OCTOBER 2007

mander" in a new maritime strategy. Interestingly for the readers of the REVIEW, his prime example is the success enjoyed by the SIXTHFLT Area ASW Force in the Med during the early 1980s, when the Commander of SUBGRU EIGHT was dual hatted as CTF 66, the ASW Force, as well as CTF 69, the Attack Submarine Force. The very real cooperation between the Submarine Commander and the Maritime Patrol Air Commander was, of course, the key to that success.

CDR John Alden has provided us with an analysis of World War II submarine mining which is a rare look at the quantitative side of that part of undersea warfare. A very useful next step would be for one of the community's systems analysts to take CDR Alden's results and do an operational cost-benefit comparison. Perhaps that would help future operational planners to act on the on the old question of the trade-off between loading a submarine for a mining mission and sending it off for a pro active war patrol. The final decision on that question, of course, is the operational commander's but it should be useful for him to have some quantitative factors on which to act.

We also have the continuations of two serial-type articles in this issue. The story of the survivors of FLIER, sunk by a Japanese mine in August of 1944 in Philippine waters, continues with Part II of III, and John Merrill's SOSUS article concludes with Part II. The Survivor's Story picks up on the several swimmers reaching a deserted island and deciding to continue their very rudimentary and dangerous island-hopping in the hope of finding food and shelter, as well as friendly help.

An unusual treat is a translation of the Russian Navy Commander-in-Chief's, Admiral Masorin, Navy Day speech in which he outlines his Navy's plans for expansion. His talk of nuclear powered submarines and many aircraft carriers was backed up by the First Deputy Prime Minister's comment that "...the problem now is not lack of money, but how to optimize production...". Given recent political developments in Russia and an increasingly strident tone to pronouncements in international affairs, perhaps all of this bears careful attention. Refer back to Jerry Holland's Up Scope for a Look Around.

Jim Hay

FROM THE PRESIDENT

I hope you all have had an enjoyable summer. The fall season opened with the Submarine Force leadership on the move. Jon Greenert was promoted to four stars and relieved, as Commander Fleet Forces Command, and Van Mauney was promoted to Vice Admiral and relieved as Deputy Commander of the Strategic Command in Omaha. RDML Bruce Grooms is Acting Director, Submarine Warfare Division (N87).

The Annual Symposium will start 31 October initiating the new fall schedule, just about the time you receive this edition. Next year the date will be 22-23 October 2008.The 2008 Corporate Benefactor Recognition Days are scheduled for 6-7 February 2008. Corporate Benefactors continue to be the foundation of League support. Currently there are 76 corporations actively supporting the initiatives and activities of the League.

The Naval Submarine League will hold the Seventh Annual Submarine History Seminar on 11 April 2008 at the Navy Memorial. RADM Jerry Holland has created the program *Fifty Years Under The Ice* to celebrate the Submarine contribution to National Security by operations under the polar cap.

Preparations are well underway for next year's Submarine Technology Symposium (STS) to be held at The Johns Hopkins University Applied Physics Laboratory on 13-15 May 2008. The theme is *Assure, Dissuade, Deter... Through Innovative Submarine Technologies*. VADM George Emery has identified all the Session Chairs and plenary speakers. The Call for Papers and Exhibits has been released. You can find more information about STS on the League webpage.

I am pleased to report that the League continues to work with our members and Corporate Benefactors to support initiatives that assist the best Submarine Force in the world. There continue to be challenges, but Congress has taken the initiative to start funding two submarines per year. The CNO set a cost goal for VIRGINIA Class submarines at $2B each to allow an increased build rate to two submarines per year. Team Submarine lead by RDML Hilarities has been aggressively pursuing changes that create the necessary savings.

Your thoughts are needed on what the League can do to fulfill its mission of educating the public on the importance of submarines as a major contributor to our national defense. I urge you to submit your ideas in the form of an article for THE SUBMARINE REVIEW. We will continue to put these ideas in front of those who can act on them. League members are uniquely qualified to contribute papers in support of the Submarine Force.

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

J. Guy Reynolds
President

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FEATURES

COMMANDER, NAVAL SUBMARINE FORCES
at NDIA's New London Clambake
September 11, 2007
VADM Jay Donnelly, USN

Fellow flag officers active and retired, senior executives, member of the National Defense Industrial Association, distinguished guests and especially to all the submariners past and present – Greetings. It's an honor to address you this morning.

Thanks to Mr. Paul Normand and the National Defense Industrial Association for organizing this year's Joint Undersea Warfare Technology Fall Conference.

What a great venue with a wonderful tradition. This is my first Clambake as Commander, Submarine Force and I am looking forward to the opportunity to carry on a conversation about *Maintaining the Competitive Advantage* and to synchronize the Undersea Enterprise with you, members of the industrial and the technological communities.

Lee Iacocca once said, "You can have brilliant ideas, but if you can't get them across, your ideas won't get you anywhere."

Today and tomorrow we, the members of the Undersea Enterprise, will attempt to get across our ideas. We will tell you about the things we are hard at work on and how you can help us to maintain the competitive advantage. And we will listen intently to your ideas during the technical sessions tomorrow and Thursday.

Lee Iacocca was a master of maintaining the competitive advantage. He did this by quickly recognizing changes that were occurring in the automobile business, adapting his efforts based on the changes, and routinely leading the way to the marketplace with new products.

His competitive acuity was behind the original Ford Mustang in the 1960's, in 1971 he marketed the first domestic subcompact for under $2000, in the 1980's he transformed the Jeep line with the modern SUV, and in 1983 the first mini-van was introduced when Chrysler was having trouble paying the bills and maintaining product competitiveness.

Under his leadership Chrysler quickly gained the competitive advantage and has maintained it to this day. They are still the leader in mini-van sales with 40% of the market.

Lee Iacocca did not beat the other automobile manufacturers by inventing new technologies that the others did not have access to. Instead, he followed the trends in the market and outraced the competition to the finish line, over and over again.

On this day in 2001, the Nation received a catastrophic message that our competition had changed. With that change, a new strategy was needed to maintain our military advantage. The focus of U.S. national security is no longer a single country, but on several potentially hostile states, as well as sub-national terrorist organizations. The ability of these adversaries to gain access to basic weapon technologies, many of the same technologies used by our military, is becoming greater every day.

Like Lee Iacocca's strategy, U.S. military dominance today comes from rapidly integrating commercial technologies that are available to everyone, into military capability that can be promptly delivered to, and exploited by, a well-trained and well-led military force. The *run faster* strategy.

The United States maritime strategy is changing to meet the challenges presented by an interdependent global system. While the U.S. remains the world's leading superpower, we share the rest of the world's dependence on the global system and therefore have a stake in the health and welfare of the greater global community. The Navy will play a critical role in deterring, preventing, limiting, and localizing disruptions to the global system. The Navy, and therefore the Submarine Force, must be flexible, adaptable, versatile, and, when necessary, lethal, to remain ahead of those that wish to harm us.

To accomplish this, the new maritime strategy will focus on using the maritime domain to influence actions that will prevent wars.

While remaining fully capable of winning wars, we must enhance our ability to influence events around the world and win military conflicts before they occur. It will require a thorough and in-depth situational awareness, a Maritime Domain Awareness.

The Submarine Force will be critical to the success of this new strategy.

We will play an integral part in developing this Maritime Domain Awareness by providing accurate and timely Intelligence, Surveillance and Reconnaissance (ISR), a bread and butter mission of submarines. Information that only the submarine can acquire and provide will be needed to thwart our adversaries from gaining the initiative on our forward deployed forces.

However, unlike our traditional stealthy posture, we will have to readily communicate with U.S. and international coalition partners as part of an enhanced maritime information sharing network.

This will be a challenge for the Submarine Force with the limited bandwidth of our current communications systems and must be addressed.

Nuclear-powered submarines, as elements of Sea Power 21, will provide the President, Joint Chiefs of Staff and Combatant Commanders with persistent, clandestine, non-provocative options and, when appropriate, overt, rapid, and unanticipated striking power to address a broad range of complex threats to security. These capabilities are a critical component of the maritime strategy in dealing with both state and non-state sponsored threats across the spectrum of conflict.

Submarines provide these capabilities through the unique combination of stealth, endurance, agility, and firepower made possible by operating undersea independently or as part of an interoperable Joint Force. They can provide these capabilities from the deep ocean or the littorals.

Their closed environment, ability to operate in close proximity to adversaries without provocation or detection, and inherent defense against anti-access threats enable our subs to apply their persistent multi-mission capabilities from areas that are beyond the reach of other Joint Forces.

The Combatant Commanders (COCOMs) are relying on us and we must be prepared. The submarine is the platform that will be called upon to operate in an anti-access environment. Later this morning RADM Walsh, Commander, Submarine Forces, U.S. Pacific Fleet, will tell you how the Combatant Commanders plan to use submarines to fight in the Pacific, if required.

As the U.S. Joint Force transforms to meet new challenges in an uncertain world, four Strategic Concepts guide the role of our

submarines in Sea Power 21.

Assure Access — Our submarines must maintain the ability to penetrate and operate in hazardous littoral areas where others cannot in order to hold anti-access threats at risk and deny sanctuary to adversaries.

Develop and Share Knowledge — Our submarines must maintain the ability to clandestinely observe the undersea, surface, air and land environments, as well as the electromagnetic spectrum. They must be able to communicate the information gathered to the Joint Force Commander with the responsiveness necessary to rapidly defeat threats to our national security. The submarine's inherent stealth helps counter deception and denial attempts. This provides national and military leaders with critical insights into an adversary's capabilities, tactics and operating patterns.

Strike Rapidly, with Surprise — Our submarines must have the ability to rapidly provide offensive attack options ranging from strike warfare and special operations forces, to information operations.

These attacks, emanating from apparently empty oceans and littorals, create uncertainty in a potential adversary, disrupt and complicate his planning, and cause him to devote assets to defense.

Dissuade and Deter — Some states are deterred from using their naval forces to coerce neighbors or disrupt commerce because our submarines can hold them at risk. The nuclear-powered submarine's ability to gain access under all circumstances, obtain penetrating ground truth, and strike with swiftness serve to counter both state and to non-state sponsored threats. Survivable submarines, equipped with conventional and nuclear weapons, serve as a deterrent to other nations that would threaten the United States and our allies.

The submarine has been and will continue to be under high demand. The COCOM demand signal has gone from 15.4 SSN-Years in 2005 to 19.55 SSN-Years next year.

But, we are a low density asset. In 2007, we were able to meet only 56% of the COCOM demand for our units and currently there are 52 fast attack submarines in the force. In the next decade this number will gradually drop to 48 SSNs. Under the current shipbuilding plan, during the 2020 to 2034 timeframe we will dip below 48, the number of submarines needed to meet our obligated requirement

of 10-15-10 to the COCOMs, and will reach a minimum of 40 SSNs.

To meet our Surge Ready requirements with this shrinking force, we are transferring FIVE of our SSNs from the Atlantic to the Pacific fleet. This year 3 were transferred.

We will move one next year and one in 2009. This will place 60% of the operational fast attack submarines in the Pacific and, as the Virginia Class begin to become available in 2009, they will be distributed to maintain the 60/40 split between the Pacific and Atlantic fleets.

Another key initiative to reducing the impact of force shrinkage is the Virginia Class cost reduction plan. We are well on our way to providing 2 Virginia Class submarines for 2 billion dollars each in 2012, commonly referred to as *2 for 4 in 12*. RADL Hilarides will speak about this success story in the afternoon, but *2 for 4 in 12* is not enough to prevent the size of the force from dipping below 48 fast attacks.

More will have to be done. We are working to reduce construction time to 60 months. We may be able to selectively extend the operational life of some of our 688-class SSNs to help fill that gap beyond the year 2020. We must find ways to shorten maintenance periods, perform major modernization during depot maintenance availabilities, and lengthen the time between availabilities to recover operational time. This afternoon, RDML Eccles, Deputy Commander Undersea Warfare and Deputy Commander Undersea Technology, will talk more about the need to plan and execute availabilities more effectively.

We are currently nearing the end of the LOS ANGLES Class maintenance bow wave that was created by changes to the class maintenance plan. Today I have thirteen ships in the shipyard and am only meeting 32 of the 35 deployable submarines needed to meet the Fleet Response Plan requirement. As little as a one month delay in the shipyard maintenance period for some of these ships at the wrong time in their life cycle could result in the loss of a deployment over the life of the ship. A ship only has 15 deployments during her life, so the loss of a deployment has a big impact on the return on investment to the taxpayer.

We are working hard to provide deployed SSNs to the Combatant Commanders, but it comes at a cost. In order to meet operational

commitments, we have compressed the Fleet Readiness Training Plan schedules, referred to as the FRTP. The FRTP is the period of time between deployments that we use to prepare the ships and crews to go out again. Average FRTP length across the force has decreased from greater than 17 months to just over 16 months, decreasing the time that the Commanding Officer has to train his crew and maintain his ship.

This has also reduced the time available for experimentation, modernization and other CNO tasking. Reducing the FRTP length has enabled us to meet the COCOM demand in the short term, but is certainly unsustainable over the long term. We must do a better job of completing shipyard maintenance on time for the future health of the Force.

As I said earlier, the COCOMs are asking for over 19 SSN Years of forward deployment in 2008 and we are only able to provide them with 10. That means those ships will be expected to work hard during their deployments to meet as many of the high priority COCOM requirements as possible. So, they must deploy with 100% capability. But, we have had some real problems with reliability of some of the tactical systems onboard.

Currently the reliability of our TB-29A towed arrays and handling systems is at 15%. Based on casualty reports we are also experiencing high failure rates in the AN/BQQ-10(V)1 Tactical Sonar System and with the Type 18B periscopes. We must do better than this.

In the new maritime strategy, the submarine will need a new range of tactical systems and payloads. We need innovative solutions, like the Littoral Warfare Weapon, which will allow us to maintain security while conducting higher risk missions, like Special Operations Force (SOF) insertion or ISR in the littorals. We need to be able to reliably employ UAVs and UUVs while operating submerged. And to be able to tactically control them with the ability to receive and direct Fire Support electronically.

They will need to be modular, integrated with other payload systems and affordable. But, Commercial off the Shelf Technology is not the panacea for providing these new systems at reduced cost. We have found that these proven technologies still require careful planning, good engineering and hard work to ensure they provide

reliable capability at the right cost.

The message I want to clearly get across is that we need more reliability from our ships and tactical systems with less maintenance time required.

Thus far I have spoken a great deal about SSNs, but our SSBNs are a vital part of the Submarine Force and will also play a critical role in the new Maritime Strategy. The men on our ballistic missile ships make up 32% of the operating personnel in the Force. Like the fast attacks, they are in high demand because they are the only 100% survivable leg of the Strategic Triad.

Our 14 SSBNs are currently meeting the COCOM demand. For the next 11 years, we will have more than one SSBN in an Engineered Refueling Overhauls at one time, and we are just meeting our employment requirements with degrades on a case by case basis. There is no room for an overhaul to overrun. We don't have the flexibility to absorb that maintenance delay and meet our commitments to STRATCOM. Any further degrade of a submarine requirement could have a significant impact on STRATCOM ability to execute their mission. We can let this happen.

The OHIO Class ships begin decommissioning in 2027. Planning for the replacement Sea Based Strategic Deterrent is being considered. The 30-year shipbuilding plan calls for a 2019 construction start date with design efforts starting in 2014. A recent Rand Corporation Study recommended commencing design efforts 5 years early in order to maintain the industrial design base and achieve a more mature design at the start of construction, saving money in the long run. RADM Mauney, Director Submarine Warfare Division, OPNAV N87, will speak to you next and provide more detail on this project.

SSGN is a reality!

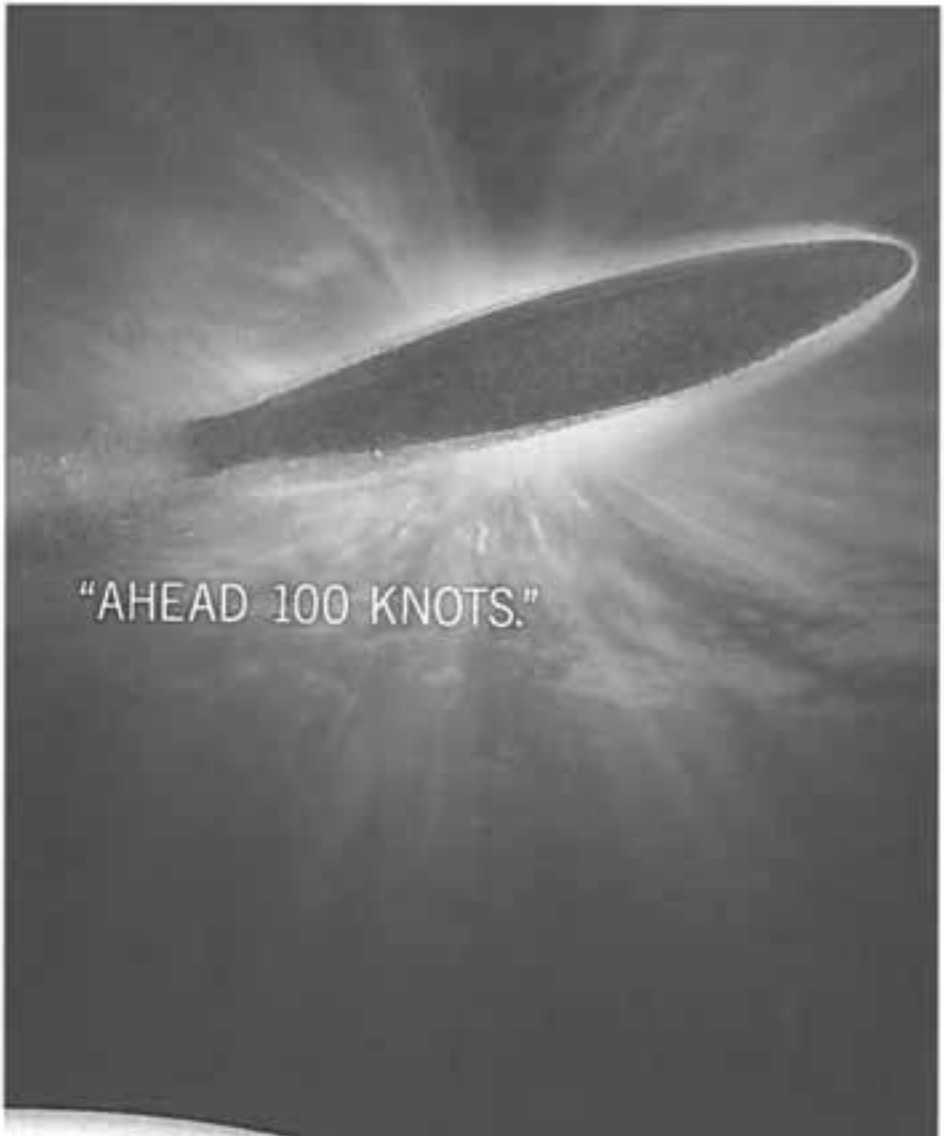
Twelve years ago, the idea was developed to take advantage of the highly successful OHIO Class submarines that were no longer needed for their strategic mission and convert them into powerful multi-mission platforms.

