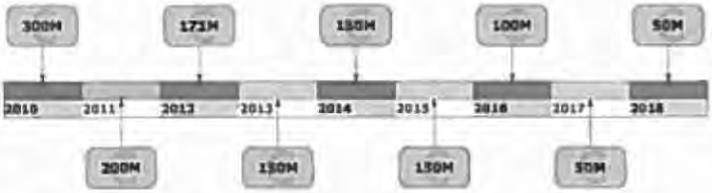
On 28 September 2010, the Greek Parliament voted to accept the transfer of HSY from ThyssenKrupp Marine systems (TKMS) to ADM, including the procurement of two additional Type 214 class submarines (HM corvettes not yet firm).

As noted above, the two additional type 214s were one of the main items of the proposed sale of the shipyard. These two new build submarines will replace two type 209 units in the HN inventory that will not receive their mid-life upgrade (MLU). OKEANOS was the first 209 to receive the MLU, including an air independent propulsion (AIP) system. That sub completed MLU under a 2001 €800M (US$1.11B) contract whose original scope was for three units. With the construction and procurement agreement for the two additional Type 214s (signed on 30 September for a total contract amount of €1B (US$1.39B), upgrades for the two remaining 209 MLUs in the original sub modernization contract have been cancelled.

In addition to the contract for the 214s, the Greek Government agreed in the September contract to pay approximately €300M (US$417M) for old obligations that include:

- €117M (US$162.6M) for the remaining material already procured for the MLU of the remaining two 209s
- Delete penalties from the delays of the both the Type 209 MLU and the Type 214 procurement
- Delete obligations and penalties from the above contracts for Greek Added Value Tax and offsets

The agreed upon payment schedule for both the Type 214 procurement and repayment of the old obligations is as follows:



With the negotiations complete for the sale of HSY, contract discussions for the FREMM frigates continue to progress. On 24 September 2010, the Greek Government and MBDA came to an agreement on the missile and launcher load out for the FREMM that is expected to see a final contract in 2012. AMI still estimates a total program build of 6 Greek FREMMS.

Launchers for the FREMMs will include three, Sylver A-50 launchers for Aster 30 missiles, a total of 24 cells and one Sylver A-70 launcher (8 cells) for Aster 30 missiles on the bow. As well as Aster 30s in the A-70, future deployment of the Naval Scalp land attack missile could occur should they be purchased in the future. On the stern of the ship, six, four-cell Sylver A-35 launchers will house the vertical launched (VL) Mica short range missiles.

While the FREMM program was an element of the July negotiations, it now appears that the construction of the six FREMM frigates is not part of the final HSY purchase agreement. The FREMM program may still be a bargaining chip for further development of a national shipbuilding strategy centered on HSY. AMI's sources indicate that there are preliminary discussions within Greece to do just that, following a strategy very similar to that adopted in Canada. Should this new strategy include a future merger of Elefsis and HSY or even a sale of Elefsis, the FREMM program could certainly sweeten the deal.

CHINA

New Submarine Class Launched

On 03 October 2010, AMI International received information that Wuhan Shipyard launched a new class of submarine on 12 September 2010 for use by the People's Liberation Army – Navy (PLAN).

While the new submarine was originally believed to be yet another unit of the Yuan (Type 041) class, photographs show that the vessel is unlike the Yuan in many aspects; including the location of the dive planes, length and shape of the sail, hull form and tail plane configuration. In fact, this new unit looks more like a Chinese rendition of a Kilo class, albeit with minor differences.

Reporting on the subject suggests that the Chinese have once again copied a foreign (Russian) design of a weapon system; however, there are enough differences between the Russian and Chinese submarines that AMI believes this is just a logical progression of Chinese submarine design.

Additionally, it is likely that this new design will be a separate construction line at Wuhan, running in parallel with the Yuan class. Although, facing some delays, the Yuan seems to be on track to deliver the next two units in 2011 as planned while the new class goes through testing and then eventually into full-rate production.

From photos of the new submarine, it appears to be a standard length submarine that likely does not have any air independent

propulsion (AIP) system, indicating that it will likely be used for local patrols, similar to the Kilo class currently in inventory.

AMI anticipates that this new design will likely become a class of around eight units, augmenting the eight Kilos in inventory and allowing for increased patrols in territorial waters.

From the November 2010 Issue

United States—Shift in Littoral Combat Ship (LCS) Acquisition Plan?

As of late November 2010, AMI continues to receive information that the US Navy (USN) is recommending to Congress a new acquisition plan for the Littoral Combat Ship (LCS) program. Various sources and press releases indicate that the USN is now seeking congressional approval for the procurement of up to 20 new LCSs under a split procurement program rather than continuing forward with the current plan to down-select to one design by the end of 2010.

On 04 November, the USN began discussions with Defense Committee members (SASC and HASC), their staffs and the industry teams involved in the LCS procurement (Marinette Marine and Austal) into the possibility of gaining US Congressional authorization to award two 10-ship blocks as an option to the current acquisition plan of authorizing only 10 units to a single contractor. The new acquisition plan would require Congressional approval. This proposal is in the planning stages only and has not been approved by the US congress. The original acquisition plan to select a winning design by the end of 2010 for a ten unit build is still the official strategy in accordance with the terms of the current solicitation.

The new plan would authorize 20 units, ten each for the Lockheed Martin/Marinette Marine design and ten units of the Austal design to be built through 2015.

AMI believes there are several reasons that the new strategy is being considered at this time. The USN Senior Acquisition Executive (Assistant Secretary of the Navy for Research, Development and Acquisition) Mr. Sean Stackley, has confirmed

that bids for Austal Ships and Lockheed Martin have come in at costs below the US$480M Congressional cap.

When considering the projected costs of the 17 units (US$10.8B – or US$635.2M per unit) included in the FY 2011 Future Years Defense Plan (FYDP), there are sufficient funds to build all 20 units. The actual number of vessels procured will only increase from 17 to 20 under the two-block procurement plan in the same five-year period.

Also under the FY2011-2015 FYDP is the procurement of 16 mission modules for US$1.1B. The rate of procurement for the mission modules will have to increase slightly in order to meet the faster procurement schedule of the hulls. However, when considering the cost of procuring 20 LCSs in the next five years under the two-block buy in addition to the costs of the mission modules (under a separate funding line); it is likely that the USN will be able to procure the next 20 LCSs and the additional mission modules within the current budget.

This is a win-win-win for the USN, Lockheed Martin/Marinette Marine and Austal. AMI's 2006 assessment of surface combatant ship costs projected the LCS program as considerably cheaper than other comparable surface combatant programs throughout the European market. It appears that it still holds true today.

