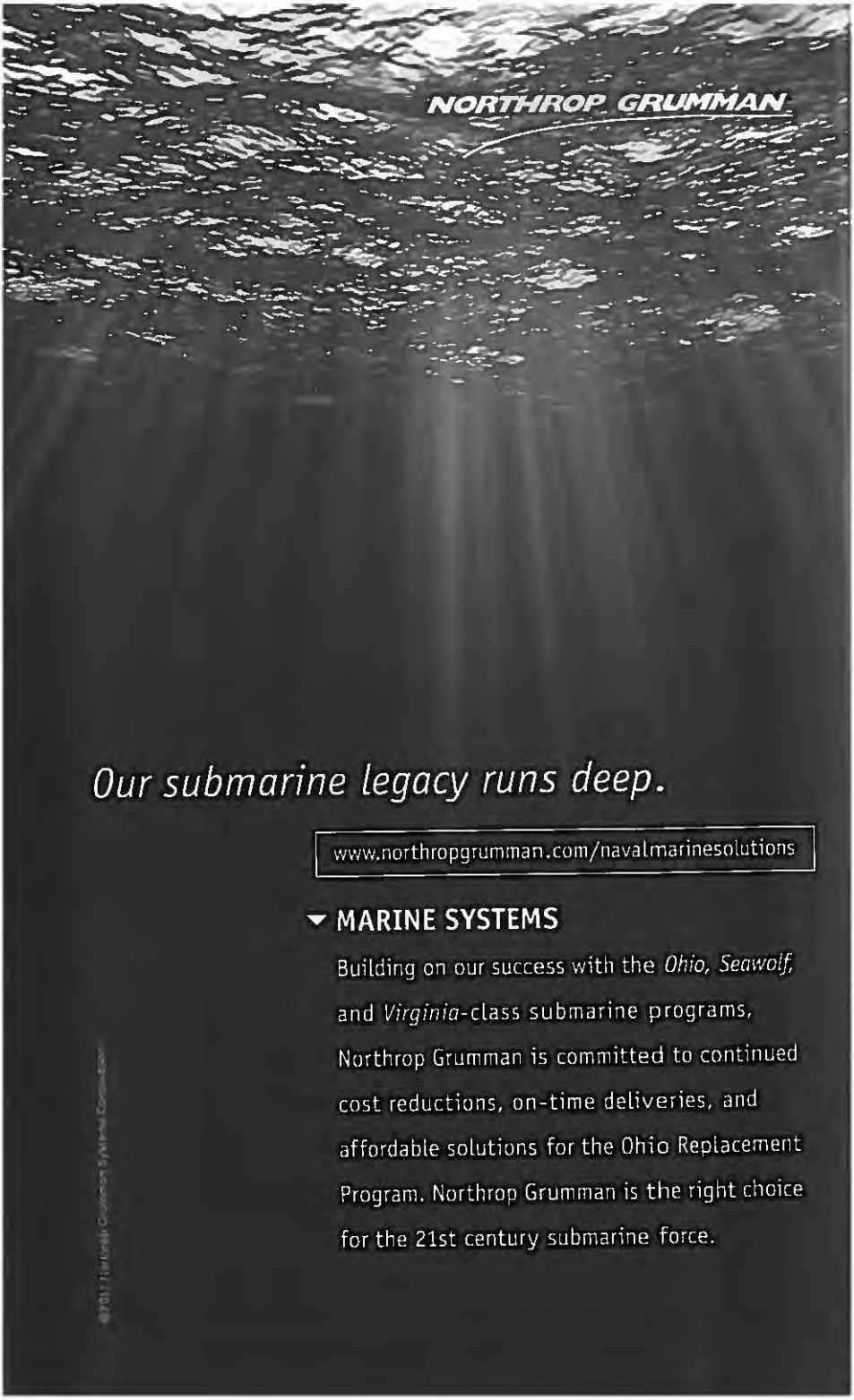
APRIL 2011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EDITOR'S COMMENTS

The Submarine Force leadership has formulated a *Way Ahead* which is of prime importance to the future of submarines as a major part of America's security for the twenty-First century. The critical factor of their *Way Ahead* is the recognition of the current national fiscal environment and three major force structure problems, which have to be addressed and solved within that environment. The plan was introduced at the Naval Submarine League's Corporate Benefactors' Day and those presentations lead off this issue of THE SUBMARINE REVIEW.

The Commander, Submarine Forces, VADM John Richardson's speech outlined the general objectives and mechanics of the plan and RADM Michael Conner's detailed the three problems and the avenues to be used in answering those significant challenges. His presentation is probably the most detailed and far reaching ever reproduced in these pages. The first point to be realized must surely be the seriousness of the three problems; the challenge of producing the OHIO Replacement SSBNs, on time and in numbers needed; meeting the shortfall of SSN numbers as the 688s retire; and the underappreciated severe decrease in strike assets upon the retirement of the SSGNs. The second point, which stands out is the obvious necessity for the entire submarine community to be cognizant of this effort.

The *Way Ahead*'s opening argument is that the OHIO Replacement Program has to be the first priority. To insure that replacement against undue risk and avoid the complexity of developing a new missile, the plan is to continue with the D-5 Trident II missile. RMDL Terry Benedict, Director of Strategic System Programs, briefed the complex plan by which SP is updating the baseline D5 missile system for the new generation SSBNs. His presentation at the February event is also published here as an integral part of the *Way Ahead.*

As a further part of that integrated undersea strategy, is the work being done by the submarine community in its continuing appraisal of emerging technologies. The series of Submarine

Technology Symposia sponsored jointly by the Naval Submarine League and the Johns Hopkins University Applied Physics Laboratory is an excellent example of that support. Mr. Dan Tyler, Head of the National Security Technology Department at JHU/APL, and his associates have characterized the objectives of that series and encapsulated its history in effectively describing the rigor and thoroughness whereby the submarine community come together to support undersea development.

For our Special Presentation, Air Force General Chilton, the former Commander of the US Strategic Command has graciously permitted us to transcribe and publish his remarks to All Hands at King's Bay early this year on the eve of his relief and retirement. The General's talk centered on Deterrence; its absolute importance to the nation, and how little it is understood by the general public. He also complimented and thanked the submariners for their contribution to this vital effort in the prevention of total war. His personal, knowledgeable remarks place the strategic force priority of the *Way Ahead* in a very appropriate context.

The issue is filled out with a collection of articles, opinions and reviews which again illustrate the breadth of submarine community interest. As to breadth, for the history buffs, the Fleet Boat guys, and especially for those looking to a natural expansion of submarine capabilities to emerging needs, CDR John Alden has given us some fascinating information on the submarine gun actions against Japanese picket boats. His discussion of the *deck gun* capabilities goes back to the 20s and the Submarine Officer Committee differences between the ADM Hart's group *no-gun* opinion and the young turks led by Lockwood arguing for a *competent -gun* capability. It seems determination of requirements has always been a source of heated discussion.

Jim Hay
Editor

FROM THE PRESIDENT

The Submarine Force is delivering submarines ahead of schedule and below cost. The approval of the FY 2011 budget has funded two submarines per year for the first year in the Five Year Defense Plan and Navy Shipbuilding Program. The leadership of the Submarine Force has a clear vision for the future as budget and force structure issues define the challenges that lie ahead.

The Naval Submarine League completed its fiscal year on 31 March 2011 meeting its goals and objectives. The League's investment portfolio recovered the unrealized losses during the recession and is now adding to its overall value. Sponsorship by the Corporate Benefactors for the Annual Symposium, Corporate Benefactor Recognition Days, and the Annual History Seminar keep these important events viable, and their generous support allows the League to keep the cost for attending events down while providing outstanding quality in both program and venue support.

Corporate Benefactors continue to be the lifeblood of the NSL and eight new benefactors were added during this fiscal year. When you see Corporate Benefactors at one of the League events, please thank them for their continued support and encourage new submarine-related businesses to join the League as Corporate Benefactors. All of us in the Naval Submarine League need to get the word out to our communities about the value and capability of submarines addressing the uncertain demands of the future. The Submarine Force leadership has established a clear plan and we need to do our best to support it. With the assistance of the Submarine Industrial Base Council, we will also launch an educational campaign to assist the over 5000 businesses currently supporting the submarine building program in presenting the importance of the submarine to national defense, their business base, and their community.

The Corporate Benefactor Recognition Days held 2-3 February 2011 was well attended and successful. Substantial active duty submarine flag officer participation and high quality guest

speakers were highlights of the event. On Wednesday evening, ADM Kirk Donald identified the substantial challenges that lie ahead with more than 250 members of the League's submarine support community and the Benefactor's appreciated the opportunity to interact with the active duty flag officers at the reception that followed. The Honorable Robert Work, Under Secretary of the Navy spoke to the luncheon audience and noted the significant financial pressure that the Defense Department and Navy will experience over the next five years. VADM Steve Stanley, Principal Deputy Director of Cost Assessment and Program Evaluation, Office of the Secretary of Defense, addressed this pressure, discussing the overall reduced funding that will be available over an extended period to meet combatant commander requirements and the importance of the Submarine Force leadership in establishing their strategy to chart their "Way Ahead". VADM John Richardson used the event as a first opportunity to brief Corporate Benefactor's on his "Way Ahead" for the Submarine Force and RADM Mike Connor, Director, Submarine Warfare, expanded on these concepts with the introduction of three levels of effort to meet immediate, current year and next five years of submarine operations with the current and project force requirements. RDML Dave Johnson and RDML Terry Benedict each provided the current status report for the two major submarine acquisition programs.

The Annual History Seminar, ***"The Rise of the Submarine Launched Ballistic Missile"*** was held at a new venue, the National War College, as part of the Commandant's Lecture Series, hosted by RADM Doug McAneny, the new Commandant. This outstanding facility and speakers provided insights on the importance of the submarine launched ballistic missile in the environment of the new START treaty, with over 70% of the strategic nuclear arsenal migrating to the submarine.

The Submarine Technology Symposium will occur at The Johns Hopkins University Applied Physics Laboratory on 17 to 19 May 2011. Registration for this outstanding event was closed on 6 May due to facility seating restrictions. The Submarine Force leadership will expand on their "Way Ahead" strategy in this

classified forum. Featured speakers include the Chief of Naval Operations, Commander Fleet Forces Command, Director, Naval Reactors and other members of the Submarine Force Leadership team. The entire first session will focus on the current state of submarine capabilities to meet mission requirements. A submarine Flag Officer will kick off each session and a technical presentation by an active duty submariner will be included in each session.

The final NSL event for 2011 will be the Annual Symposium to be held at the Hilton McLean Tysons Corner, Virginia on 19-20 October 2011. The Submarine Force Fall Cocktail Party will be held on the first evening of the program. Please be on the lookout this summer for the mailing to all members, which will include a ballot for the election of NSL Board of Directors.

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

The online Membership Directory provides an outstanding resource for contact information on League members and your continued assistance in updating this resource is appreciated.

On a personal note, thanks for your encouragement and support as I take on this assignment. I look forward to visiting many of the chapters this year and look forward to meeting with you during these meetings.

John B. Padgett, III
President

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WAY AHEAD—AN INTEGRATED STRATEGY

NAVAL SUBMARINE LEAGUE
CORPORATE BENEFACTOR RECOGNITION DAY
VADM JOHN M. RICHARDSON, U.S. NAVY
COMMANDER, SUBMARINE FORCES
3 FEBRUARY 2011

Admiral Mies, Admiral Stanley, Admiral Connor, Admiral Padgett, Naval Submarine League, and Corporate Benefactors, thank you for all you do to support the Naval Submarine League and the Submarine Force.

You've heard that phrase—this person needs no introduction—I am not that guy. Thank you, Admiral Padgett, for the very kind introduction, but what is missing from my bio is that I am here in a large part because of all of you and the personal influence that so many of you have had on my wife Dana and me. Many have been very kind educating me about the complexities of their businesses and the challenges that they face. Many, both on active duty and from the private sector have been very patient in mentoring me throughout my career, and giving me chances to succeed.

I'm proud to be a product of all your influences. For Pete Scala and the rest of the signal processors in the room, if you did a Fourier Transform on me, you'd get a weighted sum of all of you.

I think that it's exactly this close-knit team of active duty, retired, and business contributors that is the secret potion. It's a community that is bound together by the challenge—the responsibility—of fielding the best technology in the world, in the hands of the best people in the world, and putting them together in the most dangerous and challenging environments in the history of conflict.

I would argue that it's a community where the people and the operational challenges combine in a crucible that forms a culture, a binding energy, and an asymmetric influence that few groups in history have had—I'm reminded of the U.S. Marine Corps and

maybe even more so, the Jesuits—where there are no retirees on the roster, but those who "pray for the church and the society." I'll have more to say about that later.

Last night you heard about the Strategic Environment in Admiral Donald's terrific speech. He laid out the challenge in clear terms and outlined broad areas where the Submarine Force will continue to contribute—to meet our responsibilities—to the Navy and the Nation in the future. The picture he painted was one of opportunities and constraints, of obligations and obstacles. As I listened to Admiral Donald's talk, I started to feel more and more comfortable, and towards the end I was downright hopeful! For these are precisely the conditions where our competitive advantages and our unique contributions shine brightest—our competitive advantage becomes more clear. We do best under adversity—it's our nature. Our ships are designed for it, and our people are trained for it and our force thrives in it.

And you don't have to believe me - just look to our history.

In 1941 at the beginning of WW II, the Submarine Force was the first to take the fight to the enemy after Pearl Harbor as Jumpin' Joe Grenfell on GUDGEON got underway on Dec 11, 1941 to execute unrestricted submarine warfare. Those were dark days—certainly from a military perspective and also financial hardship as we were still recovering from the Great Depression. There was a tremendous amount of adaptation from a peace-time Navy to a war time footing—changes in operational boldness, initiative, as well as technology. 203 ships were built and operating during the war—at peak, building a submarine per week.

During the Cold War, again we responded with agility both at sea and in business. Last Saturday night I was in King's Bay at a dining-in celebrating the 50-year anniversary of the first patrol of the GEORGE WASHINGTON—the *Georgefish.* Think about those amazing times—faced with the existential challenge posed by the Soviet Union. In 1942, Enrico Fermi took the first reactor critical under the bleachers at the University of Chicago. Barely a decade later, in 1955 USS NAUTILUS sailed to sea on nuclear power. Five years after that, USS GEORGE WASHINGTON, a converted Scorpion class submarine, was commissioned in 1959

and put to sea in 1960. At that time, we did not even have the Polaris missile built! In July 1960, the first Polaris test shot was conducted. By 1967, we had commissioned 41 SSBNs—the "41 for Freedom." Now THAT'S speed to market! Forty-one strategic deterrent submarines in eight years. The current environment requires the same flexibility, creativity, optimism (or resilience to pessimism) and speed to market.

Since 1991, we've shown the same agility. The world has again changed, from a bi-polar structure back to the way the world historically has been—more multipolar, more complex. And the U.S. Military, and our Submarine Force, have also transformed from a bi-polar mission set against a highly mechanized threat, to the multiple missions against a host of threats that we again see today. In time, the Cold War will be seen as an historical anomaly. But throughout, our operational agility has served as a testament to the flexibility and adaptability of the force—a tremendous achievement to design, build, and put to sea an entirely new submarine class—Virginia—designed from the ground up for a new strategic environment.

Our Submarine Force history is a testament to strategic, operational and tactical agility while overcoming adversity. And we've been at the high stakes table the whole time—national survival. We're all in.

A key question that we have to ask ourselves right now is what is the true nature of the situation that faces us now? Is the picture that Admiral Donald painted an existential one, demanding the urgent response that served us so well before?

A question worth asking, because it shapes our approach—both in magnitude and direction. As Admiral Donald made clear, we are continuing in an era that's characterized by increasing worldwide demands on the U.S. Navy in general and the Submarine Force in particular. Many nations are building significant undersea capability that can threaten sea-lanes, increasing the pressure to maintain access to the global commons. Anti-access/area-denial technologies and tactics will require the Submarine Force to be positioned forward, ready to seize the initiative if required. Our critical undersea infrastructure is

becoming more vulnerable to disruption. The undersea strategic deterrent forces of other nations are becoming more active.

Coincident with these increasing challenges, in 2011 we are also entering an era that will very likely be characterized by reduced resources at all levels to meet these challenges. With the budget deficit exceeding 1.3 trillion dollars, the national debt growing, and the interest on that debt consuming more of the budget, there will be tremendous pressure to do more with less. We have little experience in the ranks for managing requirements in an environment of declining resources—the defense budget has steadily grown for more than a decade, so we have LCDRs and CDRs with no real experience operating in an environment of doing with less.

We will be expected to rise to the challenge and we will. But the only way to reconcile the diverging trends of increasing requirements and responsibilities versus diminishing resources is through a thoughtful, balanced approach that strives to succeed better at doing what is essential, understand where we need to make necessary changes and discover and eliminate what is superficial and has been dragged along.

We're giving this strategic environment a lot of thought, and have started to design a campaign that will help us navigate in this complex and uncertain future. I'd like to take a few minutes to describe the emerging lines of effort of this Undersea Warfare Design.

As I said, last night Admiral Donald provided the strategic underpinnings of this effort.

Admiral Frank Caldwell and the team out in COMSUBPAC are working hard to describe the line of effort that ensures that the Submarine Force is living up to all of its responsibilities to the Combatant Commanders, as we operate in peacetime and maintain our readiness for war. Admiral Mike Connor and his team at N87 have done some stunning work regarding the line of effort that describes how we will continue to meet our responsibilities in the future and he will describe that in the next talk. Then to close out the series, Admiral Dave Johnson and Admiral Terry Benedict will provide you a tactical update of the programs in progress that will make this future become real.

But before I get started on the emerging lines of effort, I'd like to spend some time talking about the design characteristics or nature of this strategy, and importantly, where we are in the process.

A critical feature is that it *must be a unifying effort* for the whole sub community. There can be no daylight between the many facets of the team. Clausewitz is very clear about the vulnerability of seams in command structure, and any chinks in our armor will be exploited to our disadvantage.

Next, you must know that it is currently *just taking shape.* Nothing about this is final, and I am asking you to challenge these ideas, starting with the question and answer period after I stop talking. I firmly believe that in many ways, our fates are bound together—the commercial industrial base and the active duty Submarine Force. And so to the greatest degree possible, I believe that our strategies must reinforce one another. So I'm bringing you in early to help shape this before the cement gets dry. The reason I spent some time geeking out about Fourier transforms before is not because I'm a geek (ok, maybe I am a geek), but so that I could make the point now that the path ahead will be a superposition of all of our inputs—a weighted sum. I need your perspective, because it's a crucial part of the narrative. But we don't have a moment to waste. Time is precious—always the most unforgiving dimension of strategy and so we'll be moving quickly. More later on that.

Another feature is that it's not just unity of command, but *unity of effort.* Look at who constitutes the team to move this forward—a terrific representation is in this room. Certainly there is the active duty Submarine Force, but even in the active ranks it's not super clean. COMSUBPAC and COMSUBLANT and all of us must *execute along our lines of authority.* N87 is a completely different environment. PEO SUBS and his team, the labs, public shipyards are in still another different environment. I believe that we gain a critically important insight and perspective from the private sector, from people who may never have served in uniform, but who have so much experience and dedication to the Submarine Force. The emerging Design must provide commander's guidance that is specific enough to define the

mission and what success looks like, but it must also be flexible enough to allow each of us to tailor it to our specific environments and to enable initiative to take advantage of fleeting opportunities to achieve the aim.

It is *commander centric* - top down from the Commander, president, or CEO, providing his or her guidance. This is not a staff product. Further, it must incorporate a sense of humility that recognizes that we will not get it perfect, and so we must be ready to adapt. Our plan must have organic sensing, feedback, and learning elements built in. As we execute, and thereby learn and adapt to the environment, we'll need a robust, honest, and vigorous dialogue between commanders and leaders. Command and feedback will win the day. Stovepipes and *lanes* will keep us from reaching our potential. So we need to start talking a lot to each other—leader to leader.

While we're on the topic of humility, we need to cast this strategy in terms of an honest assessment of our obligations - to one another and to the nation. Humility is the recognition of the truth. No braggadocio, no chest beating, but neither a dodge about the responsibilities, obligations and commitments we have. There are truly things out there that only a submarine can do effectively and we must fill those roles.

So having outlined the constraints of the strategy—what we must do—let's discuss some assumptions. Many of these were covered by Admiral Donald last night, but some are new.

- Survivable U.S. SSBNs will provide nuclear deterrence for the United States and many of our allies for the foreseeable future.
- Combatant Commanders will continue to value the unique capabilities that an SSN and SSGN can deliver.
- Unmanned underwater system technology will advance with increased endurance and capability.
- Information Assurance will continue to grow in importance and we must protect our information and our systems from attack.

- The operational environment will become more complex, further stressing the human element in submarine operations and warfighting.
- Adaptive, determined and tenacious adversaries will exploit our weaknesses with little or no notice.
- Available financial resources will decrease due to budget pressures.

The campaign design is organized along three lines of effort, the first of which is to *Provide Undersea Forces Ready for Operations and Warfighting*. There was a question last night about how are we to maintain standards in this environment, and this line of effort addresses how we do that. In fact, in these times of reduced resources, we can be very glad that we have standards. Without standards, we are governed by good intentions, and in the end, good intentions alone will lead to disaster at sea.

We succeed when we deliver ready submarines to the Operational Commander. When they cross the line and chop to the forward COCOM on time, and remain on station as assigned, meet operational availability (Ao) requirements—fully manned, certified for their missions, and materially ready. Ao is necessary but not sufficient. We need to get ships underway without stealing parts and people from other ships. Can't take parts from MARYLAND to get RHODE ISLAND to sea, and you can't steal crew from USS NEW HAMPSHIRE to man USS HAWAII. Our process must be sustainable.

We succeed when we maintain Submarine Forces ready for war. Our individual ships must understand the adversary and must be ready and proficient at delivering ordinance against the enemy. Additionally, we must maintain the force, as a whole, ready to fight a war. We must ensure we have sufficient ordnance and surge forces available to meet our war plans.

Training—there is lots of room for improvement here. If we agree that the situation will only get more complex, and that the human brain will not notably improve in its ability to process more information, then our training and equipment must strive to present information in a more understandable fashion. Layering on another flat screen, or another module in the existing system will

not do the trick. I believe that there's a lot to be gained in the human-machine interface, and we must really challenge ourselves here—get out of our comfort zone.

One new area where we must broaden our thinking is in the arena of undersea warfare command. Our near future will include considerable numbers of long-range UUVs, fixed and distributed sensors, gliders, manned submersibles, ordnance, and a host of other undersea tools. We're working to define the operational details of managing, de-conflicting and optimizing these tools in a holistic undersea warfare context. If it goes in the water, the area undersea warfare commander should know about it and it should be on the "UTO" – the Undersea Tasking Order. We need these tactics, techniques and procedures in place so when the technology comes, we'll be ready for it.

The second line of effort is to *Conduct Effective Undersea Operations and Warfighting Today*. If line of effort one was building, maintaining, and modernizing the car, and training the drivers then line of effort two is racing the car. They are closely related, but different. We will succeed when we accomplish our mission while remaining safe and covert, and being ready for war. Our current operations must be conducted safely, securely, and effectively. We must have the persistence and self-reliance to remain on station. We need to understand the adversary, environment, capabilities and war plans. We need to know how many hours or days we are from entering the fight—the CO should know this!

We will succeed when the Fleet Commander assesses that we meet the requirements at the unit and force level. To get at this, we need a vigorous and meaningful dialogue between Operational Commander and TYCOM on the ability of submarines to conduct operations and warfighting.

The third line of effort is to *Prepare for Future Undersea Operations and Warfighting*. We succeed when we develop the required force structure, payload capacity, and ordnance to meet the missions in the future. Admiral Mike Connor and his team have done some stunning work in this area, and he'll flesh out this line of effort in the next talk.

The way ahead is to first refine the plan. Flesh out key strategies, consider assumptions, consider problems and opportunities, and barriers and enablers. We need to clarify execution roles. Cascade accountabilities to the group, squadron and unit levels.

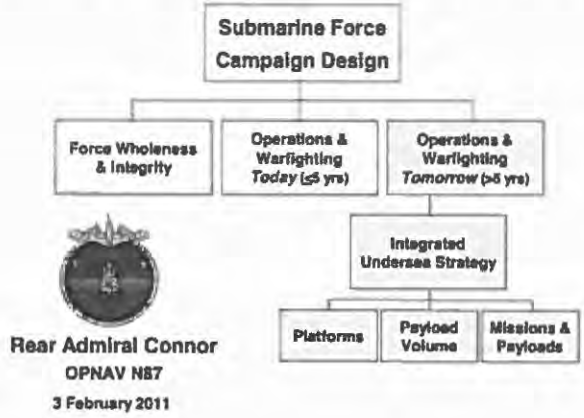
Next we need to begin and sustain communications. Somebody asked about this last night, and this will be a team effort led by COMSUBFOR. This will be a decentralized effort, and I'm very grateful for the Submarine League for their willingness to help get this message out. We'll have this largely done and approved by the Submarine Flags by April. It will be ready to roll out, in classified form, at SUBTECH in May, so if you want to hear it, get your tickets now. If you want to be part of it, you're right on time...we want you aboard.

After we roll out the plan we need to monitor execution, which we will accomplish by regularly scheduled reviews of performance, adjust course when needed, communicate when the plan has changed, and make performance a matter of consequence. I've been at SUBFOR for three months now and have had the opportunity to visit several ships and many of the organizations that make up the Submarine Force. I am energized by the enthusiasm of the people that I have met and proud to be part of a great team that is charged with continuing the tradition of meeting our obligations that the Submarine Force has developed over the past 111 years. Thank you and I would be happy to answer any questions that you have.

NAVAL SUBMARINE LEAGUE
COPRORATE BENEFACTORS

REAR ADMIRAL CONNOR, USN
OPNAV N87
3 FEBRUARY 2011

Thank you for that kind introduction. I am very grateful for the opportunity to present the Integrated Undersea Strategy in this forum. Our strategy represents the culmination of focused effort over the past year by senior Submarine Force leadership and will be used as the blueprint to guide key decisions affecting future undersea warfighting capability. It is no coincidence that we chose this meeting with our vital industry partners to first unveil this strategy outside Navy lifelines.



VADM Richardson outlined his overall Submarine Force *campaign Design* expounding upon Lines of Effort 1 and 2. The portion of the Undersea Strategy that I will talk about is well aligned with the overall campaign and nested within Line of Effort 3 as depicted on this slide.

My task today is to show how we are going to equip our forces with the *right* platforms with the *right* capabilities, and with the *right* payloads needed for operations and warfighting tomorrow.

The challenge we face is how best to address essential undersea warfighting issues of a very complex world in the face of extremely tight fiscal realities. To do that we need a coherent plan—a long-term investment plan that addresses the full spectrum of undersea capability—platforms, payloads, payload volume, operations—and makes integrated decisions about them in a way that helps us thin out options, focus resources and time, and still end up with the needed capabilities at the end of the day.

That is what the Integrated Undersea Strategy provides. It is as much about where to make cuts as it is about where to add funding. It is about making these many decisions in a coordinated, coherent way so that gaps are not created and so that overlaps and hedging are reduced to the bare minimum. And... it will allow us to be the ones that have a plan that works in a time when we have resource constraints.

Many of the issues faced by the Submarine Force can be seen on this single slide (Figure 1). I'll use it repeatedly in this discussion, so it is worth taking a minute to get oriented. Fiscal years are across the top. The FY12 FYDP is represented by the pink vertical band on the left. Procurement plan is at the top, SSN force structure levels are next down, followed by SSBNs with SSGNs at the bottom. The VIRGINIA five-year blocks are separated to make it clear what we are looking at. So, what are the big issues we need to focus on?