This fall the first conversion, USS OHIO, will make her first SSGN deployment and the others are following shortly behind. The FLORIDA completed a highly successful Strike Op Eval this past Summer and will deploy in the Spring of 2008. MICHIGAN is

finishing up her modernization and will soon begin her first 15 month operational cycle. The last, but certainly not the least SSGN, the GEORGIA will return to service in March of next year. They are here on budget and on schedule. And they have arrived just in time. The COCOM demand is high. OHIO's first deployment will be to the U.S. Pacific Command's Area of Responsibility. This part of the world is becoming an increasing area of concern. RDML(sel) Bonnelli, Deputy Commander Naval Special Warfare Command will tell you more about the need for SSGN in the Pacific tomorrow.

As you can see, the demands on the Submarine Force are great and are growing. To maintain the competitive advantage with a shrinking force, we must continue to employ Lee Iacocca's *run faster* strategy and do it better by delivering ship's on time, on budget and with highly reliable capabilities.

Thank you for your attention and I look forward to hearing your thoughts and ideas over the next few days.■



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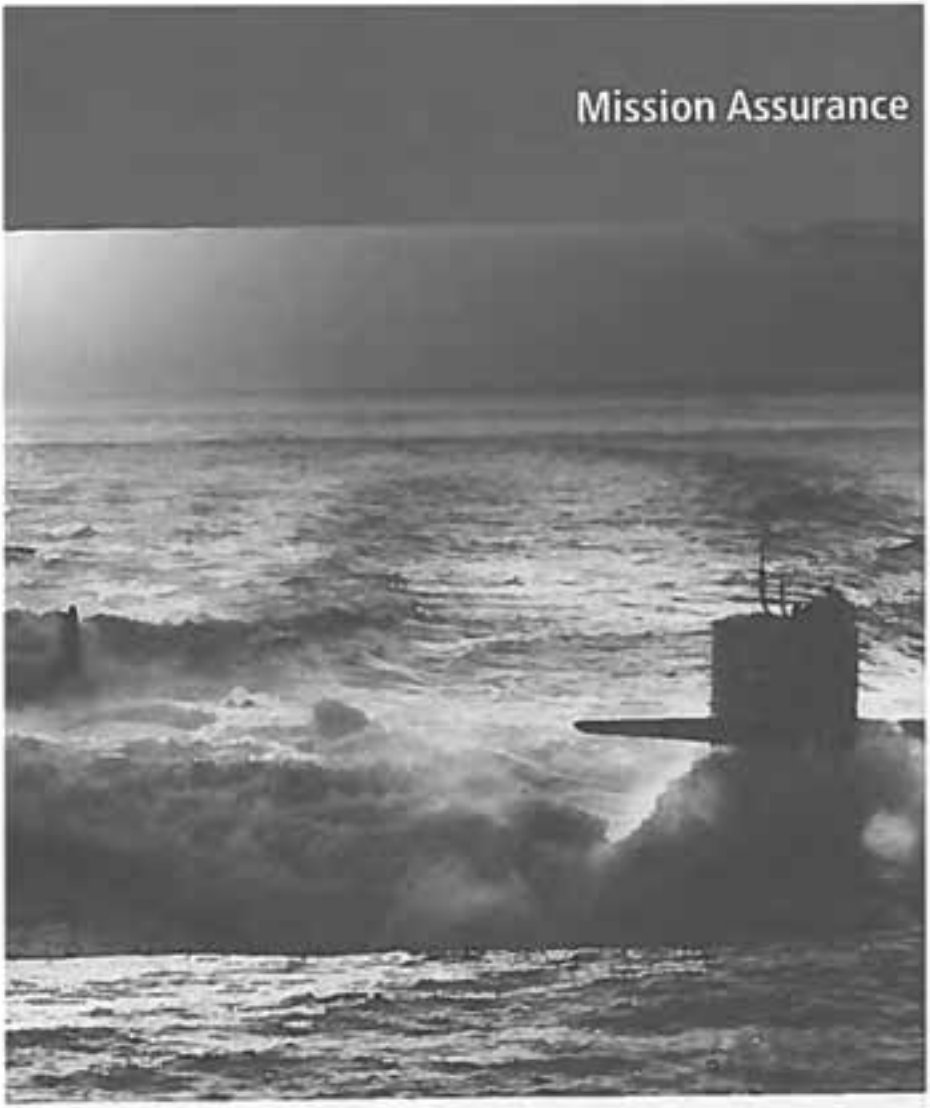

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EULOGY FOR CAPTAIN WARREN RICHARDSON COBEAN, JR., USN(Ret.)

Captain Warren R. Cobean, Jr., USN (Ret), 84, died at home in Greenwich, CT on June 27, 2007. He will be best remembered as one of the original members of Admiral Rickover's *Nuclear Navy* and as the first reactor officer and later executive officer of USS NAUTILUS, the world's first nuclear submarine.

Captain Cobean, or "Bus" as he was known, is survived by his wife of 61 years, Jean Beaumont Cobean; sister Ruth C. McPherson; son Warren R. Cobean III; son Charles S. Cobean; daughter Lisa C. Muse; and nine grandchildren and four great-grandchildren.

Bus Cobean was born in Montevideo, Uruguay, in 1923 and spent the first eight years of his life in Monterrey, Mexico, before his parents returned to the U.S. He spent the rest of his youth in Roswell, New Mexico, working on his uncle's ranch, and, later, attending New Mexico Military Institute. He always blamed his ugly feet on a life of ill-fitting boots.

He entered the U.S. Naval Academy in 1943, where he wrestled and played Plebe and Jayvee football. A blocking back, he was ultimately kicked off the football team for *losing too many teeth.*

It was at the Naval Academy where he met his wife-to-be, Jean Beaumont. The daughter of Captain Charles Beaumont, then teaching at the Academy, Jean was, so the story goes, dating Bus's roommate. The roommate got sick on the eve of a big dance and asked Bus to escort his date in his place. He dutifully stepped in, and that was the beginning of a lifelong love affair.

Because of World War II, the famed class of '47 graduated in three years, in 1946. He served first in NEW JERSEY (BB-62), then LST611. But the world under the sea had captured his interest, and in 1949 he graduated from Submarine School. He then served in BESUGO (SS-321) before becoming Aide and Flag Lieutenant to the Commander Submarine Force, US Pacific Fleet.

It was shortly thereafter that Admiral Rickover picked him to be in the first group of four officers to help him reach his dream of

creating a *Nuclear Navy*. He once said, "All those stories about Rickover putting people in closets and shortening the legs of chairs just to intimidate them—they're all true."

With the others in this select group, then-Lt. Cobean reported to the Pittsburgh Area Office of the Atomic Energy Commission for instruction in the operation of nuclear propulsion plants and for graduate studies in nuclear power at University of Pittsburgh and Bettis Atomic Energy Lab.

His training came to fruition in Idaho Falls, Idaho, at the Naval Reactor Center, where he participated in the initial *criticality* of the first naval nuclear propulsion prototype. The biggest challenge, he said, was to fit a working reactor into the prototype *hull* replicating NAUTILUS, which was then under construction in New London. The work at Idaho Falls was ultimately successful, and Warren Cobean was the first member of the U.S. Navy to bring a reactor critical. He was granted reactor license number #1.

From March, 1954, to January, 1958, he served on NAUTILUS (SSN-571) as part of the commissioning crew, first as Reactor Officer and then as Executive Officer. He participated in the first arctic exploration by a nuclear submarine and completed a cruise that became known as *20,000 Leagues under the Sea*.

During this time he was designated as *Qualified for Command of Submarines* and soon received his first command, TIRU (SS-416), stationed in Pearl Harbor. TIRU won the coveted "E" for excellence, not once, but twice in consecutive years.

After the TIRU, he served on the staff of Commander Submarine Squadron 14 from 1959 to 1961, which at the time was formulating plans for the training, construction, testing, and deployment of the first fleet of Ballistic Missile Submarines.

He returned to sea duty in 1961 as captain of HALIBUT (SSGN-587), a one-of-a-kind nuclear-powered guided missile submarine. HALIBUT, too, earned the "E" for excellence while Capt. Cobean was in command.

His most harrowing assignment (at least of those he would talk about) was during the Cuban Missile Crisis in 1962. Instead of joining the blockade of Cuba, the HALIBUT's orders were to travel to Vladivostok and sit on the sea floor to monitor the movements of the Soviet fleet. Should the Soviet Navy appear to make a move to

confront the naval blockade around Cuba, that would be considered an act of war, and the HALIBUT was to surface and attempt to stop the Soviet fleet. Fortunately, the Soviets backed down in Cuba, and the order was never sent.

From 1963 to 1966, Capt. Cobean commanded JAMES MONROE (SSBN-622), and from 1966 to 1967 commanded GEORGE C. MARSHALL (SSGN-654), both of which began active duty under his command.

He became Deputy Director of the Strategic Systems Project, which directed both the Poseidon and Trident missile systems, from 1968 until 1972, when he retired, receiving the Legion of Merit. During this period, he earned an MBA from Harvard Business School.

Captain Cobean began his second career, first at Con Edison in New York, and later at Burns and Roe, in New Jersey, where he eventually became President. After retiring from Burns and Roe, he became a consultant to the Boards of TVA, Duke Power, Toledo Edison, and other utilities.

His ashes were committed with honors at the USNA Columbarium after services in the Chapel on 23 July.■

—Charles S. Cobean

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HERE'S TO BUS COBEAN

by VADM Nick Nicholson, USN(Ret.)

Good afternoon Ladies and Gentlemen:

I have had the privilege of knowing and serving with Bus Cobean ever since we entered the Naval Academy in 1943. We were both from small towns far from the sea, (Winnemucca, Nevada and Roswell, New Mexico) and were assigned to the same cutter crew that first week. The crew was especially happy to have Bus on board since he was our muscle man. We were assigned to the same battalion at USNA and 2 years after graduating both applied for sub school. After one year on diesel subs we were both selected along with Les Kelly to be on the first engineering crew of NAUTILUS.

After academic nuclear training in Pittsburgh, we were sent to the NAUTILUS prototype in Idaho. We wrote from scratch all of the procedures for operating and maintaining the engineering plant. Bus and his crew not only wrote the first procedures for operating the reactor, but he was personally in charge of bringing the nation's first power reactor critical in March 1953. We carried out extensive tests of the plant, and uncovered and corrected problems. We then undertook a 96 hour voyage in the desert simulating driving a submarine across the Atlantic at an average speed of 25 knots. From there we all became plank owners on NAUTILUS. Les, Bus and I each advanced to Executive Officer as NAUTILUS revolutionized naval propulsion and in fact naval warfare. Bus was Executive Officer during NAUTILUS' first attempt to reach the North Pole in 1957. Because of her successful demonstration of nuclear power more than 200 nuclear powered ships and submarines have been built. They helped win the Cold War and contribute today to the global war on terrorism.

Both Bus and I were subsequently ordered as Commanding Officers of diesel submarines in the same division in Pearl Harbor. Bus on TIRU beat me on PICKEREL for the E. He was admired and absolutely adored by his crew as Charlie Cobean, Jean, Pat and I were privileged to see during subsequent TIRU reunions.

Not only did Bus make significant contributions to the success of

NAUTILUS and therefore the nuclear Navy, he played significant roles in the success of the nation's strategic submarine program. He commanded two SSBNs, was key member of Squadron 14 responsible for the deployment of the first Polaris Submarines and finally became Deputy Director of the Strategic Systems Project Office which developed the Trident as well as Polaris and Poseidon missiles.

After retirement from the Navy he became one of the premier experts in the country on civilian utility nuclear plants. After starting at Con Ed he not only became President of Burns & Roe, but he became a highly respected consultant to the Boards of several utilities.

On one occasion Bus even allowed Les Kelly and myself to assist him in assessing some problems at the Tennessee Valley Authority. The resultant Cobean Report led to improvements in the management and safety of those reactors.

Throughout all of these years, Pat and I have shared with Bus and Jean the successes and disappointments, the highs and lows of our respective lives and we treasure these memories.

What a legacy Bus has left with significant contributions to the nuclear Navy, to the nation's strategic deterrent systems and to civilian nuclear power!

Ladies and Gentlemen, I propose a toast to one of the finest Naval Officers and gentlemen I have ever known, to Bus Cobean.

Editor's Note: It is my privilege to add a personal note to these tributes to Bus Cobean. My relationship with him was somewhat special in that I relieved him of his last submarine command when it was my first. He was a Captain and I was a Lieutenant Commander. The ship and crew was USS GEORGE C. MARSHALL (SSBN 654) Blue and it was his fourth submarine command.

I have often remarked that when I relieved Bus Cobean, GEORGE C. MARSHALL was the best built, best trained and best run submarine I had ever seen. It was a delight, and an honor, to follow such a consummate professional and fine gentleman.

Once again, a thank you to Bus Cobean. *-Jim Hay*

REMEMBERING USS JAMES MONROE (SSBN 622)

by CAPT. Mark Golden, USN (Ret.)

Captain Golden was commissioning Gold Crew Elecrical, Reactor Control and IC Division Officer on USS JAMES MONROE (SSBN 622), 1962-1965. An Olmsted Scholar, he later commanded USS TECUMSEH (SSBN 628), completing a career total of fourteen SSBN strategic deterrent patrols plus two tours of duty aboard SSNs.

Capt. Golden, his wife Jeanie, and their two miniature schnauzers, currently reside in Bloomsburg, PA. After his Navy career, Capt. Golden served as an engineering group supervisor and manager at the PPL Susquehanna Nuclear Plant until retiring in 2002. He now is a volunteer Naval Academy Blue and Gold Officer, and an Olmsted Foundation Liaison Officer.

The "Forty One for Freedom" SSBNs were being launched at the rate of one a month. The first launching I witnessed was that of JAMES MONROE (SSBN 622). LTJGs. Jim Patton and myself, Mark Golden, both stationed on USS SCORPION (SSN 589), had been invited by our former XO, LCDR (later VADM) Ken Carr and our former Navigator, LCDR (later CAPT) Dick Lumsden. At the celebration following the launching, Ken asked us if we would like to transfer to his precommissioning crew. Having spent almost all of the past year at sea covering both SCORPION and SHARK commitments, we both said yes. Soon thereafter, we both received orders. Jim, assigned to the Blue Crew, was sent to the precommissioning course at Bettis Atomic Power Laboratory, while I, ordered to the Gold Crew, went right on shift work as an engineering officer of the watch, conducting cold and hot operations.

Our two skippers were in place, Commander Sandy Sandeford as Blue CO, and Commander Bus Cobean as Gold CO. The recent passing of Captain Cobean is what prompted this article.

I had not had much experience as an Engineering Officer of the Watch on SCORPION. A new submarine at the time, fresh out of new construction when I came aboard, most of my time on

SCORPION was spent as JOOD/OOD. Typical of a new construction crew meeting newcomers, emphasis on SCORPION was placed on knowing details rather than focusing on operations of the power plant. Working through the test programs on MONROE quickly remedied that.

Several significant events took place during our construction period, plus myriad lesser occurrences.

One of the lesser occurrences happened during compartment testing. There were no standard procedures or lessons learned then, so we used our best judgment, which was not always good enough. The event in mind was the pressurization of the Operations Compartment. We all put our heads together, and thought we had covered every contingency, but we failed to consider the battery agitation system. As a result, all 126 of the individual cell ceramic domes got sprayed with battery acid. After the test was complete, as Gold Crew Electrical Officer, I set out to arrange using the shipyard's ultrasonic cleaner.

You guessed it. Their ultrasonic cleaner was broken and out of commission. So I did the next best thing. Our galley had recently opened. Our cooks gladly provided three blueberry pies for the cause. Thus armed, I was able to acquire the ceramic domes for a downstream SSBN, which would get ours, properly cleaned, once the ultrasonic cleaners were restored.

At the end of cold and hot operations and initial critical testing, a team from Admiral Rickover's Naval Reactors Office descended upon us. The NR Team conducted interviews, walk-throughs and operational testing of the crew, required for certification as ready for Sea Trials. I had had a chain erected across the entryway to the Maneuvering Room in an effort to control access. Mr. Panoff, the NR Team Leader, was rather short, and my engineering shift crew needled me saying that he could stand up to his full height and walk under the chain.

That was the least of our worries. There was a series of phone calls back and forth to Naval Reactors all afternoon. Then suddenly and with no explanation, the NR Team packed up their brief cases and walked out. As my shift got relieved, we were certain that we had dropped the ball and failed the examination beyond any hope of recovery. Being sailors, we all went out for a few beers, which I paid

for in recognition of their great efforts. My crew dropped me off at home, where I fell into bed, sleeping deeply until the next morning.