The USN is also considering the likely operational tempo of the current and future fleet and the declining number of general purpose combatants—specifically frigates—available to meet those commitments. This is another factor prompting USN support for procuring more LCS hulls earlier. An LCS contract that enables building of the first of 20 new ships immediately will provide more hulls sooner to meet future operational commitments.

The other part of the equation is the state of the US shipbuilding industry. With consolidation of naval shipbuilding infrastructure driving reductions in skilled shipbuilders, a bulk order for LCS will stabilize the workforce at *Tier II* shipyards such as Austal Ships and Marinette Marine against further job cuts. This could be expanded further when the thirty additional units are

ordered under the next FYDP, as AMI anticipates that the competition will be opened further.

AUSTRALIA

Austal Buys Australia Technology Information (ATI)

On 08 November 2010, Austal announced that it had reached an agreement to acquire Australian Technology Information (ATI) Pty Ltd of Canberra.

Established in 1990, ATI is an independent, Australian owned systems engineering company with a business development office in the USA delivering products and services supporting command and control systems; Global Positioning Systems (GPS); tactical data links and self replicating digital communications; primary and secondary radars; forward looking infrared (FLIR); general electronics and 3D visualization and systems integration.

For in country support, ATI partners with Raytheon, Kelvin Hughes and Telephonics Corporation. Supporting Raytheon, ATI provides maintenance and repair of electronic systems supporting the Australian Defense Force (ADF). ATI also supports Kelvin Hughes at their Naval Marketing and Maintenance Repair Facility for naval-related equipment, repair, operator and maintainer training. ATI and Telephonics partner to provide defense communications, radar and electronic equipment technologies to domestic and international customers.

With the acquisition of ATI, Austal will now be able to expand its product and services offerings with ATI's state-of-the-art systems engineering capabilities and further develop its support to the ADF and international defense customers.

DID YOU KNOW?

UNITED KINGDOM – On 01 November 2010, BAE Systems announced that it would launch the second Royal Navy (RN) Astute class submarine, HMS AMBUSH (S 21) on 16 December 2010.

GREECE – on 02 November 2010, the Hellenic Navy (HN) commissioned its first Type 214, HNS PAPANIOLIS (S 120) at Germany's HDW shipyard.

ALGERIA – On 02 November 2010, the second of two Kilo II (636) class submarines for the Algerian National Navy (ANN) was turned over to the Algerian sea service at Russia's Admiralty Shipyard.

From the December 2010 Issue

SAUDI ARABIA – Naval Requirements List Continues to Grow

In late November 2010, AMI received information concerning additional programs for the Royal Saudi Naval force (RSNF). AMI sources indicate that the RSNF is currently discussing three major programs including:

- A modernization program that will include the three Al Riyadh class frigates, four Medina class frigates, four Badr class corvettes and nine Al Saddi class corvettes. The RSN expects these classes to remain in service until 2020.
- A program to procure mini and mid-sized submarines.
- A program to buy a helicopter carrier.

Although no suppliers were mentioned in connection with the modernization programs, AMI believes that at least one or several of the major systems houses involved in the original procurement programs will likely be selected to oversee the modernization effort each individual class indicating that Thales, Atlas elektronik (Cassidian – formerly EADS), and Boeing could be leading candidates to refurbish these four ship classes (with a corresponding shipyard). The RSNF has indicated it wishes to keep these vessels service until 2020. Some of these vessels will be replaced by the new frigates that are currently being considered.

In regards to the submarine procurement, sources indicate that the RSNF has already consulted with Saudi Crown Prince Sultan Bin Abdulaziz and will meet with a US delegation in the near term regarding the requirements for the four mid-sized submarines and

undetermined number of mini-submarines. Although the US has not built conventional submarines in over four decades, it could join with a major builder such as DCNS or Thyssenkrupp Marine to fulfill this requirement. General Dynamics, DCNS, Fincantieri, BAE Systems and many other smaller submarine builders such as James Fischer could become competitors in the mini-submarine program.

Sources also indicated that the Saudi Ministry of Defense and Aviation (MoDA) has seen some activity between BAE Systems of the UK and the Saudis. It appears that a BAE solution could be preferred by high ranking RSNF offices for the helicopter carrier. France is also attempting to fulfill the helicopter carrier requirement. BAE Systems and DSNS must be considered the two top contenders for the helicopter carrier program.

Although no timelines were mentioned in these latest three programs, one thing is certain, it appears that the MoDA and the RSNF have their plates full as the sea service is currently evaluating a major procurement of 150 patrol boats (mostly for the Coast Guard), six medium landing craft (LCMs) and three helicopters in addition to the procurement of up to four new frigates.

Of all the programs being considered at this time, AMI believes that the frigate is much further along as a design has been under consideration since 2005. It will probably be followed by the 150 patrol vessels. AMI believes that the helicopter carrier and submarine programs are several years down the road, if they in fact ever come to fruition.

CHINA - Update on New Construction Programs

Since the last complete rewrite of AMI's China country report in December 2009, significant changes have taken place in that country that warrant this update on the state of the People's Liberation Army—Navy programs that are currently in progress.

Aircraft Carrier Programs: In September 2010, AMI reported that the People's Liberation Army—Navy (PLAN) had begun construction on their new aircraft carrier in a *Navy only* shipyard located on an island facility built specifically for the program.

Analysis of these sources suggests that the new China State Shipbuilding Corporation (CSSC) Jiangnan facility, located on Chang Xing Island near Shanghai, is the location of the new carrier's construction.

The new PLAN aircraft carrier will likely be in the 60,000-ton range and powered by eight Ukrainian DA-80 gas turbine engines driving four controllable pitch propellers for a maximum speed of 30 knots. Photos of the ex-VARYAG taken in November 2010 reveal a weapon load-out that will likely be incorporated on the new carrier as well.

Information received regarding the ex-VARYAG from multiple sources as well as from recent photographs indicates that the carrier is just months from beginning sea-trials and that engine testing has already taken place as evidenced by exhaust from the smoke stacks. Sources state that the power plant consists of six Ukrainian DA-80 gas turbines as well as eight diesel generator sets.

New equipment noted on the carrier includes the following:

- One MR-760MA Fregat-MA Top Plate-B 3-D air-search radar.
- One 4-panel Type 348 Sea Lion multi-function radar.
- Four 20-round multiple launch rocket systems for decoys.
- Four Type 730 close-in weapon systems.

It is anticipated that the carrier will be available for local area operations and training by the end of 2012 and will be used primarily for training the air wings that will eventually be embarked on the new production carriers.

Destroyer Programs: In November 2010, AMI received additional information regarding the construction of the new Type 052D class destroyers at Jiangnan. Information and photos received show this program is approximately three years ahead of the originally anticipated schedule with the 20 November 2010 launching of the first of class.