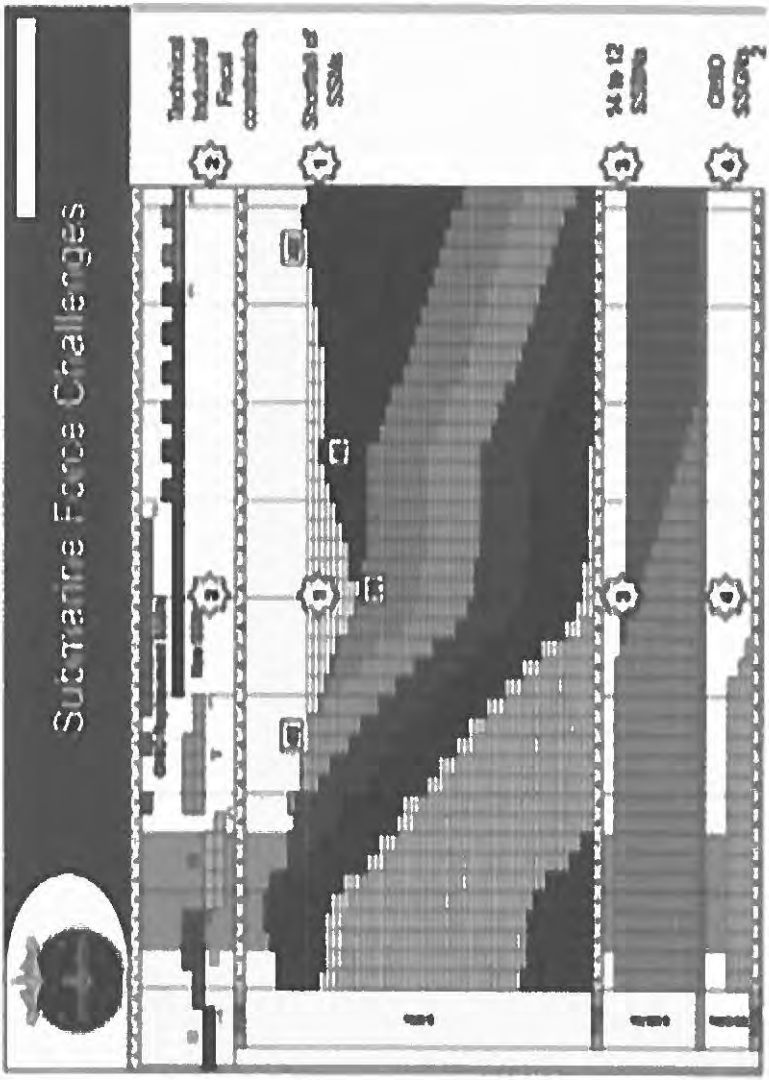
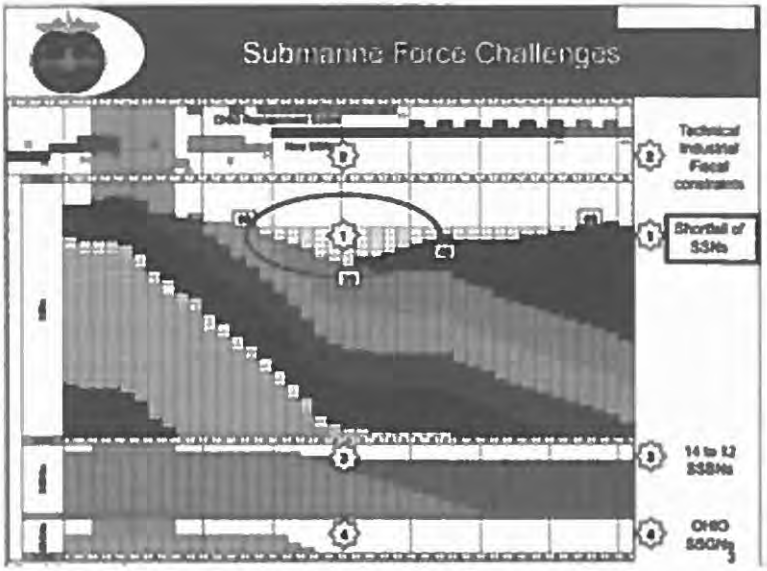
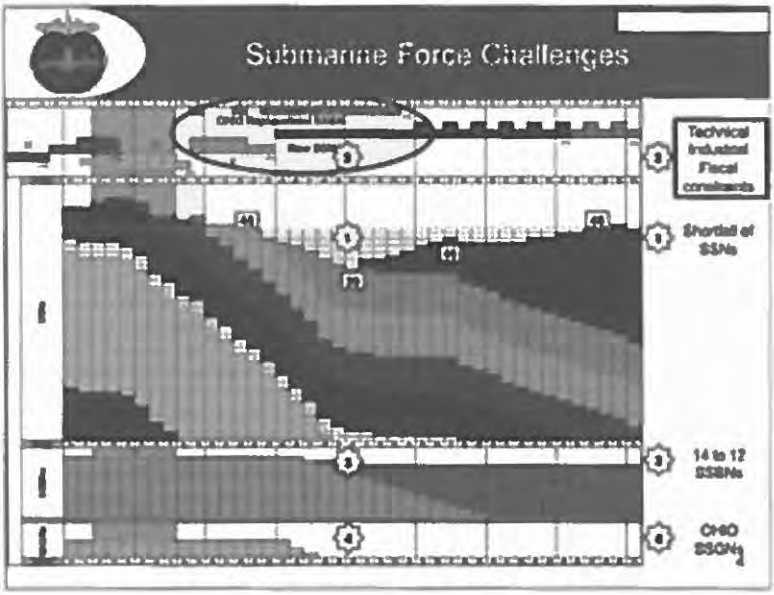


Figure 1

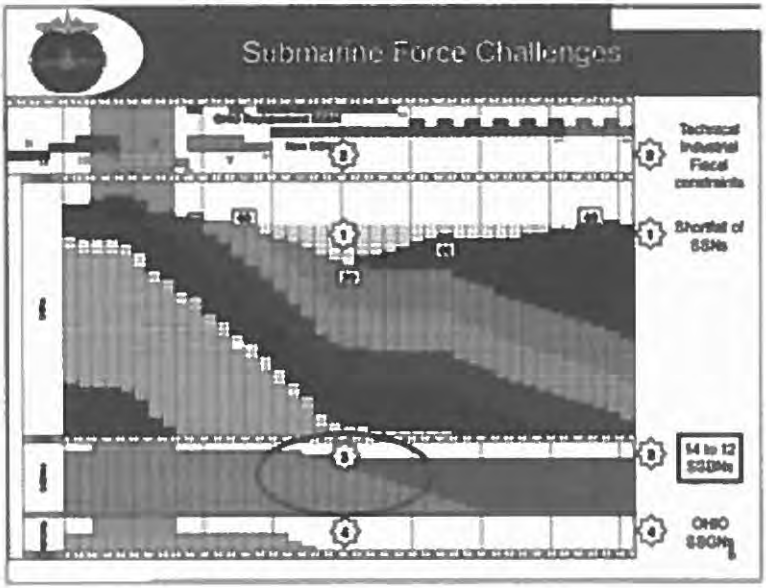


First, you'll notice this large dip in SSN force structure. The force peaks at about 55 in 2012 and then goes on an uninterrupted 18-year slide of 30 percent, ending up at about 39 in 2030. This *is* our program of record. You will notice that we cross through our minimum redline of 48 SSNs in 2024.

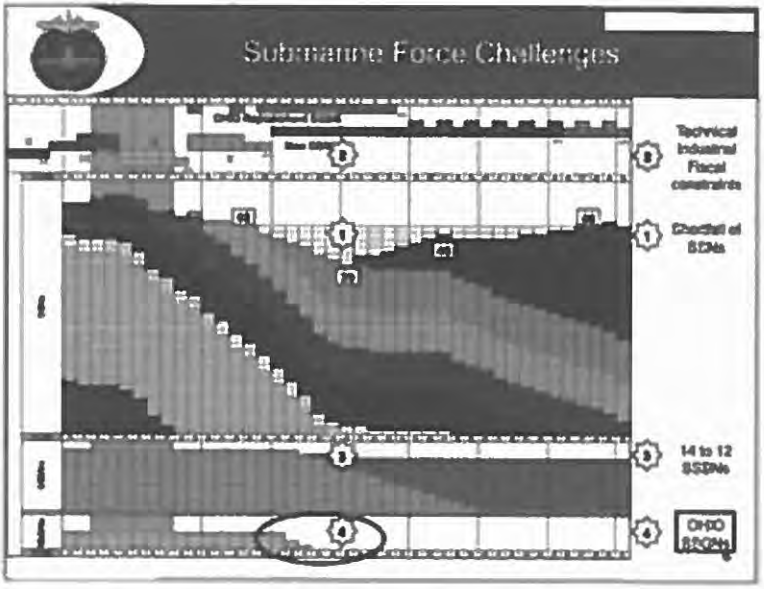
This trough is a big problem. We can't even come close to covering our global COCOM requirements today. How are we going to do it with 30 percent fewer submarines? So that is our first issue that must be addressed. But we can't solve this one without understanding all of the issues we have at once. We have to come up with integrated solutions, not point solutions. We need answers that fix more than one problem.



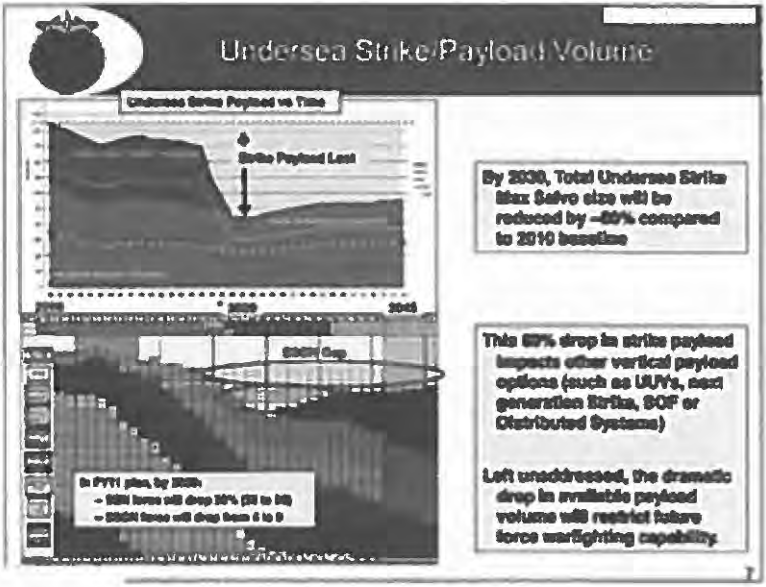
While we are on SSNs, you'll notice another complication that must be addressed is the timing of the transition to the next generation SSN. The current program of record inappropriately assumes we would do that at the end of Block 5 in 2025, right in the middle of OHIO Replacement procurement. Such a transition would not be orderly, and does not reflect a sound strategic plan. Developing a new SSN in that timeframe is something we should ***not*** do. VADM Stanley's comments were particularly perceptive in this area.



If we look at SSBNs we see that we face another, different kind of challenge. It's not as dramatic when compared to the SSN shortfall, but it presents its own daunting challenges. We have to build a new SSBN under tremendous cost pressure, and it must be so reliable and easy to maintain that a force of 12 will cover the same presence requirements as is covered by the current force of 14 OHIOs. There is no schedule margin in the delivery of this SSBN, and that means that the R&D line and the procurement burden must be closely guarded as our foremost priority. We cannot afford to assume risk while maintaining our most survivable nuclear deterrent.



Now down a layer to the SSGNs. Here is another challenging problem. We have four double-crewed SSGNs with a unique forward-based crew change-out CONOPS that allows us to get on average about 2.5 submarines of forward presence from these four ships. Each ship carries in excess of 100 Tomahawk missiles and is capable of carrying up to 154. These platforms have tremendous capacity to support Special Operations teams with covert insertion and extraction capability that is unique. And all four of these ships are going to decommission by 2028.



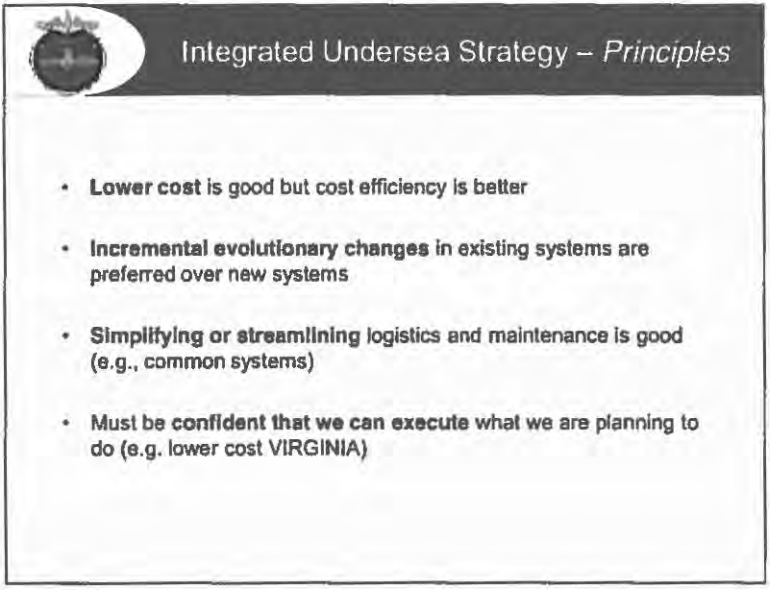
The point they decommission unfortunately coincides with the low point of the SSN trough I mentioned above. As a result, our Navy's undersea strike capacity will decrease by a staggering 60 percent, impacting not only strike volume but other critical large diameter payload volume needed for UUVs, Distributed Systems, and SOF.

Consider the gap that results from SSGN. To replace the 2.5 submarine forward presence provided by our SSGNs would require an additional 13 SSNs. That is simply not going to work. To replace the 600 plus TLAM strike capacity of these four platforms would require adding a staggering 50 SSNs to our force structure. That's obviously not viable. No number of SSNs can recreate the value of consolidated command and control of SOF teams consisting of scores of SEALs. So, we can see that this one is a hard problem.

And we should keep in mind that there are other payloads that we will need to carry in the future that cannot be accommodated by the payload volume in the existing program of record. Our plan

will have to include looking at the ways that we can use payloads and payload volume creatively as part of the solution to reduced force structure.

Before we leave force structure, there is one more idea we should step back and notice. Large force structure fluctuations can be destabilizing because they provide windows of opportunity for our adversaries. They also complicate planning for our shipbuilders here. So, part of our integrated strategy is to work to create greater force structure stability in a highly affordable manner.



So, based on all of these different pressures, we have put together an undersea strategy to guide our investment decisions. In making our choices, we were governed by a few basic *principles*:

Number One: Lower cost is good but improved cost efficiency is even better. We will not be afraid to ask for increased investment in areas where we think it is really needed.

Number Two: Making incremental, evolutionary changes in existing systems as a means to enhance capabilities is much preferred over making new program starts.

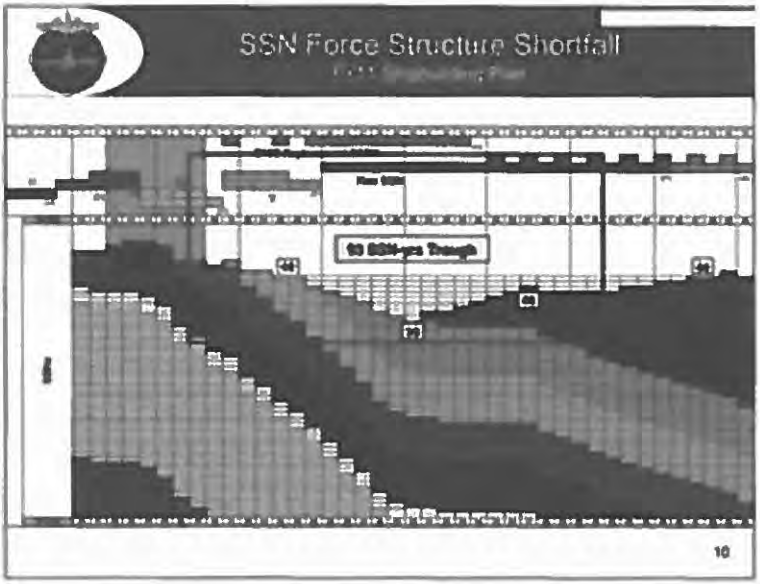
Number Three: Anything that can be done to simplify and stabilize logistics and maintenance is good (for example, common systems with other platforms).

Number Four: The plan must be executable with a high degree of confidence.

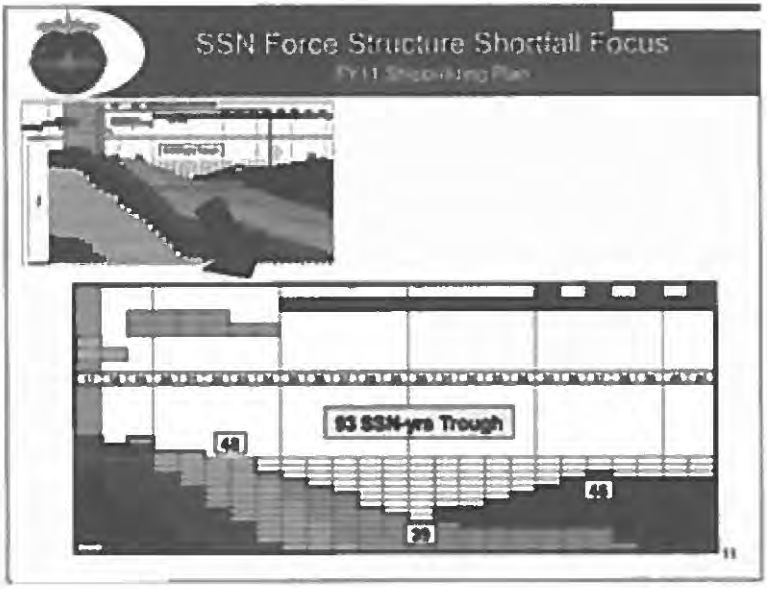
With these pressures in mind, here is what we are going to do:

First of all, we must get OHIO Replacement done right, so our <u>top priority is to fully support fielding this national security imperative without disruption or delay</u>. The OHIO Replacement is the highest priority and all other facets of the

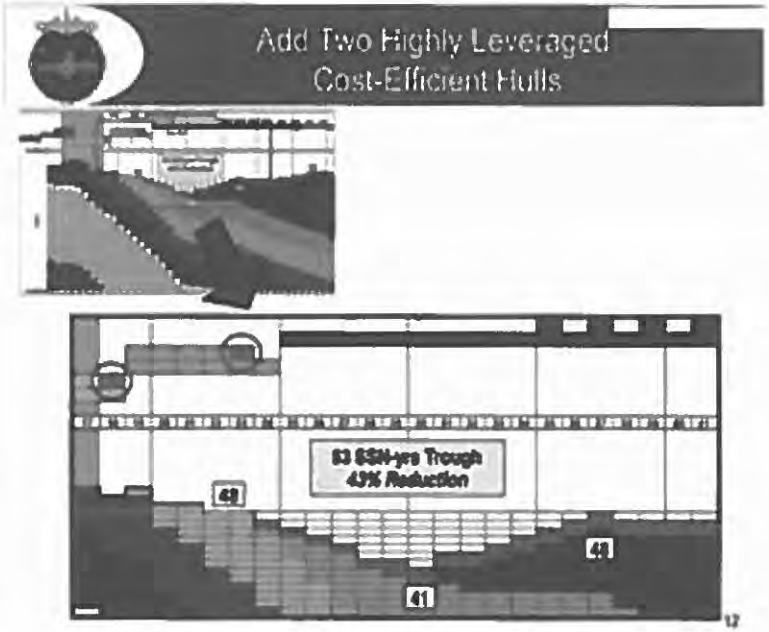
Integrated Undersea Strategy must be subordinate to it. We cannot afford to disrupt this program because the stakes for the Nation are simply too high. The current schedule is a good one, and we want to make sure that the OHIO Replacement SSBNs enter service on time, with the right performance, and on budget. We have saved cost by limiting requirements and by building the ship around the highly successful D5 LE missile. Terry Benedict will talk more about that.



Next up is SSN force structure. As I stated in my introduction, SSN force levels are forecast to drop by a substantial 30 percent. This decline disproportionately undermines U.S. deterrence and warfighting.

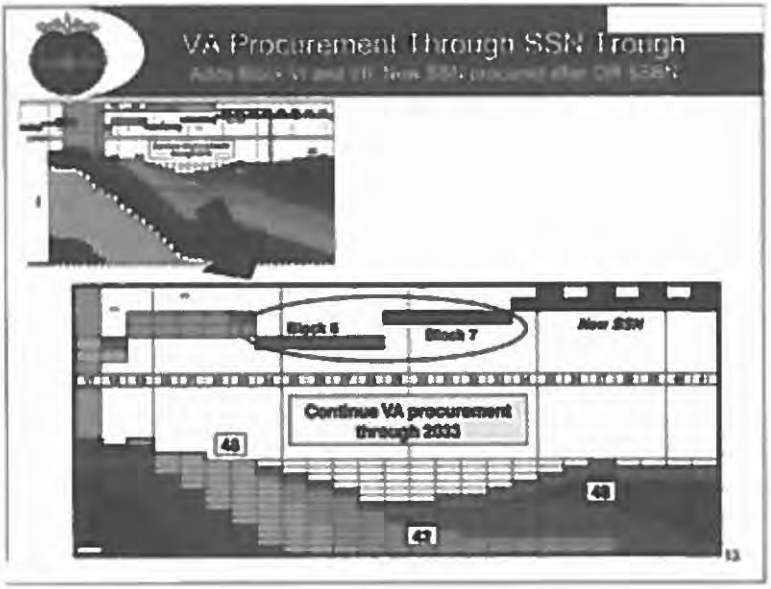


But what action within reasonable fiscal constraints can be taken to alleviate the trough?

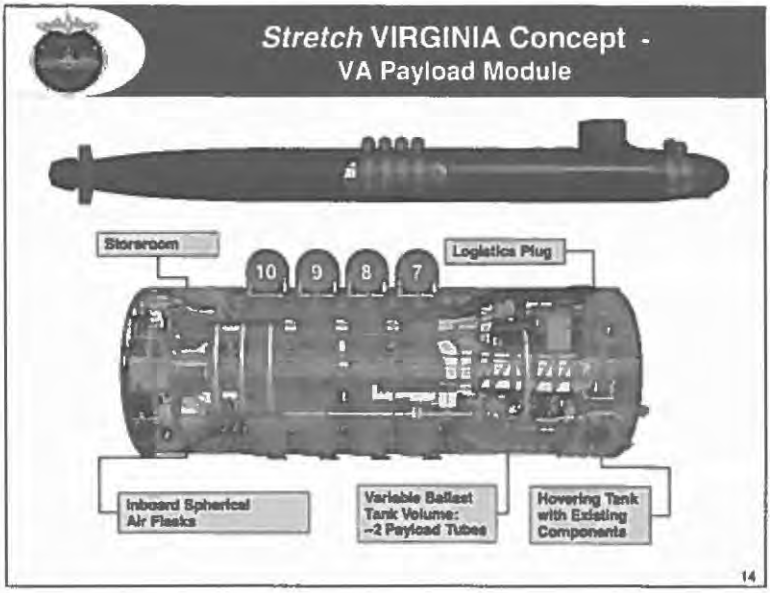


Step number two of our strategy adds two highly—leveraged, cost efficient SSNs to the shipbuilding plan.

These two SSNs are the most highly leveraged force-structure investments we can make. They are also highly cost efficient because each of them represent the final hull in a multiyear procurement—the most affordable ships in the Block. With just these two ships, the gap is reduced by almost half. These SSNs are perfectly timed to paint additional SSN force structure across the bottom of the trough with maximum efficiency. Is this step realistic? So far, we have gotten very good feedback from Navy leadership on this, but there is far to go.

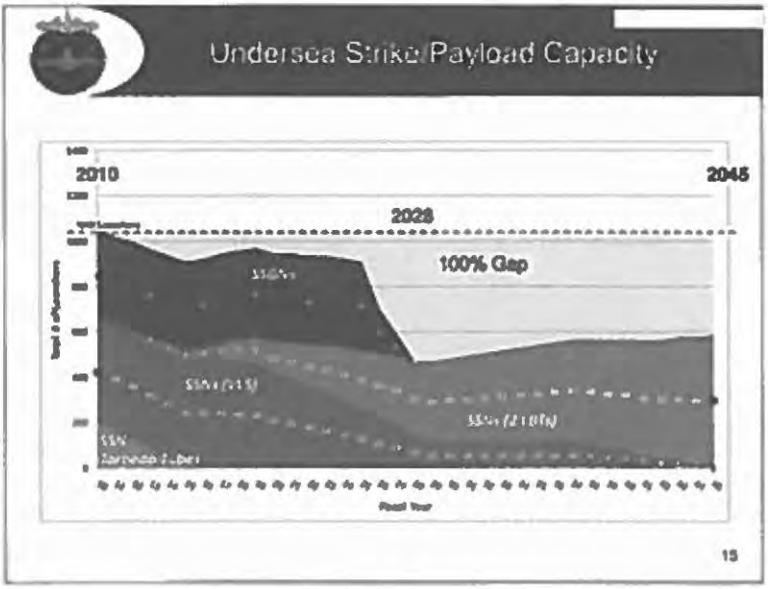


Step number three: "Delay the Virginia Follow-on SSN" until after the completion of the OHIO Replacement SSBN build. Extending the period of time that the Submarine Force takes advantage of block-by-block evolutionary enhancements to the existing VIRGINIA will improve cost effectiveness and force structure affordability. This will also move the R&D investment to the right so it does not compete with OHIO Replacement and will provide an opportunity to incorporate OHIO Replacement lessons into the Follow-on VIRGINIA SSN. Finally, this shift will enable us to climb out of the SSN trough using an existing and highly successful design. The VIRGINIA and its variants will be the longest built family of designs, but the inclusion of incremental design changes with each block will ensure that the platforms remain militarily effective.

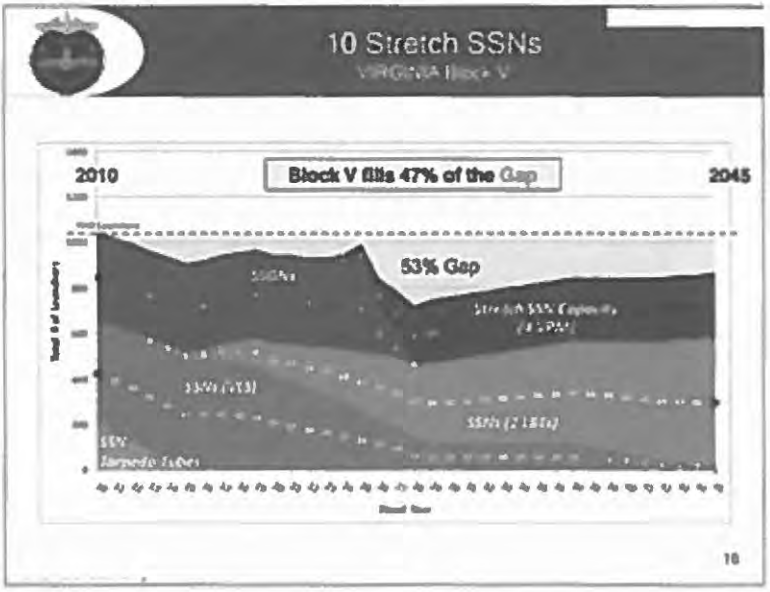


Step number four: Add a VIRGINIA Payload Module to 20 already planned VIRGINIA SSNs. This will enable them to carry a significantly increased volume of strike missiles or other payloads. Adding four large payload tubes centerline to VIRGINIA—class SSNs would increase their strike volume from 12 to 40 missiles while protecting the full payload volume for sea-control missions.

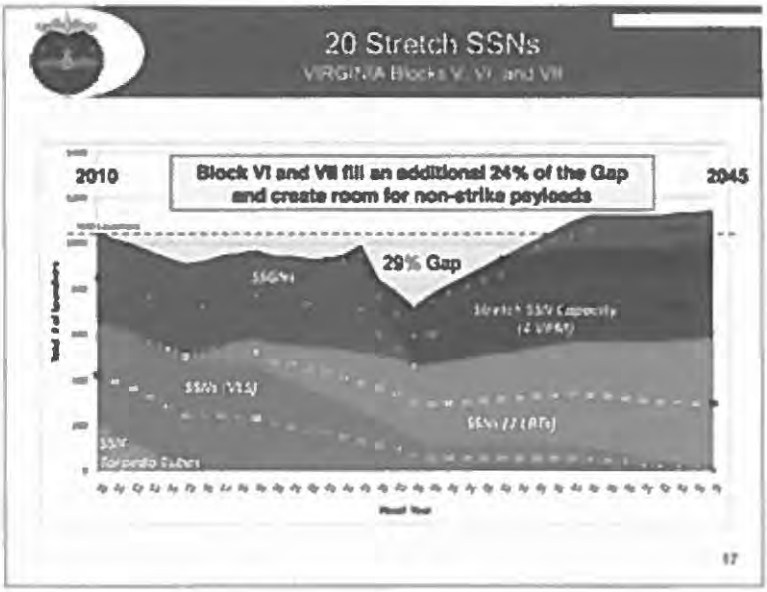
This design option has been technically studied and is feasible. Consistent with our principles, it would use tubes like the large 87-inch bow tubes on Block III and later VIRGINIAs, making payloads that could be used in SSGN tubes and existing VIRGINIA bow tubes able to be used in these tubes. In addition, the hardware and support equipment would match other large tube applications to a significant degree. These tubes would have the advantage of manned access, similar to SSBN tubes today. A variety of payloads could conceivably be used including those that required manned access for service, replenishment or even entry into a vehicle.



Now back to undersea strike shortfall: can a block of stretch VIRGINIAs even begin to mitigate this shortfall? What if we were to stretch all 10 ships of Block 5?



The gap in undersea strike volume would be reduced by almost half and notice that the timing of the new payload volume is right when you need it—but there is still a gap. What if we continued to stretch VIRGINIA SSNs within the new 5—ship Blocks 6 and 7?



Well, the undersea strike gap would be reduced by an additional quarter while enhancing options for other payloads beyond strike.

We are using a rough number of between $400 and $500M per stretch, and without question we need to drive this cost down. This may seem like a lot of money—until you consider that you can stretch ten VIRGINIAs for the cost of one new SSGN.

This approach does not fix the entire SSGN undersea strike volume gap just as the added SSNs do not fix the entire SSN gap.

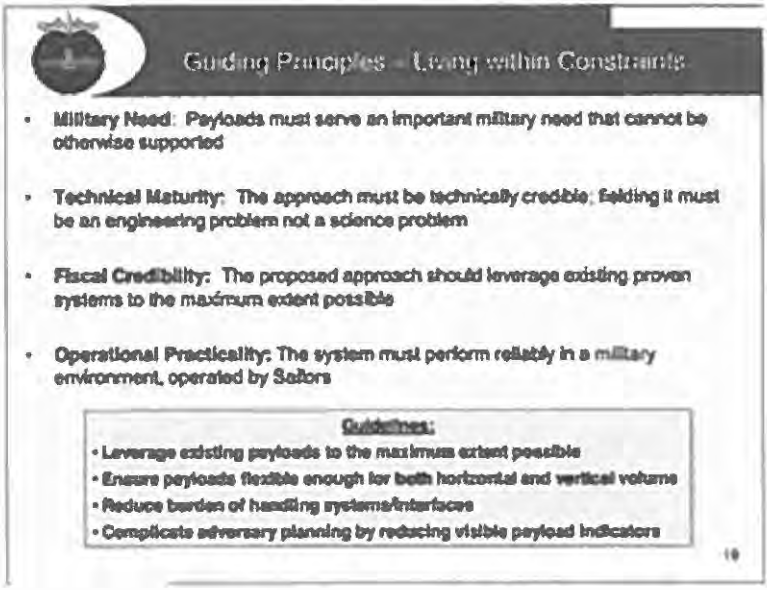
Stretching VIRGINIA-class SSNs only provides a partial solution to the strike volume shortfall. These force-structure and payload volume steps are a *necessary* part of the solution, but by themselves they are not *sufficient*.