The evening news and all the press clearly explained what had happened. On sea trials, one of our submarines had failed to resurface, apparently suffering a series of failures. THRESHER had been lost at sea with all hands.

Our beautiful submarine, almost ready to go to sea, was torn apart, with all engineering insulation torn off, all sea water piping retested, all waivers from construction pulled out and reevaluated. After assessing what had contributed to the loss of THRESHER, virtually all the Reactor Plant Manual procedures were revised with a new philosophy. Significant ultrasonic testing was done, and numerous system modifications were installed as part of the SUBSAFE program. In parallel, we had to retrain the entire combined engineering crew, both Blue and Gold. Once completed, we successfully passed the NR examination, a significantly safer submarine.

Let me describe another important event. I was catching up on paperwork in the work barge, and happened to look out and notice the shipyard's flag at half staff. I called their administrative office, and learned that President Kennedy had been assassinated. The word quickly circulated throughout the command.

Since we were in a state of official mourning, our regular commissioning party was cancelled out of respect for the fallen President. Not willing to let our hard-working crew finish construction without recognition, the shipyard hosted a private party to quietly and privately celebrate the occasion of our commissioning.

After successful sea trials and DASO [demonstration and shakedown operations for the ballistic missile systems], JAMES MONROE sailed to her new home port of Charleston, SC, and my Gold Crew completed two deterrent patrols before I was transferred to NATHAN HALE as Engineer Officer.

No other Navy assignment short of my own command meant quite as much to me as my tour of duty on JAMES MONROE, completing all the testing, getting all our troops qualified twice, passing my Engineer examination, and getting an Engineer assignment. No other SSBN skippers stand out quite as much in my mind as Sandy Sandeford and Bus Cobean. May they rest in peace.■

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ARTICLES

UP SCOPE FOR A LOOK AROUND!

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

Jerry Holland is a frequent contributor to The Submarine Review. He is currently Vice President of the Naval Historical Foundation and the Editor in Chief of their book, The Navy.

Observing through a periscope is a narrow experience. At one time or another most submariners have found themselves focusing intently on the contact of interest/target while other contacts, far and near are not just overlooked but lost. Sometimes this focus catches one *in the shorts* with a fast closing contact materializing from outside the bearing down which one has been peering. Hence the maxim that someone should remind the periscope operator, Captain or Ship's Eagle Eye, that it has been "x minutes since a look around." Looking at the big picture every once in awhile provides a necessary perspective in appreciating the true situation.

The present focus in the Submarine Force management and literature concentrates on getting a second new ship per year authorized and funded as soon as possible in order to augment future force size. Submerged in a Defense Department focused on the ground in the Middle East, one can lose track of where the Submarine Force stands and become discouraged over what its future prospects are likely to be. But the future is grounded in the past and present. Within this context the American Submarine Force is a healthy institution with a very successful past and a fairly well defined future.

The recognition that if there is another war at sea the only significant threats that will confront the United States will be from submarines and mines is generally lost in the anxiety engendered by

the war in Iraq and the intellectual effort to craft a maritime strategy that can appeal to the whole country. Submarines and mines are the weapons systems of any underdog trying to contest the sea against a dominant naval power. Because none of the Navy's principal functions for the immediate future, e.g., to haul marines, to support actions ashore by the Army and Marines, to protect the logistics for these forces, and to fight piracy are inherent roles for submarines, it is easy to fail to recognize why submarines and their partners in anti-submarine warfare are vital. But whatever lies beyond the immediate concerns in Iraq, in the area of maritime operations American submarines will be required to fulfill their historic roles as the forward element of the fleet and the secure base for the nation's deterrent force.

Any operation that depends upon the ocean can be accomplished only if opposing submarines are not a threat. In situations where the entry of other forces is prevented by enemy threats or where control of the air is not assured, submarines may be the only force able to remove or neutralize the enemy threats. Well in advance of any conflict, American submarines will have surveyed the battleground, observed potential enemy capabilities and tactics, studied the environment and gained confidence in their own ability to operate successfully in distant waters. Such reconnaissance operations have been well executed in the past and there is no reason not to expect similarly successful operations to be a major activity in the future. Successful anti-submarine warfare operations are carefully orchestrated efforts involving many organizations. As the rest of the Navy relaxes from ASW to concentrate on other missions, the importance of submarines in this warfare area grows. With the loss of the short range ASW aircraft, reduced standards for ASW helicopter crews[1], the retirement of TAGOS ships and a shift of vision by Maritime Patrol Aircraft to operations ashore, submarines are expected to maintain their unique capability to take on others' submarines. The slow, methodical management and carefully calculated probabilities associated with *Awfully Slow Warfare* will come from submarine warfare officers. There is no Jointness in this mission.

Executing these tasks in peace as well as fulfilling the crucial offensive operations in war requires capabilities that reside in large capacity ships with long legs, great endurance and adequate

weapons. Ships with these characteristics make up the present force and its future. Battery powered submarines might be suitable for defensive operations in narrow waters, but the maritime interests of the United States are world wide and distant from our shores. Though the Navy continues to flounder in the design and mission of new surface warships, the character and nature of its submarines are fixed. Regardless of wishes for less expensive submarines expressed by observers focused on capital costs, the United States will not invest in other than nuclear powered submarines.[3] This clear definition and the successful track record that goes with it contrasts markedly with other shipbuilding programs. The surface combatants' future, for example, is clouded in the debate between numbers, capital costs, realistic mission execution and threats to survivability.

Attack Submarine Force levels are of great and ongoing concern because of the portending retirement of the bulk of today's force, the Los Angeles class, and because each new ship represents a large capital investment. While official studies establish the need for a force of 55 attack submarines, six years elapse between authorizations by Congress to delivery of the submarine. Anticipating the retirement of large numbers of Los Angeles Class submarines in the next two decades, Submarine Force levels will fall below that established need in the near future and at the present rate of construction could dip to less than thirty sometime in the decade after next. The need to be concerned about force levels is obvious but there are significant encouraging signs in today's arrangements.

The present shipbuilding program provides for one new submarine to be laid down every year. Two yards are involved and the half each assembles rotates in each new ship. This is not an efficient or cost-effective mechanism. However it has the advantage of keeping two building yards in operation and creates the necessary framework for expansion or acceleration should circumstances warrant. While hull size and major machinery remain the same in each ship, currently each new ship has a number of significant improvements over its immediate predecessor. These changes continually advance the technological capabilities and standards for American submarines.

This continuing upgrade is not the most economical way for building or maintaining a class of ships, but it keeps both the

research and development and equipment design functionaries challenged and continually tests and deploys new technologies. An active research program seeking ways to improve capabilities and reduce costs has the advantage of being able to incorporate promising developments within a new hull reasonably soon after they are proven.

The long-range building program shows the construction rate increasing to two per year starting in 2012. If that happens, the force size would remain above forty until at least 2028. Observers of the American political scene note that this promise comes due in the next administration and it is not unusual that Administrations make promises that their successors, not themselves, will have to fulfill. Yet, in recognizing that submarine building programs have not faced the embarrassing and excruciating inflation of costs that have been characteristic of other Department of Defense programs, Congressional actions buttress the promise even indicating a willingness to accelerate the pace. Congressional reductions in the Army's Future Combat Systems and the National Ballistic Missile Defense programs to fund a second advance procurement for a Virginia Class submarine is testimony to the record of success and a reputation for excellence both in an effective weapons system and a cost effective program.

Nothing marks the change in the roles of the attack submarine as the installation of vertical launch tubes in the later *Los Angeles* and the *Virginia* Class submarines. With the advent of the SSGN, submarines now bring the majority of the tactical cruise missiles to the battlefields. The SSGN carries the largest cruise missile magazine at sea.[3] This share will only grow in importance should surface warships require their missile magazines to include missiles for air defense.

More to the submarines' advantage as strike vehicles, not all missile launchers are equal. The ability of submarines to position themselves in waters that are otherwise unsuitable makes them prime strike platforms for the highest value targets. Close cooperation between off-board sensors and shooters, and a rapid response by the command loop and the weapon, are needed to successfully target those that are mobile or that require quick reaction to time-urgent intelligence. The longest period in the interval between the target

detection and destruction is the weapon's time of flight. Because the submarine can be stationed close to enemy shores, the time of flight of submarine launched weapons is the shortest available whether the weapon is a cruise missile or a ballistic one.

Additionally, the ability of submarines to reload tube fired weapons makes their missiles uniquely efficient. Since the number and location of missiles in theater will always be a matter of concern, taking into account this feature when selecting launch platforms maximizes the utility of all the missiles in theater. For single rounds or small salvoes, using the submarine tube launched weapons allows reloads to be used effectively and reserves the vertically launched weapons, both submarine and surface ship, for efforts requiring large salvoes.

In general, individual submarines need not be practiced in cooperative behavior, as are forces operating in the air or on the surface. Bombardment is a joint mission requiring cooperation with other forces but that interface is made best at a central operating authority and not in a submarine control room. In strikes ashore, the submarine is simply a shooter where someone else is detector and director.

Calls for uninterrupted communication connectivity are becoming less strident as analyses of the missions submarines conduct indicate that most of the information necessary to conduct these missions will flow toward the submarines with only small amounts of brief reports or replies coming from them. In spite of this reasoning, communications with submarines continue to be a problem where they are made to be problems. Submarines will never match the capabilities of ships that are not limited by physical laws or space for antennae. However, the major driver in communications in any organization is not technology but the culture of the boss. The most familiar and usual model for naval officers is anti-air warfare where information displayed is near real time, continuous and in which reaction time constant is measured in seconds. Aided by high capacity satellite links and network displays with close to real time information, the process allows continuous current locating data and instant communications with subordinates. The combination provides comfort to seniors who cannot survey a battlefield or are otherwise out of touch with the actual action. The pressure to force submarines to act like

other forces in this regard and become a part of a *net* seems constant. This pressure is a principal driver in the schemes to provide mechanisms that will allow communication while the submarine is below periscope depth and while transiting at moderate to high speeds. Doctrinal process can substitute for real time communications in any application but is particularly useful in warfare areas where one of the communicants would prefer to remain quiet. These include spies, Special Forces and submarines.

Over time Submarine Forces have developed doctrinal measures that substitute for real time communications in much of what they do. Unfortunately, driven by the air war model, many communication requirements are not carefully analyzed and officers unfamiliar with submarine operations are uncomfortable with the notion that it is not possible to communicate with the submarines all the time. Antenna improvements have increased bandwidth remarkably but convincing others that there are ways to command without chattering all the time has not been easy. The timeliness quality of communications should be determined by the mission and not the personal quirks of the participants. In essence, much of the problem revolves around whether the message is vital for the mission or whether it is simply to alleviate the commander's anxiety. As all who have worked in command centers know, too often anxiety wins out over significance.

For previously identified targets or items of high interest, very short messages are required both in reporting urgent matters or shooting. The long programming messages once required for targeting missiles have been superseded in large part by the use of the Global Positioning System to both identify the target's position and direct the missile to it. With this development, the targeting message can be relatively short depending upon previously prepared instructions and flight paths chosen.[4]

Ballistic Missile Submarines remain the major bulwark of a secure deterrent strategy now seen to be anachronistic by many. But the continued existence of nuclear weapons guarantees their fundamental role as a bedrock of international stability. The SSBN force remains not only a guardian of that stability but a strong disincentive for competition. As a Harvard study of May 2006 explained,

> " ... in the coming years. Russia and China will face tremendous incentives to reestablish mutual assured destruction, but doing so will require substantial sums of money and years of sustained effort. If these states want to reestablish a robust strategic deterrent, they will have to overcome current U.S. capabilities, planned improvements to the U.S. arsenal, and future developments being considered by the United States. U.S. nuclear primacy may last a decade or more."

Optimists suggest that economic factors, international trade and interdependence have rendered major power war futile and so nuclear weapons have lost their value. However, nuclear deterrence extends beyond Mutual Assured Destruction. As long as the United States maintains its dominance in the nuclear arena, raising the stakes in a confrontation, or even attempting to build a competitive force becomes an irrational choice.

If there is any diminution in the American nuclear arsenal, the last leg of the Triad to be diminished or eliminated will be the submarine based force. Already the Air Force has reduced the number of bombers that are capable of handling nuclear weapons and as age degrades the land based ICBM's, they are more likely to be dismantled rather than replaced. In a decade or less, the submarine based weapons will be the foundation of the American nuclear dominance; they very well may be the entire force by 2025 and so more important than ever. Design of replacement sea launched ballistic missiles is well along and discussions regarding the size and makeup of the replacements for Trident submarines circa 2020 have already begun – without a dissent on their importance or practicability.

In short, present prospects for improvements and continued recognition of the importance of submarines in the future seems assured.

How did the Submarine Force come to be so far in front of other major portions of the Navy – and the military in general?

> Leadership longevity is first. The Submarine Force benefits from having its most senior leader in place for a long and

definite term. While officially responsible only for the propulsion plant, this stable leadership provides long-term direction to the entire organization and insurance that technical and operational standards do not decay.

A strong base of technical expertise and expectations in every member of the organization is next. Understanding why things work the way they do (i.e. laws of physics), submariners since World War II expect everything in the hull to work and anything that doesn't is pursued until it does. Skilled operators who appreciate the technical dimensions can make intelligent tradeoffs among characteristics including costs.

In new designs and developments, a focus on operational excellence coupled with passionate desire to get better translates into continual modernization, improvements to ships, sensors and weapons.

Care in personnel assignments assures that high quality officers man submarines and their support activities even while paying the expense incurred by the mandates for joint duty or professional education.

Research, design, and development is sustained in all phases of the submarine's construction, equipment and operation.

Responsible and responsive constructors, contractors and suppliers share the commitment to improved performance.

Even as the American Navy retires submarines that are as good as any and far better than most other contemporary navies, this combination of aims, performance, technical understanding and dedication remains a legacy from those who have gone before and a promise for those coming in the future. While concentrating on the needs of the day, a "look around" remains important to realize the valuable lessons of the past, evaluate their application in the present and appreciate the need to maintain them in the future.■

ENDNOTES

1. To qualify in ASW helicopters no longer requires any contact experience with an actual submarine.
2. The House Armed Services Committee action on the 2008 Authorization Bill directs "...all new classes of submarines, cruisers and attack aircraft carriers are built with integrated nuclear power plants."
3. Burke class destroyers have 90 VLS slots. These can hold either land attack (Tomahawk) or anti-aircraft missiles. The twenty-two tubes in an SSGN hold 154 missiles.
4. In Exercise Giant Hammer, with the CJTF on board the FLORIDA (SSGN-728) only one message required more than the 256mbs capacity available-that was a PowerPoint presentation being sent ashore.

WHAT A DIFFERENCE 50 YEARS MAKES
A TALK TO THE UNITED STATES SUBMARINE VETERANS, INC., HOLLAND CLUB BREAKFAST, 2007 NATIONAL CONVENTION, ABOARD MS OOSTERDAM, NEAR JUNEAU ALASKA, 17 SEPTEMBER 2007

by Mr. Joe Buff

Mr. Buff is a novelist who has written several submarine-related books. He also has appeared frequently in THE SUBMARINE REVIEW. He uses the novelist's craft to comment meaningfully on seemingly arcane subjects through broad observation and specific research. His first career was in financial management.

Crisis/Opportunity, and an Exhortation

It is an honor and pleasure to be here. The Holland Club recognizes Sub Vets who have been Qualified in Submarines for at least 50 years. A half century is a long time in human experience. In 2007 we are privileged to be able to learn much from two consecutive, action packed 50 year spans between the founding of the Submarine Force in the year 1900 and its Centennial during 2000. We are part way into the third half century of the Silent Service, yet debates that rage over adequacy of funding and infrastructure, and heated disputes over fundamental purpose and value, call into question whether the Sub Force will be allowed to retain the robustness required going forward for the life-and-death jobs which only subs can fulfill.

A watershed event approaches quickly, when first the full U.S. Senate and then, following a conference reconciliation, both the Senate and the House of Representatives, will vote on whether to increase the construction of VIRGINIA-class fast attacks from one per year to two starting as early as 2009 instead of 2012.

Precis: The Talk's Main Argument

A scrutiny of Silent Service contributions in war and peace proves that American submariners and submarines consistently display unique attributes of agile, stealthy, persistent access to denied areas for superbly completing anticipated mission taskings. Perhaps more importantly, they possess the adaptability and small footprint needed to complete inevitably unanticipated critical new undersea warfare mission taskings better than any other military platform.

Missions Matter Most

Why scrutinize mission types? They explain what subs and their crews are *for*. Missions describe what they *do*. Unlike arcane details of technology and tactics, crucial parts of which must remain classified, overview mission descriptions can *speak* to everyone. Unlike stirring tales of great battles and the heroes who fought them, which are embedded in the past, mission tasks emphasize benefits to come *today and tomorrow*.

Missions: Expected vs. Actual, First 50 Years

In the Pre-World War I era, a leading role for submarines was *harbor defense*. Subs then were mainly coastal craft. Their ability to submerge gave stealth, which provided *surprise and survivability* that surface warships lacked. Used in an outer ring of harbor defense vessels, subs expanded the zone of jeopardy, and warning time, against approaching hostile fleets.

That was not the only mission submarines were asked to perform early on. During the *First World War* they scored some great successes against capital ships farther out over the continental shelf. Nowadays we would call this a part of *anti-surface warfare*. ASuW was contemplated long before WWI, since the ASuW mission was carried out unsuccessfully (though survivably) by TURTLE in the *War of Independence*, and successfully (though fatally) by CSS HUNLEY in the *War Between the States*. But few pundits had predicted that subs would be effective well outside harbors—yet they were.

Subs in the Great War also played a big role in *commerce warfare*, previously earmarked as a task mainly for surface raiders.