Based on photos, the new destroyer displaces around 8,000 tons, smaller than originally anticipated, and seems to be a cross between the proposed Types 052D and 051D destroyers, possibly allowing for faster construction of more units.

General specifications of the Type 052D include:

- One 100mm gun.
- Two Type 730 close-in weapon systems.
- Four multiple launch rocket systems of both decoys and land attack munitions.
- Eight surface to surface missiles.
- One 4-panel Type 348 Sea Lion multi-function radar.
- One MR-760MA Fregat-MA Top Plate-B 3-D air-search radar.
- One Type 517 Knife Rest A-band radar.
- One Band Stand missile data link.
- Two Light Bulb data links.
- One Type 344 Rice Lamp for gun direction.
- A bow mounted sonar.

Regarding surface to air missiles, there are no cells visible on the bow of the vessel, nor does there seem to be room for any. All missiles would be housed in the after portion of the ship and will likely be a vertical launched variant of the SA-N-7 Gadfly housed in a 32-cell launcher. As final fitting out continues, AMI will report any updates to the design as well as more detailed missile load-out information.

AMI's source also has indicated that three additional units of the class are scheduled to be built at the rate of one every 18 months. Unit two is already under construction and should be launched in late 2011.

Mine Countermeasure Vessels: In early November 2010, another unit of the Wozang class mine countermeasure vessel (MCMV) was launched. Although there are some slight differences to the first of class unit, the hull and armament appear to be the same. Only the superstructure shows some slight modification with the lengthening of the bridge.

The Wozang class is made of glass reinforced plastic (GRP) and is around 60m (196.8ft) in length with a beam of 10m (32.8ft) and is likely powered by podded propulsors based on the stern hull form. Forward of the bridge is a deck-house that likely contains a variable depth sonar and combat information center. On the forecastle is one 37mm twin gun mount. A full array of mine-sweeping and neutralization equipment will be employed, including remotely operated vehicles (ROV) and autonomous underwater vehicles (AUV).

Since no additional units were built for over two years, unit one was believed to be a test vessel. It now appears that any bugs have been worked out in the design and the Wozang class will move forward. AMI believes that the class will enter the production stage with around ten units ultimately being built at the rate of one every 18 months.

Amphibious Vessels: On 18 November 2010, the second unit of the Type 071 landing platform dock (LPD) was launched at Hudong shipyard, about 3 months ahead of schedule

The hull as launched appears to be virtually identical to the first of class, KUNLUNSHAN, including sensors and armament. The only minor changes are to the superstructure near the bridge and appear to allow for more internal room in the pilot-house.

The LPD is approximately 160m (524.9ft) in length with a capacity of carrying up to three of their newly designed 33-meter LCACs, in addition to having a roll-on-roll-off (RORO) deck capable of transporting 20 tanks or 75 armored personnel carriers. The LPD also has a flight deck and hangar for two large transport helicopters, accommodations for up to 1,000 troops and staff personnel, command and control communications equipment, one medium caliber gun, a short range SAM system and four AK-630 CIWS.

With regards to the LCACs, the pilot house is on the port side of the craft with no navigation house as in the United States' (US) LCAC. Along each side, as in the US version, are the two engine compartments housing the gas turbine engines as well as the lift fans and air-screws. The deck of the Chinese LCAC is 28.8m

(94.5ft) long, 50% longer than American counterpart and can carry 2 light armored combat vehicles.

The Chinese LCAC is 33m (108.2ft) in length with a beam of 26.8m (87.9ft). The cargo deck is 28.8m (94.5ft) in length and 7.2m (23.6ft) in width. The bow ramp is 7.5m (24.6ft) wide and the stern ramp is 4.9m (16.1ft). Payload is reported to be 60 tons and the craft has a displacement of 170 tons when fully loaded.

It is powered by 2 QC-70 engines (7000 kW each) providing a maximum speed in excess of 40 knots and has a range of approximately 200nm. It is however reportedly less maneuverable than its American counterpart, due to the fact it does not possess reversible pitch air-screws or vectoring nozzles.

AMI anticipates that the PLAN will continue its plans to procure up to thirty-seven of the new LCACs to equip the projected fleet of Type 071 class LPDs.

Maritime Safety Administration (MSA): Although not covered in AMI's Worldwide Naval Projections Report (WNPR), the expansion of the MSA is certainly noteworthy in that China seems to not only be focusing on their naval aspirations, but is also realizing the need for new and more capable vessels to patrol its EEZ.

This expansion of the MSA was drafted into the 10th 5-year plan in 2000. The first phase of the buildup occurred in 2004 and 2005 that included the following;

- One 3000-ton class built by Jiangnan shipyard.
- One 1500-ton class built by Wuchang shipyard.
- Three 1000-ton Type I class (two by Wuchang and one by Huangpu).

Currently there are numerous cutters being built at multiple naval shipyards for the MSA. In the Huangpu shipyard two cutters, HAIJIAN-23 and HAIJIAN-75 were launched in September 2010. They are two of the four 1000 ton Type-II class cutters that are on order for Huangpu and are 75.8m (248.7ft) in length long with a beam of 10.2m (33.5ft).

In the Wuchang shipyard, HAIJIAN-15 and HAIJIAN-84 are currently receiving final outfitting and should commission by early 2011. Each cutter is 88m (288.7ft) in length with a beam of 12m (39.4ft), a 5.6m (18.4ft) draft and displaces 1,740 tons. They were launched earlier this year and will likely deliver in early 2011.

Also in Wuchang, a 3000-ton class cutter began construction in April 2010 and is scheduled to commission into the MSA in May 2011. Additionally, Wuchang is also contracted to build numerous 600-ton cutters the MSA and on 12 November 2010 received a contract for the construction of the largest MSA vessel to date, the HAIXUN 01, which is 128.6m (422ft) in length displacing 5,420 tons.

As part of the continuing buildup, projections for the MSA indicate the following vessels are to be procured in the 2011- 2015 timeframe:

- Three 5,000 ton.
- Three 4,500 ton.
- Four 3,000 ton.
- Six 2,000 ton.
- Sixteen 1,500 ton.
- Fourteen, 1,000 ton.

While the PLAN continues to expand their scope of operation to more of a blue water/global Navy, the MSA will be required to take on many of the roles that have been traditionally conducted by the PLAN. As such, an expansion of the MSA as well as adding much larger vessels to the inventory will certainly be required.

UNITED KINGDOM – Vangaurd Class Nuclear-Powered Ballistic Missile Submarine (SSBN) HMS VENGEANCE: On 02 December 2010, Babcock International announced that it had been awarded a contract by the UK Ministry of Defense (Mod) to commence the planning phase for the refit of the Ballistic Missiles Submarine HMS VENGEANCE. The planning phase for the Long Overhaul Period and Refuel (LOPR) will last for 18 months, at

which time the submarine will enter Devonport's Royal Dockyard for three and a half years.