This is why the Undersea Strategy needs to include a *payload strategy* that evolves existing payloads to service future military applications. Let me describe one recent example: Based upon a COCOM Urgent Operational Needs Statement to address an emerging target set, CNO cast the net out among resource sponsors to attain a quick solution. Most approaches brought to the table would take years to tens-of-years and had a substantial price tag. VADM Richardson mentioned the proposal that was presented to the CNO as an all out effort that would be completed in 25 years. Sensing opportunity, we challenged the folks at NUWC to modify ADCAP software to address this need. They developed a software change, tested it in the lab, incorporated it into a spiral update to the weapon, and conducted in-water firings—all within the space of 6 months. And we achieved this without asking for *any* money, we just shifted other development priorities and raised this one to the top of the deck. This type of responsiveness gives us great credibility with the fleet and within the Pentagon. As we look to the future, we plan to extend this

torpedo *open architecture* beyond software improvements only and I'll discuss that in a minute. I didn't make this happen. I put the marker down, but Dave Johnson at PEO SUBs and Don McCormack at NUWC made it happen.

We need to make investments to improve our off-board capabilities as a way to further compensate for force structure shortfalls. Each submarine will need to be able to hold a broader set of targets at risk and do so over a broader geographic area. Incremental, evolutionary changes in existing systems will be key to producing revolutionary affects, especially when you consider that in many future scenarios we will be the only friendly forces with early access.

The future development of all payloads must follow four guiding principles in order to be credible.



First, any development in payload must serve an important military need that cannot otherwise be supported. For example, the ability to knock down the door and hold enemy forces at risk while

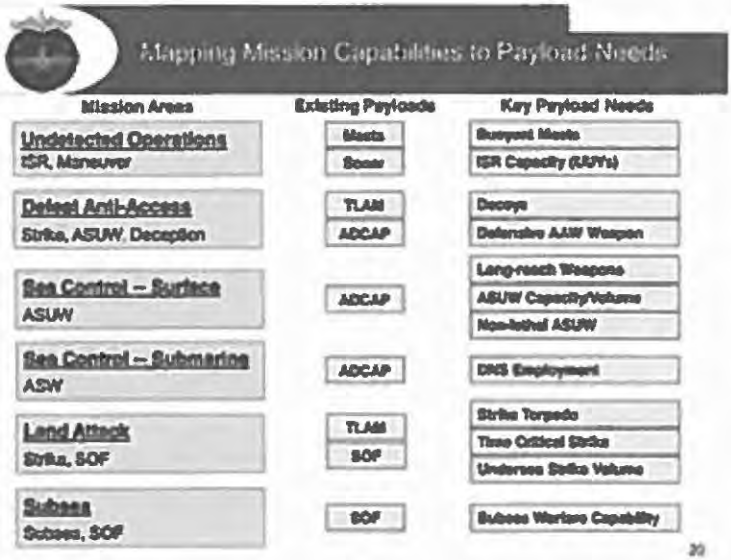
penetrating Anti-Access defenses is a mission that the Joint Force needs in order to succeed and which is best met through undersea forces. Future submarine payloads must be capable of fully leveraging our uncontested access to enable the flow of joint forces capable of larger capacity strike and broader exploitation of sea control. We envision conducting anti-surface warfare from long range, executing time-critical strike against defended targets, and employing UUVs capable of reaching shallow water anchorages and ports. The Submarine Force is by no means unique in its ability to deploy UUVs and long-range weapons. It is, however, unique in its ability to do these things from within an adversary's defensive perimeter. We are the key that opens the door for the Joint Force.

Second, the evolution in payload must be technically and fiscally credible. The fielding of new payload technology must be an engineering problem, not a science problem. As much as possible, the proposed approach should leverage existing, proven systems. Technology that has already been developed by industry and the Navy can be spun-off to more effectively use our available payload volume.

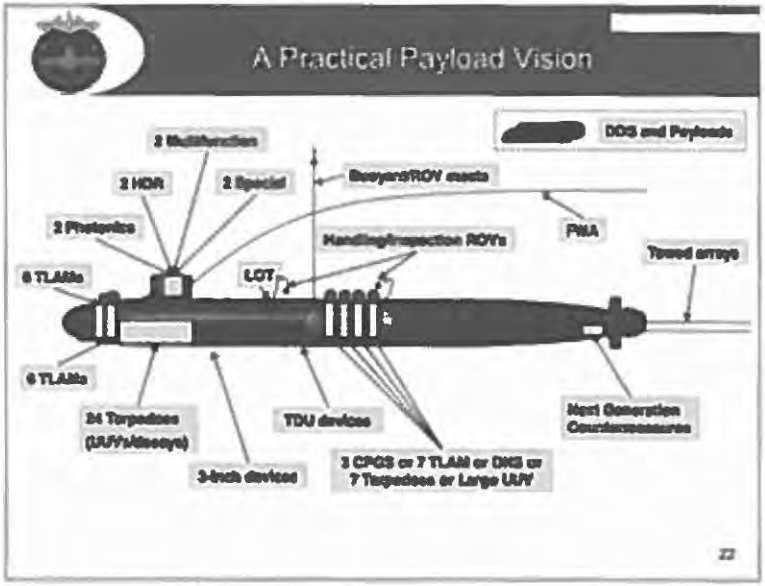
The MK 48 ADCAP's ability to be modified to meet new challenges provides an example of where incremental, evolutionary changes can increase our effective reach and engage more targets while leveraging a proven vehicle, launcher and interface. We are in the early stages of applying demonstrated UUV capabilities to the ADCAP, at a fraction of the cost of starting a new kinetic UUV weapons program from scratch.

The final principle that should guide our payload development strategy is operational practicality. The system must perform reliably in a military environment, be operated by Sailors and have minimal impact on other capabilities. An SSN that can deploy multiple payloads using existing system such as the TDU, torpedo tubes, dry-deck shelters, large diameter vertical tubes, and countermeasure launchers is not only practical, but provides operational ambiguity that is difficult to counter. Imagine having to defend against every possible SSN capability because you cannot determine through imagery or observation its payload mix or mission.

Our payload strategy must leverage existing payloads, optimize both horizontal as well as vertical payload volume and minimize reliance on complex handling systems. Only then will our forces most effectively complicate adversary planning.

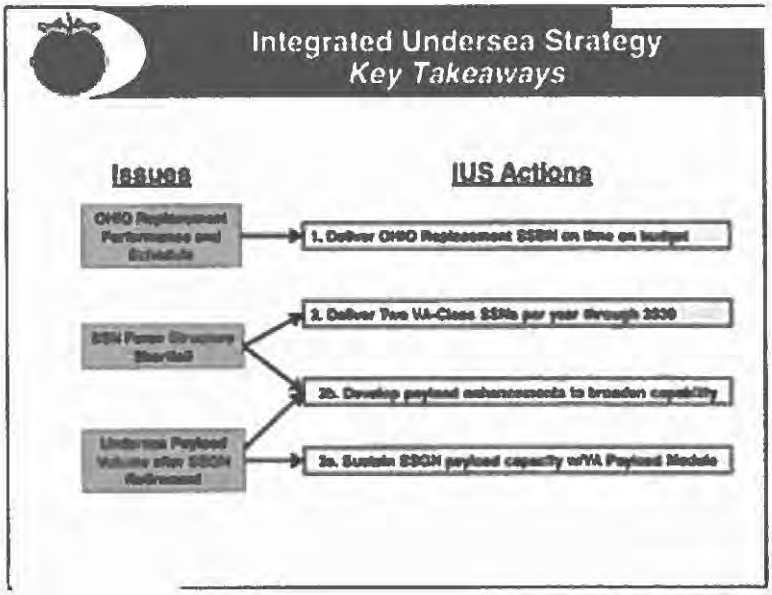


Here you see a menu of sorts, which shows on the left the missions that VADM Richardson currently delivers to the Joint Force. In the center column, you see the payloads that help deliver the capability for those missions. In the right hand column we identify payloads needed for the future. There is much work to be done to develop these future payloads and we look forward to working with you to fulfill it.



So now with the foundation of the Integrated Undersea Strategy set, I want you to consider for a moment what our force will be like in 2030. First, we will have two additional highly leveraged SSNs to mitigate the deepest part of our trough. About one-third of our force will be Stretch VIRGINIAs and they will be equipped with these *highly evolved, extended-reach, multi-purpose payloads*. We can no longer restrict our thinking to today's torpedoes and Tomahawks launched from the baseline VIRGINIA. Future military capability must be viewed in the context of the Block 5 Stretch VIRGINIA with the enhanced payload module.

So we have begun the task of putting the challenge out to industry and the labs to help us realize this vision. We will build upon concept work this year and expand upon projects that show potential.



As I conclude, I want to re-emphasize that our Strategy is predicated upon cost reduction and leaner business practices. One purpose of the strategy is to help us thin out our programs. As the country works through one of the most fiscally stressing periods in over a generation, it is our duty to tighten our fiscal belts in proportion—anything less would unduly detract from our higher national security objectives—that of reducing our deficit. I need you to rise to this challenge with your innovations and adapted business practices.

What I ask you to take away from today's discussion are four key elements shown here.

- Keep OHIO Replacement on track.
- Reach and maintain delivery of two VA-Class SSNs per year for as long as possible. Specifically, add two additional highly leveraged, cost-effective SSNs.
- Begin planning to conduct detailed design of the VIRGINIA Payload Module to incorporate into Block 5.
- And open the aperture on evolutionary payload enhancements.

It's an exciting time to be in the Submarine Warfare business. I look forward to your comments and suggestions and would be happy to answer any questions you might have.
Thank you.

SUBMARINE TECHNOLOGY SYMPOSIUM

By Mr. G. Daniel Tyler
With contributions by J. Andrew Razmus and G. Richard Thompson

Dan Tyler is the Head of the National Security Technology Department at The Johns Hopkins University Applied Physics Laboratory and serves as Co-Chair of the Submarine Technology Symposium. He is responsible for the Laboratory's support to the Navy's undersea warfare mission. He holds a bachelor's degree from the Massachusetts Institute of Technology and a master's degree from Johns Hopkins University, and he participated in the Executive Program at the Stanford Graduate School of Business.

Submarine Technology Symposium Overview

The Submarine Technology Symposium (STS), co-sponsored by the Naval Submarine League (NSL) and The Johns Hopkins University Applied Physics Laboratory (JHU/APL), is widely recognized as a premier military technology symposium. Each year since its inception in 1988, 500–600 people directly involved in submarine programs have attended. The success of this program, its status and popularity, are living testaments to the continuing efforts NSL and APL personnel have devoted to administering the STS, the unwavering support of the Senior Leadership of the Submarine Force (OPNAV, Acquisition, and Fleet Operational Commands), and an enthusiastic submarine technical community that supports the Symposium through attendance, and more importantly, through the voluntary preparation and delivery of exceptional papers.

In 1986, Mr. James Austin, who at the time was the Head of the JHU/APL Submarine Technology Department, conceived the Submarine Technology Symposium. Jim initially engaged RADM Al Kelln, USN (Ret), and fleshed out the basic characteristics of the proposed Symposium. Together, they *sold* the idea for joint sponsorship of the Symposium to the NSL. The concept was to hold an annual three-day symposium at JHU/APL facilities to

"provide a classified forum for examining current, emerging, and future technologies that may aid the submarine warfighter and enhance current and future technology availability." The objective was "to stimulate the symposium audience to respond to existing, emerging, and future requirements of the Submarine Force."

STS Relevance to the Integrated Undersea Strategy

The Submarine Technology Symposium by purpose, design, and effect has been inherently aligned with and supportive of the development of the Integrated Undersea Strategy (IUS), especially as that strategy has emerged and evolved over the past two decades from the Cold War to the multilateral situation of today. Many of the precepts and focal points of the current IUS, such as expanded missions, advanced payloads, stealth, connectivity, asymmetric capability, and affordability, have been themes and topics covered over the course of the STS. To assure timely relevance and impact, the STS has been particularly sensitive to the critical challenges and potential needs of the Submarine Force (and U.S. military operations as a whole) at the given time of each Symposium as defined by the changing global circumstances, evolving military needs, and increasing military threats. With each Symposium, a theme was identified that aligned the thrust and technical content to identified current needs, as well as the emerging needs of the Submarine Force.

Starting in 1988–89 as the Cold War was coming to a close, the growing importance of broadening the contributions of the submarine to national defense was recognized. While STS continued to address the submarine's vital traditional roles, a new focus was added to highlight technologies with the greatest potential for enhancing the warfighting capabilities of the submarine in an evolving national security environment: e.g., new missions, coordinated operations, submarine communications and information management technologies, advanced platform technologies, and organic and off-board sensors. By the mid 1990s, with the recognition of a *new world order*, the Symposium introduced themes that specifically supported the submarine's roles in regional and expeditionary as well as global warfare. Keynote presentations and technical papers addressed new and

expanding missions and enabling technologies—C4ISR, stealth and survivability in the new environments, means for maintaining battle-space dominance, and notably a technical paper on new submarine payload concepts for enhancing payload capacity that is very much like the expanded mission module design now being considered for the Virginia Class. In the late 1990s, the themes further evolved to address the emerging *Joint Vision 2010* and innovative technologies to enable the new submarine vision and ensure its role as a premier component of this Joint vision. Key topics included technologies for operations in the littorals, precision engagement and power projection, information and asymmetric warfare, and focused logistics. In concert with moving into the 21st Century, the themes focused on strategic concepts for the 21st Century and enhancing performance through technology refresh and reaching forward through innovation. The latter were especially important at the time (and still today) with the pressures on force levels and DoD budgets requiring capabilities through more affordable and innovative technologies. A key paper included the rapid technology insertion concept for submarine combat systems that has proven to be an invaluable and highly affordable means for advancing submarine combat system capability in the face of evolving threats and limited funding. Moving more to the present, STS has continued to align itself with evolving military and naval issues, with themes addressing access assurance, irregular warfare, enhancing the submarine's military value, and planning for the future in an uncertain world. SSGN technologies, technologies for enhancing the submarine's contribution beyond the undersea battle space, full-spectrum ASW, and technologies for strategic flexibility were recent topics of the STS.

To assure and provide authoritative relevance, currency and competency, a highly effective format and composition for the STS was established and followed, including key presentations by senior DoD, Navy, and submarine leadership to provide the real military context, vision, and critical issues facing the Submarine Force. Key participation has included multiple visits by the CNO, Secretary of the Navy, Undersecretary of Defense, CINCs, and routine participation by Submarine Force leadership. To ensure

current and timely attention to technology, participation has included the directors of DARPA, ASN/RDA, and ONR, as well as distinguished leaders from industry and academia. A frequent and well-received participant has been Mr. Ron O'Rourke of the Congressional Research Service, Library of Congress, who has provided exceptionally well-established, frank views and constructive comments on budgetary matters in general, and Submarine Force considerations in particular, as viewed from a Congressional budget standpoint. Recognizing the importance of understanding the threat, as well as the possibilities for global technology development to provide both challenges and opportunities, frequent threat and foreign technology updates have been included in the symposia. Finally, an open question-and-answer session with Navy and DoD leadership is often included that further provides timely and authoritative input and comments on operational and technical issues and questions.

The Submarine Technology Symposium continues to be a valuable and unique forum where technical leaders from Government, industry, and academia can propose and examine technologies for enhancing current and future submarine capabilities. The continued involvement and direct participation of DoD, Naval, and Submarine Force leadership at each event ensures a Symposium that addresses and is well aligned with current and evolving Naval vision, and the Integrated Undersea Strategy. The broad and very well attended participation by industry, Government research laboratories, and academia, ensures a venue for presenting and considering leading research and technologies that may be the key enablers for the Submarine Force of the future. The combination of key operational leadership and a broad spectrum of technologists provides a unique and critical opportunity for operational problems to be understood and potential technologies revealed and reviewed that invariably helps establish the way ahead for the Submarine Force.

STS Process for Ensuring Viability

Two key elements of STS planning and execution are employed for ensuring its continuing viability: 1) a broad commitment from organizations and individuals that provides adequate

resources and time to *do the job right* and 2) a build-test-build, spiral development mentality for continuously assessing and improving Symposium execution and ensuring increasing value added to the Submarine Force.

Preparation for the succeeding year's Submarine Technology Symposium begins during the current year's Symposium (held each May). Members of the Symposium Executive Committee (EXCOM) take note of what is going well and what could be improved. Additionally, Symposium attendees are asked to fill out a critique sheet (provided as a tear-out page of the Symposium program) evaluating all aspects of the Symposium from arrangements (food, parking, registration, facilities, etc.) to technical content. Suggestions for future symposia are also solicited. For those who prefer commenting on line, an interactive critique form is posted on the STS website (http://www.jhuapl.edu/SubTechSymposium/), and Symposium attendees receive an email requesting their participation in the feedback effort.

Immediately following the current year's Symposium, the EXCOM gathers for a *hot wash-up* in which it compares notes and reviews written feedback on the critique sheets. Action items are initially established and a July date is set for the EXCOM's Kickoff Meeting for the next Symposium. The current year's Assistant Program Chair *fleets up* to Program Chair, the *old* Program Chair remains on the EXCOM as an advisor, and a new Assistant Program Chair is identified. Chair of the Arrangements Committee generally remains the same, and new members are identified as necessary for any retirements from the EXCOM.

The primary purpose of the Kickoff meeting is to establish a theme for the Symposium with associated topics for each session, as well as to agree on a tentative schedule. Advance work by the Symposium General Chair and Co-Chair with input from the Submarine Force Leadership helps guide the committee's work. Candidate chairs for each session are identified as well as initial suggestions for Keynote, Luncheon, and Banquet speakers. Feedback from the written and online critiques is reviewed in both written and tabulated format, and corrective action items are assigned. Before the next EXCOM meeting, members coordinate

and refine the Symposium theme and session content via email. At the second EXCOM meeting, themes, session content, and Session Chair assignments are solidified. Assistant Session Chairs are selected by the Session Chairs. An overall detailed schedule is firmed up, and the Call for Paper Abstracts is prepared and released a short time afterwards.

The next series of events consists of Session Chair meetings (up to seven of them) with the entire EXCOM, and additional EXCOM-only meetings (for a total of five). Some of these meetings may be teleconferences. At the first Session Chair meeting, Session Chair responsibilities are laid out and guidelines for development of the sessions are explained. Future Session Chair meetings concentrate on the selection of primary and alternate abstracts and the sessions' development status. Commander, Submarine Forces approves selection of each abstract and the final drafts of the papers. When satisfied, COMSUBFOR gives written permission to conduct the Symposium. Session Chairs (and others) provide guidance to their authors, review their papers, aid in the preparation of presentations, and conduct murder boards for each presenter. At the EXCOM meetings, details of the arrangements are approved, including everything from the menus and budgets to action items assigned from past feedback. Keynote, Luncheon, and Banquet speakers are finalized, as well as the members of the Leadership Round Table whose discussion rounds out the final day of the Symposium. Progress of session development is monitored closely. Guidance and assistance are provided as appropriate.

The endgame starts a day before the Symposium with a walk-through of all presentations by their authors in the Kossiakoff Center to ensure there are no bugs in the slides and videos as well as to familiarize the presenters with the mechanics of the Kossiakoff auditorium. The morning of the Symposium, while attendees are registering and enjoying the continental breakfast, all speakers are treated to a full breakfast, last-minute guidance, pep talks from the EXCOM leadership, and a heartfelt thank you for their hard work in preparing for the Symposium. The cycle then starts anew.

Good Morning and thank you ADM Padgett for your kind introduction. I am appreciative of the opportunity to speak here today.

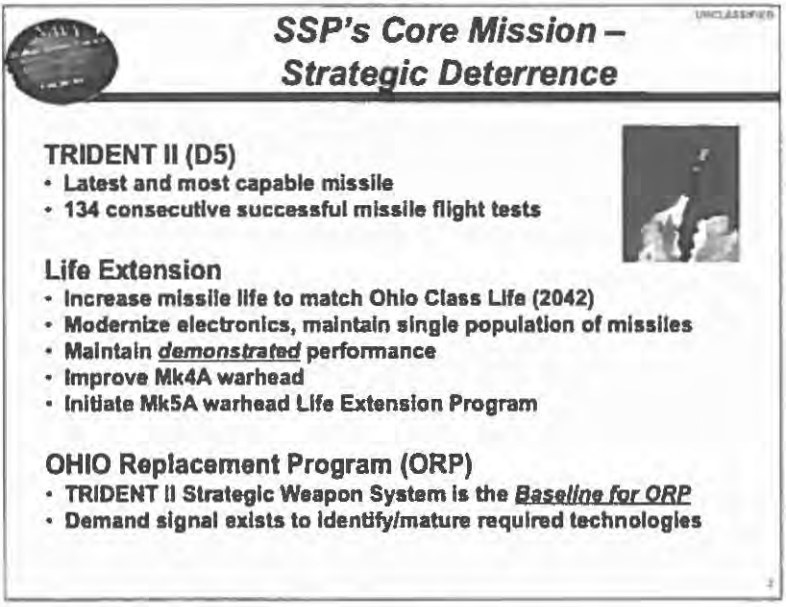
This is an extremely busy time within SSP. Today we are:

- Ensuring TRIDENT II is supported on Ohio Class submarines through 2042
- Conducting or designing Life Extension efforts in all the functional subsystems of the SWS
- Support PEO SUBS as we begin the development of the OHIO Replacement Program (ORP)
- Preparing for Entry into Force of the New START treaty—this will happen on Saturday
- Under the New START treaty we assume responsibility of about 70% of the 1550 nuclear assets permitted for the US
- Our system reliability remains at an all time high, evidenced by 134 consecutive successful flight tests and our annual Strategic Weapons System (SWS) planning numbers provided to US Strategic Command (STRATCOM)

Simply said, we have challenges ahead.

This morning I will address three topics:

- Our efforts to support TRIDENT II life through the 2042 Ohio Class program
- Our efforts to support PEO SUBS in the development and deployment of the ORP
- Finally, I will highlight the major industrial base concern that we face today.



Today we are an all TRIDENT II force. We have transitioned not only the submarine force but we have also modified the entire shore base structure to TRIDENT II—specifically Strategic Weapons Facility (SWFPAC) buildings and processing capability.

An underlying philosophy to the 5 sub bullets under Life Extension is the concept of Homogeneity. As SSP proceeds forward with Life Extension we will strive to ensure we maintain

one population of missiles and guidance systems. We will do this from a performance perspective. This greatly eases the STRATCOM target planning, SSBN load out issues, missile processing efforts and Launch Control Console (LCC) for the program.

We are also taking measures as we make modifications to ensure we maintain *demonstrated* performance. This is no small task. Our TRIDENT II design requirement is lower than our demonstrated performance. Said another way, we are significantly exceeding our required performance. If we were to fall back to our Capability Development Document (CDD) requirement we would drive a demand signal for a great number of assets to meet the STRATCOM plan. This increase in missiles or platforms is something that in today's constrained fiscal environment would be unacceptable.

We have proven we can execute this concept through our efforts on the MK4A warhead Life Extension (LE) effort. Not only have we successfully implemented COTS HW and SW in this system we achieved significant cost reductions. We intend to do the same in missile and guidance LE efforts as well as the MK5A effort we have recently initiated.

All this effort leads directly to the ORP program where the TRIDENT II SWS—all functional subsystems—Navigation, Launcher, Fire Control, Missile, Guidance and Reentry are the baseline for the ORP. In order to continue to meet program requirements and cost constraints we must ensure we fully utilize the commercial technologies available to us.

If you look at the TRIDENT II SWS in terms of its subsystems—starting in the lower left hand corner.

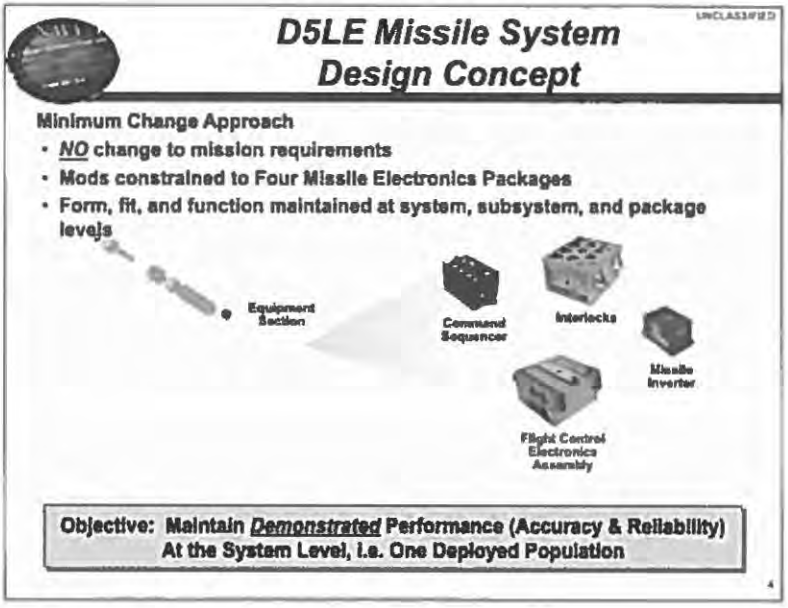
Trident II (D5) Missile .... We continue to fly 4 Follow-on CINC Evaluation Tests (FCET) flights per year–minimum based on our high reliability. This limited set of flights provide SSP the appropriate sample size. As we look to the future, our flight tests will increase for D5LE testing. Starting in FY12 and running through FY22 we will have additional test flights, above the normal FCET flights, to evaluate the missile and guidance LE efforts.

The MK6LE guidance system has completed Critical Design Review (CDR). The flight hardware is built and in test for a 1st QTR 12 flight. The D5LE missile completed system CDR last week. We will begin production of initial flight systems immediately and our first missile LE flight is 4th QTR 13. IOC of the combined Missile and Guidance systems are FY17.

In reentry systems the MK4A LE program has achieved IOC and we have initiated the MK5A efforts this year.

In Shipboard System Integration (SSI) we will implement our efforts in increments. Using Open architecture for subsystem integration we are on track. Starting first with launcher and FC we will move to the data recording system and finally to navigation and FC. All shipboard efforts utilize to the maximum extent possible COTS hardware and software.

As Admiral Johnson just briefed, OHIO Replacement has conducted its Milestone-A mtg and is about to enter into the Technology Development phase. SSP is supporting from a number of aspects, most specifically integrating the D5 SWS into the SSBN through a Common Missile Compartment concept with the UK as a strategic partner. We are conducting this effort under the Polaris Sales Agreement, which we execute in SSP.



The D5 Life Extension Concept is being implemented to affordably extend the life of the missile system.

The effort entails modifications to 4 of the missiles electronics packages; these packages required update due to obsolescence and aging issues:

- Command Sequencer (receives preset power and preset data from fire control and converts it into a format useable by the reentry system)
- Missile Inverter (the out-of-line safety element for the missile; installed only an alert status. All power for the missile is routed through the inverter)
- Interlocks (contains the logic and safety blocking elements that control missile interface signals)
- Flight Control Electronics Assembly (controls the missile during boost and post boost flight by converting guidance system inputs into steering valve commands)

In an effort to contain costs, no changes were made to mission requirement as part of the modifications – meaning no additional capabilities were designed into the packages. Additionally, each package was designed to meet the same form, fit and function of the package it replaced, keeping the deployed system as one population. The maintenance of one population will have a significant impact on lowering the number of flight tests required to certify and validate the design, thereby lowering cost. This was all done with the goal of maintaining the high-demonstrated performance of the missile system.

I am able to report today that equipment has been built—it exists … we have begun testing that equipment … and, Critical Design Review is complete on all 4 packages.

The other side of the System Life Extension effort involves the MK6 Guidance System.

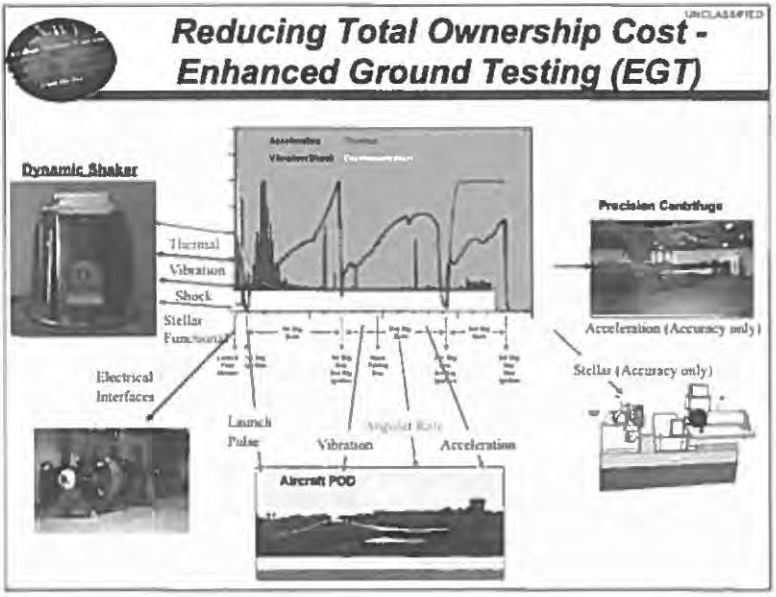
Like the effort for the missile system:

- The goal for the MK6LE was to affordably extend the life of the system to at least the end of the Ohio SSBN life of 2042
- The driver was addressing obsolescence issues, and
- Maintaining demonstrated performance was the program requirement

The effort involved redesign of:

- Electronics Assembly, and Guidance Inertial Measurement Unit

Guidance is ahead of missile, all engineering is complete and flight H/W testing is underway. In a moment I will show you how an innovative testing philosophy has helped the program lower total ownership costs and increased our technical confidence prior to flight.