Once Germany declared unrestricted submarine warfare, this *guerre de course* reached a level of lethality, and of sheer brutality, hardly imagined in the lead up to 1914. German U-boats in WWI sank more British merchant shipping tonnage than they did in WWII — the first vivid demonstration of the enduring value of subs as a maritime striking force that could assist materially in bringing a warfighting opponent toward his knees on the intercontinental and thus essentially nautical stage.

Looking back, we can say that subs in the WWI era quickly proved their value at *stealthily penetrating denied areas*, since warship formations and escorted convoys would do their violent utmost to deny marauding subs the least bit of access.

WWI subs and their crews were called on for other pressing missions that no one had thought much about before. One of these was *aviator rescue*, which arose as soon as the war ushered in combat aircraft. A particularly intriguing WWI chore sometimes assigned to submarines, because they showed they could do it surprisingly well, was *anti-submarine warfare*. In WWI, ASW targets were diesel subs surfaced over the continental shelf.

In the *Pre-World War II era*, major powers resumed the competition for worldwide supremacy, which couldn't be won without fielding a first class navy. Submarines were viewed as the advanced guard for battleships, as *fleet scouts* that would locate the enemy formations, report on them, and soften them up before that long anticipated but ever ephemeral *decisive fleet action on the high seas*. U.S. submarine designs were given greater cruising endurance, speed, and payload capacity, so they could range ahead of the capital ships and pack a punch when they came upon the adversary. These enhanced capabilities soon proved of tremendous import—but mostly not for fleet scouting.

After direct U.S. involvement in *World War II* began with the shock of Pearl Harbor, the Submarine Force, especially in the early dark days in the Pacific, carried the fight to the enemy. But subs were not after all best used for open ocean fleet scouting. American ASuW against warships and merchant shipping reached unsurpassed levels of intensity and effectiveness. Subs served potently as *intelligence trip wires, ultra-smart minefields, and mobile covert coast watchers*, in the constricted, disputed waters where so much of

the naval combat actually took place. Once again, the best way for subs to accomplish war aims was to use their stealth to penetrate denied areas and strike with surprise and survivability. Little of this was articulated, or even much suspected, before December 7, 1941.

And once more, submariners and their subs were drawn into ASW. During WWII, the targets for ASW work were diesel subs running on the surface, occasionally in deep water. This was a heck of a stretch for both men and machines, but they did it, while deployed *out there* in the hostile front line environment—which again shows the adaptable nature of subs and their crews.

An additional unanticipated role for subs was also invented of necessity, on the spot: *radar picket*. This was forced on the U.S. Navy as a desperate response to the lethality of another unexpected weapon, the kamikaze human guided cruise missile. Early warning of inbound massed kamikazes was needed for defense of island hopping landing forces and self-defense by their escorts. When lone destroyers sent far forward turned out to be overly vulnerable to kamikaze attack themselves, submarines were tapped for the radar picket role. The subs, again because of their stealth, could operate largely *unimpeded*, while *unsupported*, in *otherwise denied areas*.

Missions: Expected vs. Actual, Second 50 Years

By 1950, a *Cold War* was definitely on between East and West. Once more subs and their people were stretched to the very limit of capabilities and endurance. This was in part due to the extreme secrecy of the Manhattan Project, which prevented senior Silent Service leadership and military contractors alike from envisioning submarine roles in a world possessing the atom bomb—until that world, via Hiroshima and Nagasaki, was suddenly and mercilessly thrust upon them. The men and machines of undersea warfare rose to the occasion, and then some. With nuclear weapons proliferating in a face off between two big opposed camps, a new mission emerged: *indications and warnings*. When a thermonuclear holocaust might start with a surprise attack in which one bomb could wipe out a whole city, it was vital to know in advance if the enemy was beginning to think about any belligerent move. Electronic countermeasures became an ever more valuable way to spy, an indispensable part of *intelligence, surveillance*, and *reconnaissance*.

Given the way many emanations hug the surface of the earth as they dissipate with distance, subs were uniquely able to get close in shore, with stealth, in enemy home waters, for clandestine, prolonged, uninterrupted interception, with favorable signal to noise ratio, of naval and national information of great import. Stealth now served the purposes of survivable *physical and electromagnetic access* into *otherwise denied areas*—access which was dramatically extended by *special operations divers* accomplishing amazing feats of *undersea espionage and salvage*. In the ominous Cold War context, remaining undetected in order to eavesdrop effectively became especially acute. And as events like the U-2 shootdown would demonstrate, submarine undetectability was key to avoiding the local act of access turning into a conspicuous, undeniable provocation of global scale. Not even the Space Age's constellations of spy satellites could satisfy equally well all these demanding mission parameters.

Everything on the undersea front changed profoundly with the advent of *practical nuclear propulsion*. The anti-submarine role for U.S. Navy submarines changed along with it; instead of being a mere supplement, they quickly became the platform of choice. With a few notable exceptions, the targets for ASW work were nuclear subs operating submerged in deep water.

The mating of hydrogen bomb warheads to long range delivery platforms ushered in an arms race in which it was paramount to assure a *viable second strike option* against a nuclear exchange ever breaking out. Bombers and land based missiles were augmented by what stands as the greatest defense system design-engineering-construction-deployment accomplishment of all time, nuclear subs carrying highly accurate submerged launch nuclear armed ballistic missiles. SSBNs with SLBMs form the most stealthy, survivable leg of America's thermonuclear triad.

For the first time but not the last, several different submarine missions comprised one big, complex, dynamic, integrated global mission. As a package, indications and warnings, anti-submarine warfare, and the survivable second strike option allowed the aggressive pursuit of *proactive undersea strategic deterrence*. The posture wasn't to just build more and more overkill weapons in a dreary and dangerous perpetual stalemate. Proactive strategic deterrence, by flexing submarine muscle and demonstrating undersea

superiority, achieved *war-winning soft power via the flaunting of barely restrained hard power*. The Silent Service gained the *ultimate access into denied areas*, helping *shape* influential minds throughout Soviet society. No one could have possibly predicted that in 1950.

The Next 50 Years – Global War on Terror

The *post-Cold War* period was a time of consolidation for the Silent Service. This changed radically on September 11, 2001. The *Global War on Terror* gelled as an episodic and bloody slugfest in which information is power and perceptions are everything. Outside of land locked Afghanistan and Iraq, many terrorist activities take place in or near coastal population centers, span littorals, and transit oceans and seas. The new type of fighting—assymetric and amorphous — has required the constant updating of traditional submarine missions and the definition of whole new missions. Many of these taskings were virtually unheard of in their present guise as recently as 2000, but now are increasingly commonplace.

Intelligence, surveillance, and reconnaissance for maritime security have taken on many new dimensions from brown water through green water to blue water. Piracy is a significant detriment to international order, rule of law, and thriving commerce. Modern pirates operate in littoral areas that are frequently hotbeds for terrorism; their activities and personnel overlap. *Suppressing piracy* yields dividends against terror. One means of unconventional weapons of mass destruction delivery is a cargo ship. Al Qaeda reportedly controls as many as two dozen vessels worldwide. *Constantly monitoring, tracking, and taking down terrorist "Q-ships"* is vital. Terrorism obtains funds from trafficking in drugs, conventional weapons, and human beings. *Interdiction of contraband trade* has provided an immediate, powerful way to sever enemy logistics, disrupt enemy attacks, and produce indispensable intelligence to plan further counter-terror efforts. Here is the latest incarnation of anti-surface warfare, *in a nimble, surgical, combined arms and very multi-national way*. Subs are ideal for quietly *staking out and policing* the nautical communications arteries used by evildoers, helping *efficiently vector in surface and airborne forces*. Especially when equipped with *next generation undersea and aerial mini-vehicles*, subs are ideal to help covertly *identify and trail* these

diverse threats, providing *sustained covert access into even very shallow waters with seamless all-weather presence out to far past any international limits.*

Because the opposition consists of sub-state and trans-state bad actors, aided sometimes by regimes or factions within pariah states, *mapping of hostile command and control infrastructures* — which redesign themselves constantly and relocate frequently -- is particularly important. For the same reason, *unconventional WMD indications and warnings* need priority. The Silent Service perfected these skills, as *mind readers and mind benders*, during the Cold War, and beneath a cloak of secrecy is putting them into practice every day.

The proliferation of modern diesel boats, some equipped with air-independent propulsion, shifted the emphasis of *anti-submarine warfare.* Drug dealers have even resorted to all-battery-powered submersibles. In the Global War on Terror, the primary targets for ASW work are non-nuclear submarines operating in littorals. And the strenuous perfecting of difficult blue water ASW continues apace, not only to protect our military and commercial shipping assets underway, but also to prevent terrorists and rogues from traveling "from their littorals to our littorals." Cooperative multi-national exercises demonstrate that the best weapon against an enemy diesel sub continues to be an American nuclear sub.

Covert special operations are crucial to prosecuting the War on Terror. Given the grueling op tempo and hectic recruiting of SEALs and other elite commandos, insertion and recovery via sub are undoubtedly a frequent occurrence. *Kinetic power projection onto land*—such as cruise missile precision attacks, launched with unique tactical surprise from under the sea—is already a proven technique. Reliable targeting data is essential to the success of any special op or fire support mission. Subs are playing a sizeable role, sometimes as *sensor* and sometimes as *shooter*, in this revolutionary *net-centric warfare.*

The Next 50 Years — Emerging Peer Competitors

The U.S. Navy's about-to-be-released New Maritime Strategy will address the immense challenge of *optimum engagement with emerging peer competitors.* China and Russia are both building up their navies, including their submarine fleets, with some opacity

regarding intent. Several near peers are busy modernizing their strategic arsenals, and have stated or implied that American interests may stand high on their target lists. *Strategic nuclear deterrence* will clearly remain one priority for the Submarine Force—our SSBNs will need to be ably protected by SSNs in order to guarantee that they stay survivable.

Exciting new tools and doctrines will assure that the Silent Service keeps ahead of ambitious competitors, but only if funding is adequate. Innovative anti-torpedo torpedoes, and supersonic anti-aircraft missiles, fired from the torpedo room or vertical launching system tubes, will soon allow submarines to *stand and fight* even in the worst case of being detected and tracked. This will render them even more survivable—potentially, in certain instances, it will allow them to take greater risks for ever more impactful mission performance.

The continuing initiative of *comms at depth and speed* will steadily enhance the ability of a submerged sub to maintain real time, two way, low probability of intercept *connectivity with joint and combined forces* and higher command authorities. The resulting enhanced situational awareness all around, and new opportunities for teaming with other friendly platforms throughout a wide theater, will surely lead to more cutting edge assignments being placed on the shoulders of submariners, in no small part because nuclear subs equipped with adjuvant vehicles are *exceedingly agile* with an *extremely low footprint*, and will always remain so.

Conclusion and Suggested Action

There is no group more credible in conveying how essential submarines are to the public than Holland Club members and your many friends. The message for Americans and their policy makers is simply this:

The U.S. Navy's Sub Force builds every day on a long track record of unbeaten adaptability whenever faced with urgent new types of missions. It provides America with a unique, indispensable capability for agile, uninterrupted, stealthy access into denied areas globally. A strong Silent Service is vital and decisive to the current and future path of war or peace between peoples and nations.

Ladies and gentlemen, thank you very much, and God bless.■

WHAT ROLE CAN A THEATER ANTI-SUBMARINE WARFARE COMMANDER SERVE IN A NEW MARITIME STRATEGY?

by Mr. Robert J. White

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Introduction

There is a clear call for open sea lanes and forward force projection as part of our National Security Strategy and the policy documents that flow from it. "We fight our enemies abroad, instead of waiting for them to arrive... We seek to shape the world, not merely be shaped by it."[1] Submarine warfare presents a serious threat to that strategy. There are many historical examples where that threat, whether real or perceived, either denied access to sea lines of communication or caused significant force losses for their use. In fact this lesson has been learned, forgotten, and relearned time and again.

> The U.S. Navy played a pivotal role in the defeat of the German U-boats in World War I, but paid scant attention to the task of protection and defense of maritime trade in the interwar years. Although the U.S. Navy took part in an undeclared war against the U-boats in 1940-1941, it was unprepared for the task when the Germans unleashed their U-boats against U.S. shipping off the East Coast in January 1942. The coastal convoy system was not introduced until six months after the United States entered the War. It took several more months to establish a convoying system along the Gulf Coast ... The U.S. Navy's failure was due more to the lack of organization and inadequacy of doctrine than to a shortage of escorts.[2]

The Falklands campaign illustrates just how effective the submarine is as a force multiplier. At the onset of the war, the Argentine surface fleet was a major concern to the Royal Navy. The British SSN CONQUEROR put an end to that threat by sinking the cruiser GENERAL BELGRANO after only six days at sea.[3] The loss of one of its two capital ships compelled the Argentine surface fleet to return to port and become a fleet *in being* for the remainder of the war. During the battle to retake South Georgia, an Argentine submarine threat forced the ship carrying the Royal Marine invasion force to move 200 miles off the island.[4] Though the British detected the submarine and quickly put it out of commission, the Royal Marines were unable to return in time to support the invasion.[5] The threat posed by the sole remaining Argentine submarine SAN LUIS caused the British to expend "more than 150 depth charges and torpedoes against false contacts."[6] That single threat was unsuccessfully engaged by "two ASW aircraft carriers and more than a dozen frigates and destroyers plus associated ASW aircraft."[7] These actions diverted too many assets to operational protection and similarly interfered with offensive engagements.

Anti-submarine warfare (ASW) is a Navy core competency as designated by the Commission on Roles and Missions of the Armed Forces in 1995.[8] It is an asset-intensive team effort. This was evident in both World War II and the Cold War. By many accounts, the competency was again left to atrophy with the end of the Cold War

and the fall of the Soviet Union. In fact, for most of the post-Cold War era, "there has been no consensus on ASW war-fighting or investment strategies, the various communities (submarines, surface combatants, aircraft, and undersea surveillance) have largely set their own priorities and fended for themselves."[9] In this era of shrinking acquisition budgets, rising system costs (e.g., USD $2.5B[10] submarines, etc.), and competing strategic priorities (i.e., the war on terror), this *go it alone* approach is clearly unaffordable. The solution therefore rests on better coordination of the assets available. Today, accordingly, there is a reinvigorated focus on ASW technology, training, and tactics.[11]

However, a wide gap still remains between our employment of ASW at the tactical, engagement/battle level, and our employment of ASW at the operational, campaign/theater, level. This seam could be exploited by our enemies to threaten our sea lines of communication and restrict our ability to quickly project power in forward areas as our doctrine and strategy call for. The employment and coordination of theater ASW assets, both U.S. and regional allies', is inconsistent due to a lack of operational doctrine. Consideration of operational art offers an opportunity to mitigate submarine warfare risks by bridging the gap between ASW tactics and national/regional strategy.

A persistent anti-submarine warfare command with operational control of theater assets and regional expertise, as well as functional expertise, can fill this seam. Such a command would best exploit operational factors to counter threats and maintain the initiative. This paper looks at a successful historical example from the Mediterranean and a current effort in the Pacific. It then makes several recommendations for implementing just such a command.

Reinvigorated Focus: Tactics, Technology and Operational Art

It is a given that Navy culture focuses on air, surface, and submarine warfare communities. There are no cultural norms in place to foster team ASW nor are there incentives to promote it. As a result, we tend to focus on platform driven tactics, techniques and procedures (TTPs). It is also a given that ASW tools are highly specialized and scientific in nature based on the complexity and

variability of the medium in which they are required to operate. As a result, the tendency is to search for the next technological *silver bullet* to solve the physics of ASW.

In April 2004, the creation of Fleet ASW Command (FLTASWCOM) was heralded as an exemplar of the renewed Navy focus on ASW.[12] FLTASWCOM was the ASW center of excellence; its mission addressed five areas:

- Foster high performance of fleet operations on all ASW platforms through quality, integrated and Fleet ASW training;
- Assess ASW performance at theater, carrier/expeditionary strike group, and unit level ship, aviation squadron, and submarine levels against standardized, common metrics;
- Improve Navy individual student ASW training and qualification;
- Promote rapid delivery of selected new ASW technologies and training through aggressive support for the Sea Shield, Sea Trial, and Sea Warrior processes;
- Improve Theater Undersea Warfare capability.[13]

Two of the 5 mission statements support Theater ASW.[14] On 1 October 2006, the Navy disestablished Commander, Mine Warfare Command (COMMINEWARCOM) and merged it with FLTASWCOM to create the Naval Mine and Anti-Submarine Warfare Command (NMAWC).[15] The new command is now the center of excellence for both MIW and ASW. NMAWC's mission addresses six areas:

- Develops doctrine, tactics, techniques, and procedures as the MIW and ASW Center of Excellence;
- Focuses efforts across the MIW and ASW mission areas to include resource sponsors, Systems Commands, Laboratories, and experimentation initiatives; Articulates MIW and ASW operational and future readiness capabilities requirements; Promotes rapid delivery of new technologies and training, through support of Sea Shield and Sea Trial;

- Promotes MIW and ASW training and qualification improvement; Supports the numbered Fleet Commanders in MIW and ASW integrated training and certification;
- Supports MIW and ASW performance assessment at all levels against standardized, common metrics;
- Supports Theater ASW;
- Supports Operational Commanders with: a standing deployable MIW Battle Staff; deployable mine countermeasures staffs; Combatant Commanders' MIW operational and contingency plan development; and maritime component commander and theater ASW staff support. The MIW Battle Staff, as the Naval Component Commander MIW Commander, executes delegated Operational Control of Air, Surface, and Underwater MCM forces.