The overhaul will include the replacement of the reactor core in addition to upgrades to strategic and tactical weapon systems and hull maintenance. The planning phase is being conducted by Babcock, the MoD and Rolls Royce. The LOPR will commence in 2012 following the departure of HSM VIGILANT, which will be concluding its LOPR.

INTERNATIONAL – Unmanned Systems Developments
Europeans Launch Unmanned Systems Programs

Europeans Launch Unmanned Maritime Systems Program: Ten European Defence Agency (EDA) member states (Belgium, Finland, France, Germany, Italy, Netherlands, Poland, Portugal, Spain, and Sweden) and Norway have agreed to launch a US$70M unmanned maritime systems (UMS) program. The agreement, signed on 09 December 2010, aims to improve mine counter measures, harbor protection, and antisubmarine warfare. A systems-integration group, established to coordinate the program, will also study future UMS launch and recovery techniques, torpedo defense, and energy supply for UUVs.

In a press release issued by the EDA, the UMS initiative is intended to encourage collaboration, reduce administrative burdens, and eventually shorten the concept-to-contract period associated with research and development. A wide-ranging network including navies, universities, national laboratories, and various industries are scheduled to participate.

DID YOU KNOW?

RUSSIA: On 14 December 2010, the Russian Navy launched its second Borey class nuclear powered ballistic missile submarine (SSBN), RS ALEXANDER NEVSKY, from the Severodvinsk shipyard.

INDIA – On 06 December 2010, the Indian Navy (IN) launched its fourth Saryu class (105-meter) offshore patrol vessel (OPV), INS SUMITRA, from the Goa shipyard.

DISCUSSION

Re: A JUNIOR OFFICER'S VIEW—Pro

LT Hong's analysis makes a strong case to, "Split the engineering and tactical officer career tracks" (THE SUBMARINE REVIEW, October 2010 issue, p. 109), based fundamentally on the fact that, "Every submarine officer must be a nuclear engineer and a tactician". Result: "too many tasks, not enough time", which increases the probability of mistakes in both the engineering and OPS areas.

The introduction of women into the Submarine Force provides a fortuitous opportunity to test the concept of two separate career tracks—warfare duty (WDO) and engineering duty (EDO)—for submarine officers (also applicable to surface warfare officers).

Some women have already been selected for submarine duty and nuclear power training in accordance with the existing policy that all submarine officers must be nuclear engineers. In addition, to test the two-track system, call for women volunteers for submarine duty from the fleet who have a minimum of two years sea duty and are qualified OOD's. Order them to a revised SOBC course to include, for example, virtual reality trainers (VESUB), Piloting and Ship handling Trainers (SPAN 2000), and additional/refresher training in electronic chart piloting and navigation (ECDIS), network-centric warfare, and effective utilization of the myriad advanced features incorporated in current periscopes.

Thus, in a little over six months from accession they would report to their first boats with a level of training in operational subjects and skills that will undoubtedly enhance the operational and combat readiness of the *forward* business end—the *raison d'etre* of all warships.

CAPT R.A. Bowling, USN(Ret), Ph.D.

Re: A JUNIOR OFFICER'S VIEW—Con

I read Lt. Hong's 'Discussion" article regarding possible ways to improve/change the Submarine Force (THE SUBMARINE REVIEW, October 2010). There is one section of the article I find a bit hard to believe, specifically that some higher authority would require the XO and CO to review *the training exam.* While it has been almost 30 years since I was CO of an SSN, as I recall most of my priorities were those I set for myself:

1. Tactics and Warfighting
2. Training and looking out for the officers and crew
3. Not running aground
4. Not having a collision
5. Passing major exams (ORSE, ORE, NTPI)
6. During major maintenance periods:
    a) Not letting seawater in the ship
    b) Not letting primary coolant out of the pipes
    c) Not pulling more than one rod during Control Rod Testing

I had tours as both an Engineer (USS SCAMP) and Navigator (USS POGY) and felt well prepared as XO and CO for those tours.

In summary, I think it is more the individuals than the *system* and would recommend we continue as we are.

Captain Mike Raggett, USN (Ret)
Former CO USS POLLACK (SSN603)
COMSUBRON THREE

RE: A JUNIOR OFFICER'S VIEW—
A Summary of the Problem

by RADM W. J. Holland, Jr., USN(Ret)

Lieutenant Hong's proposal to relegate the engineers to *back aft* and let the *real sailors* maneuver the ship is not new or without respectable precedents. The Royal Navy made that decision with the advent of steam propulsion and has followed that plan ever since. However in judging the merits of this division of labor the objections of the two great engineers who created the modern U.S. Navy deserve some attention. Both Isherwood in 1870 and Rickover in 1950 insisted that the operation of the ship required commanding officers to be in charge of every aspect of the ship's operation. When this happens, the results over time are beneficial and can be seen in every facet of the ship's operation and maintenance.

The general aversion among surface warfare officers to assignment as *snipes* has effects easily identified in the general degradation of the material condition of surface ships over time. At least twice in the last forty years, once in each generation, drastic measures had to be taken to restore the material condition of the surface warships and the competence of their officers to operate them. More recently, INSURV findings on AEGIS Weapons Systems generated a flag level panel (The Balisle Board) whose review of surface ship material conditions in general resulted in findings critical of maintenance, manning, training and management.

Among the findings of this panel, acceptance of degraded conditions and failure to pursue correction by officers in charge indicates the lack of substantive technical knowledge by individual officers. This situation is not the result of malfeasance or neglect but rather ignorance, the result of short duty tours, lack of education and delegation of responsibility for their material conditions outside of the chain of command.

The decision to require line officers to master the technology of ship's propulsion—made over a hundred years ago—set the stage for a grasp of technical details in commanders. The proposal to relegate these details back to engineering duty specialists carries the second-order effect of removing technical competence from line officers just when the technologies of maritime warfare have become even more complex than those of ship's propulsion. The knowledge demanded of submarine officers in the understanding of the physics of their propulsion plant also generated understanding of the physics of sound in the sea.

No commanding officer can know everything about how his ship runs but he can, if motivated, find out anything that any member of the wardroom or crew knows. But unless he has enough knowledge to determine that something might be wrong he is at the mercy of his subordinates. He cannot begin corrective measures or even set the tone for his department heads and chief's quarters unless he has an appreciation of the nature of the equipment and the fundamentals of its operation. This knowledge and appreciation is not a product of the Prospective Commanding Officer course, it is the substance of several years as a division officer and then as department head and then attention to details throughout the ship as the executive officer. After this education, one arrives as commanding officer with a detailed understanding of how at least two divisions and one department work, as well as a general understanding of the rest.