Implementing Changes to the Trident II SWS

1. Maintain a comprehensive network of shore based testing facilities

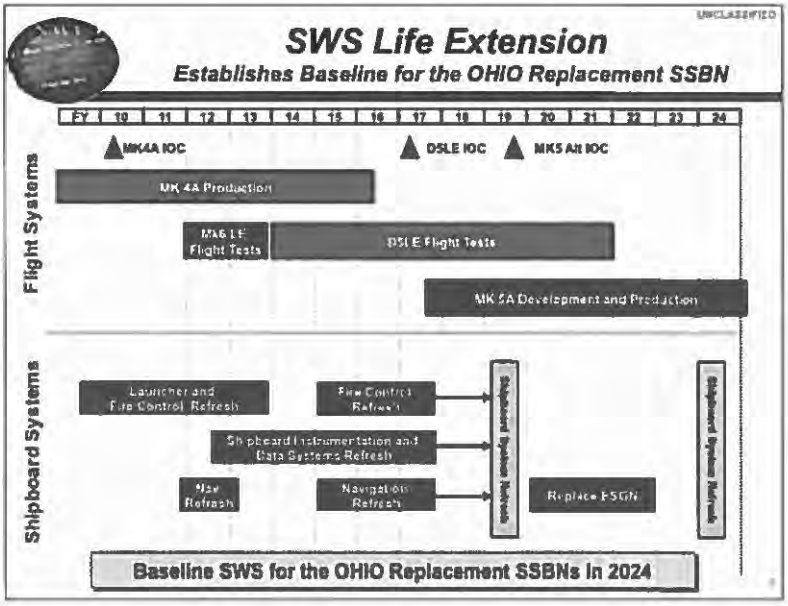
2. SSP has defined the Trident II SWS as a collection of distinct elements and enforces strict adherence to a comprehensive library of coordinated interfaces between system elements
Allows for different contractors to develop or modernize different elements in parallel
Maintains overall system characteristics

Allows for modernization of individual components or subsystems with minimal full scale flight testing

3. Example: Mark 6A Guidance System
Complete replacement of the missile's guidance subsystem Components and subsystem rigorously tested at SSP's shore based test facilities, including F-16 flight testing via a special wing mounted guidance test pod

Compatibility with other subsystems assured through strict adherence to coordinated interfaces

Able to certify with minimal flight tests

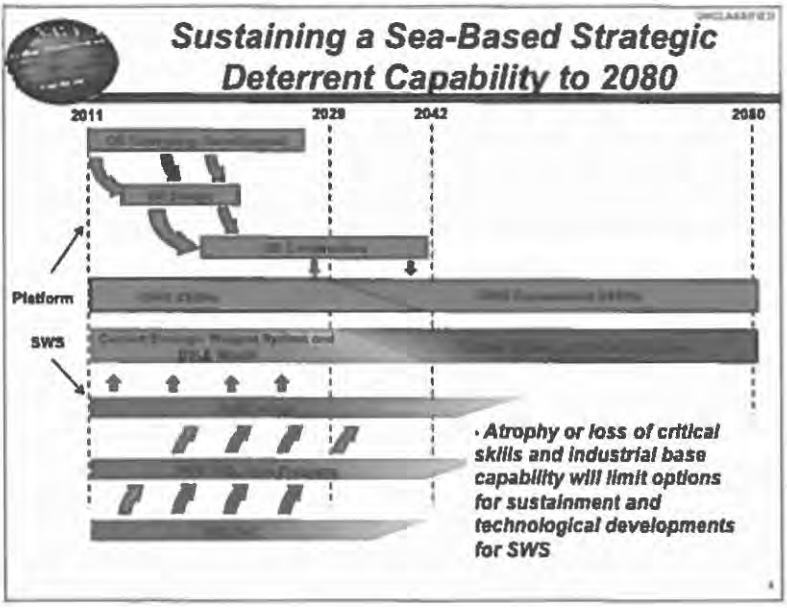


While Admiral Johnson laid out the ORP schedule to begin construction in 2019 and IOC in 2029, SSP has a significantly different schedule to support. As you can see here I have separated Flight hardware on the top from Shipboard systems on the bottom.

The LE efforts I just detailed, all of them, in all the functional subsystems must be completed by 2024 in order to support the baseline install for ORP. This is our challenge.

We are executing to complete all efforts by 2019 with the exception of the Electrostatic Gyro Navigator (ESGN) replacement. The ESGN effort will be conducted between the FY19 and FY24 refresh periods.

These efforts not only form the baseline for ORP but are the majority of the effort required to get Ohio SSBNs through 2042.



It is paramount that SSP's unique critical skills, technical knowledge, and industrial capabilities are reinvigorated and maintained to support the Strategic Weapon System. The SWS has unique aspects that are not common to the commercial market. Areas such as :

- Radiation hardened electronics
- Solid rocket motor propellant—specifically class 1.1 nitro based propellant. We require this class of propellant due to our constrained volume and safety on the SSBN.
- Guidance systems which do not rely on GPS.
- Precision navigation systems that are supportable over an extended period of time

As we look to the future toward 2080 of the SWS there could be any number of options:

1. Requalification of current system, restart of D5LE production line
2. Follow on life extension period to current efforts
3. Follow-on SWS (new missile, etc.)

The decision on which path we take is not one that is required to be made now. Topics such as the next Arms Control agreement, the status of certain industrial bases, and of course the threats we face will all play major roles in determining the next set of system requirements. What I am certain of is the fact we have embarked on the correct architecture path to minimize the impacts of any decision—whether it affects the shipboard systems or the flight hardware.

Third topic: Let me address one industrial base concern.

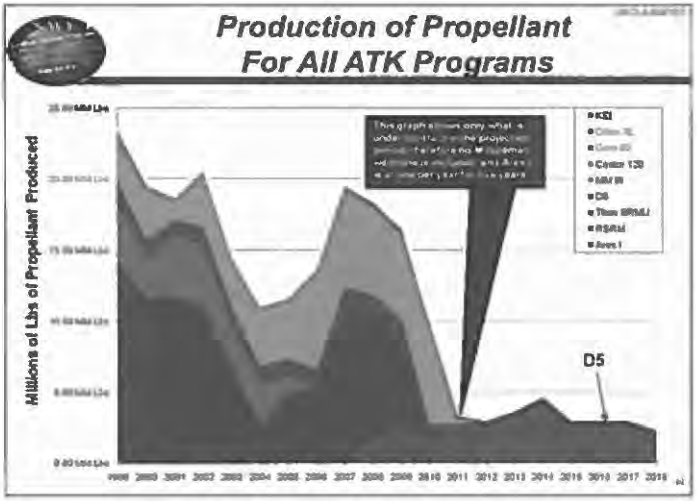
This is my number one industry concern—the status of the Solid Rocket Motor (SRM) industry.

The original TRIDENT II motor service life goal was 25 years based on material. As time has progressed we continue to gain confidence that our assessment is correct and we now believe we can achieve 30-years of effective motor life from our assets.

This requires that we remain in production through the Five Year Defense Plan (FYDP) at a minimum sustaining rate of 12 motor sets per year.

However, outside decisions are significantly affecting our program's efforts. The recent NASA decision with regard to Shuttle and Aries as well as the USAF's decision to eliminate the warm line at ATK has placed significant overhead burden on SSP's costs. We are working closely with ATK to minimize impacts and ATK has been aggressive targeting overhead reduction opportunities.

My opinion is this is not an SSP issue—or a Navy issue—or potentially a DoD issue. This is a National issue that requires a comprehensive strategy for R&D and production. I say this because it is an issue that crosses Government department boundaries and significantly affects National capability in multiple areas—from strategic deterrence to space launch to intelligence capability.



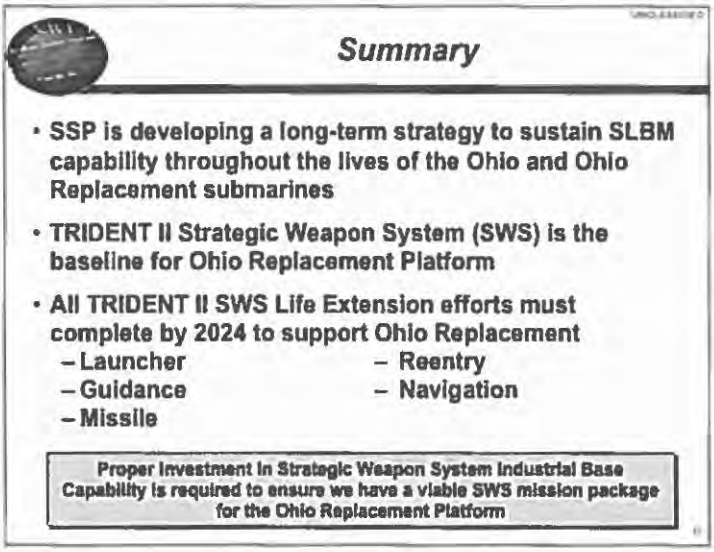
Graphically you can see the significant reduction in volume of propellant production on the years. The key drivers over the last few years has been the shuttle boosters and the MMII production segments. These have ended. The uncertainty of NASA's future plans is driving the SRM—sometimes not always in the best direction.

Congress is aware of the issue and we have been working closely with OSD(IP) for the better part of 12 months to draft a report on future actions. This is the challenge—how should OSD act or react to the uncertainty in the industry sector?

SSP faces the reality of being the only major program in production at ATK's facilities. In addition, we are the only program in production of Class 1.1 type propellant. The AF uses

1.3 as does commercial applications due their ability to simply increase the volume of the launch tubes.

SSP will continue to actively engage in this area and ensure we are, to the maximum extent possible, driving the solution.



We are working hard to make sure the OHIO and OHIO replacement submarines have a reliable, survivable, effective SWS capability for the long term

Likewise, we understand the need to focus on affordability as we do that.

We understand the technology and skill set required to successfully execute the SWS mission requires an investment to sustain the *unique* skills required. These skill sets must be maintained across all the function subsystems.

While there is great attention to design details and cost planning for the platform we can not take our eyes off the significant SWS effort that will run in parallel to the platform effort, and delivers the mission package.

I am here to ensure you that SSP will remain focused and attentive to the details of the SWS to ensure we deliver an effective mission capability.

SPECIAL PRESENTATION

THE POWER OF NUCLEAR DETERRENCE

GENERAL KEVIN P. CHILTON, USAF
ALL HANDS CALL, SUBMARINE GROUP 10
KINGS BAY, GA
JANUARY 19, 2011

It's great to be with you here today as I come to a close in my career in the United States Air Force and my time in command of United States Strategic Command. But before I pass this great command off to General Bob Kehler and go out the door in a few weeks, I want to thank you in person for all that you do, not only for STRATCOM, but for the United States of America. You provide an essential leg to our nation's strategic triad and a key element of our deterrent mission.

STRATCOM and the Submarine Force have a relationship that is different from relationships between other combatant commanders and assigned forces. What you do for STRATCOM, how you train to do that mission, how you maintain the equipment to do that mission, where you are and what you are doing when you are at sea for STRATCOM are on my radar scope every day. Every day, I check the health and status of the SSBN fleet. I review weekly the maintenance status and any issues that Admiral Bruner or any of the other senior task force commanders would want to bring to my attention. Very few other combatant commands have that kind of relationship with assigned forces. It is an important relationship, and it is one that is absolutely essential.

We are called a functional combatant command at STRATCOM because we don't have a particular geographic region assigned to us; instead, our focus is on the global problem set, that is, missions defined by their global nature. Our lines of operations are specific missions that we perform every day. Additionally, we prepare to execute beyond those missions in a time of conflict.

Let me give you a couple of examples. Every day we operate and defend our military satellites, our missile warning satellites, our weather satellites, our GPS satellites, and our global communications satellites with which we do nuclear command and control. In a sense, our operational tempo for space is the same as if we were at war every day. If nothing else, every day in space we are at war with debris that we dodge to keep our satellites viable. We also have a mission set in cyberspace, where we operate and defend the military computer networks. Cyberspace has become a war-fighting domain that is every bit as important as air, land, sea, and space. It is a domain that we must be prepared to defend and a domain in and through which we can expect to be called to execute offensive combat operations.

But STRATCOM's first and most important line of operation is the mission we have to deter attacks on the United States and our allies. The deterrence mission is where you all fit in, every single day. Unlike other mission sets, deterrence is about day-to-day operations *and* focusing on and preparing for a day we hope will never come—a day when we engage in combat against a threat to the existence of our nation. In your case, these two activities, day-to-day operations and preparation for combat, are inextricably linked. That firm link is the nature of deterrence.

A lot of people—too many, in fact—don't understand what deterrence is all about. Let me tell you the one question that frustrates me to no end. I want you to be able to answer this question if you ever hear it asked. It is unfortunate when people say, "Why do we have nuclear weapons anyway since we are never going to use them?" I don't blame the asker; I blame myself for not educating our populace on why it is such an unfortunate question. The simple fact that we use our nuclear deterrent every second of every day is just not understood. Indeed, we used our SSBNs *every* single day of the Cold War, and we use them *every* single day today. Not only did they help to prevent nuclear war during the Cold War, they helped to prevent the Soviet Union from forcefully and brutally expanding its empire into Western Europe. What your SSBN forebears did and what you do every day is inextricably linked to a worst case scenario—the outbreak

of war on a global scale—and one of your key roles remains to prevent that kind of war.

As even the Cold War example shows, you serve more than the singular purpose of deterring *nuclear* warfare. In fact, your deterrence mission underpins our entire Department of Defense operations. It's no coincidence in my mind, no coincidence at all, that conventional world war has not occurred on this planet since August of 1945, even though history, all the way back to the earliest recorded days, is filled with never-ending conventional wars on the scale of the globe as the combatants knew it. But suddenly in August of 1945, the thought of having another war like World War I or World War II started to fade away from people's minds. What you do goes beyond preventing a nuclear war, it goes far beyond that.

Now consider present-day nuclear-armed threats to our nation. Let us never forget that countries exist in the world today that pose an *existential* threat to the United States of America. That is, they have the capability to destroy our form of government, to destroy our society, and to take America back to a stone-age lifestyle. We must not be lulled into the notion that deterrence has no purpose today or in the future. Your work is important today, and when we look to the future, which we are very poor at predicting, I'm sure it will be equally important tomorrow. Indeed, the future could be even more dangerous than today, considering the possibility that even more countries, some hostile to us and our allies today, could field nuclear weapons. Consequently, we should not put at risk, today or in the future, the security and the *existence* of our nation by not paying attention to what you do every day and appropriately resourcing and supporting your mission.

The world is more complex today than it was in the 1960s, 1970s, and 1980s. We have multiple potential adversaries, and multiple threats confront our nation. And, as I said earlier, our nuclear deterrent underpins everything we do. How, you might ask? Let me paint a scenario for you. How many of you were alive in 1981 when Ronald Reagan became our president? We were coming out of a period of inadequate investment in our military force structure. President Reagan determined to turn this

around and, as he increased the budget for the Department of Defense, he didn't just throw money at the Navy, Air Force, and Army. He had a vision: he would grow the United States Air Force to forty combat wings. To give you a perspective, we have the greatest Air Force in the world today with fewer than twenty combat wings. He would grow the United States Army to eighteen combat divisions. Today we have the equivalent of ten, and we still have the greatest Army in the world. For our United States Navy, the vision was a 600-ship fleet. Today we have fewer than 300, yet we are the greatest Navy in the world.

So here's the scenario: tomorrow, I will give the U.S. military the Reagan buildup. I am going to give you forty combat wings, eighteen Army divisions, 600 naval combatants, and all of the personnel and resources required to keep that force fully trained and ready to perform any mission our commander-in-chief may direct. But I am also going to *take away* our nuclear deterrent forces while I give twenty nuclear weapons to a small-time thug of a dictator along with the delivery system to target twenty different cities in the United States of America. Now you tell me, who would the world fear more? Who do you think would kowtow to whom? This is the power of strategic deterrence, the power of nuclear weapons, that so many people tend to forget or ignore.

Our strategic forces underpin our conventional might. They provide the backbone and the foundation for our political leaders to stand toe to toe with potential adversaries and stare them down for the better interest of the United States and to prevent wars from happening. The long shadow of our strategic deterrent spreads around the globe, and it supports the defense and the security of this nation today every bit as much as it did during the Cold War. And our nuclear forces will most certainly remain vital to the security of our nation and our allies for the foreseeable future.

Let me discuss what is required for deterrence, two things fundamentally: capability and will. Our political leaders provide the will, and our job is to provide the capability. The capability is provided not simply by buying submarines, D5 missiles, and the warheads that go on them. The capability we need for effective deterrence includes what you do every day, which is to provide *credibility* to the deterrent force. Without your demonstrated

credibility, we cannot deter anyone. I don't care if you are the biggest kid on the block, if nobody thinks you are *ready* to fight, then you cannot *deter* a fight. Adversaries have got to believe that you are not only properly equipped, but also that you are ready in all regards to do what our leaders say you can do. You demonstrate that credibility in day-to-day operations, in exercises, in the way you train, in the shipyards and maintenance facilities as you get your ships ready for sea, and every time you go to sea. And you demonstrate it in the high standards you maintain in literally everything you do.

At STRATCOM we have a lot of missions. Beyond what I described earlier, we are deeply involved in missile defense, combating weapons of mass destruction, and ISR. We have so many things to keep us busy in Omaha, we often joke that we feel like the circus act who juggles eight balls at one time. But we constantly remind ourselves that seven of the balls are made of rubber while one of them is made of crystal. If we drop a rubber ball, we will be embarrassed but it will bounce. We'll pick it up and keep juggling. But if we *ever* drop the crystal ball of nuclear deterrence, it won't bounce, and the world will take notice. The failure will damage the *credibility* of our capability, which will damage our deterrence. . .and the safety of this nation.

As you know, the triad consists of our air-breathing deterrent, our land-based intercontinental ballistic missile deterrent, and our submarine-launched ballistic missile deterrent. You are an absolutely essential part of the triad, the vital leg of the three-legged stool that provides security for the United States of America and underpins our Department of Defense. The world understands your strength, readiness, professionalism, and stealth. The result: potential adversaries acknowledge that if they cross the line, they can be absolutely certain that you are on station, ready, willing, and able to conduct your mission. That certainty strikes fear into their heart and makes them pause. Your iron-clad credibility is the greatest strength that you bring to our deterrent forces. And you do it so well.

Today, as I mentioned at the start, I came to thank you. Let me also encourage you to continue moving forward, to never be satisfied with where you are, to look for ways to sharpen yourself,

both personally and as a team. We demand perfection from you, and yet as humans we know we cannot achieve perfection alone, which is why we have teams. We must work together and have each other's back. Your job requires a team to deliver the perfection that is required for this deterrent. Take care of your shipmates when you are at sea and follow the procedures that are so strict and demanding that someone not as steeped in your business may wonder why they must be so precisely followed. In short, you as part of the team need to commit yourself to nothing less than perfection because perfection everyday means credibility in the deterrence mission.

Let me conclude with this: as I watch you and depend on you to deliver perfection, I am really bothered that we never have a parade for you guys We take you guys and put you under water for months at a time. We never see you marching down Main Street, and we never see a flyby for our SSBN force on Armed Forces Day or Memorial Day. In fact, we are not allowed to talk much about what you do. But along with that comes, I hope, a sense of pride within the Silent Service, a sense of pride that when you look at yourself in the mirror, you know you are something special because you are part of something bigger than yourself. You do something incredibly important for this nation, and the fact that not many people know about what you do is *not* okay with me. But it *needs* to be okay with you in your heart. Too often we can come to work without remembering why we put on the uniform. But every once in a while I want you to pause and look in the mirror and remind yourself just how important you and what you do every day of the year are to this great land of ours. Pause and reflect on why you do what you do—feel the sense of pride I want you to have. And know in your heart that there is a commander at STRATCOM who will replace me and a former commander sitting on a rocking chair someplace who is just so proud of each and every one of you.

Some people think the highest calling of a military person is to fight the nation's wars and win. I do not believe that. I believe the highest calling of any military person is to work in such a way that prevents any adversary from challenging our nation to a fight. The greatest calling is to prevent war from happening, to prevent

American blood from being spilled, not by accommodation, but through strength. Deterrence is the highest calling. Deterrence is your calling. I salute you, and I thank you for what you do. God bless you all.

ARTICLES

THE RISE OF THE SUBMARINE BASED BALLISTIC MISSILE A BRIEF HISTORY

By RADM William J. Holland, Jr., USN(Ret)

Editor's Note: The topic for Naval Historical Foundation/Naval Submarine League's Annual Submarine History seminar in April was The Rise of the Submarine Based Ballistic Missile. RADM Jerry Holland wrote a short historical summary for the program at that event. It is reproduced here as a big picture context for the emphasis given in this issue to the OHIO Replacement Program.

At the beginning of the Cold War, seaborne strategic deterrent missions were assigned to **Regulus** cruise missiles, first based on carriers and then between 1958 and 1964 on five submarines, four conventionally powered (SSG) and one nuclear powered (SSGN). The missile's utility was limited in range and accuracy. The need to surface during launch made the submarines vulnerable to attack during launch and a fueled missile on deck represented a serious hazard, particularly in rough weather.

To replace **Regulus**, a joint Army-Navy ballistic missile design program began in December 1955 that eventually produced the Jupiter intermediate- range ballistic missile (IRBM). But in the following year, when Edward Teller and Harold Brown promised a warhead light enough to be able to be lifted on a solid fuel missile, the Chief of Naval Operations, Admiral Arleigh Burke, directed abandoning the Jupiter program in favor of a solid fueled submarine launched ballistic missile (SLBM).

The **Polaris** program started development in 1955 and in July 1960, USS GEORGE WASHINGTON (SSBN 598), the first US missile submarine, successfully launched the first **Polaris A-1** missile from a submerged submarine. USS GEORGE WASHINGTON was the first of forty-one submarines each with sixteen launch tubes. In an ambitious shipbuilding program, all were constructed between 1958 and 1967.

These first missiles had a range of about 1,200 miles. Each subsequent version was larger, weighed more, and had a longer range. The range increase was most significant. The **A-2** range was 1,500 nautical miles, the **A-3** 2,500 nautical miles. **Polaris A-2** entered service in 1961 and deployed on 13 submarines, serving until 1974. The **A-2** is the first and only American SLBM or ICBM to be fired in an end-to-end test conducted in May 1962 when USS ETHAN ALLEN (SSBN608) launched at a target point in the Pacific Ocean. The final version of **Polaris**, the **A-3**, with a range of 2,500 miles left no land target inaccessible and provided an increase in sea room. The **A-3** featured multiple re- entry vehicles that spread the warheads about a common target. The **A-3**, initially deployed in September 1964, was retired in early 1982.

On 6 April 1963 the United States and the United Kingdom signed the Polaris Sales Agreement for the U.K to purchase the **Polaris A-3** missiles for the four submarines of their Ballistic Missile Fleet. HMS RESOLUTION deployed on the first Royal Navy SSBN patrol in June 1968.

The next development, the **C-3 Poseidon** brought major advances in explosive power and accuracy. Slightly longer, considerably wider and heavier than **Polaris A3, Poseidon** had the same 2,500 nautical mile range but a greater payload capacity (10 - 14 warheads), improved accuracy, and Multiple Independently - targeted Re-entry Vehicles (MIRV). **Poseidon's** first test occurred in August 1968 and was first launched from USS JAMES MADISON (SSBN 627) on 3 August 1970. The weapon officially entered service on 31 March 1971, eventually being installed in Lafayette, James Madison and Benjamin Franklin classes.

The **Trident I** and **II** programs were the result of the 1966-67 SECDEF—**STRAT-X** study to examine future missile basing concepts and performance characteristics to counter potential

Soviet offensive forces and anti-ballistic missile proliferation in the1975-1990 time frame. **Trident I (C4)** had the same physical dimensions but twice the range (4,000 nautical miles). First launched from USS FRANCIS SCOTT KEY (SSBN 657) in 1979, **Trident I** replaced **Poseidon** in 12 SSBNs of JAMES MADISON and BENJAMIN FRANKLIN classes and in the first of the Ohio class SSBNs. **Trident I's** initial deployment was in 1979 and the missile served until retired in 2000.

The last of the original forty-one missile submarines, USS KAMEHAMEHA (SSBN 642) was decommissioned in April 2002.

Development of the **Trident II** began in 1983. This second variant has a longer range (7,000 nautical miles), a heavier payload and enough accuracy to threaten any, even the most hardened, targets. First launched from shore in January 1987, the first submarine launch was attempted by USS TENNESSEE (SSBN-734) in March 1989. The launch attempt failed spectacularly but simple changes solved the problem and **Trident II** entered service in March 1990. Since then, **Trident II** has executed 135 consecutive successful test launches.

The Trident II was the original missile on the British Vanguard Class and Ohio Class SSBNs from USS TENNESSEE (SSBN-734) on. The D5 missile is currently carried by 14 Ohio Class submarines and is expected to remain in service until 2027.

The first ballistic missile submarines to be designed from the keel up since the Ethan Allen Class, USS OHIO (SSBN 726) was commissioned in 1981. The first eight (SSBNs 726 through 733) were armed with **Trident I (C4)** SLBMs, subsequently upgraded with **Trident II (D-5)**; the final 10 (SSBNs 734 through 743) were armed with larger and more powerful **Trident II (D5)** missiles. These ships were originally designed for a 30-year life but have now been certified for a 42-year life, composed of 20 years of operation, a two-year mid-life nuclear refueling overhaul, and then another 20 years of operation.

A total of eighteen Trident II SSBNs were constructed each with twenty- four tubes. Four have been converted to carry cruise missiles. The remaining fourteen carry over fifty percent of the total deployed US strategic warhead inventory. Under the new

START treaty the SSBN will assume responsibility of approximately 70% of the 1550 nuclear assets permitted for the United States. To support this requirement the Navy has initiated the OHIO Replacement Program that will build 12 new SSBNs to replace the Ohio Class submarines when they reach their end of life.

DEGRADING ANTI-ACCESS/AREA DENIAL (AA/AD) ZONES FROM WITHIN: THE VALUE OF COVERTLY INFILTRATED SUBMARINE ANTENNAS

by CAPT Jim Patton, USN(Ret)

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

Background

There is presently a significant degree of concern about how naval power can be used to affect events ashore if the land-based power in question can create credible maritime Anti-Access/Area Denial (AA/AD) zones, which hold legacy power projection platforms at great risk if they attempt to approach within weapons range. For the foreseeable future, however, these AA/AD zones will not be effective against modern nuclear submarines. The issue becomes, therefore, how these multi-mission submarine platforms can be best employed to weaken if not defeat (non-kinetically if possible) these zones and enable entry of surface warships at a greatly reduced threat level.

Discussion

An even casual study of the military history of the United States will quickly reveal that of all military platforms, the submarine has most often been called upon to provide a *new* service, which was not a design element for that particular vessel.

For example:

- After the Pearl Harbor attack in December 1941, there was an urgent need to bring the fight to Japanese home waters, and submarines designed (and crews trained) to serve as scouts for surface battle groups were pressed into service

to conduct independent offensive operations against Japanese maritime and naval forces throughout the western Pacific. Their success in this role is legendary.

- After WWII, and facing a potential adversary not dependent on large numbers of merchant ships for essential logistics but who possessed a huge Submarine Force that threatened vital Allied shipping, the U.S. Submarine Force was tasked with quickly developing the Tactics, Techniques and Procedures (TTPs) which quickly made them the world's premier Anti-Submarine Warfare (ASW) force—a mission not even conceived when many of the platforms were designed.

- Again, when the absolute survivability of a large nuclear retaliatory force was an essential element for any Assured Mutual Destruction (MAD) strategy, it was the submarine that was again turned to, with some nuclear attack submarines (SSNs) under construction actually converted to have a missile compartment rolled in and welded up. These ballistic missile submarines (SSBNs) and their Submarine Launched Ballistic Missiles (SLBMs) continue today as the predominant component of what was the nuclear *Triad*, as the airborne and land-based missile *legs* have been reduced.

- When the need arose in the chaotic multi-polar world following the fall of the Berlin Wall and the implosion of the Soviet Union to occasionally employ very precise conventional weapons effects ashore from previously unseen platforms and unexpected axes from the littorals, the SSN-launched *Tomahawk* Submarine Launched Cruise Missile (SLCM) quickly became the weapon of choice—so effective in fact, that four of the Ohio-class SSBNs were converted to SSGNs, each carrying a Carrier Battle Groups worth of SLCMs in addition to as many as 75 Special Operating Forces (SOF).

Transformation was and still is a formidable buzzword in and about the Capitol Beltway, and it has been well documented, by instances as related above, that *transformation ability* does not inherently exist in most combat platforms, and essentially has to be designed in as a military characteristic—in submarines historically referred to as *space and weight reserved.* There is now a new evolving and *urgent* mission need that, again, a transformational platform needs to undertake—that of penetrating AA/AD barriers and taking those systems down from inside. It should come as no surprise that the submarine will again likely be this platform. What might come as a surprise to some is that a primary element in executing this emergent mission will not be such as better torpedoes, superior sonars, SLCMs, SLBMs or SOF, but rather the submarine's antennas.

In today's Radio Frequency (RF)-based Information Age, antennas are everything. Whether space-based, on cell-phone towers or imbedded in your laptop or Personal Data Assistant (PDA), antennas are the ubiquitous and largely unnoticed *things* that enable almost everything. In many cases, however, the antenna in question has to be *close enough* to do what it is you expect it to do, and if you can get an antenna *really* close, there are an extraordinary number of things that can be done.

For example, although the traditional view of a submarine antenna is to support the means to get some occasional information or advice from your masters ashore and to very infrequently send them some, other options now conceivably exist for properly designed antennas such as:

- The interception and exploitation of even extremely low-powered RF emissions from within the AA/AD zone and ashore.
- The *injection* of false or deceptive traffic into an adversary's networks.
- The conducting of *cyberattacks* on an adversary's information systems within the AA/AD zone and ashore.
- The *jamming* of radars and other RF-based surveillance systems.

- Through Electronic Intelligence (ELINT) and Communications Intelligence (COMINT) intercepts and analysis, determining the identity and location of key nodes in the AA/AD complex so that contingency targeting plans can be developed.
- The real-time support of various and sundry operations in the littorals and on the sea bottom by embarked SOF.