Theater ASW support is now explicitly stated in one of the six mission bullets. It remains to be seen whether one command can be an effective center of excellence for two missions and has the capacity to avoid diluting its focus. However, the fact remains that at least some theater level ASW operational *thinking* is taking place.[16]

Consider the creation of Task Force ASW in 2002 and its publication of the "Anti-Submarine Warfare Concept of Operations for the 21st Century" in December 2004.[17] These events were also heralded as emblematic of the Navy's renewed emphasis on ASW.[18] The ASW CONOPS' near-term transformational goal is to leverage "advances in acoustic processing, data collection and sharing, communications, collaborative real-time planning, reachback support, rapid maneuver, and precision engagement."[19] Its long-term transformational goal is to *build on these advances to fully leverage an integrated network of sensors coupled to stand-off weapons*. It then posits that "our long term transformation strategy will exploit (these) tactical advances to achieve two key operational level objectives..."[20] These objectives are identified as *hold enemy forces at risk* and *secure friendly maneuver area* which can be translated as the ability to take the initiative and force protection, respectively. Initiative/offense is certainly a principle of war at all levels and force protection is an element of operational level warfare. But the

implication that these objectives can be achieved through technology applied at the tactical level falls short of full operational level theater considerations.

Granted, this CONOPS is intended as the guiding document for the ASW Master Plan; that is, the acquisition strategy for ASW technology. Where then is the guidance for employing operational level ASW? The CONOPS is driving the plan to focus the acquisition community in developing and fielding technology. NMAWC is developing the tactics and training for employing that technology. These are the enablers. Where is the ASW operational "vision"[21] that will tie tactical successes together into theater success that leads to achieving strategic objectives and the desired end state? It is clear that operational thinking is occurring. The CONOPS contains references to new technology for "battlespace preparation and monitoring, Joint Force ASW, force protection, and command and control."[22] All are operational functions. Its image of network centric operations challenges us to move away from traditional weapon and platform centric development. It could even be considered operational *thinking*. However, the focus is technology. Revolutionary high-tech netted systems of systems dependent on the development of autonomous sensors and unmanned platforms lead us away from non-materiel approaches, in this case the employment operational art in theater. Operational practitioners are still needed to properly apply ASW at the theater level.

Tactics and training are in place. Technology guidance is in place. NMAWC's mission implies operational thinking will go into tactics development and training. It is apparent that Task Force ASW included operational thinking in the CONOPS. However, operational thinking and vision must still be applied to specific theaters. An operational level bridge is required to aggregate tactical successes into theater-level success. That bridge is the Theater ASW Command.

The Theater ASW Commander Concept

The Theater ASW Commander (TASWC) should be the expert in the theater area of responsibility (AOR) who can exercise operational control of all ASW assets: submarine, surface, and air. Ideally, a standing organization can be established to be responsible

for ASW command and control (C2) throughout the AOR.

A Navy ASW initiative is to assess TAWSC to local ASW commander (i.e. task/strike group) coordination of operational tasking and water space management and deconfliction."[23] In fact, the Naval Warfare Development Command (NWDC) tested various TASWC operational concepts through the Fleet Battle Experiment process. NWDC "determined that both a Theater ASW Commander executing an offensive ASW campaign, and integrating that campaign with the defensive ASW requirements of a carrier battle group commander through reachback capabilities can be highly desirable, and are quite feasible."[24]

Further exploration of operational art, theater-level warfare, and joint doctrine leads to additional TASWC attributes, capabilities, and responsibilities. The TASWC is responsible for all ASW activities in his AOR throughout all the levels of war ensuring full spectrum ASW dominance. During pre-kinetic operations, the TASWC acts as the focal point for ASW planning in support of theater contingency plans (CONPLANS). It can also support the actual operation plan. As part of Phase 0, the TASWC can help shape the operational maritime environment in favor of the U.S., friendly governments, and potential coalitions. It accomplishes this through solidifying relationships with regional counterparts and developing allied and friendly ASW related "capabilities for self-defense and coalition operations, improving information exchange and intelligence sharing, and providing U.S. forces with peacetime and contingency access."[25]

As part of Phase I efforts, the TASWC can help deter potential adversaries by taking all the ASW related actions in preparation for the kinetic phases of the plan. It is already operating in theater as a forward deployed force. It can act as the Combatant Command's ASW subject matter expert to friendly navies. It can develop requirements for special permissions necessary to access territorial airspace and waters for both platforms and deployable sensors.

In these pre-kinetic phases the TASWC also contributes to the regional component of the "1,000 Ship Navy Global Maritime Network."[26] These partners can bring expertise in littoral diesel submarine operations. They are close to and may even control maritime chokepoints that are identified as decisive points in

contingency plans. All are key elements in the preparation and evaluation of friendly and enemy courses of action.

In addition, the TASWC can work in conjunction with the Combatant Command's Joint Intelligence Center (JIC). It can maintain an up-to-date operational 'picture' in support of the ASW contribution to the Joint Intelligence Preparation of the Operational Environment (JIPOE) or Battlespace (JIPB) as it was previously known. It can provide specialized expertise for the development of theater submarine warfare related Commander's Critical Information Requirements, Priority Intelligence Requests, and Named Areas of Interest in support of preliminary intelligence, surveillance and reconnaissance collection plans. Finally, if the need for Crisis Action Planning (CAP) should arise, the TASWC is ready to go with current knowledge of and assets in the battlespace.

During kinetic operations, supporting and supported relationships can be further defined between the TASWC, a Joint Task Force Commander and its Joint Force Maritime Component Commander (JFMCC) via plans and warning orders.

"When Old is New Again"[27]

The general concept of a Theater ASW Commander is not a new one. In 1976, the Sixth Fleet Commander created Task Force 66 (CTF 66) to support the incoming ASW surface ship squadron deploying with new developmental towed-array sonar.[28] The Chief of Naval Operations wanted the surface group to stay together focused on evaluating the new technology and not be co-opted for escort duty as had been with the previous squadron. CTF 66 established a coordinated land based patrol aircraft, submarine and surface ship theater ASW force. Sonarmen from the air and submarine forces trained their surface counterparts. According to COMSIXTH FLEET:

> The ultimate success story of the ASW squadron was when a Soviet Echo II-class nuclear submarine was picked up by an Atlantic Command submarine outside the Med, trailed through the Strait of Gibraltar without losing contact, and passed to the ASW squadron. Once in the Med, contact was alternately maintained by submarines, P-3s, and the ASW squadron. Contact was passed from the submarine to the P-3s

to the ASW squadron and back to the P-3s. If the ASW squadron lost it, they would tell the P-3s and the submarines, and the submarine that was in trail would get the ASW squadron back on contact. They tracked them for ten days. The ultimate act was on 28 August 1976, when the skipper of the Echo II got mad and ran into the side of the USS Voge.[29]

Unfortunately, after the surface ship squadron completed its deployment and success of the new towed-array declared, the theater focus was lost, coordination skills were allowed to atrophy, and assets were once again detoured to escort duty.

In the early 1980s the Cold War was back in the headlines. President Ronald Reagan anointed the "evil empire" in his historic speech to the House of Commons on June 8, 1982.[30] The SSN was in ascendancy and ASW was the recognized freedom of the seas enabler. To address the threat in the Mediterranean, a Coordinated Area ASW Commander, COMASWSIXTHFLEET was established.[31]

Figure 1. Coordinated Area ASW – 6th Fleet AOR circa 1980-82.

In the early '80s ComSubGru EIGHT was the senior of the two national commanders involved (CSG 8 as CTF 69 and ComFairMed as CTF 67), therefore was also CTF 66. Since CSG 8 was double-hatted as ComSubMed, a NATO command with a standing staff, liaison with Allied assets was facilitated when appropriate. CTF66 became so proficient that it could determine, *a priori*, the path a submarine would take through the straits based on the hand-off of contact information from the Atlantic Command.

The impact on ASW competency was dramatic. Prior to the establishment of COMASWSIXTHFLEET, towed array contact time was roughly 70 hours per annum. By the end of the first year, that number increased by an order of magnitude. It doubled again by the end of the second. Prior to establishment, ASW surface craft supporting on station carrier battle groups were available for ASW operations only during and while transiting. This meant assets were available neither when nor where they were needed. After the standup, assets were assigned for 45-day rotations under COMASWSIXTHFLEET operational control. This period also saw the first contact hand-off between a U.K. SSN and a U.S. SSN.

Contemporary Initiatives

Recognizing an increasing submarine threat in 2000, the Navy began experimenting with theater ASW in the Atlantic and Pacific with CTF-84 and CTF-74, respectively. In 2003, the Naval Warfare Development Command experimented with the TASWC concept as a part of Fleet Battle Experiment KILO (FBE-K). In this role, CTF-74 commanded a significant force of real and simulated submarine, surface, and land-based air ASW assets. Its role was to offensively prepare the battlespace prior to the arrival of an expeditionary strike group. In addition, FBE-K explored C2 procedures, water space management, and the passing of contacts of interest between the TASWC and local ASW commanders within the surface groups.[32] The successful experiment concluded that theater ASW requires additional training, staff, and doctrine.[33]

Follow-on analyses, war games, and FBEs, as well as other Pacific exercises including Thundering Dolphin, further exercised the concept.[34] However, it is not clear from open sources whether

progress is being made and whether the focus remains at the operational level.

Technology and Tactics Alone Do Not Suffice

Technology and tactics are necessary, but not sufficient to solve the problems presented by submarine warfare. From an analysis of the Falklands campaign John Benedict posed five controlling factors impeding ASW operations against submarines. They are no less valid today.

> First, diesel submarines are inherently quiet when operating on batteries and represent difficult detection opportunities for passive sonars. Second, adverse (often unfamiliar) acoustic environments are all too common in Third World operational settings. Third, less operational and technical intelligence data may be available on the adversary than for the Soviets, particularly if the adversarial relationship is unexpected. Fourth, it is often a rapidly developing "come as you are" conflict and potentially involves long supply lines. Fifth, early catastrophic losses (e.g., sinking of the BELGRANO) can be an effective deterrent to the forces affected and will undermine the popular support for the conflict.[35]

That diesel submarines are quiet is a truism. The diesel submarine in shallow water is a hard problem. This problem is a key driver for new technology. It argues for better passive sonars, active sonars, and non-acoustic sensor development. However, technology and tactics must not be emphasized to the exclusion of all else. Technology and tactics alone fall short in addressing the remaining requirements for successful ASW operations. Oceanographic information and intelligence information is required. Without this information, correct tactics cannot be employed. It took the British only a few weeks to realize their information shortfall.[36] The fact that the SAN LUIS completed a six week deployment against the Royal Navy and was ready to redeploy at campaign end proved they never recovered from it.[37] Indeed, the British never knew that of the four Argentine submarines, only two were operational at the start of the campaign.[38]

The TASWC addresses this shortfall by focusing theater oceanographic collection efforts well in advance of any conflict. Further, it acts as a clearinghouse for theater intelligence on friendly and potentially hostile forces. The TASWC mitigates force shortfalls and long logistics tails by bringing regional components of the *1,000 Ship Global Maritime Network* to bear. Available U.S. forces are supplemented through pre-existing cooperative relationships. Forces are interoperable through previously conducted TASWC exercises. Finally, increased resources and theater expertise reduce the likelihood of catastrophic losses.

Current transformation doctrine calls for the rapid deployment of fewer, smaller, and lighter forces. Unfortunately, submarine warfare will confound those plans by imposing factor time, factor space, and/or factor force concessions. U.S. forces cannot afford the losses of attrition based warfare as conducted in World War II. The Royal Navy was successful in the Falkland's in spite of their ASW efforts, not because of them. A credible and capable Royal Navy submarine force sank the GENERAL BELGRANO. A limited Argentine submarine threat hampered South Georgia invasion plans and triggered massive Royal Navy ASW operations. Worse yet, all those efforts failed to prevent the SAN LUIS from making two torpedo attacks on surface ships and possibly a third on a submarine.[39] In fact, the attacks were unsuccessful, not because of British ASW operations, but because the Argentine torpedoes failed.[40] Imagine the devastation a credible and capable Argentine submarine threat would have caused. One day a proficient adversary will again operate a Submarine Force making the hope of Falklands-like success both risky and ill advised. Finally, rapid deployment does not afford the time to relearn the lesson in crisis. Therefore, the U.S. must be proactive, not reactive, in preparing for the submarine warfare threat. "History of past wars has shown that neither superior technology nor superior tactics can, by themselves, ensure victory in the field."[41] The TAWSC ensures that this lesson is not lost.

Unity of Command or Unity of Effort

Ownership of resources means they are available when you need them. Reliance on others for resources puts availability at risk. Unity of command, therefore, is the classically preferred solution.

"Go for unity of command first, unity of effort second," is conventional wisdom.

Command and control of theater assets may be just too hard to achieve. The reasons are several. First, ASW resources are scarce. There are fewer platforms available today and the autonomous sensors called for in the CONOPS are still years in the future. Second, there are many competing tasks for these assets. Escort duties, the war on terrorism and national tasking are just a few. Finally, assets may have been transferred out of theater to support contingencies such as the war in Iraq. In point of fact, theater assets may not exist.

One approach removes OPCON from the TASWC altogether. In this case the Theater ASW Command essentially becomes the Theater ASW Coordinator. In this role it becomes a planning cell for theater level ASW operations and a clearing house for theater ASW information. Plans would be passed to transiting strike groups for their implementation. At completion, modifications and data would be returned to the TASWC to update plans, databases, and libraries. It could perform the functions identified in the concept short of C2. However, this approach would deny the TASWC the key operational function necessary to "to quickly grasp the essential elements of the situation in a relatively large part of the theater, make a decision, and then energetically strive to achieve strategic or operational objectives by using all available sources of power."[42]

A far better solution is to take advantage of the CTF 66 example from the early 1980s. In this case, task units to the TASWC for short rotations either at the beginning or end of deployments. For this period, 45 days in the aforementioned example, the asset is dedicated to theater ASW under TASWC OPCON.

Recommendations

Shared vision engendered by clear leadership is required. To fully benefit from a Theater ASW Command, the Navy needs to institutionalize the concept. A prime opportunity presents itself with the Chief of Naval Operations' call for a New Maritime Strategy.[43] Include the TASWC as an integral part of that strategy. Develop and publish doctrine based on experimentation with CTF 74 and the past experience of CTF 66, as well as others that may have anecdotal

information to contribute.

Regional Combatant Commanders should establish TASWCs where they are required. The requirement is determined by existing CONPLANS. When a CONPLAN specifically identifies submarine warfare in the enemy's most likely course of action and/or most dangerous course of action, establish a TASWC in that theater. Also, if the CONPLAN lists maintenance of sea lines of communication as a critical requirement for friendly courses of action, establish a TASWC. Further, if the CONPLAN identifies submarine warfare as an enemy critical factor or ASW as a friendly critical factor, a TASWC should be established.

Use the model of CTF 74 and CTF 66. Take advantage of the existing infrastructure of a forward deployed command but change its focus. Staff the TASWC with senior post-command tour experts in air, surface, and submarine ASW. Give the TASWC operational command and control of theater ASW assets and information systems. Train staff in the operational art and joint doctrine. Include them as subject matter experts during Phase 0 and Phase I shaping and deterrence efforts.

Further, formally link the TASWC with the Regional Combatant Command's Joint Intelligence Center. TASWC will then be able to maintain an up-to-date operational picture in support of an ASW contribution to the JIPOE. In addition, it will be able to support crisis action planning with up-to-date information. Finally, link the TASWC with coalition partners through Phase 0 shaping and Phase I deterrence efforts.

There is no doubt that institutional risk is associated with new concepts. The Theater ASW Commander is no exception. Limit that risk by building on the past success of CTF-66. It worked for three main reasons. First, there was commitment from the top. This commitment dedicated ASW assets to operational control of the theater commander. The TASWC uses those assets to shape the theater, perform oceanographic surveys, or perform any other tasking necessary to fill the seams. As in the CTF-66 model, the TASWC can evaluate new technologies resulting from the Task Force ASW CONOPs. Feedback provides senior decision makers with information on how best to apply acquisition resources. Second, assets were scarce then as now. Use the same 45-day rotational model to transfer

OPCON between task groups and the TASWC. Under this model the TASWC becomes a viable operational command. Staff positions will attract senior post-command tour officers with the expertise necessary to function as a theater level staff. Third, forces under OPCON to the TASWC dedicate time to true team ASW. The end result is technical competence, effective operational concepts, and finely honed planning skills. That is the Theater ASW Commander.

Conclusions

We tend to ignore the lessons history teaches. "Past experience, if not forgotten, is a guide to the future."[44] By its very nature, operational art takes into consideration lessons of military history. Employing operational art is not a guarantee of future military success. It is, however, ignored at great peril. "An exclusive focus on technology and tactics is likely to result in time-consuming and costly attritional warfare against a strong and resilient opponent. It would make one's forces vulnerable to an opponent who, while technologically inferior, thinks better and faster and uses his smaller force more creatively, perhaps asymmetrically."[45] Operational art employed by the Theater ASW Commander is vital to successful transformation.

Should every theater have its own standing ASW command? No. But when one is created, use a model institutionalized in doctrine. History is replete with examples of learning and re-learning the devastating effect of submarine warfare. Do not wait for a crisis to illuminate a need. Take the proactive approach and fully exploit operational art.

"Tactical employment of one's forces cannot be successful without a clear and unmistakable focus on operational warfare, that is, on the theater-wide employment of combat forces and logistics."[46] A theater ASW command staff dedicated to team ASW, well versed in Joint Operations, that employs operational art, can mitigate the risks posed by the submarine warfare threat to maritime assured access.

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U.S. SUBMARINE MINING SUCCESSES DURING WORLD WAR II

by CDR. John D. Alden, USN (Ret.)

Little historical attention has been given to the mining operations conducted by U.S. submarines during the Pacific war. In comparison with our submarines' outstanding torpedo successes, their mine-planting forays appear as a minor sideshow. Indeed, the official Joint Army-Navy Assessment Committee (JANAC) tally of Japanese ships sunk during the war attributes only five ships totaling 18,553 tons to mines laid by U.S. submarines, but it does not identify the boats credited with those sinkings. Consequently, the count of ships and tonnage sunk by individual submarines has never included the victims of the mines planted by those same boats.