Lieutenant Hong cites the essay of Admiral Stavridis and Captain Hagerott [see James Stavridis and Mark Hagerott, "The Heart of an Officer: Joint, Interagency, and International Operations and Navy Career Development," in the Naval War College Review, Spring 2009 issue, pp. 27-41] in which they argue for a greater emphasis on general history, language and sociology at the expense of engineering and technology. Both officers, holding PhD's in non-technical disciplines, consider their career paths as that most appropriate and useful. So it is—for them. But the thrust of their argument, based upon their own histories and experiences, is not congruent with the mission of the Navy. Officer selection, training, education, and experience are not, and should not be, intended to prepare officers to serve as joint

combatant commanders. The Navy needs to produce only a handful of senior officers each year for these tasks. But several hundred officers are required as commanding officers of battle groups, amphibious ready groups, ships, aircraft squadrons, and the shore stations supporting them. To execute their responsibility, these officers need to know how their equipment works.

These commanding officers are those who execute the actual function of the Navy—to serve at sea or in direct support of those who do. The Navy's job is at sea, there to perform effectively and efficiently over long periods. The individual components that perform the functions are highly technical in form and substance. While a grasp of history, political science, and sociology is useful and mastery of language is extremely beneficial, these are not areas that help officers to operate and maintain complex machinery. In their essay Admiral Stavridas and Captain Hagerott acknowledge that their suggestion should not apply to those involved in operating nuclear power plants, thereby acknowledging the vital nature of expertise as an inescapable element of the operation of the ship. However, conditions such as the Balisle Board has described in the surface warships point to the conclusion that technical competence and engineering management knowledge and skills are needed by all officers involved in operating and maintaining a complicated warship.

Previous episodes in which concerns with the machinery of the ships were relegated to the sidelines resulted in such a poor state of material conditions and upper-level supervision that Admiral Holloway, then Chief of Naval Operations, had to require special engineering training for all officers going to command at sea: the establishment of the Propulsion Plant Examining Boards and years of attention were needed to restore surface ships to reasonable standards of readiness.

Those mandates and corrective actions did not pertain to the Submarine Force. Understanding the nature of machinery, attention to detail and pursuit of corrective measures for degraded material conditions has been a hallmark of submarines—starting with commanding officers—since World War II. To relegate the major responsibility for a major segment of the ship to someone other than

the commanding officer would be a step toward creating the conditions that the Balisle Board has identified in surface warships.

In dealing with the other side of this issue, can a good engineer be a sound tactician, a skillful ship handler and a respected leader? Evidence from the Cold War operations indicates that usually the better engineering managers are the better tacticians. Understanding the geometry of a bearings only solution, dealing with the settings for multi-sensor sonar systems, deciding the settings for a long range acoustic homing torpedo or maneuvering a submarine for a bottom survey of an uncooperative target are among the facets of submarine command not generated in philosophical discussion or found in a chapter of Mahan. Nor are they gained overnight or imparted by the laying on of hands. The skill sets for submarine officers are wide and diverse but the foundation lies in an appreciation that if the ship can't get underway she is a liability, not an asset.

FEARLESS FREDDIE THE PIED PIPER

by CAPT. Don Ulmer, USN(Ret)

The late World War II submariner great, Rear Admiral Frederick (Fearless Freddie) Warder served his *twilight* tour as Commandant of the Eighth Naval District headquartered at New Orleans, Louisiana, 1959-1962. An old diesel boat axiom went; give a job to the officer least qualified to do it. He has the greatest need, and what better training than on the job? Thus the admiral selected his aide, an unlikely Lieutenant from a New London based submarine.

Though the hapless Lieutenant's new job involved no decision-making authority beyond scheduling the admiral's haircuts (usually overruled), the new aide was given insight to naval, social and political life that exceeded his wildest dreams.

The white tie and tailed de rigueur New Orleans social set embellished each of its continual social events with the admiral's presence, the aide tagging along in his newly purchased formal uniform and dress aiguillettes not unlike those worn by doormen standing before posh downtown hotels. Mardi Gras, most prominent among these soirees, the two submariners found themselves heavily involved. They later agreed from the inside, these were fraught with tones of mid-nineteenth century antebellum convention leaving the impression the Civil War had really been won by the South.

At the Admiral's quarters on Naval Base, New Orleans, the aide once took a phone call from the local congressman's Washington DC based staff and found himself squarely between a rock and a hard place. The staff member at one end had no wish to come to New Orleans, but insisted this sentiment not be shared with the Congressman. The reluctant legislator sitting nearby stated he did not want the *staffy* to come to the Big Easy, but he too did not want this known. And so the aide got baptized in on-the-job juggling training.

The aide accompanied his admiral in 1960 for an office call on the late Arkansas Governor Orval Eugene Faubus, best known for his 1957 stand against the desegregation of public schools during the Little Rock Crisis. He defied a unanimous decision of the United States Supreme Court by ordering the Arkansas National Guard to stop African American students from attending Little Rock Central High School. Faubus had mellowed considerably by the time of the admiral's call. Despite his initial staunch segregationist stance, the governor moderated his position substantially, later endorsing the Reverend Jesse Jackson in the 1984 Democratic presidential primaries. The aide heeded advice by Abraham Lincoln; *Better to remain silent and thought a fool than to speak out and remove all doubt.* He accordingly sat quietly and listened. The governor attempted to return the call a day later at Admiral Warder's motel room only to find the old sailor had gone bass fishing on nearby Lake Ouachita. Faubus opted for second best and closed the loop by visiting a surprised aide who received the governor in his own room in boxer shorts and T-shirt.

The ceremony celebrating Texas's own, the Honorable John B. Connally's ascendancy to Secretary of the Navy for the newly elected Kennedy administration, found Admiral Warder among the distinguished guests. Organizers of the event opted for a stag head table that included Vice President Lyndon B. Johnson and Admiral Warder with other notables. An apprehensive aide drew the duty of being escort to Mrs. Idanell Brill Connally, wife of the new secretary. The gracious lady put the young man quickly at ease. "Call me Nellie," she told him through a smile he'd remember the rest of his life.

Mrs. Connally is known for personal grace and deep commitment to public service, however the distinguished alumnus of the University of Texas credits her high profile to her marriage to the late Texas Governor John B. Connally. Actually, Nellie was a celebrity in her own right, working tirelessly and effectively for numerous worthy causes over several decades. She rode in the Presidential limousine on the day President Kennedy was assassinated and her husband seriously wounded.

All the aide will say about his most exciting naval involvement of those days is, "If I told ya, I'd have to kill ya," so leave it

at that.