Almost by definition, many, though not all, oceanic littorals within AA/AD zones involve shallow waters. In some number of years past, that fact would have seemed to argue against employment there of large nuclear submarines who were, at the time, most comfortable when in waters deeper than 100 fathoms. However, with decades of experience currently under their belts in waters such as the Persian Gulf, U.S. SSNs and even SSGNs consider long duration (many weeks) operations in waters as shallow as 20 fathoms as *normal.*

Another myth, which has been largely discredited is that submarines operating in restricted waters such as would be found in many AA/AD zones would be at an unacceptable risk to visual detection. Again, real world operations in shallow, congested waters in which at any one time there might be many dozens of visual contacts has shown that given modern software for contact management, the chances of visual detection or dangerously close encounters can be managed. In fact, the few, but openly discussed cases in which there was a collision involving a submerged submarine, the root cause was almost always complacency—not the complexity of orchestrating safe stand-off distances.

Conclusions

For at least the fifth time in less than a century, U.S. military effectiveness stands to be challenged with a problem for which there is no *off the shelf* response. In the case of the last four instances, the platform that stood up and developed an effective *new* response to the intractable issue was the submarine. It will surprise few submariners if this is not the case once again. If this is to be the case, however, industry will need to leverage the very

best of technology for antenna design and operation, and push even further the already considerable limits of receiver sensitivities and signal processing—all of which are doable dos.

In the grand chess game of international strategy, an ability to construct credible AA/AD zones against surface warships might represent a *Check*, but is certainly not *Mate*. There are other men on the board that could be considered analogous to pieces with the range and agility of a Queen, but also with the Knight's ability to go over or through (in this case under) an opponent's blocking pieces. It is almost inevitable that the submarine and its antennas will prove to be the undoing of any maritime AA/AD scheme.

FIXED SONAR SYSTEMS THE HISTORY AND FUTURE OF THE UNDEWATER SILENT SENTINEL

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Executive Summary

One of the most challenging aspects of Anti-Submarine Warfare (ASW) has been the detection and tracking of submerged contacts. One of the most successful means of achieving this goal was the Sound Surveillance System (SOSUS) developed by the United States Navy in the early 1950's. It was designed using breakthrough discoveries of the propagation paths of sound through water and intended to monitor the growing submarine threat of the Soviet Union. SOSUS provided cueing of transiting Soviet submarines to allow for optimal positioning of U.S. ASW forces for tracking and prosecution of these underwater threats. SOSUS took on an even greater national security role with the advent of submarine launched ballistic missiles, ensuring that U.S. forces were aware of these strategic liabilities in case hostilities were ever to erupt between the two superpowers. With the end of the Cold War, SOSUS has undergone a number of changes in its utilization, but is finding itself no less relevant as an asset against the growing number of modern quiet submarines proliferating around the world.

Introduction

For millennia, humans seeking to better defend themselves have set up observation posts along the ingress routes to their key strongholds. This could consist of something as simple as a person hidden in a tree, to extensive networks of towers communicating

with signal fires. Regardless of the means, the goal was the same: to gain advanced notice of the approach of one's enemies to allow for defensive forces to be prepared in a timely manner.

This strategy continues to hold today, though the technological means to do so are radically different. Many of our tools for long-range observation are now based on orbiting satellites. Instead of keeping watch from a high tower, we use photographic reconnaissance. Instead of using signal fires for communication, we use radio signals that are relayed through satellites. However, one area of great concern with which satellites continue to have difficulty is the detection of submerged vessels approaching our shores.

Since World War I, sonar has been used with varying degrees of success to detect submarines. By the end of World War II, it was considered the premier sensor to locate submarines that were able to stay below the surface of the ocean for longer periods of time. Keeping forces constantly at sea to maintain a continuous patrol, however, is expensive and very time consuming. A method was sought that could provide the detection capability of sonar without the prohibitive cost of seagoing time and resources. That method was the fixed sonar system, an array of hydrophones deployed along the ocean floor in strategic areas, designed to detect an enemy submarine as she either left her home waters or approached ours. These silent tripwires came to play a vital role in the rapid buildup and undersea forces of the 1950's and beyond. They still have an important role even today, as their capabilities continue to be refined to meet growing acoustic detection challenges.

Early Designs

The first sonar hydrophones, developed during World War I, could detect submarines from several miles away. However, self-noise was a very limiting factor (and still is today to a lesser degree). These early convoy escorts had to come to a complete stop to be quiet enough to listen for an enemy submarine, greatly hampering their effectiveness in protecting a convoy. (Cote, 2003) Having seen the effectiveness of the lone submarine against commercial assets, the Royal Navy spent several years after the end of the war developing a new technology to aid in the detection

of a single submarine at sea. This new development—called ASDIC—was one of the most closely guarded secrets of any military program at the time. The meaning of ASDIC is still debated, but could possibly mean Allied Submarine Detection Investigation Committee or Anti-Submarine Division Supersonics. ASDIC was the first active sonar and provided a step-jump improvement over earlier passive arrays by providing not only bearing to a contact, but also the range.

Once the United States entered World War II, the British began sharing the technology behind their new secret asset. The United States used it to set up high frequency active sonar transducers—known as the Herald system—mounted on submerged tripods outside of several commercial ports. The Herald transducers were operated via cable run to nearby shore-based stations. They could be trained as needed to detect and track a target. The Heralds also incorporated a magnetic tripwire detector that was a precursor to modern Magnetic Anomaly Detectors. (Gerken, 1986)

Acoustic Research Makes Major Strides

Further research into passive acoustic arrays and sound propagation through the water, both during and after World War II, resulted in a breakthrough discovery. Maurice Ewing and J. Lamar Worzel located the presence of a deep-water sound channel that trapped and focused low frequency sound waves, allowing them to propagate over distances of thousands of miles. (Cote, 2003) At the direction of the Office of Naval Research, this Sound Fixing and Ranging (SOFAR) channel was exploited by Bell Labs in late 1950 to begin development on the Sound Surveillance System (SOSUS). SOSUS was to be a vast network of seabed acoustic hydrophones that would utilize the characteristics of the SOFAR channel to detect submerged adversarial submarines at long ranges.

Detecting contacts underwater, particularly from long range, is a difficult task given the interference of acoustic noise in the signal reaching the hydrophone being monitored. Two methods of improving the signal-to-noise ratio (SNR) are antenna gain and processing gain. Given the relatively limited processing power of

then-current computer technology, improvements in processing gain were difficult to achieve at the time. Antenna gain, however, was already being exploited in the design of the large hydrophone arrays being installed in the bows of hunter-killer submarines (SSKs). In addition, as the array length grew, the minimum frequency that could be detected also improved. This made SOSUS very well suited to aid in the detection of submarines at long distances. Its 1,000 foot long hydrophone arrays could detect even the lowest frequencies being generated by submarines at ranges of hundreds of miles. To maximize their low frequency detection capability, the SOSUS arrays were installed perpendicular to the expected direction of sound arriving from submarines transiting at the axis of the SOFAR channel.

The realization that the broadband nature of the noise signature of submarines also contained measurable narrowband components led to the next step-increase in submarine detection capabilities. These narrowband components are usually associated with a particular piece of machinery, be it a pump, generator, or gearbox. Using a tunable set of frequency filters, these tonals could be picked out of the general signal being received by the array. The process of sorting out these narrowband tonals was termed Low Frequency Analysis and Ranging (LOFAR). LOFAR gave sonar array designers a way to dramatically improve the processing gain of their systems. As intelligence about adversarial submarine design improved, the aspect-dependent nature of many narrowband tonals could provide even more detailed information about a submarine's general direction of transit. It was later realized that these tonals can also act as a form of acoustic fingerprint for identifying a given class of submarine and sometimes even a specific boat.

The Beginnings of the Network

Bell Labs' first design for SOSUS – named Project Jezebel – was installed off the coast of Eleuthera, Bahamas in 1951. This test installation was so successful that 1952 saw the decision to install SOSUS arrays along the entire Eastern coastline of the U.S. Two years later, SOSUS arrays were planned along the Western coastline and in the waters surrounding Hawaii. These systems

were completed and began operations in 1958. The next installation was completed in 1959 off the coast of Argentia, Newfoundland, demonstrating the incorporation of allied nations into the ever-expanding Anti-Submarine Warfare (ASW) detection network.

In use, the detection network entailed a multi-stage process. The SOSUS arrays were connected to land-based Naval Facilities (NavFacs) that received and processed the acoustic information. The refined data was then passed to evaluation centers that incorporated other cueing sources, such as high-frequency direction-finding radars, to generate a submarine probability area (SPA). ASW forces were then directed to the SPA to attempt to gain local contact with the submarine. Completing this sequence of events entailed an inevitable time delay. It also suffered from a relatively high false alarm rate, adding further difficulty to the task of locating and tracking the target. (Cote, 2003)

SOSUS Comes Into Its Own

LOFAR was a great development in the ability to detect submarines. However, against diesel submarines, it was hampered by the fact that the target low frequency tonals were only emitted while the submarine was snorkeling. Thus, a sub could be tracked as it transited to its patrol area, but further localization was at the mercy of the sub's operating routine for recharging its batteries. The advent of nuclear power in submarines, though, showed the great potential of the SOSUS arrays.

Nuclear submarines have numerous pieces of machinery supporting the operation of the reactor that are required to run at all times. The acoustic stealth of early nuclear designs was further compromised by the continued practice of mounting engineering equipment directly to the hull, as well as the use of traditional, but noisy, propeller designs. Their tell-tale narrowband tonals were a constant noise source while they were at sea, making them prime targets for SOSUS. SOSUS also helped to highlight the noisy signatures of the U.S. nuclear subs. The most noted example of this involved USS GEORGE WASHINGTON (SSBN-598) as she transited for one of her first deterrent patrols in 1961. East coast SOSUS stations tracked her during her entire trip across the

Atlantic Ocean to the United Kingdom. Another first in long distance detection was achieved in 1962, when the SOSUS station in Barbados detected a Soviet Hotel/Echo/November (HEN)-class submarine as it passed through the Greenland-Iceland-United Kingdom (GIUK) gap.

SOSUS was also proving its value to the aviation-based ASW community. Using the cueing from SOSUS and their own LOFAR-based sonobuoys, ASW patrol aircraft were becoming more effective at tracking adversarial submarines. Coordination with SOSUS, however, caused their tactics to undergo a good deal of refinement. Detections were being made at much longer ranges, and so the area of location uncertainty for the target sub was much larger by the time the ASW aircraft arrived at the original detection point than had been experienced before. This was particularly troubling when attempting to track diesel submarines, as they would only be snorkeling for a finite period of time. Nuclear submarines and their constant noise signatures made this problem much less significant. The growing effectiveness of SOSUS continued to spur development of new ASW tactics in the coming years.

Bringing the Fight to the Enemy

The ability to detect and track Soviet submarines almost at will emboldened the Navy's vision of ASW operations. In 1965, Navy leadership decided to install SOSUS arrays in locations as close to the Soviet home waters as possible. This strategy would offer as much lead time as possible to position U.S. and Allied surface, submarine, and aviation ASW assets to best prosecute the coming threat. The Navy began by looking for natural choke points where the Soviets would have to transit to reach their open-ocean patrol areas. An array was built in the Norwegian Sea in 1964 to watch for submarines leaving their bases on the Kola Peninsula, and NavFac Keflavik was established in 1966 to supervise the GIUK gap. By 1981, thirty-six stations were keeping watch for submarines of the Soviet Union and their allies around the world. These barrier stations provided the cueing data needed by ASW prosecution vessels. The constant monitoring capability

of SOSUS reduced the need for ships, subs, and aircraft to maintain the barrier watch for Soviet subs. The granting of basing rights in places like Rota, Spain and Keflavik, Iceland greatly increased the proximity of ASW aircraft to the expected Soviet transit lanes. SOSUS also freed up American attack submarines (SSNs) to be able to forward deploy in Soviet waters to conduct intelligence gathering, as well as provide the first line of defense in case hostilities were to break out.

The need for a permanent advanced warning system was highlighted by the deployment of four Soviet Foxtrot-class submarines to the Caribbean Sea during the Cuban Missile Crisis in October 1962. The detection of one of the Foxtrots by SOSUS and its subsequent prosecution by ASW patrol aircraft marked another milestone in the program's continuing development. (Association, 2010) SOSUS provided the ideal combination of round-the-clock watchfulness without alerting the adversary to the presence of the sentries.

SOSUS Continues its Evolution

One of the great concerns of the ASW community, and thus one of its primary driving factors, was maintaining its established acoustic advantage over the Soviet Navy. Leaders in the community predicted that it was a matter of when, not if, the Soviets would improve the noise silencing on their submarines to eliminate the early-warning capabilities provided by SOSUS. A primary focus in maintaining that edge was the continuing refinement of acoustic and computing hardware to further enhance array and processing gains.

One of the innovative enhancements to SOSUS was altering how it processed the data from its hydrophone strings. Instead of linking all the hydrophones on a string into a single array, it was determined that splitting the hydrophones into two or even three arrays on a given string would still provide an acceptable level of acoustic detection. The advantage to this technique is that these arrays could be steered to look at separate acoustic arrival paths, which helped to resolve the issue with bearing resolution that was present when a string was configured as a single array. The

computers that processed the acoustic data saw continuing improvements as well, allowing for frequency spectra to be resolved at a finer level. This development of passive acoustic detection capability also helped to improve the quieting efforts of American submarine designers. (Cote, 2003)

Navy leadership recognized the vulnerability of SOSUS's passive detection to quieting efforts by the Soviets shortly after the system was first implemented. As a means to prevent the possibility of future obsolescence, SOSUS designers took up where the Herald system left off and tried to develop active echo-ranging capabilities that would work across entire ocean basins. The most notable of these efforts was Project Artemis, which ran during the first half of the 1960's. Artemis, like most other large-scale active echo-ranging systems, had difficulty in developing a low frequency active transducer powerful enough to operate over the desired ranges. It was also inhibited by an inability to perform enough signal processing to account for the effects of reverberation on the outgoing pulses. Ultimately, the idea of an ocean-wide active sonar network was abandoned as unfeasible. In the meantime, technological improvement in passive acoustics continued. However, the biggest challenges to the viability of SOSUS were on the horizon.

SOSUS Meets Its Match

The 1970's saw the introduction of two significant—and different—threats to the ability of SOSUS to fulfill its early-warning detection role. The first, introduced in 1973, was the Delta-class ballistic missile submarine (SSBN). The second, introduced in 1978, was the VICTOR III SSN. These two Soviet submarines were the harbingers that the days of overwhelming U.S. ASW superiority over the Soviet Union were drawing to a close.

The Delta was not a remarkably new design for Soviet SSBNs. In fact, it was viewed by American intelligence analysts as yet another example of the Soviets failing to improve their quieting techniques. One analyst was quoted as saying:

> Those of us who are in the technical community had staked our reputations on the fact that when the Delta-class submarine(s) went to sea in 1976 they were going to demonstrate a fundamental quieting program, and we said that to the rest of the world and they did not do it and we lost a lot of credibility. (Cote, 2003)

What made the Delta so formidable to SOSUS was its submarine launched ballistic missile (SLBM), which had sufficient range to reach the continental United States from the waters in the vicinity of the Barents Sea and the Sea of Okhotsk. This meant that Soviet SSBNs no longer had to transit through the elaborate series of choke points and acoustic barriers to be able to endanger the U.S. with their nuclear payload. At the same time, the United States publicly declared that one of its first goals upon the commencement of hostilities with the USSR would be the destruction of all Soviet SSBNs. These two factors—the Delta's long-distance launch capability and the announced targeting of their SSBN fleet in the event of hostilities—caused a fundamental shift in the strategic and operational policy of the Soviet Union. They implemented their bastion strategy, in which their SSBNs would conduct their patrols within friendly home waters or under the protection of the marginal and permanent Arctic ice. There were even reports of Deltas conducting strategic patrols while still in port. The bastion strategy meant that U.S. SSNs would have to pass through Soviet ASW barriers to reach their prey in the event of war.

Despite this radical shift by the Soviet strategic forces, SOSUS could still operate against the other classes of Soviet subs, which were still at a noticeable acoustic disadvantage. 1978 was another milestone in the improvements to the Soviet submarine program. This time, it was the introduction of VICTOR III SSN, a measurably quieter nuclear submarine. VICTOR III and its mid-1980's descendent, the even-quieter AKULA, put the U.S. Submarine Force on notice that its acoustic advantage was coming to an end. The Victors and Akulas incorporated numerous technological improvements, from equipment rafting to improved

propeller design, to reduce their acoustic signatures. The Akulas, in particular, achieved the long sought-after goal of being quiet enough to evade detection by SOSUS. These dramatic improvements in acoustic quieting technology were the direct result of the classified information collected by SOSUS that was leaked to the Soviet Navy by the Walker/Whitworth spy ring. (Whitman, 2005) Prior to that compromise of information, U.S. intelligence indicated that the Soviet Submarine Force had little indication of the degree to which their submarines were acoustically vulnerable. Despite the setback, proponents of SOSUS could take some comfort in knowing that it would be some time before the rest of the Soviet Submarine Force would reach the acoustic silence standard set by Akula, if such a program was even feasible for the Soviet Union to undertake.

New Life and New Developments

The Navy was not willing to resign SOSUS to the annals of Cold War history. Through efforts led chiefly by Destroyer Squadron (DESRON) 31 as it worked to restore its long-dormant coordinated ASW skills, operational commanders were given more ability to access and incorporate SOSUS and other elements of the Integrated Undersea Surveillance System (IUSS) into their planning and tactical employment. Specifically, DESRON 31 developed techniques for the reverse cueing of contacts to SOSUS operators. This involved sending contact data back to SOSUS monitoring stations to prompt their review to look for the vessel in question and allowed the operators at sea to take advantage of the significantly greater acoustic processing capability of SOSUS base stations.

The 1980's also saw the fielding of two new sonar systems. The first was the Surveillance Towed Array Sonar System (SURTASS), which was essentially a SOSUS-like array towed from a DOD-contracted civilian ship. This array, incorporating the use of a low frequency active (LFA) transducer, achieved the goal of open-ocean active sonar search envisioned by Project Artemis. Further experiments with LFA may be able to incorporate both SOSUS and SURTASS arrays as receiving stations to track quiet modern submarines. The second new development was the Fixed

Distributed System (FDS), which used an array of hydrophones designed to take advantage of shorter-range direct path acoustic signals. These sensors would then be networked together through fiber optic cables and routed to an operating station on shore for signal processing. The advantage to FDS is that it can be deployed in both deep and shallow areas because it does not depend on sound propagation through the SOFAR channel. The successor to FDS was the Advanced Deployable System (ADS). ADS operated in much the same fashion as FDS, except that it was intended to be deployed from a ship on an as-needed basis in a forward operating area. The development program for ADS was cancelled in 2006, though remotely-operated, forward-deployable systems continue to be under development. These new systems, now known as Distributed Netted Systems (DNS), are taking on an increasingly important role in the emerging field of Subsea Warfare. DNS perform some of the same monitoring functions as SOSUS, but also have more advanced communications capabilities, such as being able to communicate directly with ships at sea without a shore-based relay station, as well as a growing variety of non-acoustic sensors.

The future of SOSUS is likely heading in a much different direction from what its designers originally envisioned. While it is still considered an important national security asset, the opportunity is also being granted for civilian use of the array and its data collection capabilities. SOSUS has been used in several areas of research, including seismology, marine mammal migration, and looking for global warming trends in oceanographic conditions. Users are required to possess a security clearance, as the data is still in use by Defense Department personnel, but it provides an excellent infrastructure that might not otherwise be feasible for development and deployment by research and academic institutions. SOSUS has also been used by law enforcement personnel, most notably in drug interdiction efforts for over-water supply routes from Central and South America.

Conclusion

SOSUS has had a storied service record over the last fifty-plus years, though many of those stories are only recently being

declassified for public consideration and analysis. It was a revolutionary system that provided a significant technological advantage to the United States in its conflict with the former Soviet Union. For all the secrecy associated with the information it provided, SOSUS had a profound impact on the growth and development of modern ASW techniques and tactics. It directly contributed to the acoustic advantage that the U.S. Submarine Force enjoyed for many years, allowing U.S. subs to operate with near-impunity in virtually every region of the world with water deep enough to accommodate them. Even as SOSUS has been pushed towards obsolescence by continuing advances in submarine design, such as air-independent propulsion and ultra-quiet nuclear submarines, its legacy of technological innovation has continued. SOSUS continues to be a valuable resource as its capabilities are applied to new areas of study, ensuring its relevance for years to come.

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THOSE PESKY, PLUCKY PICKET BOATS
PART I OF III

by CDR John D. Alden, USN(Ret)

Standard histories of the World War II campaign against Japan have almost nothing to say about them. They were judged too small and insignificant to be counted in the official record of Japanese ships sunk by our forces during the war, so the usual tallies of ships credited to each of our submarines do not include them. Descriptions of the Imperial Japanese Navy provide little information about them, and there was nothing like them in the U.S. Navy. Our sailors and airmen knew them as picket boats, and our submariners found them to be real "thorns in the flesh."*

The Navy's first encounter with the Japanese picket boats occurred on 24 February 1942 in the course of an air raid on Japanese installations on Wake Island, during which two pickets were sunk. A more significant contact transpired on 18 April 1942 when the NITTO MARU #23** spotted and reported the task force carrying Lt. Col. James H. Doolittle's bombers toward Japan, thereby breaching its security and forcing the planes to be launched earlier than intended. The NITTO MARU #23, a 90-ton steam trawler, and two additional pickets were sunk and eight others damaged by planes from the carrier ENTERPRISE and gunfire from the cruiser NASHVILLE, but they had fulfilled their mission and significantly reduced the effectiveness of the Doolittle raid.

* The material on specific U. S. submarine attacks has been taken directly from the original patrol reports; other general information is from standard reference works. Japanese information is mainly from several detailed reports and other archival sources. I am indebted to William G. Somerville of England and Erich Muehlthaler of Germany for translating these documents.

** In Japanese usage ship names that include numbers are written with the number preceding the name, e.g. #23 NITTO MARU, but this makes alphabetizing awkward, so most U.S. writers prefer to put the number last. Where alternative spellings for names are given, these generally result from different readings of the same Japanese kanji by different translators. The usage of suffixes such as Go etc. defies simple explanation.

What manner of opponents were these boats? Unlike the U.S. Navy, which preferred to build most of its smaller types of warships from the keel up, the Japanese Navy mobilized hundreds of fishing craft and other commercial types to serve as converted gunboats, minesweepers, patrol boats, submarine chasers, and auxiliaries of various kinds. Alterations were held to a minimum, the ships retained their commercial *maru* names, and many of the crews were simply enrolled as reservists and retained on board.

Among these conversions were 404 former ocean fishing vessels designated *tokusetsu kanshitei* or *specially equipped guard boats*. They are listed as ranging from 32 to 269 gross registered tons, which measures only their commercial cargo capacity; as warships their displacements probably fell mainly between 150 and 250 tons. The official register describes them variously as steam vessels, ketches, or schooners, but all had engines in addition to any sails carried. They were armed with one or two light guns, such as older model 5- or 6-centimeter short-barreled weapons, plus machine guns, rifles, pistols, and two to four depth charges. Most importantly, they were fitted with powerful radio transmitters and antennas mounted on high masts for long-range communications. With reservist crews augmented by regular naval commanding officers, gunners, and radio operators, their main function was to patrol picket lines 500 to 700 miles off the Japanese coastline and warn of approaching enemy forces.

Organizationally, the pickets in the northern Pacific came under a unit called the 22nd Squadron, which also included several attached converted gunboats and miscellaneous support craft, with headquarters in Yokohama. Those in the south came under the 4th Fleet. Within the northern group, 194 boats were assigned to the 1st through 6th Guard Forces or Fleets, which were responsible for the main picket line sectors. In the south, 74 were assigned directly to the 4th Fleet. The rest were divided among 20 or more organizations including other main fleets, local defense fleets, and base or district forces. Casualties were high: at least 179 were sunk by U.S. forces—28 or more by submarines—and about 21 were lost by non-combat causes. Most of the rest are known or presumed to have been returned to their owners after the war.

To make matters more confusing, there was an additional set of pickets called *zatsuekisen kanshisen* or *miscellaneous guard boats* about which less is known. These were under naval control but were manned by civilian crews and presumably were not as well armed as the regular converted boats. The publication *Warships of the Imperial Japanese Navy, 1869-1945* by Hangeorg Jentschura, Dieter Jung, and Peter Mickel omits many of the 404 previously described but identifies as guardboats 124 that are not included in that group. It also reports that 32 of these so-called pickets were sunk by submarines. According to more authoritative sources, most of these vessels were actually serving in other roles, or are listed incorrectly. As will be seen, submarine skippers were never sure what kind of armed Japanese small craft they were engaging.

Our submarines began to encounter some of these little ships as the earliest patrols from Pearl Harbor approached Empire waters, but the skippers had little guidance as to dealing with them. Up until World War II, the leaders of the Submarine Force were divided into two camps regarding the proper use of the deck gun. The faction headed by the influential Admiral Thomas C. Hart believed that gun battles should be avoided as jeopardizing the submarine's primary mission of scouting in advance of the battle fleet and torpedoing enemy warships. Hart, who was president of the General Board when the characteristics of the WWII fleet submarine were developed, would accept nothing larger than a 3"/50 caliber dual-purpose surface and anti-aircraft gun as a last-ditch defense weapon. Additionally, peacetime training emphasized evading anti-submarine vessels and attacking enemy ships with minimum exposure of the periscope by going deep and firing torpedoes on sonar bearings.

The leader of the younger, more offensive-minded, party was Charles A. Lockwood, who favored the powerful 5"/51 caliber gun. As a compromise, Hart agreed to allow the installation of strong gun foundations starting with the Tambor class in case it should later be decided that a heavier gun was necessary. The reaction of submariners to the picket boats is thus closely related to the development of surface gun tactics and the general policy regarding attacks on minor targets.

EARLY GUN ATTACKS

The first recorded submarine attack on a small Japanese vessel was made on 20 February 1942 during the second patrol of TROUT (SS 202) under the command of Frank W. *Mike* Fenno, Jr. Returning from a supply run to Corregidor with 20 tons of gold and silver as ballast, he made a night surface attack on what he identified as some sort of patrol vessel, fired three torpedoes and claimed one hit. He was credited with a 200-ton PC, but this is not supported by Japanese records. In endorsing the patrol report, the squadron commander noted that the proper course in such cases was to avoid action, but approved Fenno's decision in this particular instance. ComSubPac concurred.

Next, three noteworthy encounters occurred during the second patrol of POLLACK (SS 180). On 10 March1942 skipper Stanley P. Moseley submerged and made a periscope inspection of two sampans, which he found were fishing and showed no sign of guns or radio antennas. The next day he came upon them again, and decided to attack them at night with his deck guns. The first one received three hits from the 3" gun and was set afire. The second sampan, swept by 200 rounds from the .50 caliber machine gun, appeared to settle. Neither case was written up in the attack section of the patrol report and no damage was claimed, consequently they do not appear in the Submarine Operations Research Group (SORG) analysis of submarine attacks. Similar attacks in a few other early patrol reports were ignored in the same way, as if too trivial to warrant mentioning.

Earlier that day Moseley had made a successful torpedo attack on the 1,454-ton cargo ship FUKUSHU MARU, sinking it with one hit out of four fired. Later, six torpedoes fired at another freighter failed to hit, whereupon Moseley battle surfaced and engaged the target with his deck gun. The 3" gun jammed after the first shot, but 11 more rounds were fired by hand, resulting in two hits. However, these failed to slow the target, which Japanese records identify as the slightly damaged BAIKAL MARU, 5,266 tons. On 26 March lookouts sighted a converted fishing boat, painted white, with a large radio antenna, and sporting four machine guns. In retrospect this appears to have been a picket boat, but Moseley decided it was a Q-ship (or decoy) and

proceeded to avoid. Many other skippers would soon report similar or worse gun failures, while some were suspicious of Q-ships throughout the war.

The endorsements to this patrol report are revealing. The division commander noted that this was the first time 3" and .50 caliber guns had been used by a Pacific Fleet submarine, but criticized that it was a needless waste of torpedoes to fire them at a 150-foot ship: either use the gun or let it go. As for the sampans, they were "only fishing boats and are no excuse for a submarine to dive." ComSubPac approved the division commander's comments and also noted: "This is the first instance where a submarine of this Force has been permitted by weather or other circumstance to use the gun against the enemy." He added that using the gun gave the commanding officer freedom of movement and at the same time "started the destruction of Japan's vital fishing fleet."

On POLLACK's next patrol Moseley made more gun attacks on small craft. On 12 May 1942 lookouts sighted a fishing boat circling on station. It was painted white, had a Japanese flag painted on its clipper bow, tall masts, and a high superstructure from amidships to the stern. Moseley surfaced after dark and left the target burning all over after hits from 66 3" and 200 .50 caliber rounds; the flames were still visible 65 minutes later. On the night of the 17th Moseley sighted a white light, closed to 100 yards and raked a sampan with 220 rounds from the machine gun when the firing pin of the 3" gun could not be cocked. Contact was lost in the darkness and no attack report was submitted. Four more sampans were attacked on 20 May, of which two were claimed sunk, one damaged, and the last left burning. Then on the night of 31 May another trawler was encountered, lying to without lights. Moseley surfaced, blasted the target with nine 3" and 220 .50 caliber shots, and left it blazing. (This ship was the picket SHUNZEI (or SHUNSEIS) MARU #5 of 92 tons, reported sunk with 11 crewmen killed. The other victims, which have not been identified, were probably unarmed fishing vessels.)

In his endorsement, the division commander noted that Moseley's gun attacks offered conclusive proof "that submarines have little to fear from Japanese sampans and large fishing boats. Judicious destruction of these vessels is a diversion for the crew

and is costly to a nation which depends to a great extent on her fishing industry."

The first gun attack recorded by SORG was made on 11 April 1942 by Eliot Olson during the second patrol of GRAYLING (SS 209). In a night surface attack against what he thought was a 200-ton fishing sampan, he fired the .50 caliber machine gun until it jammed, then continued with nine rounds from the 3" gun, three of which he believed were duds, but left the sampan afire and settling by the stern with apparently only two men still alive. Later, however, he observed that the fire had been put out and the craft was under way again. In the patrol report he blamed defective 3" shells for his failure to sink the sampan, but the division commander praised his aggressive action as *highly gratifying.* ComSubPac credited Olson with damaging a 200-ton sampan but blamed the crew for the ammunition problem. The fuzes, he said, had to be set on *safe* when used against surface targets. Olson was apparently unaware that the shells were mainly intended to be used against aircraft. (They were not VT or proximity fuzes; these were not introduced until 1944.)