Unfortunately, it is extremely difficult to pinpoint a ship's sinking to a specific minefield, let alone to the submarine or other agent that may have laid the mines. Casualties usually occurred hours, days, or even months after a minefield was laid, when the enemy could have had ample time to sweep the mines or cordon off the dangerous grounds. In several locations both submarines and aircraft planted mines in close vicinity, while the positions reported for Japanese losses as well as those recorded for the Allied minefields themselves are often of questionable precision. The figures almost never correlate exactly with each other, and are usually several miles apart.

In addition to the possibility of being detected and swept, mines had their own internal weaknesses such as exploding prematurely, breaking their tethers and drifting out of position, or failing with age. In spite of such problems, mines were known to be very effective offensive weapons against enemy shipping when planted clandestinely in strategic locations such as harbors or channels. They were also widely used defensively to protect against enemy approaches to beaches or harbors. Accordingly, mines were extensively used by all combatants throughout the Pacific theater, often in the same general areas, where they were likely to become a threat to friend and foe alike.

The problems of identifying a mine victim are illustrated by the only instance when a U.S. submarine actually observed a victim exploding a freshly laid mine. LCDR Roy Benson in TRIGGER (SS 237) was in the process of planting a field of 19 magnetic mines on 20 December 1942 off the cape Inubo Saki when a freighter conveniently ran into one, blew up, jack knifed and sank. Two days later in the same area he torpedoed another victim which he last saw going down by the bow, and on 26 December he sighted yet another ship heading into the mined area, followed later by a distant explosion.

JANAC was never able to identify the ship seen to sink in the minefield, but Benson was credited with an Unknown Maru. His torpedo attack was later assessed as sinking the TEIFUKU MARU. Postwar Japanese records are somewhat confusing and contradictory, but the most likely conclusion seems to be that the ship seen to sink in the minefield (the Unknown Maru) was the MITSUKI MARU; the torpedo victim, which was damaged but not sunk, was the YOSHU MARU; no ship was sunk or damaged by the mine explosion heard on the 26th; and the TEIFUKU MARU actually hit a mine on 29 December, was run aground, and became a total loss. The records for most of the other ships credited to mines suffer from similar confusion.

Minelaying was seldom regarded as a primary mission for U.S. submarines. Although many other navies included submarines specially fitted for laying mines, only the single USS ARGONAUT (SM 1) was designed primarily as a minelayer. By 1941 ARGONAUT, then the Navy's largest submarine, was old, slow, unwiedly, under-armed, and overdue for a thorough modernization. Operating as an ordinary submarine, she was on station off Midway Island when the Japanese attacked Pearl Harbor. On her return, she was ordered to Mare Island for her much-needed updating. The original minelaying installation, featuring internal stowage and transfer facilities for 60 Mk XI mines laid from two 40-inch diameter stern tubes, was retained. Although the authorities in Washington had deemed it worth refurbishing, forces afloat had other ideas. On her return to Pearl Harbor the mine gear was immediately stripped out to provide space for carrying Marines to the Makin Island raid. Being then reclassified as a submarine transport, ARGONAUT was

ordered to Brisbane to conduct special missions such as evacuating refugees from the Philippines. While en route she was directed to attack a convoy, only to be sunk by Japanese destroyers with the loss of 105 lives.

Abandoning the concept of dedicated submarine minelayers, the Navy shifted to developing mines that could be ejected through the torpedo tubes of all fleet submarines starting with SARGO (SS188). The main drawback was that only a small load of mines could be carried. In the early months of the war, when Allied surface and air forces had been driven back from the Far East, distances to enemy targets were so great that submarines were the only effective means of laying mines surreptitiously in Japanese waters. Aircraft mining in the South and Southwest Pacific theaters did not start until March 1943. Herb Mandel, who was then on FINBACK (SS 230) during her shakedown early in 1942, recalls going out on GRUNION (SS 216) to observe a practice mine plant. This training must have been discontinued shortly thereafter, as his own boat never did such an exercise, nor did GRUNION ever lay a live minefield. However, as skipper of PERMIT (SS 178) at the end of the war, Mandel laid a dummy mine plant for the Bureau of Ordnance in Provincetown Harbor, so obviously even the oldest fleet boats had been refitted to handle mines.

The first submarine minefield was laid out of Fremantle by W. J. Millican in THRESHER (SS 200) in the approaches to Bangkok on 16 October 1942. It was followed four days later by another in the same area planted by Donald McGregor in GAR (SS 206). Both submarines carried maximum loads of 32 Mk 12 mines, which took the space of 16 torpedoes. Although their designed maximum load was 40 mines, in practice U.S. subs carried at least eight torpedoes for use in an emergency before the mine plant or to attack targets thereafter. All minelaying missions but one were carried out by boats of the Tambor or later classes, probably because the earlier types had fewer torpedo tubes. The only exception was the one by STINGRAY (SS 186)—a Salmon-class boat with only four tubes forward—in April 1943.

Most of the early mine loads were probably carried in the forward torpedo room. Later in the war typical loads were gradually reduced to only eleven mines, then increased again to 23 in 1945. According

to E. C. Hawk's report of the plant laid by POMPON (SS 267) in December 1943, his 11 mines were fired alternately from tubes 9 and 10 in the after torpedo room. When HARDHEAD (SS 365) laid a field of 23 mines, her commander, F. A. Greenup, fired 10 from tubes 3 and 4 forward and 13 from tubes 9 and 10 aft.

The Mk 12 was a non-tethered ground mine housed in a streamlined case and actuated by a Mk 3 magnetic exploder, a complex device that had to be set according to the polarity and strength of the earth's magnetic field in the location where it was to operate. It could also be adjusted to be sensitive to a particular size of target passing overhead and to detonate only after a selected number of targets had been counted. These features were intended to make the mines harder to find and sweep, and probably had to be pre-set in the shop before going on patrol. The ship count was set for the first target to be detected in all but six fields where the mines were set at various combinations between one and nine counts.

Although the Mk 12 mine's explosive charge would remain active indefinitely, the exploder was powered by a battery, possibly activated by sea water, with an expected life of 90 days. In order to function as designed, it had to be planted in depths ranging from seven to twenty fathoms with the submarine running either fully surfaced, with decks awash, or at periscope depth, depending on the circumstances. In the Pacific war U.S. submarines initially placed these mines spaced between 280 and 1500 yards apart, while in later fields the spacing was between 500 yards and one mile. Two of the reports I have seen note that the mines had to be laid in a carefully plotted sinusoidal curve, apparently to make sweeping more difficult. A delay mechanism could give the boat 45 minutes to clear the area, but in most cases no delay at all was set. The first five patrols using Mk 12 mines experienced 11 failures, including premature explosions in each case. In August 1944 these mines were refitted with the improved Mk 3 Mod 2 exploder, making them twice as sensitive.

Other characteristics of the Mk 12 mines and their exploders are apparently still classified, which leads to some questions about their performance. According to Captain Franklin G. West, Jr., Training and Readiness Officer of the Mine Warfare Command in 1990, the Mk 12 mine was inoperative after the 90-day battery had expired.

However the life of a battery is not that exactly predictable, so allowance has to be made that mines might be viable somewhat longer. Also, it apparently did not have a sterilization mechanism. As will be seen later in a detailed analysis of claimed casualties due to mines, losses were credited to submarine mines much later than three months after the fields were planted, either due to lack of knowledge of the exploder's real characteristics or to some other unspecified mechanism by which it might have been set off.

In October 1942 the WHALE (SS 239) under J. B. Azer sailed from Pearl Harbor on her first war patrol with a load of 24 Mk 10-1 mines to be laid in Empire waters in Kii Suido. The objective was to plant them close inshore in order to force enemy traffic into deeper water where it would be more vulnerable to torpedo attacks. These were tethered mines touched off by contact with chemical horns and planted in fairly deep water with the mines themselves held at a selected depth below the surface. The WHALE's were laid in 15 to 42 fathoms of water with the explosive casings held two fathoms below the surface, but later plantings were made in water as deep as 63 fathoms. These mines consisted of two major sections—the floating sphere and its anchor—and their connecting cable, without any outer casing. Like their Mk 12 counterparts, they too were susceptible to failures: in the WHALE's case, one proved to be a floater. Only three later missions, all from Pearl Harbor, used these mines. B. F. McMahon in DRUM (SS 228) took 24 of them to Bungo Suido in December 1942, and in April 1943 W. N. Wylie in SCORPION (SS 278) carried the only load in which both Mk 12 and Mk 10-1 mines were laid together. In the final mission Creed Burlingame in the SILVERSIDES (SS 236) planted 24 of them in Steffan Strait as part of a coordinated operation with aircraft, the strait being the only entrance to Kavieng, New Ireland, that aircraft mines could not block. Following that exercise, the boat continued on to Fremantle, Australia.

As might be expected with weapons such as these, submariners did not like handling mines. In addition to their inherent hazards, they required taking one's boat into dangerously shallow waters near enemy ports, displaced more versatile and familiar torpedoes, and almost never produced visible or creditable results. Several missions were to replenish older minefields, in which cases accurate naviga-

tion was crucial. Examples of the risks are numerous. When J. B. Azer took WHALE inside Japanese minefields in order to lay his mines in a shipping lane, he detected a Japanese mine in the process. After planting his load in three sub-fields, he was forced down by destroyers, but had the satisfaction of seeing some ships previously damaged in a torpedo attack head straight toward the mines and later heard four heavy explosions. Unfortunately, these may have been premature, as no victims have been identified in post-war Japanese records.

Roy Benson in TRIGGER (SS 237) recorded having to pass up favorable torpedo targets to avoid alerting the Japanese, start his mine plant while surfaced in bright moonlight, and break off temporarily when ships appeared. These difficulties were offset by his unique experience of actually watching his victim blow up and sink. While patrolling in the Gulf of Siam on 13 June 1945, BERGALL (SS 320), under J. M. Hyde set off an Allied mine and was lucky to escape with reduction gears so badly damaged that she had to return to the States for repair. Patrol reports are replete with similar examples of mine hazards. In April 1945, GUITARRO (SS 363) had to run for miles on the surface under a bright moon, dodging traffic all the way, to reach her assigned position in Berhala Strait. Her skipper, T. B. Dabney, has provided this account of his experience after leaving Fremantle and reaching the area to be mined.

> "We ran on the surface, with all four main engines on the line, since it was a race against time. Arriving in the strait at about midnight, we had loaded our mines in the tubes, in preparation for accomplishing our mission. We were surprised to find two small ships with escorts exiting through the straits. Since we were in the narrow confines of the straits, in shallow water, and small boats all around us, we had to download our mines in the forward tubes and reload torpedoes, in case we were suddenly detected before we could commence our mission. The convoy passed within a thousand yards, apparently without detection. The small fishing boats, although close at hand, gave no indication of giving our presence away. We reloaded our mines and took position to lay our mines in

a sinusoidal curve. We successfully completed our mine field operation... and started our return at top speed on the surface, just before daybreak. We had a hundred miles of open water to cover before arriving at the 100 foot curve, suitable for diving. A Japanese plane spotted us and we had to dive. The bomb load fell around us but there was no damage.

In his patrol report, Dabney aptly referred to the area as *Wader's Paradise.* The water there was only seven fathoms deep.

Thanks to RADM M. H. Rindskopf we have a first-hand account of the Mk 10-1 mine plant laid by DRUM (SS 228) on her fourth patrol. On 12 December 1942, en route to Bungo Suido "in the unfortunate condition of having two of her forward tubes loaded with mines," skipper B. F. McMahon encountered the 13,360 ton carrier RYUHO with a deck load of planes. He fired the available four tubes and obtained one hit, but was driven deep before he could swing around for a stern shot, allowing the damaged carrier to escape. According to Rindskopf, who was a junior officer at the time, two mines were stowed in a tube but had to be fired one at a time.

"We carried mines only forward so with four in tubes (two each) that meant 20 in the room, two to a rack. That meant that we carried four torpedoes in tubes and no reloads forward with four and four aft. It is even possible that the torpedoes in the after room were Mk 15 destroyer type which had to be loaded through the tube because of the length. That was due to the shortage of the Mk 14 early in the War. We did not have to back down to launch as the mine was ejected by the same air impulse as torpedoes. I have some recollection that there were two aspects which might have been affected: first, the gyro spindle in the side of the tube was not required for the mine and might have gotten in the way during loading; second, is the lever at the top of the tube which triggered the torpedo starter. That wasn't required for mines but whether it got in the way or how it might have been withdrawn is fuzzy indeed. The mines may have been the same diameter as the torpedoes or a bit small.... The Mk 10 had the anchor attached

to the case and antenna without any streamlining or outer casing. Shoving them around the torpedo room and loading was no particular problem since we fired at a planned fairly rapid pace. ... We did not stick around long enough to see whether any targets ran through the field.... I do recall that from the continual firing and venting inboard, the pressure in the boat went to something like 12 inches. Since we did not have a compensating depth gauge, the diving officer had to make adjustments in gauge depth to keep us at 62 feet."

Notwithstanding the many problems, senior commanders recognized the mine's strategic value, and mines also constituted an alternative weapon when torpedo shortages would have necessitated going on patrol without full racks. In all, 33 Commanding Officers in 32 submarines planted minefields between October 1942 and May 1945, laying 576 Mk 12 magnetic bottom mines and 82 Mk 10-1 of the tethered type. Of these, 13 Mk 12s were failures, six of which exploded prematurely, and three Mk 10-1s were floaters. Ten patrols were made from Pearl Harbor and 23 from Fremantle, Australia. The only boat to lay two fields was TAUTOG (SS 199), first under J. H. Willingham on 2 November 1942 and then under W. B. Sieglaff on 7 March 1943. Apparently one mine plant per skipper was considered enough of a sacrifice.

British and Dutch submarines, including three designed specifically as minelayers, also laid 30 minefields, at first from Ceylon and later while patrolling from Fremantle under U.S. operational control. Although these are beyond the scope of this article, J. L. McCallum in BREAM (SS 243) had an unsettling experience on a special mission carrying British commandos with limpet mines to attack some anchored Japanese ships. On 14 March 1945 two of the frogmen were launched in a rubber raft but never returned. This demoralizing occurrence did not exempt the crew from planting a regular minefield on BREAM's very next patrol.

What were the results of these heroic efforts? Unfortunately, they are both meager and uncertain. The largest number of submarine mine victims claimed in any official U.S. source appears in the report of the Strategic Bombing Survey (SBS), which was conducted

immediately after the war. Although its main thrust was obviously aerial bombing, it also investigated offensive mining and concluded that 27 ships were sunk and 27 damaged by mines laid by U.S. submarines. As noted earlier, the official JANAC report of 1947 listed only five ships as sunk by U.S. submarine mines, of which four are also claimed by SBS.

Since 1947 significant new data sources have come to light, and I have used these to check the SBS and JANAC assessments. (To save space, these sources are described in the Appendix). My analysis reduces their claims to at best nine sinkings and eight cases of damage that can probably or possibly be credited to U.S. submarine mines. (None are assessed as fully confirmed, because sources are incomplete, indefinite, or even contradictory.) On the other hand, from these additional sources I have identified three cases of possible or probable sinkings and six of damages not claimed by SBS or JANAC. Table I summarizes the 26 cases that I consider credible.

In determining whether a claimed mine casualty should be categorized as probable, possible, or neither, I have tried to take into account all available data including the relative positions of the casualty and the minefield, the age of the mines and likelihood that they could have been swept, or other mines known to be in nearby locations, possible air or torpedo attacks, and the general reliability of the data sources. My conclusions are necessarily subjective and other analysts may differ. New data and information on other sources will be appreciated.

For readers interested in a more detailed analysis of the date, Table II gives particulars of the minefields laid by U.S. submarines. Table III lists all 28 sinkings claimed by SBS and JANAC, with notations to the applicable Japanese sources. Similarly, the 27 SBS damage claims are listed in Table IV, and the nine other cases in Table V.

APPENDIX—
SOURCE DESCRIPTIONS AND ABBREVIATIONS

SBS or Strategic Bombing Survey – The Offensive Mine Laying Campaign Against Japan; originally published 1946, reprinted by Headquarters Naval Material Command, 1969. This survey was conducted immediately after the war and includes many sections and appendices other than the above. The data were derived from intelligence reports but clearly not including naval Ultra intercepts. I am indebted to Ted Hajduk of Detroit for original SBS records detailing the ships attributed to the different minefields.

J or JANAC—Japanese Naval and Merchant Shipping Losses During World War II by All Causes; Gov't Printing Office, February 1947. JANAC counted only ships sunk but excluded merchant types, including small converted naval types with *maru* names, of less than 500 gross tons. Its intelligence sources apparently including sanitized information from Ultra messages and Japanese records captured at the end of the war. JANAC also attributed seven sinkings to British (including Dutch) submarine-laid mines. Only one of these appears in the SBS tally and is more likely to have been sunk by a U.S. submarine.

I OR IJN— The Imperial Japanese Navy in World War II, Part IV, Monthly Losses of Combatant and Non-combatant Vessels; Military History Section, U.S. Army Far East Command, 1952. After the war General MacArthur had Japanese researchers compile an extensive list of all ships believed sunk or damaged during the war, which was issued as a monograph. The ships are listed by month with separate sections for warships and non-combatants. Tables and maps give the date, ship type and tonnage, location, cause, and extent of damage. Not all records are complete, and locations are often given as general areas rather than latitudes and longitudes. This publication contains the most extensive records of damaged ships.

W or WIJN— Jentschura, Jung, & Mickel: Warships of the Imperial Japanese Navy, 1869-1945; Naval Institute Press, 1982. This book is based on data originally compiled by Shizuo Fukui and Erich

Groner in the 1950s and updated in several printings. It covers converted as well as regular warships in considerable detail, but includes little information on damage short of sinking.