With all his newly amassed experience, the aide acquired an unwarranted sense of self-confidence and mistakenly assumed the time had come to make decisions on his own. He later would concede this idea to be the worst of his naval career if not his entire life.

The French Navy, represented by the cruiser JEAN BART, came to town, and back-to-back partying commenced, most till the wee small hours, hosted alternately by the Mayor of New Orleans, the French Consul, officers of JEAN BART, and Admiral Warder.

Following the final round of parties, the French aide approached our aide and extended a gesture of respite to the partied out Americans. He offered not to invite them to an early morning event; a wreath laying at historic Jackson Square across the street from St. Louis Cathedral. Our aide accepted, believing his admiral would be pleased with prospects of a Sunday morning sleep in. Big mistake! After proudly announcing his decision, he received a spirited homily on the true role of Flag Lieutenant decision-making and other miscellaneous customs of the service ramifications. The French planned to land an armed honor guard and Navy protocol stipulated this could be done only if the local senior U.S. naval officer was present.

The dust settled, Warder devised a plan to carry out the Navy stipulation while not unduly embarrassing New Orleans' distinguished and popular guests. A mass had been scheduled at St. Louis cathedral immediately prior to the event. The admiral reasoned, *What could possibly be wrong with attending mass with his aide and the aide's precocious five-year-old daughter? Then afterwards, walk across the street to watch the ceremony just like everyone else?*

The plan was carried out. Prior to the wreath laying, the admiral, his aide, both in dress blue uniforms and the aide's nicely turned out daughter emerged from the cathedral and stood where they could be easily seen by the French officer in charge of the ceremony. Warder looked on happily, the protocol having been satisfied. The officer approached, saluted Warder and invited him to inspect the honor guard. The aide, believing his daughter's role had been played out, moved to lead her away. No! Warder had

other plans. Hand in hand the admiral and his young friend trooped *les lignes de matelots francais* (*the lines of French sailors*), the little girl inspecting each man from head to toe in the manner of an accomplished drill sergeant.

The anxious aide wrung his hands, knowing his offspring would at any moment fall into one or more antics among her plethora of little girl diversions, skipping, jumping, squealing, even an occasional cartwheel. Miraculously, this did not happen. Apparently Admiral Warder numbered pied piper among his many talents. *Daughter of the regiment*, as he would later call her, stole the show. Following the ceremony, the *daughter* conducted herself admirably, socializing with the admiral, senior French officers, and the consul himself as though it were a perfunctory event in her daily life. The day had been saved and in grand style. The aide would live to serve a bit longer.

The aide's daughter and the admiral shared an unlikely common passion: raw oysters. The ceremony concluded with no serious damage done, Admiral Warder treated his aide and new accomplice to a freshly shelled serving of the tasty bivalves at a curbside table in the heart of New Orleans' vieux carre (old square). Three beer steins sat before them, but passers-by could not discern *the daughter of the regiment*'s contained only root beer.

NAVAL SUBMARINE LEAGUE SUPPORTS PEO SUBMARINES IN SPONSORING SCIENCE, TECHNOLOGY, ENGINEERING AND MATHEMATICS EVENT

by Mr. Andy Garlikov
Marketing Communications
NGES Marine Systems Business Development

The dedicated and intelligent men and women in the military, in government, in academia and in industry have always been the key to the US Navy's undersea dominance. Without a first-rate education system, the Navy would not be able to recruit the best and brightest to operate submarines, nor would industry have the scientists and engineers to design and build them. The Naval Submarine League has always supported that system in many different ways, most recently last year.

In November 2010, the League helped sponsor a Science, Technology, Engineering and Math (STEM) event, run by the Navy's Program Executive Office for Submarines (PEO SUBS) that reached more than 500 5th grade students at the California Science Center in Los Angeles, California.

The program, called Mission Ocean, is an interactive and collaborative teaching platform developed by Purdue University-Calumet's Center for Science and Technology Education. The event demonstrated a part of what schools operate as a year-long curriculum that allows students to apply math and science learned in the classroom to driving a computer-generated research submarine on a search for an underwater volcano.

The event, the third held in the state in conjunction with the November 6th christening of the Virginia-class submarine, CALIFORNIA (SSN 781), took place at the California Science Center in downtown Los Angeles. After Jeffrey Rudolph, the

president of the Science Center, welcomed the students, CAPT Jeffrey Sapp, USN (RET) challenged the students to excel academically and to drive for success. He used examples from his Annapolis education and naval career to motivate the students—and the teachers who brought them to the event—to get the crowd excited about math and science education.

Dave Miskimens and Jeffrey Rudolph

After CAPT Sapp's warm-up, Dave Miskimens, PEO SUBS' Director of Undersea Systems, intrigued the students with his description of life on a submarine and wowed the entire audience with footage from the construction and christening of the CALIFORNIA. Every pair of eyes in the room widened when the video from the christening showed the massive size of the Virginia-class ship.

CAPT Jeffrey Sapp USN(Ret) with students

Next came the main event, a demonstration by representatives of a local Girl Scout troop of how to drive a submarine. Seven young women, all of whom had been through the Mission Ocean curriculum, successfully navigated their submarine simulator through the scenario while the audience watched and listened to every step of the process.

Following the submarine simulation the students, with support from Navy personnel from around Los Angeles, wrote postcards to send to sailors during the holiday season. They were then treated to lunch (sponsored by the Submarine League), before returning to school. In the audience was a school superintendent, Stan Sheer, who is now planning to integrate the Mission Ocean education platform into his school's curriculum this fall! Thanks to the success of the Mission Ocean program in California, students in Mississippi, Minnesota and North Dakota may also get the chance, as the submarines named after their states are launched, to learn through this valuable and effective STEM initiative.

The Submarine League thanks Northrop Grumman Marine Systems for their generous financial support that made this program, and its long-term impact on math and science education, possible.

The Rise of the Submarine Launched Ballistic Missile

Submarine History Seminar

14 April 2011

The Rise of the Submarine Launched Ballistic Missile

Thursday, 14 April 2011

Participants:

Mr. Franklin C. Miller, for twenty-two years held progressively senior positions in DOD Policy and four years as the Senior Director for Defense Policy and Arms Control on the National Security Council staff

Vice Admiral Jerry Miller USN (Ret), author of ***"Stockpile"*** and ***"Nuclear Weapons and Aircraft Carriers";*** formerly Deputy Director, Joint Strategic Targeting and Planning Staff (JSTPS).

Mr. Phillip E. Lantz, founder, President and CEO of Systems Planning and Analysis, Inc.

Moderator: Captain Peter Boyne USN (Ret), formerly Deputy Director of Strategic Systems Programs (SSP).