NEW TACTICS ARE DEVELOPED

As such comments began to be circulated through the Submarine Force, skippers' attitudes toward the use of their weapons were bound to change. By war's end they had sunk hundreds of trawlers, sampans, junks, and small craft of various other descriptions by gunfire. They had also found it prudent to use torpedoes against well-armed small warship types, including picket boats. The Japanese document *Guard Forces Ships' Combat, General Situation* lists 104 encounters of pickets with U.S. submarines, not all of which can be attributed to specific boats. In many cases the submarine avoided action, but in 42 instances the picket boat was sunk or damaged by gunfire. Eleven more were downed by torpedoes, while four others were probably accounted for by submarines that failed to return from patrol. The accounts that follow are not intended to constitute a definitive history of submarine warfare versus picket boats—an impossible task given the limited existing documentation—but will show how the antagonists approached each other as the war progressed.

TRITON (SS 201), under the command of Charles C. Kirkpatrick, was on her third patrol when on the night of 23 April 1942 they came across a big trawler estimated at 1,100 tons. Kirkpatrick fired two torpedoes at the target but missed. He then battle surfaced and attacked it with his deck and machine guns, observing four hits from 19 rounds of 3" plus damage from 675 rounds of .50 caliber, and a big hole in the trawler's bow. He noted that this was the first time the sub's gun crews had fired their weapons against a target in peace or war! (Japanese records show the picket boat SHINKO MARU #5 of 55 tons as shelled and damaged 240 miles north of Marcus Island.) Later, on 15 May 1942, Kirkpatrick made a day gun attack on two sampans, leaving the first wrecked, burning and listing. The crew of the second one abandoned ship, so Kirkpatrick had it boarded, then wrecked by 3" fire.

ComSubPac commented that the attack on the two deep-sea fishing boats was well conducted, adding that it was *interesting to note that the ships contained neither armament nor radio transmitter. The fishing industry is very important to Japan.*" (The victims were the fishing boats KOEN MARU #3 of 38 tons and KAIEI MARU of 110 tons.) No comment was made about the boarding, which also appears to have been the first by a U.S. submarine in the Pacific war.

Kirkpatrick's exploits were soon matched by Creed C. Burlingame on the maiden patrol of the new SILVERSIDES (SS 236). While some 600 miles short of the Japanese coast, well north of Marcus Island, on 10 May 1942 he encountered a patrolling trawler and engaged it with his deck gun and machine guns. Choppy seas made pointing erratic, and several times the crew was knocked away from the 3" gun. The enemy vessel returned fire with its own machine gun and rifles, and as Burlingame closed to finish it off, it got in one burst at the submarine's gun crew, instantly killing the second loader, Mike Harbin. Even though the trawler had been hit by at least 12 3" shells plus machine gun salvos and was on fire, it refused to sink. Assuming that the Japanese could not possibly reach land in that condition, Burlingame resumed course to his assigned patrol area. Shortly thereafter a medium-sized freighter was seen heading for the

trawler's last position. Burlingame suspected, probably correctly, that it was a supply ship for the trawler, so he hung around hoping in vain that it might come back. The next day the crew buried Harbin at sea.

Upon his return, Burlingame was credited with sinking a 350-ton trawler. (In fact, his target was the 131-ton picket boat EBISU MARU #5, which reached port with seven men killed and two badly wounded. It would be encountered again by another submarine less than a year later.) Probably the most noteworthy thing about the higher-ups' endorsements is that neither ComSub-Div 101, ComSubRon 8, nor ComSubPac made any mention of Harbin's loss.

On 31 August 1942 Burlingame and SILVERSIDES, at sea again on their second patrol, sighted a trawler and quickly opened fire. Closing to 50 yards, they scored three hits with the 3-incher and raked the craft with the machine gun for half an hour. "As certainly no one was left alive on board and the trawler had a heavy list to port, was settling rapidly, and smoking heavily, we left the area," he reported. (This ship was the 42-ton civilian fishing vessel MIYO MARU, which survived with the loss of only one man.)

The next night they spotted an unlighted ship, closed in, and opened fire on another trawler, which returned fire with a machine gun or possibly a heavier automatic weapon, hitting the submarine's superstructure several times but causing no damage or casualties. Altogether BURLINGAME made three passes and raked the trawler's bridge and topside with the .50 caliber machine gun but failed to set it afire. The 3" deck gun was not used because BURLINGAME considered it of little value at night except at point blank range; also its ammunition was nearly exhausted. (This craft has not been identified, but does not appear to have been a picket.)

Another significant attack was made by Willis M. Thomas during the third patrol of POMPANO (SS 189). En route back to Midway at the end of the patrol, on 4 September 1942 they encountered a small craft lying to and identified it as a naval auxiliary. It had the number 163 on its bow and was armed with one 20 mm gun, machine guns, two Y-guns, and depth charge

racks. Thomas opened up with his 3", 20 mm, and .50 cal. guns at 2,700 yards and the third 3" shell put the enemy's 20 mm gun out of action. The target was afire and soon sank, causing its depth charges to detonate. One prisoner, a naval rating, was picked up, who indicated that most of the crew had been below eating when the sub attacked. Unfortunately, during the exchange of fire the submarine's first loader, W. A. Calcaterra MoMM1c, was struck in the shoulder by a .30 caliber bullet. Although taken below and treated by the pharmacist's mate, he died from hemorrhage, and was buried the next day. In contrast to the treatment of Mike Harbin, he was posthumously awarded the Silver Star and was further honored by having a destroyer escort, DE 390, named after him. (The picket boat was the 83-ton NANSHIN MARU #27, reported as missing and presumed sunk.)

By now it was evident that the little Japanese armed trawlers were serious opponents, and so could be the sea conditions under which they operated. The new SAWFISH (SS 276) under the command of Eugene T. Sands encountered both enemies on 20 March 1943 as she was returning from her first patrol. In spite of very heavy seas, the trawler maintained a speed equal to the submarine's and kept circling across her bow. SAWFISH opened fire with her 3" gun and the Japanese responded with what appeared to be a four-pounder. Sands closed, scoring many 20 mm and .50 cal. hits, "twice cleaning out the enemy's gun crew and twice knocking over a machine gunner who was firing a machine gun from the top of the pilot house." Three 3" hits appeared to do little damage and failed to slow the enemy down. Twice the deck gun crew was almost lost as seas piled them against the lifelines. The gun officer, Lt. Clarke, actually went through the lines but held on even as his class ring was stripped off his finger. Then a plane was sighted, undoubtedly responding to a radio call from the picket boat. Sands promptly dived and continued on to Midway. (The picket was SHINSEI MARU of 148 tons, which had been escorting another picket and a gunboat that missed the battle.) The Division Commander merely noted that the gun attack demonstrated Sands's "well known aggressive character."

SCORPION (SS 278) on her first patrol, under the command of William N. Wylie, had conflicting experiences in fights with

two small Japanese ships. Early on 30 April 1943 they sighted a patrol vessel of about 100 tons that was armed with an old-fashioned one- or two-pounder on its pilot house and carried a prominent cage antenna between two masts. Wylie bore in, firing his 3", 20 mm, and .30 cal. guns. "The action consisted of chasing him around in a circle until he was destroyed. No shots were returned." The vessel (which has not been identified) was left burned to the water line.

The next morning the sub ran across a bigger patrol craft about 175 feet long, with a steel hull, wooden superstructure, and two masts. It was painted gray with the number 23 on its bow, mounted an old-fashioned 5- or 6-pounder on a high platform forward, and carried two racks of depth charges aft. The aggressive picket boat (none other than the EBISU MARU #5, which had accounted for Mike Harbin on SILVERSIDES) charged at the sub, and at 2,000 yards Wylie opened fire with all weapons. At 800 yards the 3" gun jammed, so he broke off to make repairs and replenish the ammunition supply. The enemy followed for a while, then released a heavy white-smoke float, drew aft and stopped, with the crew drawn up at quarters in white uniforms. As the sub closed to about 400 yards, the pilot house was afire and the forward gun appeared to be out of action, but machine guns and rifles were still being fired from along the bulwarks. At that point Lt. Cdr. Reginald M. Raymond, who was riding as a prospective commanding officer and firing a Browning automatic rifle from the bridge, was hit in the forehead by a bullet that passed completely through his head. The furious skipper swung the sub's bow directly toward the enemy and fired his last remaining torpedo with a 500-yard run and depth setting of two feet. With a huge blast the picket blew up and disappeared. "When struck, his flag was still at the gaff and he was still firing," Wylie noted in the patrol report. A rapidly approaching plane then forced the submarine to dive and dropped two depth charges, with the result that Raymond's body was lost.

On SCORPION's return, the division commander decreed: "Each boat in this division will dedicate one full tube nest forward" to Lt. Cdr. Raymond. ComSubPac also regretted Raymond's loss, but added that he was "in full accord with the use

of guns in destruction of sampans." However, he emphasized, skippers must carefully consider the value of the target and the risks involved and the submarine must always maintain the advantage. "Gun battles are always extremely exciting encounters and are definitely morale builders on long and sometimes boring patrols. However, these factors must not jeopardize the ultimate mission of a submarine on war patrol by allowing one's vessel to be damaged." As for Raymond, he too had a destroyer escort, DE 341, named in his honor.

For the next several months, skippers seem to have taken a more cautious approach to picket boats. On 6 July 1943 Irvin S. Hartman, in command of venerable S-41 (SS 146) on her seventh patrol, missed the picket SEIYU MARU with two torpedoes. On his next patrol he encountered an old-looking small ship on 14 September that was smoking badly and zig-zagging wildly. It had outriggers on each quarter and peculiar structures on the after deck. Hartman decided it was a decoy and broke off the approach.

Thomas L. Wogan on the eighth patrol of the elderly TARPON (SS 175) on 4 September 1943 encountered a small ship lying to, that fit the now-familiar profile of a picket boat: a 200-foot trawler with abnormally high masts. He opted to make a night periscope attack and fired his last two stern torpedoes. The first one hit and demolished the target, leaving only the stern afloat for another 30 seconds and the sea littered with oil and scattered debris. There were no survivors. (The Japanese records show the 97-ton picket YURIN (or YULIN) MARU as lost at that time.)

Samuel D. Dealey, a notably gung-ho commander, was returning from his second patrol in HARDER (SS 257) when two armed trawlers came in sight on 30 September 1943. Dealey immediately closed the range to draw fire from the enemy, and at about 7,000 yards both started shooting. Disregarding the opposition, Dealey closed in further to about 4,000 yards, firing his 3" gun. At that point one of the pickets got the range and put a salvo directly over the gun crew, prompting Dealey to judiciously back off a bit. After several hits were seen on the larger target, the two enemy vessels drew apart in order to split HARDER's fire, and finally tried to break away, throwing barrels of burning oil or smoke generators overboard. Closing again, HARDER got more hits until

the 3" ammunition was exhausted. After firing a magazine load of 20 mm shells *for good measure*, Dealey resumed course for Midway. "The experience gained by the gun crew," he noted, "is considered invaluable and the boost in morale was very apparent. After having dodged this type of enemy patrol ship for the past three weeks on station, the boys were very glad to 'dish it out' for a change." (Dealey's opponents were the pickets ASAHI MARU #2 of 164 tons and the 157-ton MATSUMORI (or MATSUSEI) MARU #3, which reported receiving only two shell hits.)

RESCUE BY SALVAGE

Excerpted from the book Undersea Valor

By CAPT Willard F. Searle, Jr., USN (Ret) and Mr. Thomas Gray Curtis, Jr.

Editor's Note: Captain Bill Searle was a Naval Academy graduate and completed a degree in Naval Architecture at MIT in 1952. He spent most of his naval career in salvage, culminating in his assignment to the Bureau of Ships as Supervisor of Salvage. After his retirement he remained active in the field of marine engineering, towing, salvage and diving. Mr. Thomas Gray Curtis, a Civil Engineer from MIT worked with Captain Bill Searle in the Office of the Supervisor of Salvage. He returned to MIT for a degree in Ocean Engineering. He continued to work for the Navy both in salvage and in the Facilities Engineering Command. He later received a PhD in Civil Engineering from the University of Minnesota and subsequently taught at several Universities.

Bill Searle's business partner, RADM Mal MacKinnon, suggested excerpting the book Undersea Valor for THE SUBMARINE REVIEW. This section about the sinking of USS O-5 in October of 1923 is considered particularly appropriate since it concerns the awarding of the first Congressional Medal of Honor to a submariner.

Since Submarine Division Eight lacked a tender at that time, on a pleasant Sunday morning 28 October 1923, USS 0-5 (SS 66), under the command of Lt. Harrison Avery, was to guide three sister subs of the division, the 0-8, 0-6 and 0-3, (in that order) through the Panama Canal. The boats were all built by the Fore River Shipbuilding Co. in Quincy, Massachusetts and had basically the characteristics of 0-5, which are listed in Table 10-1.

Table 10-1: 0-5 Submarine Characteristics

Length Overall	142'4"	**Propulsion**	Diesel Electric Drive
Beam	18'¼"	engines	model 8-EB-15NR
Displacement			2 x 440 hp
surface	520.6 tons	motors	2 x 370 hp
submerged	629 tons	**Speed**	
Armaments		surface	14 kts
torpedo tubes	4-18"	submerged	10.5 kts
torpedoes	8 Bliss-Leavitt Mk VII	**Battery Cells**	120
		Fuel	21,897 gal.

The O-5 had left the dock at the submarine base at Coco Solo at 0550 and headed for Cristobal to pick up a Panama Canal pilot. The pilot, Captain G. O. Kolle, came aboard while O-5 was stopped in the channel at the Cristobal mole from 0615 until about 0618.

The flotilla then proceeded south down the east side of the Panama Canal channel. Going ahead on both engines, steering 180 degrees true, Avery had been underway only three minutes when forced to stop engines by the United Fruit Co. freighter, ABANGAREZ, which was overtaking the O-5 to starboard, without signaling her intention.

At 0622 the freighter was observed changing course sharply to port across the bow of the submarine. Lieutenant Avery, with the advice of Captain Kolle, called down through the conning tower hatch for hard left rudder and for the boat to come ahead on both motors, but to no avail.

The freighter, on route from Cuba to Christobol, had anchored in Limon Bay earlier in the morning, waiting for first light before proceeding to Dock No. 8. Anchored about 200 yards west of the channel, about 600 yards south of channel buoy No. 1, she got underway at 0614 and came south on a course nearly parallel to that of the 0-5 prior to making the sharp turn to enter Colon Harbor.

The engine room did not respond to the orders to come ahead and turn to mitigate the damage of an imminent collision. Slowly and inexorably the 0-5 went under the bow of ABANGAREZ.

Four short blasts on the freighter's whistle, the danger signal, rent the air at 0622. She was then approximately 800 feet west and 100 yards north of channel buoy No. 4 and less than 500 feet from 0-5 when Captain W.A. Card, master of ABANGAREZ, let go her starboard anchor and put her engines in full reverse.[5] At the speed she was making, probably between 7 to 10 knots, there was neither enough time nor distance to avoid collision.

About 0624, ABANGAREZ, of 5000 dwt, rammed into the starboard side of the 520-ton 0-5 amidships, tearing a ten-foot-long by three-foot-wide gash in her control room and No. 1 ballast tank to a depth of forty inches. No hatches were secured, with the exception of the torpedo room deck hatch and the torpedo-loading hatch. No interior bulkhead doors were secured except those between the torpedo room and the forward battery room and that between the after battery room and the engine room. Flooding sent her to the bottom of Limon Bay in less than a minute.

Although the freighter was not damaged, three crew of the submarine lost their lives. More would have perished but for courageous actions and timely salvage efforts. Prior to the sinking, the word had passed to close watertight doors and hatches. Upon collision, the crew abandoned ship. SS ABANGAREZ, the Panama Canal tug PORTO BELLO, the tug TRAVENILLA, and the Panama Canal launch RODMAN rescued most of the crew.

Henry Breault, torpedoman second class, made it to the main deck before going below to the forward battery room to wake his friend Lawrence T. Brown, chief electrician's mate. As the boat sank, they were trapped, but found refuge, securing themselves in the forward torpedo room.

Rescued crew returned to the submarine base at Coco Solo by bus. Less fortunate were the three that were lost:

C.E. Hughes, MoMM1c
Thomas T. Merzler, F1c
Fred C. Smith, Matt1c

The bodies of Merzler and Smith were found two days later floating in the sea off Colon breakwater; Hughes was never found.

SALVAGE RESCUE

Significant, timely salvage saved the lives of Breault and Brown trapped in the forward torpedo room. The commander of the submarine base Coco Solo, Captain Amos Bronzon Jr., tasked Lieutenant Albert Osenger as salvage officer. He could claim the first successful rescue operation by salvage.

Even before Osenger was put in charge, rescue efforts were underway. By 0720 bubbles from the 0-5 were observed, locating the submarine seventy-two yards north of channel buoy No. 3 in water depth of seven fathoms.

Immediate salvage response started with a survey of the wreck by divers off RODMAN. They report, at 0850, that men were alive in the torpedo room who responded to rappings on the hull by returning raps. This made the need for swift salvage obvious. Dockmaster and foreman shipwright for the Panama Canal Mechanical Division, Sheppard J. Shreaves was a qualified diver and supervisor of the Canal's proficient salvage and diving crew. He personnally did most of the diving.

By 1315 Chritobal Shops Crane No. 287 was moored over the submarine. During the afternoon, preparations were made to lift the bow of the 0-5 by the submarine's towing pendant. This parted on the second lift attempt in the early evening. Divers then rove 1⅝-inch wire rope, double, through the bull nose in the stem as an alternative. When the 287 took a strain of about fifty tons, her maximum lift capacity, at about 1930, the bow rose slightly and the list to starboard was reduced.

Fortunately, being in the Panama Canal Zone, two large derrick barges, US AJAX and US HERCULES, were nearby. They were used to handle lock gates. Made in Germany, they each could lift 250 tons. When Captain Bronson requested one of these crane barges, they were at Paraiso and unavailable, due to a slide in the Gaillard Cut that trapped them in the Canal.

A landslide of between 250,000 and 300,000 cubic yards of earth cascaded into the Canal on the west side of the Gaillard cut. Working to clear the channel, two dipper dredges, US CASCADES and US PARAISO, blocked passage of vessels through the cut while they worked. At 1400, the dredges were

shifted, and waiting vessels on either side of the obstruction were able to pass. CURLEW with AJAX in tow reached the scene of the sinking around 2130 so that the derrick barge could moor over the starboard side of the 0-5 and go to work.

By 2230 AJAX was ready to take a strain on two 1⅝-inch wire ropes secured to lifting pad eyes on the deck forward of the conning tower. They immediately carried away.

With time of the essence, divers immediately began rigging two 2¼-inch straps, each of 150-foot length, shackled to the lifting pads. The port sling carried away after the bow had been raised about eight feet. Under increased load, the starboard lifting eye broke.

This last failure may have been the result of bad rigging. The rigging implied by the log entry, "rigging two (2¼") straps 150 feet long to forward lifting pads, eyes to hook and shackled to pad," suggests that the wire rope strap was bent sharply at the shackle at the pad eye, too sharply to hold the load safely without failing.

Beside the material properties of the metal used in construction, the properties of the wire rope are highly dependent upon how it is constructed, whether it has a core, how many wires are laid up in a strand, how many strands are wound into the rope, and what the strand diameters are. The efficiency of wire rope is indicated by the bending factor, *Kb*. During bending the efficiency decreases as stresses in the rope due to bending increase as a fraction of the total stress. The service life of a wire rope is drastically shortened by bending it too sharply, as defined by the ratio of the diameter of the bend, *D*, to the diameter of the wire rope, from the U.S. Navy Ship Salvage Engineer's Handbook, advises the diameter ratio D/d exceed 14, but also states, "The absolute minimum D/d ratios correspond to rope efficiencies of approximately 90 percent (Kb = 0.9).

The bight of the rigging straps was shackled to the pad eye. The diameter of the band around the shackle was perhaps three inches. Consequently the diameter ratio, D/d, was approximately 1.2. This sharp bend would have caused the wire rope failure.

An alternative approach was taken. The hull of the submarine would be used as a fairlead to prevent the strap from bending too sharply.

Diving expertise enabled lifting slings to be passed under the bow of the 0-5, in preparation for lift. By use of a fire hose, a tunnel was washed through the soft mud on which the submarine rested approximately twenty feet from the stem. Careful not to excavate too much mud and cause the tunnel to collapse, Shreaves passed a messenger line through the tunnel that drew two 2¼-inch straps under the bow. The strap eyes were secured to the lifting hook of the AJAX. A 1-inch wire preventer, secured to the port lifting pad eye, kept the straps from moving forward.

At 1303 AJAX started lifting slowly so that water could seep beneath the boat and release the mud suction. The bow was raised until the torpedo hatch was above the water surface. The two trapped men were able to escape from the wreck.

It was kismet! After thirty-one hours entombed in the torpedo room, Henry Breault and Lawrence Brown were taken to the chamber at Coco Solo for decompression and then to Colon Hospital for examination.

The sea, fortunately, was calm during salvage; it was free of the normal two-to four-foot chop. The boat was in shallow water, just seven fathoms. This made the trim angle on the boat fairly small when her bow broke the surface. Most importantly, the shallow water enabled Shep Shreaves to work for nearly twenty-four hours. This Herculean effort could not have been made at deeper depths.

Sheppard J. Shreaves was awarded the Congressional Lifesaving Medal in recognition of his contribution to the rescue. He had established a world record for the longest dive.

On 4 April 1924 Henry Breault was presented the Medal of Honor by President Calvin Coolidge on the White House lawn, "for heroism and devotion to duty...Instead of jumping overboard to save his own life, he returned to the torpedo room to the rescue of a shipmate whom he knew was trapped in the boat...."

The submarine and her commanding officer did not fare as well. A wooden cofferdam around the torn hull of the 0-5 enabled

sufficient dewatering that the boat could be towed back to Coco Solo. Most of her electrical equipment was destroyed by seawater. It was not considered economic to salvage the boat. She was struck from the Navy register and sold for scrap in 1924.

The court of Inquiry found that Captain W. A. Card was solely at fault for the collision between ABANGAREZ and the 0-5; he had violated the "Rules of the Road" and the Rules of the Operation and Navigation of the Panama Canal "...he failed to signify his intentions by making whistle signals...when he was overtaking... he attempted to cross ahead of the USS 0-5 without signifying his intentions by making whistle signals, which maneuver is contrary to the above rules." Despite the apparently clear cut case, a lawsuit, United States v. United Fruit Company (Submarine 0-5 – SS ABANGAREZ), lingered in the court of appeals for years. On 20 August 1932, Judge Wayne G. Borah of the Federal Court in New Orleans held "that the USS 0-5 was solely responsible to the collision with the United Fruit Company's ship ABANGAREZ at Colon in 1923."

The Court of Inquiry had recommended that Lieutenant Avery be tried at general court-martial on charges of (a) neglect of duty and (b) culpable inefficiency in the performance of duty. He had been so tried and acquitted.

The tragedy of this accident was compounded when, years later, Harrison Avery committed suicide. "His memory seemed to be very nearly blank for things immediately at hand while he apparently remembered and used to describe in detail various incidents which had happened many years ago."

SUBMARINE NEWS FROM AROUND THE WORLD

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From the February Issue

UNITED STATES—Future Ballistic Missile Submarine Achieves Milestone A

On 04 February 2011, a Defense Acquisition Board (DAB) decision memorandum approved Milestone A readiness for the Future Nuclear Powered Ballistic Missile Submarine (SSBN-X), also know as the Ohio Class SSBN Replacement Program. Milestone A is the point that a recommendation is made and approval sought regarding the continuation of an acquisition program. With this approval, the program will now enter the Technology Development Phase (TDP).

The TDP will establish requirements and continue design and technology development efforts that will ultimately lead to a ship construction contract. The DAB endorsed replacing the 14 Ohio class SSBNs with 12 new submarines, each with sixteen 87-inch missile tubes for the Trident II D5 missiles. The Trident II's will be replaced by a new missile around 2042.

TDP efforts (design, prototyping and technology development efforts) will continue through 2019, at which time the first of 12 new SSBNS will begin construction.

As mentioned in AMI's January 2011 Hot News, it appears a new design will be developed rather than a Modified Virginia class or a design similar to the Ohio class, which were all considered during the Analysis of Alternatives (AoA). The first new SSBN will replace the first Ohio class in 2027. The last of twelve SSBNs will begin construction in 2033 with commissioning around 2037.

The new design is expected to cost US$7B for the first unit and US$5.75B (2010 dollars) for units two through 12, for a total

cost of US$70.2B for the program according to the Congressional Research Service (CRS) although the USN is looking for ways to further reduce the cost of units two through 12 to US$5B, for a total program cost of US$62B.

INDIA—Second and Third SSBNs under Construction

In late January 2011, AMI received information that two additional nuclear-powered ballistic missile submarines (SSBNs) were under construction at Vishakapatnam Naval Dockyard (VND). Like the first unit ARIHANT, modules for the two submarines are also being built at Mazagon Dock Ltd (MDL) and Larsen and Toubro (L&T). AMIs source indicates that the ARIHANT, launched in 2010 although AMI believes the submarine will require several more years to install and test the nuclear power plant as well as complete missile trials. Realistically, the ARIHANT will probably not become operational until 2015 at the earliest.

AMI also believes that the ARIHANT may be a single unit class technology demonstrator and that two submarine lines could evolve from the single unit; the first being an SSBN and the second being a nuclear powered attack submarine (SSN). Press statements suggest that hulls two and three now under construction are more powerful than the ARIHANT suggesting these two may be larger with the capability to carry larger missiles than those aboard the ARIHANT. ARIHANT is estimated to displace up to 6,000 tons and estimated to carry up to 12 K-15 Sagarika short range ballistic missiles (SRBMs) launched from four triple tube vertical launchers.

If hulls two and three are more powerful than the ARIHANT, they may be the first two units of the new class of SSBNs. AMI estimates that the new SSBN class could displace around 8,000 tons with a missile bay of eight vertical cells for the larger K-X long range ballistic missile (LRBM) that is currently in development.

If source reporting on hulls two and three are accurate, it appears that India is moving forward with the new class of SSBNs immediately rather than waiting to incorporate lessons learned

from sea trials of ARIHANT, which will not begin for at least another year or two. This must be considered quite risky as ARIHANT has yet to spend a day at sea. With construction of units two and three already underway, the IN may find it much more difficult and/or expensive when making the necessary changes that could result from ARIHANT's sea trials.

From the March 2011 Issue

FY 2011 Defense Budget Implications and FY 2012 Submissions

On 07 January 2011, US President Barak Obama signed the Fiscal Year (FY) 2011 Defense Authorization Act. However, the corresponding appropriations bill was never authorized forcing the US Government to continue operations under continuing resolutions. A two-week extension on 04 March 2011 now allows the government to operate through 18 March. By 18 March, AMI expects that further extensions will be authorized and doubts that a final FY 2011 US Government appropriations bill will be completed. AMI believes that the next approved defense budget will probably be for FY 2012 and has already been submitted.

Assuming that a final FY 2011 budget will not be approved and the Department of Defense will remain under continuing resolutions for the remainder of the fiscal year, total funding for FY 2011 will be around US$526B; US$23B less than the US$549B anticipated under the FY 2011 defense budget had it been approved. The bottom line is regardless of what happens with the FY 2011 budget, the damage has already been done as the continuing resolution has already been in effect for six months.

Of the US$23B, it appears that the US Navy will lose around US$4.6B in its operations and maintenance (OMN) budget affecting the following programs:

- Terminate or cancel availabilities for seven ships.
- Cancel deployments of up to five ships.
- Defer four shore projects that were to begin in February 2011.

- Defer 15 shore projects that were to begin in March 2011.
- Reduce battle group assets on near term deployments.

In regards to naval procurements, the second Virginia class submarine for FY 2011 is in jeopardy as the US Navy's Shipbuilding & Conversion (SCN) budget is also at FY 2010 levels (US$14.9B). As of this writing, the US Navy has only paid for one FY 2011 hull plus an advance procurement of US$120M for the second hull rather than the full US$3.44B for two submarines plus advance procurement funding for two units in FY 2012 and two in FY 2013. FY 2011 was expected to be a milestone in the Virginia class program as it was the first year for multi-hull procurements that were to run through 2017.

Although FY 2011 is marred by continuing resolutions and much uncertainty still remains, one can only hope that the FY 2012 budget will be approved on time and the DoD and US Navy can again begin operating with a known quantity. Listed below are the details for the FY 2012 budget submission that was released on 14 February 2011.

The US Government and DoD documents provide for US$533B for the base defense budget for FY 2012 and US$118B for Overseas Contingency Operations (OCO); or a total of US$671B. The base defense budget calls for an increase of US$22B above the FY 2010 defense budget. Of the combined US$533B base budget and US$118B OCO budget; US$203.8B is for procurement and Research Development, Test and Evaluation (RDT&E) for the US Armed Forces. US$128.1B will be for procurement and the remaining US$75.7B will be for RDT&E.

In regards to shipbuilding, the FY 2012 budget submission calls for US$24.6B for the procurement of 10 ships for the USN and one for the US Army. Of the US$24.6B; US$19.9B is SCN funding and the remaining US$4.7B is from RDT&E. Procurement includes:

- One Arleigh Burke class destroyer
- Two Virginia class submarines.
- Four Littoral Combat Ships (LCS).

- Two Joint High Speed Vessels (JHSVs) (one US Navy and one US Army).
- One Mobile Landing Platform (MLP).
- One San Antonio class landing platform dock (LPD-17).
- Advanced funding for the second Ford class carrier (CVN-79).
- Advance funding for the two FY 2013 Virginia class submarines and two FY 2014 submarines.
- Advance funding for the FY 2013 Arleigh Burke class destroyer.