S—Translations from Japanese publications by William Somerville of Lincolnshire, England. The major sources are Senji Sempaku Shi (Wartime Ships History, 1991) and Senji Yuso Sendan Shi (Wartime Transportation Convoys History, 1987) both by Shinshichiro Komamiya. The former is an alphabetical listing of ships sunk; the latter lists convoys chronologically and includes much information about the ships involved. Both lists have gaps and occasionally conflict. I am indebted to Mr. Somerville for data from these and other Japanese sources.

TABLE 1—SHIPS PROBABLY OR POSSIBLY SUNK OR DAMAGED

Date	Ship	Type	Tons	Submarine	Evaluation
16 Oct 42	Sydney Maru	AK	5243	THRESHER SS200	Prob Dam
30 Nov 42	Canton	FR APK	1321	TAUTOG SS199 4th	Prob Sunk
20 Dec 42	Mitsuki Maru	AK	3893	TRIGGER SS237	Prob Sunk
29 Dec 42	Fukken Maru	AK	2558	TAMBOR SS198	Prob Sunk
29 Dec 42	Teifuku Maru	AK	3198	TRIGGER SS237	Prob Sunk
20 Jan 43	Hokusui Maru	AK	3964	SUNFISH SS281	Poss Dam
20 Feb 43	Yoshida Maru	XPF	2920	SUNFISH SS281	Poss Dam
7 May 43	Gov Gen Peagsier	Fr AP	1994	GRENADIER SS210	Mines Old?
26 May 43	Palembang Maru	AO	5236	TROUT SS202	Prob Dam
30 May 43	Takaminan Maru	AK	1992	SNOOK SS279	Poss Sunk
30 May 43	Hokuzaki Maru	AK	3948	SNOOK SS279	Poss Dam
13 Jul 43	Nagara	CL	5170	SILVERSIDES SS236	Poss Dam
27 Jul 43	Teikin Maru	AK	1972	TAMBOR SS198	Mines Old?
9 Aug 43	Enoura Maru	Civ	3295	SCORPION SS278	Poss Dam
16 Sep 43	Seikai Maru	XPG	2693	SILVERSIDES SS236	Poss Sunk ?
4 Oct 43	Hyakufuku Maru	XAP	986	SCORPION SS278	Poss Dam
4 Oct 43	W 28	AM	648	SILVERSIDES SS236	Poss Dam
20 Feb 44	Gyoran Maru	Yacht	1243	CREVALLE SS291	Poss Dam
20 Feb 44	Francis Garnier	Fr AK	1243	CREVALLE SS291	Prob Sunk
14 Mar 44	Sanuki Maru	XAP	7158	RAY SS271	Poss Dam
9 Apr 44	Rakuyo Maru	APK	9418	BLUEFISH SS222	Poss Dam
1 JUL 44	Nikko Maru	AK	3098	KINGFISH SS234	Mines Old?
26 Jan 45	Tamon Maru #15	AK	6925	DACE SS247	Prob Sunk
30 Apr 45	Yuno Maru	AO	2345	GUITARRO SS363	Prob Sunk
7 May 45	Hayasaki	AF	920	GUITARRO SS363	Prob Dam
29 Jun 45	Ilasu Maru	AO	1914	GUITARRO SS363	Poss Dam

TABLE II—U.S. SUBMARINE MINEFIELDS IN WORLD WAR II

Date	Submarine	Patrol	Fleet	Commander	Position & General Area	Mines
6 Oct 42	THRESHER SS200	5	SWP	Millican	12-50N 100-44E Bangkok Approaches	32 Mk 12 2 failures
20 Oct 42	GAR SS206	4	SWP	McGregor	12-35N 100-45E Bangkok Approaches	32 Mk 12 4 failures
25 Oct 42	WHALE SS239	1	Pac	Azer	33-46N 135-10E Kii Suido	24 Mk 10-1 1 floater
29 Oct 42	GRENADIER SS210	4	SWP	Coe	20-38N 107-04E Haiphong Approaches	32 Mk 12 1 failure
2 Nov 42	TAUTOG SS199	4	SWP	Willingham	11-18N 108-47E Cape Padaran	32 Mk 12 3 failures
2 Nov 42	TAMBOR SS198	4	SWP	Amberson	20-04N 109-18E Hainan Strait	32 Mk 12 1 failure
14 Dec 42 17 Dec 42	SUNFISH SS281	1	Pac	Peterson	34-28N 137-20E Sumo Uni Bay	24 Mk 12
17 Dec 42	DRUM SS228	4	Pac	McMahon	32-47N 132-10E Bungo Suido	24 Mk 10-1
20 Dec 42	TROGGER SS237	3	Pac	Benson	35-44N 140-56E Inubo Saki	19 Mk 12
7 Mar 43	TAUTOG SS199	6	SWP	Sieglaff	02-10S 116-40E Tanjong Ara	24 Mk 12
7 Apr 43	TROUT SS202	8	SWP	Ramage	02-00N 109-15E Api Passage	23 Mk 12
19 Apr 43	SCORPION SS278	1	Pac	Wylie	36-05N 140-45E Inubo Saki	12 Mk 12 & 10 Mk 10-1
20 Apr 43	RUNNER SS275	2	Pac	Fenno	22-15N 114-15E Hong Kong**	32 Mk 12
21 Apr 43 22 Apr 43	STINGRAY SS186	7	Pac	Earle	28-10N 121-55E Wenchow Bay	32 Mk 12
30 Apr 43	SNOOK SS279	1	Pac	Triebel	30-21N 122-30E Saddle Island** Shanghai	24 Mk 12
12 May 43 30 May 43	STEELHEAD SS280	1	Pac	Whitehead	42-07N 143-21E Erimo Saki	12 Mk 12
4 Jun 43	SILVERSIDES SS236	5	Pac*	Burlingame	02-36S 150-34E Seeffen Sima** Kavieng	24 Mk 10-1 2 floaters
2 Oct 43	KINGFISH SS234	5	SWP	Lowrance	05-10S 119-20E Cape Pepe Laikang Bay	11 Mk 12
13 Dec 43	POMPON SS267	3	SWP	Hawk	08-50N 106-05E Pulo Condore	11 Mk 12

18 Dec 43	CABRILLA SS288	2	SWP	Hammond	10-30N 103-44E Saracen Bay	11 Mk 12
3 Jan 44	BLUEFISH SS222	3	SWP	Porter	04-50N 103-35E Pulo Tenggol	11 Mk 12
4 Jan 44	RASHER SS269	3	SWP	Laughon	09-00N 106-40E Pulo Condore	11 Mk 12
14 Jan 44 15 Jan 44	CREVALLE SS291	2	SWP	Munson	10-35N 108-01E Kega Point	11 Mk 12
29 Jan 44	BOWFIN SS287	3	SWP	Griffith	03-36S 116-35E Sebuku Island ** Lost Strait	11 Mk 12
22 Feb 44	RAY SS271	3	SWP	Harrel	10-18N 107-30E Kega Point	11 Mk 12
19 Aug 44	REDFIN SS272	4	SWP	Austin	02-40N 109-15E Api Passage	11 Mk 12
14 Sep 44 15 Sep 44	PARGO SS264	3	SWP	Bell	02-39N 108-38E Kuti Passage	11 Mk 12
6 Nov 44	GURNARD SS254	7	SWP	Gage	02-08N 109-40E Tanjong Datoe	11 Mk 12
16 Dec 44	DACE SS247	6	SWP	Cole	13-36N 109-18E Pulo Gambir	11 Mk 12 2 failures
2 Apr 45	HARDHEAD SS365	4	SWP	Grennup	08-22N 105-01E Pulo Obi	23 Mk 12
14 Apr 45 15 Apr 45	CHARR SS328	2	SWP	Boyle	08-25N 104-37E Pulo Obi	23 Mk 12
20 Apr 45	GUITARRO SS363	5	SWP	Delney	01-00S 104-30E Berhala Strait	23 Mk 12
8 May 45 9 May 45	BREAM SS243	6	SWP	McCallum	08-18N 104-49E Pulo Obi	23 Mk12

Notes: All SWP patrols were from Fremantle, Pac patrols from Pearl Harbor.
Roscoe lists Redfin SS272 3rd patrol incorrectly as a mine plant.
Blair lists SALMON SS182 6th patrol incorrectly as a mine plant.
* Patrol was passage from Pearl Harbor to Fremantle
** Mines were also laid by aircraft in the same area.

TABLE III—SHIPS CLAIMED BY SBS AS SUNK (27)

Date	Ship	Type	Tons	Location	Sub	Eval
30 Nov 42	Canton	APK	1521	11-06N 108-17	TAUTOG 4*	Prob
	Vichy French ship, not in other sources					
20 Dec 42	u/i	Frt	4000e	35-45N 140-55E	TRIGGER	Prob
	Mitsuki Maru	C-AK	3893	S of Daisezaki		
	J credits Unknown Maru 4000e tons to USN mine; 1-marine casualty; not in S					
29 Dec 42	Fukken Maru	C-AK	2558	20-04N 109-18E	TAMBOR	Prob
	J credits USN mine; I&S-torp (no likely sub attack)					
7 May 43	GuvGen Paugnier	AP	1904	20-55N 107-00E	GRENADIER	Old?
	Vichy French ship, not in other sources; mines 6+ mo. Old					
18 Jul 43	u/i	Mer	4000e	20-35N 107-00E	GRENADIER	Unid
27 Jul 43	Teikin Maru	C-AK	1972	19-57N 109-05E	TAMBOR	Old?
	J credits USN mine; I&S-torp (no likely sub attack); mines 7+ mo. Old					
31 Jul 43	Nanshin [M]	Frt	250e	22-15N-114-00E	RUNNER	Unk
24 Aug 43	Shingawa Maru	XPkt	81	Yentimo Saki	STEELHEAD	Casualty
	J-marine casualty; W-wrecked; not in S; too small for JANAC					
28 Aug 43	Hinode [M.] #8	NG	118	Yentimo Saki	STEELHEAD	Unk
4 Nov 43	Tsukushi	AGS	1400	02-40S 150-40E	SILVERSIDES	Aus mine
	SBS lists as 4000e tons; J-Aus mine; I, W, & S-mine; sub mines 5+ mo. Old					
~ Dec 43	u/i	NG	2000e	Kii Suido	WHALE	Unid
~ Jan 44	u/i	NG	2000e	Kii Suido	WHALE	Unid
20 Feb 44	Gyonan Maru	NG	NG	Kega Point	CREVALLE	Poss dam

Ex-Hirondelle Ex-Phil yacht. 1243 tons, identi questionable, not in I, W, or S; survived war						
20 Feb 44	Francis Garnier	AK	1243	10-30N 108-00E	CREVALLE	Prob
Vichy French ship. J credits as 8397 PR to Army mine 22 Feb; not in other sources						
23 Apr 44	Amagasi	DD	2090	02-12S 116-45E	TAUTOG 6[5]	Army mine
J-Army mine, I, W, & S-mine; sub mines 13+ mo. Old						
11 Aug 44	Gyoyu [M.]	Mer	300	02-18S 104-55E	GUITARRO	Impos
Mines laid 20 Apr 45, no other record						
12 Aug 44	Tako [M]	Mer	200e	02-20S 104-54E	GUITARRO	Impos
Mines laid 20 Apr 45; no other record						
26 Aug 44	Atago [M.] #3	NG	55	Imabu Zaki	SCORPION	Unk
9 Oct 44	Haie Maru	AK	880	31-10N 122-25E	SNOOK	Army mine
J credits Army mine; S ran aground; not in I; sub mines 17 mo. Old						
14 Nov 44	Heiyo [M.]	AK	1320	01-45S 116-35E	TAUTOG 6[5]	Unk
27 Dec 44	n/i	NG	NG	Pulo Gambir	DACE	Unid
26 Jan 45	Tamon Maru # 15	C-AK	6921	13-34N 109-17E	DACE	Prob
J credits USN mine; I & S-mine						
22 Feb 45	Taiekawa M. #2	AO	10045	11-08N 108-44E	TAUTOG 4[5]	Army a/c
J credits Army a/c & mine; S-mine; not in I; sub mines 26 mo. Old						
25 Mar 45	Houlee	Fit	1339	31-00N 122-20E	SNOOK	Army a/c
Nationality unk; J credits Army a/c; not in I or S; sub mines 22 mo. Old						
30 Apr 45	Yuno Maru	A-AO	2345	09-58N 104-31E	GUITARRO	Prob
SBS lists as Yuno (Uyu); J credits Br mine (prob ref to HMS O-19); S-mine, I-torp (no likely sub attack); GUITARRO plaut closer & more correct than O-19's						

8 May 45	u/i	NG	NG	00-58N 103-13E	GUITARRO	Unid
-45	Yoshino [M.]	NG	3000e	00-58N 103-32E	GUITARRO	Unk
SHIP CLAIMED IN JANAC BUT NOT BY SBS						
1 Jul 44	Nikko Maru	C-AK	3098	05-39S 119-28E	KINGFISH	Old?
J credits USN mine; SBS lists but not attributed to KINGFISH; I susp (no likely sub attack); S-miner; mines 8+ nm. Old						

ABBREVIATIONS:
J - JANAC;
I - Imperial Japanese Navy in WWII;
W - Warships of the Imperial Japanese Navy
S - Somerville translations of Japanese records
Unid or Unk - ship not found in any of the above sources
Ship type prefixes: A - Army; C - Civilian; X - converted naval type

TABLE IV - SHIPS CLAIMED BY SBS AS DAMAGED (27)

Date	Ship	Type	Tons	Location	Sub	Eval
16 Oct 42	Sydney Maru	A-AK	5245	12-50N 100-45E	THRESHER	Prob
No other record						
26 Oct 42	u/i	NG	2500e	33-52N 135-02E	WHALE	Torp
	Kirishima Maru	XAO	5959	33-40N 135-15E		
I-damaged by unk agent, extent unk; S&W - no info						
18 Dec 42	u/i	Frt	NG	Ierno Umi	SUNFISH	Unid
26 Dec 42	u/i	Mer	2000e	Inubo Zaki	TRIGGER	Unid
18 Mar 43	Kasuga [M.]	NG	NG	Tanjung Aru	TAUTOG 6th	Unk
25 Apr 43	Buenos Aires M.	A-AH	9626	Hainan Strait	TAMBOR	Torp
I-minor damage by sub; S-susp; mines 5+ nm. Old						

20 May 43	u/i	Mer	NG	Hainan Strait	TAMBOR	Unid
4 Oct 43	Ilyakullo-ku M.	XAP	986	Inubo Zaki	SCORPION	Obl?
	W-on info, not in I or S; mines 5+ mo					
4 Oct 43	Mehaku [M.]	NG	3000t	Kavieng	SILVERSIDES	Unk
4 Oct 43	Kakuyo [M.]	NG	3000t	Kavieng	SILVERSIDES	Unk
4 Oct 43	u/i Mine-sweeper	AM	150t	Kavieng	SILVERSIDE	
2 Oct 43	W 28	AM	648	Kavieng Bay		Poss
	SBS attributes 1 u/i ship to SILVERSIDES but does not include 150 tons in total, may refer to this listing. Light damage to W 28 by mine 2 Oct 43; W-on info; mines also laid by a/c at Kavieng; sub mines 4 mo. Old					
12 Nov 43	Albert Sattaui	AP	2156	Cape Padaran	TAUTOG 4th	Tau Old
	Vichy French ship; no other record; mines 12+ mo. Old					
- Dec 43	u/i	NG	2500t	Kii Suido	WHALE	Unid
14 Mar 44	Senaki Maru	XAP	7158	Kega Point	CREVALLE RAY	POSS
	SBS credits CREVALLE; W-on info, not in I or S. Ray mines closer & more recent					
19 Mar 44	Nankai [M]	NG	344	Hainan Strait	TAMBOR	Unk
9 Apr 44	Rakuyo Maru	C-APK	9418	04-49N 103-36E	BLUEFISH	Poss
	Not in I or S					
9 Apr 44	Shinsho [M]	NG	5126	04-49N 103-36E	BLUEFISH	Unk
23 Jun 44	Tsurush-ima M.	A-AK	4645	Kega Point	CREVALLE	Torp
	3-sunk by JACK (SS259) 24 Jun @14-25N 119-47E, 1 sunk by sub (no attack that date); 5-left Nhatrang Bay 26 Jun, torp & sunk by JACK 30 Jun @ 14-15N 119-40E					
19 Jul 44	Hokuju [M.]	NG	4246	Inosu Umi	SUNFISH	Unk

3 Sep 44	Tou [M.]	NG	10021	10-16N 107-53E	CREVALLE	Unk
7 Nov 44	Yokai [M.]	NG	2500e	Hong Kong	RUNNER	Unk
16 Nov 44	Yamasaki [M.]	NG	5948	Hong Kong	RUNNER	Unk
4 May 45	Hayasuki [M.]	AO	6000e	Berhala Strait	GUITARRO	
7 May 45	Hayasuki	AF	920	01-00S 104-30E		Prob
	I & W identify ship as AF, 1-damaged by mine 7 May, extent unk, S-no info; IJNMS O-19 laid mines in same area but GUITARRO closer & more recent					
26 May 45	Minakigawa [M]	NG	873	33-52N 135-02E	WHALE	Unk
29 May 45	u/i	NG	NG	Haiphong	GRENADIER	Unid
29 Jan 45	Hasu (Ren)	AO	1953	01-02S 103-32E	GUITARRO	
	HASU MARU	AO	1914	Belok Strait		Poss
	S-was captured ship, hit mine in Belok Strait, Sumatra 3 Jan 45 & sank; not in J, I, or W; IJNMS O-19 laid mines in same area but GUITARRO more recent.					
- - 45	Unident	NG	NG	Shanghai	SNOOK	Unid

Notes: See Table III

TABLE V - SHIPS SUNK OR DAMAGED, NOT CLAIMED BY SBS

Date	Ship	Type	Tons	Location	Sub	Eval
29 Dec 42	Teifuku Maru	C-AK	5198	35-45N 140-54E	TRIGGER	Prob Sunk
	J credits TRIGGER torp attack 22 Dec; I medium damage by sub 29 Dec; S-torp 29 Dec & beached; total loss (no torp attack 29 Dec)					
26 Jan 43	Hokusei Maru	C-AK	3964	Off Lk Hamana	SUNFISH	Poss damaged
	I heavy damage by sub (no likely torp attack); S-no info					
20 Feb 43	Yoshida Maru	XPF	2920	34-30N 137-20E	SUNFISH	Poss damaged

I&W-medium damage by sub (no likely torp attack); not in S						
26 May 43	Palembang Maru	C-AO	5226	02-03N 109-11E	TROUT	Prob damaged
I-medium damage by sub (no likely torp attack); not in S						
30 May 43	Takamiyan Maru	A-AK	1992	31-20N 122-39E	SNOOK	Poss sunk
J credits SAURY (SS189) torp at 20-07N 124-34E, I&S-mine						
30 May 43	Hakozaki Maru	C-AK	3948	31-20N 122-39E	SNOOK	Poss damaged
I-mined; extent of damage unk; S-no info						
15 Jul 43	Negato	CL	5170	Kaviang	SILVERSIDES	Poss damaged
SBS lists but not attributed to SILVERSIDES, I-light damage by mine, mines also laid by a/c at Kaviang						
9 Aug 43	Enoteru Maru	C	3295	36-07N 140-45E	SCORPION	Poss damaged
I-light damage by mine; not in S; mines 3+ mo. old						
16 Sep 43	Seikai Maru	XPG	2693	Kaviang	SILVERSIDES	Poss sunk (1/2)
J credits Australian miner; I- mine Kaviang Bay; W-mine off Kaviang. S-disabled by a/c, drifted onto 2 mines & sunk (a/c & mines each get half credit); sub mines 3+ mo. old						

Notes: See Table III

STORY OF USS FLIER 2ND PATROL AND ITS SURVIVORS PART II OF III PARTS

by Mr. Alvin E. Jacobson

This account of several submariners' heroic efforts to survive the sinking of FLIER in the Japanese-held Philippines came to THE SUBMARINE REVIEW through the courtesy of Captain Herb Mandell, a WW II submariner and author of Submarine Captain and Command at Sea. This account was self-published in 1997 by Mr. Jacobson, who had been a Junior Officer in FLIER, and was revised by him in 2002. Some draft copies had been circulated several years ago and it is possible that the article has been published or excerpted in other venues. Captain Mandell has arranged with Mr. Jacobson for permission to publish his story in these pages. It is with gratitude that the REVIEW can give wide distribution to this important piece of the World War II submarine story.