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REMEMBERING JOHN MERRILL

By James C. Hay, Editor, The Submarine Review

The submarine community, in general, and The Submarine Review in particular, lost a true friend and valued contributor when John Merrill Sr., 93, passed away recently at his home in Waterford, Connecticut. John will be well remembered for his accomplishments in many fields; for his professional career in submarine electronic systems development, for his efforts in support of libraries and colleges within the civilian community, and for his prowess in swimming competitions at the Masters level—he was still winning medals in his nineties. Readers of this magazine will remember him for his large body of work in describing the foundations of the technological development which led to American dominance in the difficult world of undersea warfare. His writings for The Submarine Review covered over twenty subjects appearing in full or in parts in more than thirty issues. A summary listing of those articles is appended here.

John started his service to his country in the thirties as a Coast Guard surfman at a Great Lakes station. He soon showed aptitude for the radio field and early in World War II he was sent to the Capitol Radio Engineering Institute in Washington, D.C. He stayed in communications for the rest of his thirteen years as a Coast Guardsman. Married during the war, John and his wife Josephine soon settled in Connecticut. On completion of his active duty, John concurrently went back to school and started work at the Navy's Underwater Sound Lab in New London. Initially at Mitchell College, he completed his Bachelor's and Master's degrees at Hillyer College (now the University of Hartford), but he maintained a long-term relationship with Mitchell as an instructor and mentor. In point of fact, John was one of six, out of his immediate family of seven, who went to Mitchell.

John Merrill's career at the Underwater Sound Lab/Naval Underwater System Center was long and distinguished. By the time he retired he was Head of Submarine Electromagnetic Systems. In 1974 he was presented the NUSC Award for Excellence in Management and in 1979 he received the Decibel Award for contributions to submarine communications. After retirement he was given emeritus status and completed a number of projects for the New London and Newport Labs.

He was an active member of the Nautilus Chapter of the Naval Submarine League. At various times in retirement (by his lights a term used only to describe a time-period, not an activity level) he served as President of the Waterford Library Board and on the Connecticut State Library Board. He was also a Fellow of the Blunt White Library at Mystic Seaport and enjoyed working at the Shain Library of Connecticut College.

All his many friends and admirers of his work, here at the League and the magazine join with his family in celebrating his life. We shall miss him.

John Merrill's Articles in THE SUBMARINE REVIEW
Listed chronologically by the issue of publication.

April 1993	Ft. Trumbull—A Navy High Technology Site
January 1995	P.M.S. Blackett, Naval Officer, Nobel Prize Winner, Submarine Hunter
April 1996	Submarine Radio Communications 1900-1945
July 1998	April 1900: Inventor-Builder John P. Holland Delivers First US Submarine Pt I
October 1998	April 1900: Inventor-Builder John P. Holland Delivers First US Submarine Pt II
January 2001	World War II: Japan's Disinterest in Merchant Ship Convoying
January 2002	Looking Around: A Short History of Submarine Periscopes Pt I
April 2002	Looking Around: A Short History of Submarine Periscopes Pt II
October 2002	Submarine Bells to Sonar and Radar: Submarine Signal Company 1901-1946 Pt I

April 2003	Submarine Bells to Sonar and Radar: Submarine Signal Company 1901-1946 Pt II
July 2003	Depth Charges; An Early Anti Submarine Weapon Pt I World War I
October 2003	Depth Charges; An Early Anti Submarine Weapon Pt II World War I
April 2004	Mathew Fountain Maury; Naval Officer, Scientist and Oceanographer
January 2005	Sea Mines; The Submarine's Adversary and Weapon 1775-1918 Pt I
July 2005	Unlikely Allies; Great Britain, France, US and Japan in World War I
January 2006	Loran Showing the Way—Long Range Navigation (Land, Sea, Air) Pt I 1940-1942
January 2006	Sea Mines; The Submarine's Adversary and Weapon 1775-1918 Pt II 20th Century
April 2006	Cold War Physicist Nicholas Christofolis
April 2006	Obituary for Dr. Donald Miller
January 2007	US Navy and 20th Century Oceanography: Summary 1900-1960 Pt I
April 2007	US Navy and 20th Century Oceanography: Summary 1900-1960 Pt II World War II
July 2007	Remembering the Sound Surveillance System Pt I
October 2007	Remembering the Sound Surveillance System Pt II
April 2008	Origins of the National Research Council: A Presence in 20th Century Naval Matters
July 2008	RCA and the Navy
January 2009	Perceptions/Realities: Thoughts on Quantum Physics
April 2009	Submarines in Early US Naval Institute Proceedings Pt I
July 2009	Submarines in Early US Naval Institute Proceedings Pt II
October 2009	Nathaniel Bowditch: Naval Navigator, Mathematician, Scientist, Actuary 1773-1838
October 2010	Operations Research: Evolution

PROJECT AZORIAN: THE CIA AND THE RAISING OF THE K-129

by Norman Polmar and Michael White

Published by the Naval Institute Press, Annapolis, MD, 2010

Reviewed by Mr. John D. Alden

The end result was unimpressive: after a six-year effort the CIA managed to recover a relatively insignificant section of an almost-obsolescent Soviet submarine from the depths of the Pacific Ocean, while the desired missile and control compartment slipped out between broken claws of the grab device. One is immediately reminded of the recent Macondo oil well blowout in the Gulf of Mexico at a depth of over 4,000 feet, which was finally sealed by an intercepting well some 2½ miles below the sea floor. The ill-fated drill rig Deepwater Horizon only a year before had completed the deepest well in history at 35,050 feet in 4,132 feet of water.

The difference is that the salvage of the K-129 took place in the mid-Pacific Ocean 36 years earlier, using technology then "well beyond the state-of-the-art in numerous engineering and scientific disciplines." Just locating and photographing the wreck earned the USS HALIBUT (SSN 587) a Presidential Unit Citation. The grab itself was at the end of a 16,800-foot, or over three miles long, string of drilling pipe, the whole—including the object to be lifted—weighing some 8,000 tons. This was suspended from a massive stabilized platform that held the lifting rig steady despite the constant motion of the ship. Not only that, the super-secret project was carried out under the very noses of Soviet spy ships, as well as hidden from the inquisitive world press, in the guise of the highly-visible *Hughes Glomar Explorer*, a ship ostensibly intended to mine manganese modules from the deep ocean floor.

How U.S. acoustic experts were able to locate a sunken submarine that the Soviet navy couldn't find, American engineers designed and built an unprecedented ship and lifting system, and proponents of the project succeeded in extracting the necessary funding, is all spelled out and expertly illustrated by naval analyst Polmar and TV producer White in fascinating detail. Along the way they deconstruct years of misinformation and conspiracy theories published by earlier authors, thanks largely to a newly-released—although severely redacted—CIA account of the operation plus information from key former-Soviet sources.