For the US Coast Guard, the FY 2012 budget submission under the Department of Homeland Security includes US$8.677B for the year, up from US$8.59B from FY 2010. The FY 2012 budget submission includes US$358M for the procurement of six, Fast Response Cutters (FRC) and US$130M for two Maritime Patrol Aircraft (MPA).

UNITED KINGDOM – Four-Hull SSBN force Level Gaining Political Support

In late February 2011, AMI sources corroborated press reporting that indicates the United Kingdom's (UK) Secretary of State for Defense, Dr. Liam Fox, is pushing to maintain a four-unit ballistic missile Submarine (SSBN) Force in order to maintain a Continuous At-Sea Deterrent (CASD). Dr. Fox indicated that a reduction to three units would not be possible as there appears to be some concern of rogue regimes and others still developing nuclear weapons. A CASD will require one unit to be on continuous patrol with the other three in varying stages of overhaul and training. Any number of hulls under four would suggest a near continuous capability rather than continuous.

In 2009, former Prime Minister Gordon Brown entertained the idea of reducing the number of the future SSBN force to three units from the current level of four. In mid-2010, Dr. Fox publicly announced that a reduction was also possible as long as the move

would not compromise the UK's defenses. However, the Strategic Defense Security Review (SDSR) in late 2010 suggested maintaining a CASD and Dr. Fox's latest comments seem to back the position that the UK will attempt to maintain a four-ship SSBN force past the retirement of the four Vanguard class SSBNs. Even if the hull count remains at four, each unit will surely have fewer missile tubes, probably 12, four less than the current Vanguard class. The UK is also scheduled to reduce its total warheads from 200 to 160 while still allowing for four hulls with less than 16 missiles per unit.

Although there appears to be some political support to maintaining a CASD, the real question will become whether the UK will be able to afford them. Faced with severe cutbacks in conventional forces over the next couple of years, it is hard to envision the Future SSBN Program being more than three units. And it appears that the decision on the replacement date also continues to slip indicating that the decision will be on someone else's watch. The manufacture date was set for 2014 but appears to be slipping past 2016, one year after the national 2015 elections.

The cutbacks in conventional naval forces in 2011 and 2012 are in indication of how difficult it will be to fund the US$16-US$20B SSBN replacement program for the Royal Navy (RN). Ties to the US SSBN-X program must now be considered critical as the US is also struggling to find ways to reduce the per unit cost for its Ohio class SSBN replacement program that will begin in the same timeframe.

AMI believes that the Future SSBN program will take many turns between now and 2016 although the one issue that cannot be ignored is the future of the UK's shipbuilding industry, namely BAE Systems Submarine Solutions. With the Astute nuclear-powered attack submarine (SSN) program ending in 2020 (assuming all units are built), AMI believes that the UK will have no choice but to build a new class of nuclear submarines (probably SSBN) in order to maintain the industrial capability and the core skill sets involved in nuclear submarine construction. The question is how many and at what cost?

From the April Issue

NAVAL SHIPBUILDING PROGRAMS

BRAZIL – Program of Development of Submarines (PROSUB): AMI sources and brochures provided an update on the Brazilian Navy (BN) PROSUB program, which entails the acquisition of four conventional submarines, a nuclear-powered submarine and the construction of the new shipyard and naval base that will build and maintain the new sub-surface fleet. PROSUB is being managed by France's DCNS and Brazil's Odebrecht.

The shipbuilding and naval facility is currently being built in Itaquai (around 30 miles south of Rio de Janiero) by Itaquai Construcoes Navais (ICN) and will be completed in 2015. The facility will be able to operate up to six nuclear-powered and four conventional submarines. The yard will be divided into the construction sector, where two submarines can be built simultaneously and maintenance sector, which includes two dry docks. The conventional submarines are based on the French Scorpene design with modules being built at DCNS and in Brazil with final assembly at the new facility in Itaquai. The four Scorpenes and the first nuclear-powered submarine will be delivered by Itaquai by 2025.

In regards to the nuclear-submarine program, France is providing hull design and engineering assistance for non-nuclear elements only, with Brazil providing all nuclear related systems through its Navy Technological Center in San Paulo.

MAURITIUS – 1350-Ton Offshore Patrol Vessel (OPV): In March 2011, Garden Reach Shipbuilding and Engineering (GRSE) of India signed a construction contract (undefined contract price, AMI estimates around US$40M) for the delivery of one 1350-ton OPV. The OPV will be delivered to Mauritius in 32 months in November 2013. The OPV may be based on the GRSE 1350-ton Kora class corvette design that was delivered to the Indian Navy in late 1990s through 2004. The Mauritius hull, however, will probably be absent the missile systems found on the Indian Navy Kora variants. It will probably have the medium caliber and small caliber guns.

NEW NAVAL SHIP DESIGNS:

SOUTH KOREA – 1800 Ton OPV Design: A Daewoo Shipbuilding and Marine Engineering (DSME) brochure depicted a new 1800-Ton OPV design that is being offered on the international market. The DW1800P design is a multi-purpose OPV that is capable of basic naval operations including maritime surveillance, patrol and protection of offshore resource infrastructure.

The 1800-ton vessel is 91.2 meters (299.2ft) in length and has a maximum continuous speed of 20 knots. It is armed with one 76mm gun and two 20mm guns. Sensors include one air/surface search radar, one surface search radar, one-track radar and one optronic sight. The design features a flight deck and hangar for the operation and storage of one 5-ton helicopter up to sea state (SS) 5. It will also be able to store and launch two rigid hull inflatable boats (RHIBs).

This new design meets the size and operational capability requirements of OPV designs that are currently being sold by other international OPV builders. The demand for OPVs of this size continues to grow throughout the European, Asian, South American and African regions due to a continuing increase in illegal activities in coastal waters such as piracy, illegal immigration and theft of resources.

NAVAL SENSOR DEVELOPMENTS:

SOUTH AFRICA – RSR 205C X-Band Air/Sea Coastal Surveillance Radar System: a Reutech brochure depicted the new RSR-205C X-band air/sea coastal surveillance radar system (CSRS) that is being offered for export. The RSR 205C is based n the RSR 210N naval air/sea surveillance radar that is already in service.

The RSR 205C provides pulse Doppler operation with comprehensive naval electronic counter-counter measures to combat unconventional threats. Radar coverage for air targets is greater than 45 kilometers (27.9nm) and small surface targets of greater than 15 kilometers (9.3nm). Track capacity per scan is greater than 200 air and sea tracks (each) and can classify surface, rotary wing and fixed wing aircraft.

NAVAL WEAPON DEVELOPMENTS:

GERMANY – Matador Remotely Controlled Weapon Station (MaRCoWS): A Dynamit Nobel Defence brochure depicted the naval application of the RGW 90 Matador shoulder-launched weapons rocket launcher. The naval application was designed to defeat sea-based pirate and terror attacks from fast and highly maneuverable patrol vessels.

The MacRCoWS can be integrated into the ships fire control system and operates as a stabilized remotely controlled weapons station. The RGW 90 weapon is effective in defeating attacks less than 500 meters (1640ft) from the host platform. This weapon is expected to be highly effective as it requires a very short reaction time, typical of pirate and terrorist attack time-line profiles.

TURKEY – STOP/STAMP Remote Controlled Stabilized Gun Systems: Aselsan brochures depicted two naval guns systems, the STOP Remote Controlled Stabilized Naval Gun System and the STAMP Remote Controlled Stabilized Machine Gun Platform. STOP features a 25mm or 30mm gun and STAMP a 12.7mm or 7.62mm machine gun or 40mm grenade launcher. Both systems can be utilized in asymmetric warfare, air defense and coastal defense missions in large surface combatants, patrol vessels and landing vessels.

Stop (25mm guns and 30mm guns) is capable of acquiring targets and engaging them autonomously either via the ship's combat management system (CMS) or by its own sensors. The optical sensor suite of STOP provides enhanced situational awareness and the ability to identify and engage threats day or night and in all weather conditions.

STAMP (12.7mm machine guns, 7.62mm machine guns and 40mm grenade launcher) provides increased hit probability and maximum gunner survivability against manual guns.

UNMANNED SYSTEMS DEVELOPMENTS:

ISRAEL – HAROP Loitering Weapon System (LWS): An Israel Aerospace Industries (IAI) brochure depicted the HAROP Loitering Weapons System (LWS), an unmanned combat aerial

vehicle (UCAV). Combining the capabilities of a UAV and a missile, the HAROP is able to search, find, identify, attack and perform battle damage assessment (BDA). It is also able to independently acquire-real-time intelligence against time critical, high value targets as well as targets that are maneuverable (tanks, trucks etc).

With a man in the loop (controller), the LWS is capable of loitering at extended ranges and can attack from any angle, horizontal or vertical. It provides a continuous and persistent threat to enemy targets as it has an electro-optical (EO), forward looking infrared (FLIR) and color CCD (high resolution color sensor for digital imaging).

CANADA—Victoria Class Submarine: On 23 March 2011, the Defense Security Cooperation Agency (DSCA) notified the US Congress of a possible Foreign Military Sale (FMS) to the Government of Canada for 36 Raytheon Mk-48 Mod 7 Advanced Technology (AT) torpedo conversion kits. The estimated cost of the deal is US$125M for the kits, associated equipment, parts, training and logistical support.

The torpedoes are part of the Victoria Class Submarine Life Extension (SELEX) Project, which includes the upgrade to the torpedo system. The new kits will upgrade the Victoria class torpedoes from the Mod 4 variant to the 7AT variant. The prime contractor for this sale will be selected during an opening competition, later in the year.

USED SHIP TRANSFERS/RECEIPTS

THAILAND: On 28 March 2011, AMI received information that the Prime Minister of Thailand, Mr. Abhisit Vejjajiva, approved that acquisition of six Ex-German Navy Type 206A submarines for US$256.8M. The Royal Thai Navy (RTN) has been considering the procurement of submarines for the past two years following a decade of on again/off again planning to create a Submarine Force. The 2006-2014 Defense Forces Modernization plan called for the acquisition of two submarines beginning in 2012.

However, with austere defense budgets being reality, the RTN probably decided to move forward with the six used German submarines. Already decommissioned in 2010, three of the 30-year old units will be utilized for operations, one for training and two for cannibalization. Training will start for the Thai crews by the end of 2011. The three operational and one training boat will be overhauled in 2012 and 2013 with the RTN beginning operations in 2014.

THE SUBMARINE REVIEW

THE SUBMARINE REVIEW is a quarterly publication of the Naval Submarine League. It is a forum for discussion of submarine matters. Not only are the ideas of its members to be reflected in the **REVIEW**, but those of others as well, who are interested in submarines and submarining.

Articles for this publication will be accepted on any subject closely related to submarine matters. Their length should be a maximum of about 2500 words. The League prepares **REVIEW** copy for publication using Word. If possible to do so, accompanying a submission with a CD is of significant assistance in that process. Editing of articles for clarity may be necessary, since important ideas should be readily understood by the readers of the **REVIEW**.

A stipend of up to $200.00 will be paid for each major article published. **Articles accepted for publication in the REVIEW become the property of the Naval Submarine League.** The views expressed by the authors are their own and are not to be construed to be those of the Naval Submarine League.

Comments on articles and brief discussion items are welcomed to make **THE SUBMARINE REVIEW** a dynamic reflection of the League's interest in submarines.

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

THE SUBMARINE COMMUNITY

COMMANDER, SUBMARINE FORCES
COMMANDER, SUBMARINE FORCE ATLANTIC
PUBLIC AFFAIRS OFFICE
PRESS RELEASE
MARCH 7, 2011
SUBMARINER WWII POW PASSES AWAY

By JOCM (SW) (Ret) Kevin Copeland, Deputy PAO, Submarine Force Atlantic Public Affairs

NORFOLK, Va. – Marion "Turk" Turner, a retired submariner who survived three and one-half years in a Japanese Prisoner of War camp during World War II, recently passed away, following a lengthy illness. A long-time resident of Virginia Beach, Va., he was born in Moultrie, Ga., on April 22, 1918.

During his high school years at Moultrie High School he was affectionately dubbed by his peers as *Turkey*, a nickname received after he devoured some leftovers during a camping trip. The nickname remained with him, but was eventually shortened to Turk in later years. Turner enlisted in the Navy on October 12, 1939, and elected to serve on submarines as an electrician's mate. He served onboard USS CANOPUS, the Balao-class submarine USS SEALION (SS 315), and the Porpoise-class submarine USS PERCH (SS 176). It was during his assignment onboard PERCH which determined his fate during World War II.

While surfaced 30 miles northwest of Soerabaja, Java on March 1, 1942, PERCH was attacked by enemy destroyers. Driven down with a string of depth charges to a depth of 135-feet, and enduring several more depth charges, Turner and the men of PERCH repaired the submarine, and they were able to resurface early the next morning. But they were once again attacked and forced to submerge. Convinced by the oil loss and the air from damaged ballast tanks, the enemy was sure PERCH was a kill, and they went hunting for other targets. This allowed PERCH to again surface and repair some damage. On a dive to test the repairs, the

submarine was forced to resurface, where subsequently PERCH was engaged for the final time by two enemy cruisers and three destroyers. The Commanding Officer, Lieutenant Commander David A. Hurt, ordered the ship to be abandoned and the submarine was scuttled.

In later years, Turner related the following passage concerning the rescue at sea to friends Jeanine and Lorie Allen.

> "... as we were given the order to 'Abandon the Boat' when PERCH was going down, our Captain, Lieutenant Commander David Hurt, was the last man off the conning tower. We were in the water for awhile before the Japanese came by to rescue our crew. We did not know if they were going to shoot us or abandon us to the sea. Hurt was having difficulty treading water as the Japanese ship was rescuing the crew using a rickety ladder."
>
> The captain told Turner he "wasn't going to make it," and gave Turner the order, " just leave me Turk, I no longer have the strength to go on, save yourself ... leave me."
>
> Turner relayed to the Allens, "I wasn't going to listen to that, so I dove down and came up right under him, and I pushed him right up the ladder with him still protesting."

That action saved Hurt's life. And while the entire crew of 60 officers and enlisted Sailors survived that day, six later died in Japanese Prisoner of War camps. The others were repatriated, and were able to enjoy the victory over the Japanese in World War II.

Turner was repatriated Oct. 17, 1945 and stayed in the Navy until his retirement Dec. 1, 1959, but the scars of his incarceration remained for his lifetime. He had survived cruel beatings, starvation diets, and many tropical diseases at the Prisoner of War camp on the island of Makassar Celebes.

Almost seven decades after receiving his injuries, Turner was presented the Purple Heart Medal and a Korean Service Medal by retired U.S. Navy Rear Admiral Fred Metz during a ceremony held Jan. 2, 2011 at King's Grant Baptist Church in Virginia Beach.

"If you think about what he had to endure, or anyone in the Prisoner of War camps, a Purple Heart does not really signify what they had to go through," said Metz. "But it's one way this country honors the people who lived through those perils."

Turner was a strong-willed veteran with an equally strong conviction for his country, but he always had a kind word for all. He was particularly fond of sharing his time and sea stories with fellow veterans.

"Turk showed us all courage and humility during and after facing the enormous struggle of a POW," said Captain Stephen T. Koehler, who pinned the medals on Turner and is currently Commanding Officer of the amphibious assault ship USS BATAAN (LHD 5), homeported in Norfolk, Va. "He gave us perspective when we thought we were having a bad day. It only takes a thought of him with his struggle over 60 years ago, and the way he handled it with a positive attitude to shed light on our current day-to-day problems."

"He became a friend and inspiration to both me and the crew of BATAAN with this positive attitude and his zest for life. He spent a lot of his time with my young Sailors telling stories and relating his time in submarines and as a POW, for which I am grateful. He was truly a great influence on BATAAN Sailors in our quest to keep BATAAN Heritage part of our ship."

Ernest Plantz, one of Turner's shipmates on PERCH and his cellmate while both were Prisoners of War, personalized his convictions.

"Turk was my mentor and best buddy," said Plantz, a friend of Turner's for 69 years and the only surviving Sailor from PERCH. "He tutored me for my seaman qualifications and my submarine qualifications. He continued being an outstanding teacher through his life, and relaying his experiences in the Navy. Turk loved people with only good words for everyone.

"His deep faith saw him through many trials, and the love of his family helped him along the way. Turk will be remembered as one of the unsung heroes of his generation who served in the Submarine Force with honor and dignity. I loved you shipmate and treasured the friendship that we shared."

Ted Davis, a retired U.S. Navy captain and former Commanding Officer of the Tench-class diesel submarine USS GRENADIER (SS 525) concurred with Plantz.

"There is nothing Turk wouldn't do or has not already done for his country, his service, his friends, and his family," said Davis, a long-time friend and member of the Hampton Roads Chapter of the U.S. Submarine Veterans, Inc. "Turk showed us the way a hero walks, softy with love in his heart. He may have spent many tours in hell, but he served God and country for life."

In addition to the Purple Heart and Korean Service Medal, Turner earned various medals and awards during his career including the Bronze Star, American Defense, American Area Corps, Asiatic-Pacific Medal, Philippines Defense Ribbon, Good Conduct Medal, Point System, World War II Victory Medal, National Defense Service Medal, and the United Nations Medal.

He was a member of the U.S. Submarine Veterans of World War II Tidewater Chapter, having served as state commander, president, and vice-president; a life member of the Veterans of Foreign Wars of the United States, General MacArthur Memorial Post No. 392 in Virginia Beach; a member of Holland Club; Member Fleet Reserve Association Branch 5; and a member of American Defenders of Bataan and Corregidor. Additionally, he was an active member of King's Grant Baptist Church and the Joy Sunday School Class.

"Turk's legacy is one of success in the face of insurmountable odds," said Paul Rice, chaplain for the United States Submarine Veterans, Inc. and friend since 1997. "His faith in God allowed him to stand up under brutal torture and still inspire his shipmates to carry on as well. Turk was one of the many men executing the Code of Conduct before it even had a name. He was instrumental in ensuring all but six of the crew of the PERCH made it home at the end of their captivity."

Turner went on eternal patrol at the age of 92, Feb. 28, 2011. He will be cremated and his ashes will be scattered at sea.

For more information on the Submarine Force visit the Submarine Force Atlantic web site at: www.sublant.navy.mil.

Marion "Turk" Turner, who spent three and a-half years in a Japanese Prisoner of War camp during World War II, socializes at the 2010 Submarine Ball in Norfolk, Va. Turner recently passed away after a long illness. (U.S. Navy photo by MC2 Danna Morris)

TEACHING A LITTLE SUBMARINE HISTORY

By CAPT William Riffer, USN(Ret)

When my wife and I retired for the second time, we decided to move to Williamsburg, Virginia. There were a number of great reasons for this but among them was the absolute requirement for access to a major university. William & Mary fit the bill. Once here, I found that the college had an adult continuing education program called The Christopher Wren Association. Currently it teaches about 70 courses to about 1600 students in addition to sponsoring a number of other programs and activities. Many universities have similar programs. I started attending courses each semester.

After about two years several people suggested that there would be significant interest in a course about submarine history if I would put one together. I did so and it was surprisingly easy. I was amazed at the interest it generated. The first time I taught it I had 100 students. I taught again and had 100 more. The third time I had about 70. At that point I decided to wait a year or two before I taught it again. The course is pretty straightforward. It's a six hour lesson (given in three two hour classes). The first hour is pre-First World War with some specifics on TURTLE, HUNLEY, and HOLLAND. The second discusses the German U-Boat campaign in the First World War with an emphasis on how close it came to driving England out of the war. I then turn to the German U-Boat campaign in the Second World War with an emphasis on how it came nowhere near driving England out of the war despite what one repeatedly hears on the History Channel. I then discuss the American campaign against Japan, undoubtedly the most successful major use of submarines in history. Then I discuss the Cold War. This section takes about 1 ½ hours and covers the development of the nuclear submarine, SSBNs including MAD, deterrence, how the two sides operated, etc., and SSNs discussing special operations (that can be discussed), Soviet operations, and

other mission areas that developed (strike, special forces, etc.). Finally, I talk a little about the current force and make an unabashedly partisan pitch for the future need for submarines.

The reception this course received was to say the least gratifying. People really got into the topic. Of special interest was the Cold War section. I have now been asked to speak on this specific subject (Submarine Cold War operations) to four different local groups and I have happily agreed. For a longer speaking request I just give the entire Cold War section. If they are looking for a shorter presentation (which has only happened once) I take out the SSBN section and just discuss SSNs with a short SSBN overview. The whole thing is on Power Point so changes are easy.

I decided to write this experience up because a number of readers will be retired submariners with a wealth of knowledge and experience. I encourage you to consider doing something similar where you live. Not only is it good for the force (let's face it, our story is a very positive one worth getting out to the general public at every opportunity) but it is also great fun.

One final thought. If you do see an opportunity to do something like this and would like a head start, I would be happy to provide my course materials, the whole course or any portion thereof.

ETERNAL PATROL

CAPT Charles J. Beers, Sr., USN (Ret)
RADM John Lewis Butts, USN (Ret)
CAPT James B. Campbell, USN (Ret)
CAPT Charles Stuart "Chuck" Carlisle, USN (Ret)
CAPT Bennie L. "Jim" Flitcher, III, USN (Ret)
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CAPT Willis A. Matson, USN (Ret)
CAPT Gordon R. Stone, USN (Ret)

COVERT SUBMARINE OPERATIONS
–A New Exhibition at the Navy Museum

By CAPT Peter Boyne, USN (Ret)

A new exhibition, *Covert Submarine Operations*, will open in the National Navy Museum this summer. *Covert Submarine Operations* is being installed in the Cold War gallery of the museum in the Washington Navy Yard. It is a recreation of the popular exhibition, *Fast Attacks and Boomers: Submarines in the Cold War,* which was on view in the Smithsonian's National Museum of American History during the Navy's Submarine Centennial celebration in 2000.

Many Americans, particularly younger generations, know little about the Navy's role in the Cold War. This fact led the Naval Historic Foundation (NHF) to initiate action in 2005 to open a Cold War Gallery depicting the Navy's role in the Cold War from 1946 to 1991. The Gallery is located in the historic David Taylor Model Basin building and is part of the Naval History and Heritage Command's (NHHC) Museum in the Navy Yard.

The Central Gallery, completed in 2010, includes a time line of significant Cold War events, descriptions of NATO and Warsaw Pact nations, a carrier ready room with chairs from the USS John F. Kennedy (CV-67) and a full scale TRIDENT I missile in flight configuration to emphasize the deterrent role of the SSBN force during the Cold War.

The artifacts used in *Fast Attacks and Boomers* have been reinstalled and include the attack center, crew's dinette, sonar room, maneuvering room console, and crew's berthing. The piano used by the crew of USS THOMAS A. EDISON (SSBN610) is a unique addition. Videos illustrate the submarine's role in nuclear deterrence, reconnaissance, intelligence collection, training and operations conducted during the Cold War. An interactive work station gives the visitor an opportunity to detect and identify underwater sounds.

Covert Submarine Operations is the first installation in the North Gallery of the building that will eventually be completed with additional displays of the Navy in the Cold War.

NHHC, with support from the NHF, will host two fellowships this summer in science, technology, engineering and mathematics (STEM) concepts using the *Covert Submarine Operations* exhibit as a model. Middle and high school teachers have been selected to attend and will develop professional lesson plans for use in the classroom that promote technical study.

NHF has been able to underwrite this installation due to a generous contribution from Mr. and Mrs. David Leighton and a substantial multiyear pledge from General Dynamics Inc. Opening date is set for June 11 in conjunction with NHF's annual meeting.

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Mr. Scott Still

Taking The Submarine Review To The Top Of The World

Commodore Mike Bernacchi, COMSUBRON Four, at the Pole

DISCUSSION:

Editor's Note: Following the publication of his article The Survivability of the Royal Navy and a New Enlightened British Defense Strategy in the January 2011 issue of THE SUBMARINE REVIEW, I wrote to Dr. Tony Wells congratulating him on his vision and his initiative in suggesting a dedicated *Maritime* strategy. I further asked if he is seeing any movements in that direction within the U.K. This is his answer.

Dear Jim:

I think that the politics of influence are working over the pond—my article has helped contribute to that process, and in addition the recent UK debacle over the failure to extricate UK citizens out of Libya in a timely manner has reinforced the need for Expeditionary Maritime Forces that can be on scene and respond quickly. This event, combined with the UK's total failure to have any form of maritime air support in the no fly zone, reinforced the situation. Of course the one UK asset that played a serious role was the UK SSN firing its Tomahawks in unison with the US SSNs, and that great SSGN, USS FLORIDA (I have been privileged to have several rides on board FLORIDA). The fact that only one UK SSN was available was not lost on the powers that be in the UK. Worst still, since I wrote my article, the UK government decommissioned HMS Ark Royal to save money, and the last of the Harriers have gone home. Then, of course, the Libyan situation arises in short order.

I have stressed through some influential channels the need for the UK to work a maritime expeditionary strategy in consort with the US Navy, so that the UK remains fully in step with its main ally. I have suggested a joint US-UK program to examine this requirement in detail, so that the UK can seriously configure the Royal Navy for the long term.

The ball seems to be rolling. You may have read about the very recent letter that went to Parliament from a group of retired Royal Navy Admirals that received front-page publicity in the main UK newspapers and media. As a Submarine Force advocate I have tried to influence also the need for a greater UK Submarine Force level. As you and I know, numbers count, and the UK is getting woefully down near the lowest mark in spite of the high quality of the new ASTUTE class and the later TRAFALGARs. They will need all the help that we can give them, and I am so pleased that the UK government has recognized the tremendous contributions that John Butler has made to the US-UK Submarine community over many decades by his decoration from HM Queen Elizabeth.

Thank you again, Jim.

Yours, aye,

Tony Wells

Re: RADM Holland's Comments on

A JUNIOR OFFICER'S VIEW

In the January issue, the status of the naval engineer took longer to resolve than he indicates. Until 1899 engineers were in a separate corps from line officers. The crucial boost for the amalgamation of the two corps was provided by then-Assistant Secretary of the Navy "Teddy" Roosevelt, who declared:

> "Every officer on a modern war vessel in reality has to be an engineer whether he wants to or not."
>
> "What is needed is one homogeneous body, all of whose members are trained for the efficient performance of the duties of the modern line officer."

Congress wrote the change into law in March 1899. Henceforth, all naval cadets were to be trained for both kinds of duty. Engineer Corps officers above the rank of commander were designated for shore duty only, while the others were given the option of taking two years to pass the examination for line status. Many chose to retire instead. The technical functions of ship and machinery design were reserved for line officers selected for advanced education—what is now the Engineering Duty (EDO) Corps. As Lt. Hong's article and the several comments indicate, the issue has continued to rear its head ever since.

Mr. John D. Alden

USE OF MINES AS ANTI-ACCESS WEAPONS

By Mr. Norman Polmar

I was very surprised and disappointed by Rear Admiral Connor's comments on anti-access weapons in his remarks at the 2010 Naval Submarine League symposium as printed in the January 2011 issue of THE SUBMARINE REVIEW.

He cites anti-ship cruise missiles and anti-ship ballistic missiles as the principal anti-access weapons confronting the U.S. Navy. Relatively few nations and non-state actors possess land-launched cruise missiles. I believe that they have been employed on only three occasions since first employed 30 years ago: They have damaged a British destroyer and a small Israeli corvette. The one occasion in which the weapon was employed against U.S. ships—a battleship—it was shot down by a British warship.

Only China currently has land-launched, anti-ship ballistic missiles. However, the probability of a United States-China conflict is small; this view is confirmed by my discussions with U.S. and Chinese naval officials—despite the press *hype* over China improving its naval forces and flying a prototype stealth fighter aircraft. Also, the U.S. Navy has a demonstrated anti-ballistic missile capability for its surface forces in the Aegis air/missile defense system.

While China could transfer the anti-ship ballistic missile technology to other nations, they would also require the associated surveillance, targeting, and system linkage, which would be difficult to operate and are highly vulnerable to various forms of interruption.

But more significant than these systems is one that RADM Connor ignores in his comments: The naval mine. Mines are the most prolific anti-access weapon, which can be easily employed, and for which the U.S. Navy has limited countermeasures available.

In 1950 North Korea—without a navy—used mines to defeat the planned U.S. invasion of the port of Wonsan. The U.S. Navy lost several minesweepers to Soviet mines in that conflict. During later U.S. naval operations in the Persian Gulf the Navy suffered an Aegis

cruiser, a helicopter carrier (LPH), and a frigate heavily damaged by mines. In addition, a super tanker under U.S. escort was mined.

U.S. mine countermeasure (MCM) capabilities are limited, with many naval experts believing that the shift to the littoral combat ship (LCS) carrying a modular MCM package will be less effective than the traditional specialized MCM ships and MH-53E MCM helicopters. Beyond the delays with the LCS and technical problems with the MCM module, the size of the new ships brings to mind Winston Churchill's comment in World War II that the growth of destroyer size was resulting in *the hunter becoming the hunted.*

Today advanced mines are in the arsenals of several nations that are considered *potential enemies* of the United States as well as numerous other nations. Mines and mine technology are readily available in the international weapons market. These mines can be a threat to U.S. submarines as well as to surface forces. Indeed, efforts to develop submarine-launched mine detection vehicles have not been successful. Submarines can offer little if any capabilities to counter hostile mines, especially *rising mines* like the discarded U.S. Captor weapon. Both Russia and China have such mines in their arsenals and have offered them to other nations.

Advanced mines can be planted by aircraft, submarines, surface warships, merchant ships (as occurred in the Red Sea), and even small coastal craft, both military and civilian. These weapons—which can threaten U.S. submarines—represent a major omission in RADM Connor's discussion of anti-access weapons.

BOOK REVIEWS

PROJECT AZORIAN

By Polmar and White

Reviewed by Mr. Lorie Allen
Secretary of the Capitol Chapter

Naval Institute Press, 2010

Editor's Note: The Winter Business Meeting and Luncheon of the Naval Submarine League Capitol Chapter was held on February 25, 2011, at the Army Navy Country Club, Arlington, Virginia. The program featured Mr. Norman Polmar as guest speaker.

The subject of Mr. Polmar's wide-ranging and entertaining discussion was: **Project Azorian** – ***the most ambitious Ocean Engineering Operation in marine history***, which he said was either highly successful or mostly unsuccessful, depending on one's point of view.

In late February 1968, the diesel-powered Soviet G-II class ballistic missile submarine K-129, departed Petropavlovsk in the Soviet Union to take up a patrol station in the western Pacific northwest of Hawaii.

Its intended target in the event of war was the United States military complexes on Oahu in the Hawaiian Islands. The K-129 was armed with three 1-megaton nuclear-tipped missiles and two nuclear-armed torpedoes. The K-129's course was due south from Petropavlovsk. As the K-129 reached Latitude 40° North, the K-129 turned due east. The K-129 used this course to avoid detection by the U.S. Navy's SOSUS network as well as to avoid detection by the Navy's far-ranging P-3 Orion aircraft—and the submarine did escape U.S. detection.

In March, 1968, during the transit to the K-129's patrol area some 1200 miles northwest of Oahu, the submarine suffered a catastrophic operational accident, and was lost with all hands. The

Soviet Navy, unable to raise the K-129 by communications, was alarmed and rushed a search fleet from the eastern Soviet Union into the North Pacific in search of the K-129. The Soviet search failed to find the K-129.

U.S. Intelligence clearly knew that something had occurred to an important Soviet naval asset. Although not detected by SOSUS or Navy P-3s on patrol, the Navy cable ship ALBERT J. MYER had an active hydrophone deployed, and the ship recorded several *strange sounds*. While SOSUS had not detected those sounds, the Air Force Technical Applications Center seafloor acoustic system—an Air Force system—determined the approximate location of the K-129.

The submarine USS HALIBUT (SSN-587), in a top-secret deployment, trailing a sonar-camera *sled* found the K-129 remains at a depth of 16,400 feet. This was at a time when the deepest submarine recovery—USS SQUALUS (SS-192)—was 245 feet!

Enter Dr. Henry Kissinger, the National Security Advisor to then President Richard Nixon. Dr. Kissinger advised the President that he should authorize an attempted recovery of the submarine to be able to examine the nuclear missile warheads. Enter the NSA at Fort George Meade, which was interested in obtaining the crypto machines and related material. The project was assigned to Director Richard Helms of the CIA.

The United States was thus planning to attempt to recover another country's national asset, without their knowing of it from over 16,400 feet below the surface of the Pacific!

Project Azorian was thus born. The original task force was established on 1 July 1969 by the CIA. Because the Project was of such huge dimensions in cost, technical and security risk, and intelligence value(s), it sometimes caused difficult problems for the officials who had to make the major decisions affecting it. Some of the questions did not lend themselves to clear-cut unequivocal answers. But the intelligence value of the K-129 was still great. And there was always the political or physical response of the Russians if they should learn of the deep ocean recovery effort to be considered. Because of these difficult questions, there could not be and was not unanimity of opinion among senior officials in CIA, Defense, State, the White House, and other

agencies collectively responsible for *Project Azorian*. The decision on whether or not to proceed was a difficult one.

On 8 August, 1969 an Executive Committee reported and briefed President Nixon of the feasibility of the recovery of K-129. Following the meeting, the United States, under an elaborate ruse, employing a *deep ocean minerals mining venture* gained the support and public sponsorship of billionaire Howard Hughes. The degree of Howard Hughes' direct involvement in promoting the super-secret mission was significant.

Elaborate cover stories were circulated in the press regarding this very profitable new future venture in deep ocean mining and a number of firms formed separate ventures including Lockheed Corporation. But because Azorian was a black program, Lockheed—a Azorian team member, ended up competing with itself! Even a number of universities in the United States developed full-fledged *deep ocean mining programs* for their students to support the burgeoning *new* industry.

Hughes established a subsidiary, Summa Corporation, as project lead and cover that would develop a U.S. owned asset dubbed the massive heavy lift ship HUGHES GLOMAR EXPLORER. The HGE was a 63,000-ton ship when fully outfitted; it would be as big as a battleship in tonnage. It would be capable of lifting a 2,000-ton section of submarine, using 4,000-tons of special drill pipe in 60-foot sections, with a 2,000 ton recovery or *capture module* to grab the K-129. HGE would be a never-before-tried, one-of-a-kind system, capable of precisely staying on station in deep ocean seas and currents, capable of lifting 8,000 tons from a depth of more than three miles—without the Soviets watching every step of the salvage operation.

Attesting to the thoroughness of the Azorian plan, the HGE, on Independence Day, July 4, 1974, would arrive at the *deep sea mining site* she had been working toward—actually, the recovery site of the K-129, one day after President Nixon departed Moscow on a diplomatic visit. It would take several weeks to ensure that the Glomar Explorer would, in all aspects, be ready to attempt the recovery. Weather would play a role in finally deciding *when ready* for a capture attempt.

A weather hold was in effect on 17 July when the HGE was advised that a Soviet naval ship, the 459-foot missile range instrumentation ship CHAZHMA, was under way on a course toward the HGE's location and should be expected in the immediate vicinity of the HGE at 0400 hours on 18 July. CHAZHMA carried a helicopter and had sailed from Petropavlovsk to support a *Soyuz* event, or so it seemed. Measures were taken to prevent the helicopter from attempting a landing aboard HGE.

The Soviet ship closed to within one mile of HGE. CHAZHMA launched her helicopter for picture taking of the HGE at close range, which caused a measure of concern that the Soviets suspected something might be afoot. But *mining* work continued aboard HGE.

The CHAZHMA would later close to within 500-yards of HGE for closer inspection. HGE would be signaled "Why are you here?" HGE Answered: We are conducting deep ocean mining tests." "What kind of vessel are you?" Answer: "A deep ocean mining vessel." "What equipment do you have onboard?" Answer: "Deep ocean mining equipment." "How long will you remain here?" Answer: "We expect to complete our tests in two to three weeks."

That night, the CHAZHMA signed off saying – "we wish you the best" and got underway to return to Petropavlovsk. The HGE had already started lowering the capture vehicle on the pipe-pipe string hidden beneath the ship.

On 22 July, the Soviet salvage tug SB-10 arrived and began conducting surveillance of the HGE from close range, down to 75 yards at times. Altogether, the Soviet surveillance lasted 13 days and 16 hours before the SB-10, satisfied that HGE was indeed conducting *deep ocean mining tests*, signaled goodbye and departed.

HGE had actually recovered almost 140-feet of the sunken K-129 while under surveillance. But because of the hardness of the ocean floor around the K-129's watery grave, the capture vehicle had sustained damage when it was closed onto the submarine hull, and a 102-foot section of the submarine fell from the failed-capture module as she was being raised. The single surviving

nuclear-tipped missile was in the section, which had slipped away to the bottom.

In a touch of irony, a 38-foot section of the K-129 was just below the HGE when the SB-10 had completed its last close-in surveillance of the HGE before the *SB-10's* departure.

One can only conjecture the reaction and chagrin of the Soviet authorities when they later realized that two Soviet Navy ships were on scene and in effect had witnessed the recovery operation against their lost ballistic missile submarine.

The 38-foot recovered section yielded considerable intelligence value including the recovery of two nuclear-tipped torpedoes even though they had been crushed.

Mr. Polmar's presentation included a clip from the impressive film Project Azorian, which contained actual scenes of the K-129 wreckage on the ocean floor and of the lift operation. Film producer Michael White is coauthor with Norman Polmar of the new book PROJECT AZORIAN: THE CIA AND THE RAISING OF THE K-129 (Naval Institute Press, 2010).

STOCKPILE: THE STORY BEHIND 10,000 NUCLEAR WEAPONS

By Jerry Miller
Naval Institute Press, Annapolis, Maryland, 2010

Reviewed by RADM Jerry Holland, USN(Ret)

Those privileged to know Admiral Jerry Miller will not be surprised that his opinions, judgments and emotional reactions are displayed in this book without waffling or condescension.

The counterforce strategy produced by RAND without participation of anyone with combat experience or knowledge of the sea was bankrupted by submarine based weapons.

Nuclear weapons became a jobs program for scientists and technical workers. The book can be a primer for requirements writers of all weapons systems.

For Congress, production of weapons was a jobs bill and an issue to attack the other party.

For the services, nuclear weapons were a force builder: i.e. the more weapons, the more delivery platforms would be needed. This is much more than a critique of how the stockpile grew. It contains a careful analysis of the various delivery systems, the effects of Arms Limitation Treaties, the failures of political and military leaders to examine nuclear weapons and the anomalies in policy that were not just in error but nonsense.

Admiral Miller was one of the initial members of the organization charged with determining targets (the National Strategic Target List) and then formulating that into the Single Integrated Operational Plan (SIOP), reporting there in 1960, in the first increment of the Joint Strategic Targeting Planning Staff (JSTPS). In 1973 he returned as Deputy Director.

Over and over again he laments as a targeteer, "What in the world are we going to do with all these weapons". Miller's thesis

is to address the question of why the United States dedicated so much effort and so many resources to the creation of a stockpile of ten thousand strategic weapons? How did the buildup happen? Who were the individuals and groups of individuals who were responsible for the creation of this unbelievably destructive force that has never been used and that has necessitated years of frustrating and sometimes questionable arms control negotiations.

Early in the book Miller notes that Admiral Dan Gallery contended in public arenas that a shore-based nuclear weapons force provided targets for the enemy; targets that would attract many weapons and create many casualties just because of the location of the force. Gallery's argument has been turned from a fault to a blessing in arguments that land based forces make an unambiguous target that must be attacked in the nuclear war. The issues of Admiral Miller's analysis of the McNamara era is particularly telling.

> "With Kennedy's support, McNamara usurped a great deal of authority that had been in the hands of the military. He made decisions not only on what strategies would be used in warfare, but about what weapons should be procured and from what contractor. Intellectual arrogance and disdain of the military became the hallmark of the civilian staff in the Office of the Secretary of Defense. That disdain was met with frustration and contempt for the civilian authority on the part of the military." Page 24

Using as many as 7,000 nuclear weapons could not attain even a 50 per cent probability of destroying the nuclear threat.

When McNamara entered office, the nuclear war plans had 3,500 weapons. When he left seven years later the number was seven thousand and climbing to ten thousand.

> "If there were a common thread in their views and those of many of their staffs, it was contempt for military judgment." Page 28

The AEC and the Joint Committee on Atomic Energy (JCAE) were powerful sponsors of the research, development and procurement of nuclear weapons. Nuclear weapons became a jobs program first for the academic think tanks and then for the nuclear labs. In RAND and similar think tank studies he found two missing elements: none of group had any experience in combat and Miller never noticed any experience or detailed knowledge of the sea.

> "The targeteers in Omaha had no contact with those elements of the military developing requirements for weapons. This lack of communications, mostly due to the secrecy imposed on the targeting function, prohibited development of quality requirements. 'More' was the only word that seemed to be in the lexicon of those developing requirements."
> "...strategists often dictated changes in the guidance to JSTPS without much reference to that staff and its ability to implement the guidance or changes in strategy that were being made.
> "An old military axiom is you should never give an order that can't be obeyed. . . . the guidance that was issued for the preparation of the nuclear warfare plans of the 1960s failed to adhere to this axiom" –p78

By 1973, 8,000 weapons were committed to the SIOP.

Using nuclear weapons to send signals to the Soviets...did the Soviets detect this signal and did they react to it?

"A good case can be made that one of the reasons intelligence is often wrong is because security classifications has prevented review and proper oversight. SAC intelligence did not constrain its tendencies to inflate intelligence. Intelligence by itself did not have nearly the impact on the size and composition of the nuclear force as the strategies chosen for its use and the damage criteria that were prescribed.

Rarely did we experience any exchange of ideas between the policy/strategy/guidance civilian authorities and the staff preparing the SIOP." P133

Secrecy led to ignorance

"Dr Norris Bradbury, head of Los Alamos, would appear before the Military Liaison Committee mentioning that a new weapon capability was possible and ask if the military had a requirement for such a weapon. Invariably the answer would be affirmative and the cycle continued." P141

Miller's delivery system of choice is the submarine. Support of local economy took priority over national needs.

Miller's prescription:

1) size the force to
    a) protect us
    b) meet our obligation to our allies
    c) deter any opposition
2) Abandon arms limitation negotiations – unneeded and unnecessary. Most effective reductions and limits have been made by agreements between leaders
3) Begin testing – moderate program: build new warheads if needed.

The submarine provides a flexibility that presents our leaders with many options. Superior both offensive and defensive. The deterrence mission needs the Navy more than the Navy needs the mission.

THE SCORPION STORY
HOW SHE WAS LOST

By CAPT C.A.K. McDonald, USN(Ret)

Reviewed by Captain John F. O'Connell, USN(Ret)

First of all, a disclaimer. I was a department head aboard USS BARBERO (SSG 317) in 1961 and 1962 when CAPT. McDonald was the Commanding Officer, and we made one deterrent patrol as shipmates in late 1961. That said we have had little subsequent contact except annual Christmas cards since 1962. Recently CAPT. McDonald contacted me by email to ask me to write a book review for THE SUBMARINE REVIEW. My name had been furnished to him by VADM James Sagerholm, USN(Ret) who penned the Introduction to CAPT. McDonald's book.

THE SCORPION STORY is a thought provoking analysis of a tragedy that should not have happened. CAPT McDonald lays out a scenario of events that are highly possible and even probable—that led to SCORPION's loss.

SCORPION went missing on 27 May 1968. She was due to arrive at her berth in Norfolk at about 1300. The Squadron Commander and staff and her Division Commander, and dependents were all at pier side waiting. At the appointed time she was not in sight. As time passed messengers were sent to ComSubLant headquarters to query her by radio. Nothing heard, over. The Squadron Commander finally advised the waiting wives that there had been a delay for unknown reasons and he would use the *telephone calling tree* to notify them as soon as word about her arrival time became available. At ComSubLant headquarters, after repeated attempts to contact SCORPION by radio had failed, VADM Schade declared SUBMISS at 1515. That set in motion a detailed series of procedures to locate the submarine. Later SUBSUNK was declared. The search now was for the SCOR-

SCORPION's wreckage. It was not found until October of that year.

I joined the Submarine Warfare Division of the Office of the Chief of Naval Operations (OP-31) in January 1969. From my predecessor, CDR Paul Barnes, I inherited a number of bulging file folders connected with the loss of SCORPION, and including many letters from concerned citizens who proposed means of finding lost SCORPION. They ranged from idiotic to thoughtful. Later that year the question of a memorial service at Norfolk to mark the first anniversary of the loss came up. I had occasion to contact a number of close relatives of the lost crew to obtain their opinions. They ranged from thankful to bitter.

CAPT McDonald was in a unique position in the Pentagon to monitor the search for SCORPION, as Special Assistant for Submarines to the Assistant Secretary of the Navy for Research and Development. That gentleman was placed in charge of the overall search effort. CAPT McDonald details the immense effort, both physical and mental, in determining a probable location for the lost submarine, and in October 1968, finally finding her wreckage resting in some 11,100 feet of water.

However his most thoughtful, and thought provoking analysis details the possible causes of the loss of SCORPION based upon all the evidence, both that was recovered from the scene and that which remains somewhat obscure even to this day. It has nothing to do with Soviet actions, but rather rests with probable U.S. Navy bureaucratic obfuscation of a dangerous situation that came to light just before SCORPION deployed in mid-February 1968.

Three days before SCORPION sailed, at the Naval Torpedo Station at Keyport, Washington, a Mark 46 Mod 0 torpedo battery for Mk 37 antisubmarine torpedoes blew up while being vibration tested. On 14 February 1968 the Torpedo Station sent an official letter to Naval Ordnance Systems Command relating the incident. SCORPION sailed on 15 February with a torpedo load that included four MK 37 Mod 0 and ten MK 37 Mod 1 warshot torpedoes.

CAPT McDonald references *Blind Man's Bluff*, by Sherry Sontag and Christopher Drew, in stating that an order later went out to destroy all copies of the Naval Torpedo Station letter. Dr.

John Craven, who was a major player in the search for SCORPION, was later contacted by Charles Thorne, who had been at Keyport at the time of the battery explosion. Thorne had been unaware that the group looking for Scorpion and later trying to determine the cause of her loss, had not been advised of the battery problem. Craven had long been convinced that an internal explosion had taken place in SCORPION's torpedo room. Thorne's revelations about a torpedo battery problem confirmed Craven's suspicions.

One nitpick. McDonald refers to the Mk 45 torpedo as being close to operational readiness in the fall of 1967. I deployed to Westpac as XO, USS PICKEREL (SS-524) in January 1963. We carried two MK 45 war shot torpedoes.

The book is a very interesting read. Those wishing to purchase a copy can do so by sending a check for $ 24.95 to C.A.K. McDonald, PO Box 3331, Bellevue, WA 98008-3331.

REUNIONS

USS ETHAN ALLEN (SSBN/SSN608)
October 15-18, 2011
Branson, MO
POC Herb Richardson
8952 Centerway Road
Gaithersburg, MD 20879
Herb.richardson@comcast.net
Phone: 240-626-9914

USS L. Y. SPEAR (AS-36)
Dates: August 31-September 4, 2011
Location: Grand Plaza Hotel, Branson, MO
For more info: Contact Patty Kelso 913-677-1837
pattykelso@usslyspear.og www.usslyspear.org

TWO BOOKS FOR SERIOUS STUDENTS OF SUBMARINES

Reviewed by Captain James C. Hay, USN(Ret)

UNITED STATES AND ALLIED SUBMARINE SUCCESSES IN THE PACIFIC AND FAR EAST DURING WORLD WAR II

by John D. Alden and Craig R. McDonald
McFarland & Co., Jefferson, N.C.

SUBMARINE OPERATIONAL EFFECTIVENESS IN THE 20TH CENTURY

by John F. O'Connell
iUniverse Inc., New York, Bloomington

Both books are factual and the research done for each is impressive. Each could serve as a first step for looking into specific facets of submarine history. In the case of John Alden's book any meaningful treatment of the 1941-45 Pacific War would have to recognize the data he has amassed. The case for having Jack O'Connell's book on your self is more general in that it covers the overall development of military submarines, and their usefulness, in the period from 1900 to 1939.

More important, by far, than just reading each author's presentation are the lessons-to-be-learned for the present and future generations of the submarine community. For instance, in an article published in the April 2010 issue of THE SUBMARINE REVIEW, John Alden provided an overview of his work, which led to the book reviewed here. He described a data base on which he had worked for years, continually improving the basic 1945 ComSubPac results as new information was developed. In that article John Alden summed up his work as:

> "Allowing for probably minor inaccuracies in the data, it appears that about 43% of U.S. torpedo attacks succeeded in hitting their targets while 57% missed."

That is; 43% **hit** the target, **not necessarily sank** the target; and that is for 14,748 torpedoes fired. At the least, the numbers testify to the difficulty of submarine warfare and the attendant problems in assessing success. It would seem more important, however, for current submariners of all stripes to look deeply into the meaning of that statistic for today's circumstances of much lower force levels and weapon inventories.

The book about submarine operational effectiveness offers many opportunities to look for insights into the generation of submarine requirements. Unfortunately, suspicions are frequently raised that the *requirements process* consisted more of what *could* be done rather than what *should* be done. Of particular interest is Jack O'Connell's short description of the discussion amongst USN submarine officers in the twenties, concurrent with the building of the "S" boats, and the subsequent *spiral* development of the Fleet boats. Real interest in specific operational characteristics was responsible for giving the US Navy the submarines to fight World War II. An interesting tangent in O'Connell's research is the development, then abandonment, of very large submarines during the inter-war period. The Royal Navy built the 361 feet long, 3700 ton submerged displacement, HMS X-1. It was commissioned in 1925 and placed in reserve five years later. During those years France started construction of SURCOUF, a 360 feet long, heavily armed boat with a submerged displacement of 4300 tons. She lasted until 1942. Both examples of long-range commerce raiding capability were evidently lost on the Germans.

United States and Allied Submarine Successes in the Pacific and Far East During World War II,

Most of John Alden's book, 321 pages out of 347, consists of the tabulated results of 4845 submarine attacks. Those 4845 attacks are defined as only those for which success was originally claimed or were later determined to be successful. In his preface to this, his fourth and most complete, edition, Alden puts his work in context with:

> "Although the major outcomes of the submarine campaign are well known, and many accounts have been published extolling the exploits of individual submarines, no definitive record of our submarines' successes has yet been compiled"

The first 26 pages describe the evolution of his data base and the organization of each of the attack reports. Since his data base started with the Force Commander's Submarine Operations Research Group (SORG) wartime assessments, perhaps one lesson-to-be-learned has to do with ensuring the completeness of input to tactical analyses and the integrity itself of those results. The USN's Submarine Force has a tremendous advantage in this respect with the long experience and expertise of the Submarine Development Squadron.

In addition to the SORG data, which was modified by the declassification of ULTRA data, information was gathered on submarine attacks made by British and Dutch submarines. The collection of data from Japanese sources is a story in itself, but obviously has been very useful in making the final assessments. Another interesting tangent is John Alden's comparison of the SORG originated success results and those of *JANAC* (Joint Army-Navy Assessment Committee). It offers a lesson-to-be-learned in knowing the basis of data, which can be quoted in a manner negative to one's interests.

The data listing those 4845 submarine attacks deserve some in-depth analysis to at least determine if there are lessons-to-be-learned beyond the obvious problems with defective torpedoes (and why that took so long to identify from the tactical analysis being done) and the inherent difficulty of undersea warfare in which so little of the *big picture* tactical situation is actually known.

Submarine Operational Effectiveness in the 20th Century Part One (1900-1939)

Jack O'Connell's book on the overall survey of submarine operational effectiveness prior to World War II is organized for easy reference. It is divided into chronological parts with each

submarine significant part subdivided by nation. The first four eras of submarine interest are the earliest days with the invention of Whitehead's torpedo and Holland's submarine, the pre-WW I build up of the major submarine forces, the operations of Allied submarines in WW I, and the operations of German and Austro-Hungarian submarines in that war. A separate part is given over to a commentary on the effectiveness of submarines in WW I, with particular emphasis on the German campaign. Part six deals with the inter-war period of the twenties and thirties and lists both the International Naval Arms Limitation conferences and the individual efforts of the nations building submarines during that period. A special section about submarine involvement in the Spanish Civil War rounds out the chronological treatment.

Jack ends the period with a count of submarines in each of the major fleets at the time of the German attack on Poland to start WW II in September 1939. Knowing what the next several years held for those navies, that count may well be a surprise to the modern reader and to that extent at least is one good reason to go over just what led up to the situation on 9/1/1939:

USSR	218	Great Britain	69
Italy	115	Japan	62
USA	99	Germany	57
France	77		

Naval Submarine League Honor Roll

Benefactors for Twenty Years or More

American Systems Corporation
Applied Mathematics, Inc.
Booz Allen Hamilton, Inc.
Cortana Corporation
Curtiss-Wright Flow Control Company
Dell Services Federal Government
DRS Technologies, Inc.
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General Dynamics Electric Boat
Kollmorgen Corporation, Electro-Optical Division
L-3 Communications Ocean Systems
Lockheed Martin Corporation
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Northrop Grumman Corporation - Naval Marine Systems Division
Pacific Fleet Submarine Memorial Association, Inc.
Raytheon Company
RIX Industries
SAIC
Sargent Aerospace & Defense
Sonalysts, Inc.
Systems Planning and Analysis, Inc.
The Babcock & Wilcox Company
The Boeing Company
Treadwell Corporation
Ultra Electronics Ocean Systems, Inc.
URS Federal Services

Benefactors for More Than Ten Years

Alion Science & Technology
AMADIS, Inc.
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INTERNATIONAL SUBMARINE RACES ™

11th International Submarine Races to be Held at Naval Surface Warfare Center Carderock from June 27 to July 1

Teams invited to compete in human-powered design event

BETHESDA, MD. (April 21, 2011)—The Foundation for Undersea Research and Education (FURE) and Naval Surface Warfare Center Carderock Division (NSWCCD) announced that the 11th International Submarine Races (ISR), a biennial engineering design competition, is scheduled for the week of June 27.

"The Carderock Division is proud to host the 2011 ISR at our David Taylor Model Basin facility," said Carderock Division Commander Capt. Chris Meyer. "We are thrilled to be a part of such an exciting event that puts engineering skills learned in the classroom and in the lab to a practical test. We know all participants are hard at work on this year's designs, and we all look forward to seeing the innovative approaches they will bring to this year's competition."

One-and two-person teams from high schools, colleges, universities, and private groups are invited to participate in this weeklong contest. The ISR has been in existence since 1989, and has been conducted at the U.S. Navy's test tank, at Carderock, since 1995. This biennial event features races that test the creative skills of young engineering students throughout the world. Teams, wearing scuba gear, contend their submarine designed vessels along an underwater 100-meter measured course in Carderock's model basin.

FURE President Nancy R. Hussey said, "We are extremely appreciative and grateful to the U. S. Navy for its continuing support, without which this event would be impossible. Our all-volunteer organization looks forward to working with the teams, our Navy colleagues and our sponsors to make the 2011 competition a great success."

"The purpose of the sub races is to provide an educational opportunity for aspiring young engineers. Their participation in the design, construction, and operation of a human-powered submarine offers real-time application of theoretical knowledge, hands-on creativity, problem solving and teamwork skill opportunities," said Hussey. "The sub race engineering design competition is an investment in the future of our young people, not only to help them compete in the global technology economy, but to provide a better trained and experienced resource pool of bright and industrious students to help the defense industry and the government fill future national needs.

"The ISR experience increases their value to potential employers. Studies show that students who can put their classroom skills to practical use fare far better in the post-college job market," Hussey added.

The 2011 Platinum ISR sponsors to date are the General Dynamics Electric Boat Corporation and the Oceanic Engineering Society of the Institute of Electrical and Electronics Engineers. The Marine Technology Society has joined the races this year as a Gold sponsor. Many other Silver as well as in-kind sponsors, also contribute.

The 11th ISR Web site, www.isrsubrace.org, contains frequently updated information. Contestant inquiries should be addressed to the ISR Contestant Liaison and Head Judge, Claude Brancart, at (207) 729-7873 or c.brancart@ieee.org.

Organizations or individuals interested in sponsorship, contact Dave McGee at edavemcgee@cox.net or (703) 347-4713, or Nancy Hussey at seacure@earthlink.net, (843)278-1474 or (843) 830-5008 (cell)). The ISR organization is an all volunteer event; individuals interested in becoming volunteers, contact the ISR Volunteer Coordinator, Sue Peterson, at speterson@chesapeake.net. Media interested in covering this event must register with NSWCCD Public Affairs Office at CRDIVPAO@navy.mil.

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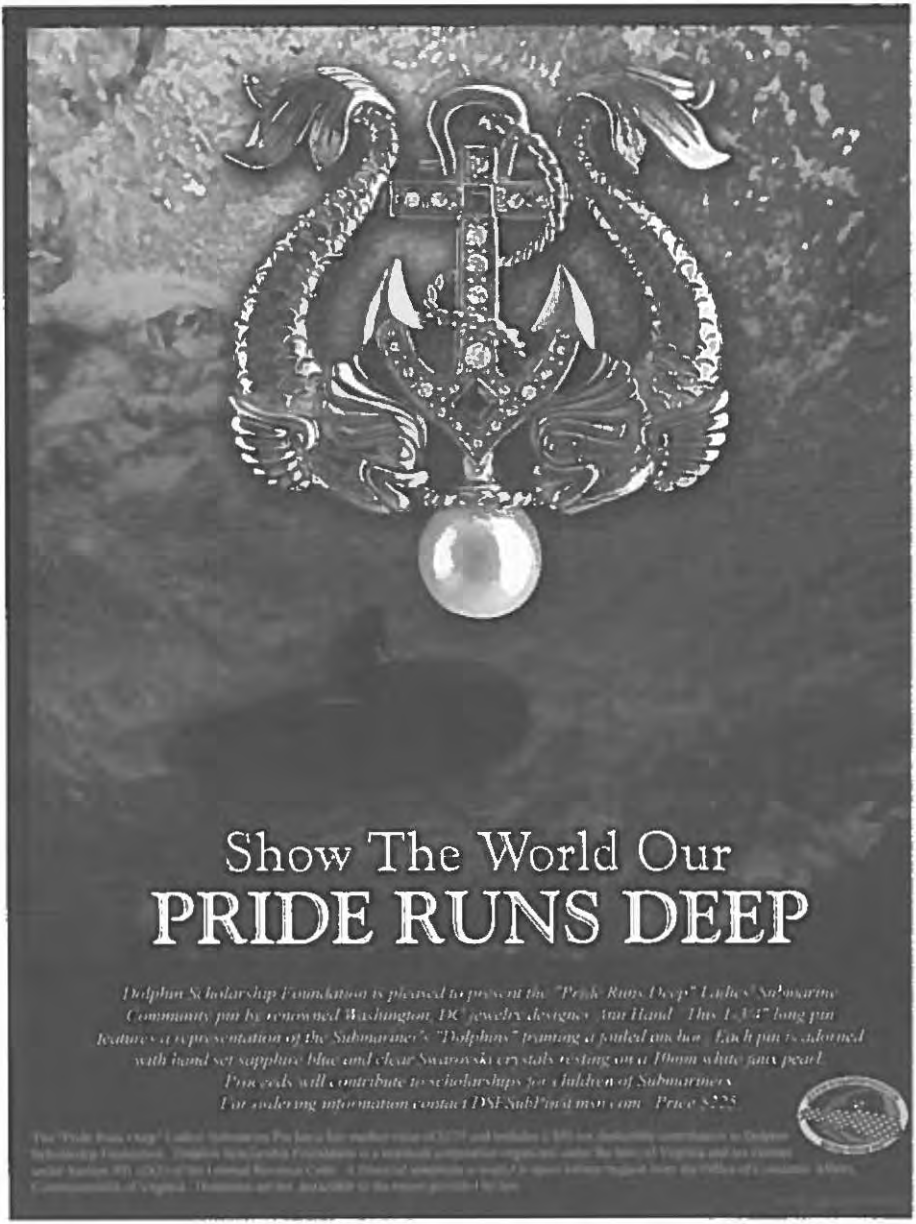

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