Three decades later, Project Azorian is still justly rated as "history's most ambitious ocean engineering effort." Ironically, it even picked up a few unsought manganese nodules in the process.

BLOOD ON THE SEA: AMERICAN DESTROYERS LOST IN WORLD WAR II

by Robert Sinclair Parkin

Da Capo Press (www.dacapopress.com), 1995, 360 Pp.
$ 21.00 (CAN $32.00), ISBN: 0-306-81069-7

Reviewed By:
CDR Mark R Condeno PCGA
Liaison Officer, Foreign Armed Forces Attaché Corps
International Affairs Directorate
Philippine Coast Guard Auxiliary

Sleek, fast and heavily armed- from stalking U-boats in the Atlantic to dodging Kamikaze suicide planes in the Pacific they were there. From convoy escorts to shelling enemy installations, United States Navy Destroyers took the brunt of some of heaviest battles of World War II.

Yet, unknown to many, 71 of the type of various classes were lost during the war, *Blood on the Sea* is their Story. The author, the late Robert Sinclair Parkin (*Under the White Ensign*), deserves a commendation for this excellent reference. A veteran of the United States Navy, he has collected information on this vessel class in his twenty year career.

Although without chapters, the book is chronologically arranged through the dates of loss of each ship. It commences as we board USS REUBEN JAMES (DD 245), then escorting Convoy HX 156, when she was struck by a torpedo from the German Submarine U-562.

Another gallant warrior lost in enemy action of the freezing Atlantic waters was the USS BORIE (DD 215) as it engaged in a surface battle with U-405. From the Atlantic, the book takes us to the Mediterranean as the USS ROWAN (DD 405) tangled with German E-boats off Salerno, Italy. We then proceed to the vastness of the Pacific during the critical days, as the war with Japan began. Apart from those present at the Pearl Harbor attack, some of the earliest destroyers to be in action were those on the

Asiatic Fleet, such as the USS PEARY (DD 226) and USS EDSALL (DD 219). The former was lost during the attack in Darwin, Australia, while the latter off Indonesian waters in 1942. Some of the destroyers listed would be lost not due to enemy action, but of Force Majeure, such as the ships lost during a massive typhoon at Leyte in the Philippines to that of the USS TRUXTUN (DD 229) during a blizzard off New Foundland.

A well written and researched treatise, the author's narrative along with accounts of survivors is lucidly told. The readers will grasp the heat of action; be it against an enemy battleship, fighting fires aboard, search and rescue, to the deeds of valor and selflessness against insurmountable odds. Added to this is the ship's history from its namesake, launching date and battle awards received. The book is well supported by a 15 page photo section, maps indicating the ships final resting place, to an appendix that contains a listing of all American Destroyer classes during the era with various details, to Destroyers lost or damage to Kamikaze attacks. A two page account on US Destroyer Escorts (DE's) is also provided. It is supplemented by a glossary, selected bibliography and a 12 page index. Blood on the Sea is an indispensable reference work to students of Naval History and US and Allied Destroyer Operations of World War Two.

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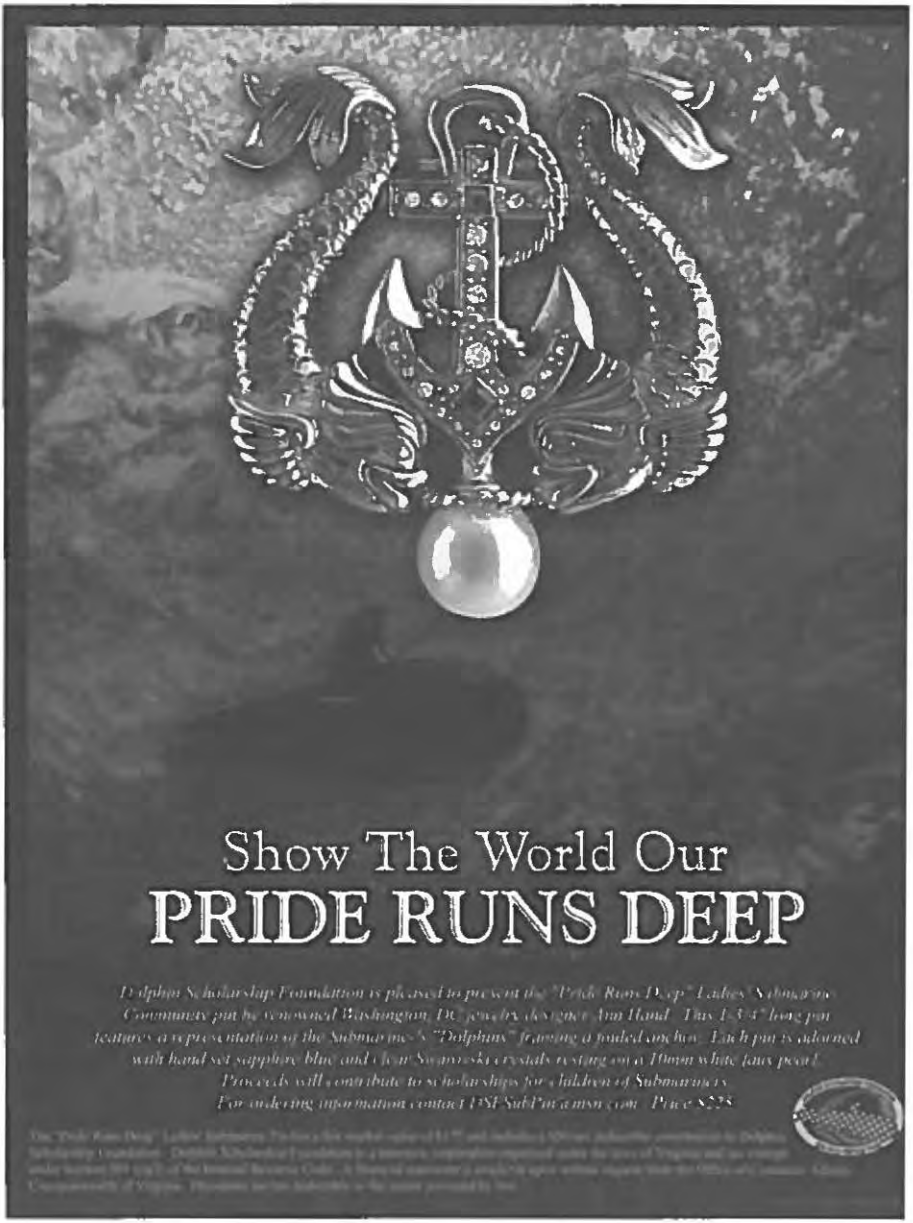

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