On her second war patrol, in August of 1944, USS FLIER (SS 250) was directed through Balabac Straits south of Palawan Island in the Philippines, to attack a Japanese convoy on the surface at night with the Captain, four officers and four lookouts on the bridge. At about 2200 the ship hit a mine and started to go under. Only those on the bridge and a few from the conning tower were able to get off the ship. They were in the water for about 17 hours before the seven survivors of the sinking and the swim got to an island. Part I described the sinking, the swim, the island and the decision to swim to another island.

The men who stayed at the camp had noticed water dripping from the coral and thought that it was fresh. It was only seawater that had splashed up there at high tide. But, as they had gathered about two shells full, we were satisfied to believe that

it was fresh, and so each took about three teaspoonfuls. We used a little shell about the size of a teaspoon to dish it out to each of us.

At about 1815, as we were sitting and looking out to where the ship had gone down, we noticed a large geyser of water come up. Shortly afterwards we heard an explosion. We have no idea what caused the explosion. It may have been a mine going off, or something from the ship. Another plane had passed over in the afternoon without deviating from its course.

Before lying down at night we laid out about 20 large shells to collect rainwater if it rained. You could possibly trace our path through the island by just looking where we had laid out shells. The sleep that night for me was not better than the first night—we again rose at sunrise.

The Captain and Jim had worked out the plan that was agreed upon. There were only two courses open for us to follow—one was to follow the chain of islands that led toward the Japanese town, which was the only sign of civilization; and the other was to follow the chain of islands in the opposite direction. That would lead to another main island where we didn't know what to expect. The latter course was chosen, because we did not want to turn ourselves over to the Japanese at this stage of the game.

We started to walk around the end of the island so we could find the closest place from which to start swimming to the next island. We knew that we could not start to the next island until late afternoon, because of the Japanese air patrol that came over at 9:00 in the morning and 1500 in the afternoon. Also, the Jap launch patrol might come by and spot us. Another reason was that we had to wait until slack tide. There was about a six knot current that flowed between the islands and we could not hope to buck that. While walking around the end of the island I found a small piece of canvas, which I thought would work well for a pair of shoes. However, I couldn't find anyway to wrap the cloth around my feet without it rubbing on the sores and make it more painful than being bare foot.

We spent the day building a raft and resting, also keeping out of the sun. The raft was constructed out of bamboo about 4 inches in diameter, which we picked up on the beach and tied together with vines that we pulled off the trees. The Captain made two paddles by splitting a bamboo pole part way up and then putting small pieces in

crossway, then tying it with vines. We also found two long sticks for polling. The raft was big enough to hold two people. We did not dare build it any larger because it would be too easy to see.

At about 1430 we started to swim to the island #2, now known as Gabung. About half way across it started to rain. However, we could not catch any of it. We just hoped that someone had left a lot of shells spread out on the island to which we were going as we had done on the island we just left.

We were able to pole about a quarter of the way across. The rest of the way we had to swim and tow the raft. The Captain rode on the raft and paddled. The rest of us took turns riding the raft and paddling. When we were about one-third of the way a patrol plane came over and we all ducked under the raft. When we were about 3/4 of the way across, the tide started to change and the current started to get strong. There were several times that we didn't think that we were making progress. Finally, we were carried into the lee of the island. From here we were able to swim to the island.

We reached the island about 1900 or 4½ hours later, which was after dark. We found a sandy beach and all were satisfied to lie down wherever there was room. Again we became very cold, and so to keep warm, we buried ourselves in the sand. This however, was of little use, because after about ten minutes, we would start to get the shakes and shake all the sand off. What I did was to lie down for about half to three quarters of an hour and then when I started shaking too much, I would get up and walk around until I settled down. Jim and I even tried burying ourselves together but we just couldn't shake in unison so that the sand came off twice as fast.

I believe there is nothing that I have ever wished for or ever hope to wish for, more than I did hope for daylight at this time. Daylight meant warmth.

The first thing we did after sunrise was to plan our next move. We decided to take the long way around the island, because we couldn't start for the next island until about 1500, after Japanese patrol and the tide current was lowest and we could more likely find some coconuts or something to drink that way.

By now, our feet were pretty well cut up by the coral and so walking was getting harder all the time. We walked in the shallow water because the coral was grown over with weeds and was easier

on our feet. The disadvantage of walking in the shallow water, however, was that you were in the sun, and we were already more sunburned than we wanted to be.

We reached the far side of the island about 1330 and did not find any edible coconuts, food, or water of any kind. Again we opened several coconuts by hand, only to find that they were no good.

After the 1500 air patrol passed, we again started for the island number 3. The water here was a little shallower in places and we were able to wade part of the way. This greatly eased the strain.

It was between these islands that we saw the fins of a couple of sharks. These were the only ones we saw during our entire trip—something for which we were very thankful. By this time, we had assumed the attitude, that let come what may—what comes just comes and what doesn't O.K.

We arrived at island number 3, now known as APO, about 1800, only about a three-hour swim and were again able to find a sandy beach. We spent the night there in the same manner as we did the previous nights, that is spending most of the night wishing for daylight.

It was the fifth day and the 3rd island. We started about 8:00 to circle the island to the seaward which was the long way again and pushing the raft ahead of us. This island was the same in form as the other islands, except that it was a little more round. We found on this island an abandoned dugout, but it proved of no use to us, because it was full of holes.

Baumgard and I became inquisitive about one of the trails leading in to the center of the island; but, after walking on the customary hard coral for about three blocks, our curiosity was satisfied that there were only monkeys on the island.

About 1100 we found a coconut, making the second one we had found so far that was edible.

Upon rounding the furthest point, we saw on the next island, island number 4, now known as Bugsuk Island, what we thought to be houses. Naturally, our hopes reached an all time high. It was agreed that we would eat our coconut and then start for the next island, planning to get there just before sunset. We found that eating the coconut was harder then it was worth. We could down only about a square inch of the meat and there was no milk in it.

At 1400 we started for the island number 4, Bugsuk. The water was fairly shallow, so we could pole a lot of the way and we were able to hang on to the raft. As planned, we were there just before sunset and also to come on to the island about a mile and one-half down from the houses. This was around a point, which should have blocked the view of anybody who might be in the houses. We reached the shore about 1730 and landed where we wanted to land. We rounded the point very cautiously and saw that the houses were abandoned. On the way to the houses, we passed a coconut grove, plus indications of a small native village, so Baumgard and I stayed and rounded up about twelve good coconuts. Upon reaching the house, we found in the rear a cistern that was filled with rainwater. Needless to say, we wanted a feast that night, eating fresh coconut and drinking fresh water, this being the first food and water we had for five days.

We found that the work of getting one coconut open with our bare hands was enough to discourage us from eating any more. We found a sharp rock and by pounding the coconut on it we could gradually work the outer shell off. Once this was off, it was easy to pound out the eye and drain the milk out of the coconut and then crush the hard shell. All of us, except Howell, drank sparingly of the water, as the captain had advised us to do.

By this time it was dark and we proceeded to find places to lie down and rest. I found a bamboo door that made a very good mattress and so slept comparatively well that night. Before going to bed, we had looked around the house and decided that at onetime it had belonged to a wealthy landowner. However, someone had attempted to wreck the house.

There were several discarded receipts for the purchase of cattle and the sale of lumber, indicating that the owner had a prosperous business.

In the front of the house was a launch about 38 feet in length, heavily constructed, which showed signs of having been purposely destroyed. There was another launch of about the same size that had apparently been in the process of being built. There were several large clearings around the house, which indicated that they had been used for vegetable gardens. Also, there was a stream in which we could see many fish that could easily be caught or netted. Thus,

plans for the next day were very cheerful.

During the night, Howell became very sick, and we believed that it was due to the fact that he drank so much water.

We arose at sunrise and had another coconut for breakfast. We were just getting organized as to who would build the fire; do the fishing; go on the scouting trips, and gather coconuts; for we were getting set to spend several days here and recuperate a little. Then, from the jungle, came what appeared to be two small native boys. Knowing that they had, undoubtedly, seen us already, we did not try to avoid them, but rather went down to meet them. The Captain spoke to them and asked them, "Americans or Japanese?" One boy said, "Americanos" and smiled; "Japanese" and motioned as though he was cutting his throat. This relieved us considerably. Next, the boy pointed to the cistern and said, "Don't drink water." This puzzled us, but remembering our policy of letting come and go what may, we disregarded his statement, and asked him if he had any food. He patted his stomach and said, "Rice." He then motioned for us to follow him back along the path into the woods.

This we did, and shortly after we started along the path, the native boys ran ahead and picked up their poles and the small packs on poles in which they carried their food. As we walked along, we passed an abandoned sugar cane field. They took us into it and motioned for us to sit down while they cut each of us a piece of sugar cane about three feet long. We spent at least a half-hour chewing on this. The only reason we did not eat more of it was because we were too tired to chew anymore.

We then continued along this path about two blocks and came to a clearing where we found a deserted schoolhouse. It consisted of a raised platform with a roof over it and had several school benches on it. There was about a hundred yard clearing around it.

They motioned to us to sit down and faster than I could start a fire using matches, they had whittled themselves a spindle and had started a fire by spinning the spindle in a notched block. It was like we did in Boy Scouts, except that they did not use the draw bow, but rather spun the spindle by rubbing it between their hands. As soon as they had this fire going, they brought out a small pan about five inches round and deep. They filled this with water from a nearby stream and poured some rice into it. While the rice was boiling, they

cut down some banana leaves and laid them out to make plates for us. They then brought us some water, which we were to drink. It was as muddy and dirty as you could find. However, they assured us it was all right by drinking some of it themselves. We were not in a position to seriously doubt it.

As soon as the rice was cooked, they laid it on the banana leaf plates and also laid out some dried fish, which they had brought along with them. There were about three fish and they looked like bluegills.

We had no more than started to dig into the rice when from across the clearing we saw ten men; three armed with guns and six with blowguns and bolos. Our spirits naturally dropped to the lowest ebb, until one man who seemed to be leading the group hollered out, "Hello." He spoke very good English and ran up to us, grasping our hands and introducing himself. He was Mr. Pedro Sarmiento, leader of the Bolo Battalion of the Bugsuk Island and a former school teacher who had been educated in Manila and was overseer of the abandoned plantation during peacetime. The other men who were with him, he explained were the natives of the island who had organized into the local Bolo Battalion.

After identifying himself, we asked him what the native boys meant when they told us not to drink the water back at the house. He told us that the man who owned the house had, when the Japanese at the beginning of the war chased him out of it, filled the cistern with arsenic, to kill any Japanese that might drink the water. We believe that this is the reason why Howell became ill that night. We were very fortunate that more of us did not become ill.

We asked him how he knew we were in the house. He said that at all times they had several points around the island, where native look-outs watched for Japanese coming to make an inspection of their island. It was one of these lookouts that had spotted us swimming to the island. He immediately notified Pedro about the swimmers.

As Pedro did not know whether we were Japanese or Allies, he sent out word during the night to the several surrounding islands to bring in guerrillas. They then had the house surrounded in the morning, and were going to attack us if we were Japanese, or to help us out if we were Allies. The native boys were sent in as scouts to

find out whom we were. If we had been Japanese, they were to pretend that they were going to the coconut grove, and if we were Allies, we were to be brought back to the schoolhouse.

Pedro then explained his plan. He had been instructed that any Allied survivors found were to be sent to the main guerilla headquarters on the southern coast of Palawan at Cape Ballilugan. We were to walk across Bugsuk Island, which was eight kilometers, or about five miles. There he had a native boat called a kumpit. He said that it was very important that we get started walking right away, because the routine Japanese patrol was to land at the house either that morning or by the afternoon. They would make their formal inspection and spend the night in the house. He said that if we could get a mile back into the island, we would be safe, because the Japanese were afraid to go that far into the island. With this in mind, we accepted his plan without any hesitation.

In fact, we were willing to start before eating, but he said that he wanted to send the boys back to the house and see that we did not leave anything indicating that we had been there. The only thing that we could have left, which was all we had, was the magnifying glass we had taken from my binoculars. This turned out to be a very welcome gift for Pedro as he used it to light his pipe. We ate while the natives went back. Then after finishing the dinner we started marching.

The ground was made up of coral. Up until now, we had not realized the extent of our fatigue, or the condition of our feet. There is no doubt that there has seldom been a sorrier looking bunch of hikers starting a walk.

They stationed native guerrillas ahead and behind us, and the rest cut the path for us. We had hoped to make it to the other side of the island by nightfall, but after walking for about an hour and a half, it became quite apparent that this was an idle dream. So, it was agreed that we would go half way that day and continue the trip the next day.

It wasn't until 1700 that afternoon that we reached the native village at the center of the island. It meant that we had walked for eight hours to gain a total of two and half miles, which was certainly a good day's work.

Upon reaching the village, we were taken to the leading man's

hut, and he had bamboo mats laid out for us. We were there probably only fifteen minutes before we were all asleep.

While we were asleep, the Captain had brought to his attention the fact that as long as you are in the Navy, you can never be free from paperwork; for while he was sleeping he was awakened by Pedro who wanted to have all our names and where we were stationed, so he could make his formal report. Writing paper was one of the scarcest items on the island, but, still, he had to make a formal report to his guerilla leader

We were awakened about 1830 to find that they had killed one of their very few chickens to make a chicken broth for us. The chicken was so thin and run-down that in the United States, you probably couldn't have even given it away. However, here it was a great sacrifice to kill it. Thus, we felt very honored and were glad to taste something besides rice and coconut. We had wild honey for dessert, which was good.

After eating, we went back to sleep again. Pedro had assured us that there were guards posted all around us to warn if any Japanese should come. The next thing I knew, it was morning and we were told we would have to get started. Water here was taken from a stream that was about four inches deep and ten inches wide, also very muddy. The water was carried in hollowed out bamboo poles about five inches in diameter and five feet long. However, it was the only water around and the natives drank it all the time, so we assumed it was all right.

Our next objective was the next village, which was half way to the other side of the island. The plan was to have a noon meal. We started out and after walking for about three hours we began to wonder how much further it was to this native village. It was then that Pedro started to tell us that it was just another kilometer. I believe that about every twenty minutes somebody would ask him how much further it was and he would say, "Just another kilometer." Pretty soon this got to be a joke.

We reached the hut at about noon and were glad to get a chance to rest and eat. Here we were introduced to something new: blue rice. Even though it was all we ate, we were beginning to learn to enjoy rice. Again our dessert was more rice with wild honey, very tasty.

After resting for about an hour, we started our march again. The native owner of this hut donated a large basket of rice, which was all he could give and was a great sacrifice. This was to be brought to the guerilla headquarters as a donation to the guerrillas. That is an example of how the guerrillas were supplied with food.

Our pace was not improving very much. About 1530 we came across another native hut. As yet we were not very hungry, however, the native insisted that we stop and have something to eat with him. So we ate more rice. Again we started walking, and again we started asking how much farther it was, and again it was, "just another kilometer."

We finally reached the Bugsuk River and our boat (kumpit). This was timed very well, for it just gave us time to get aboard the boat and have enough daylight to navigate down the river before sunset. Here we bade goodbye to the major part of our guard, but met one of the most interesting people we were to meet. His name was LaHud but we called him "The Sailor" because he very capably did all the sailing and navigating from here to Brooks Point, and was very capable at handling both.

We asked Pedro to come along with us to the next island because he was the only one who could speak English.

We also met TomPong who was to be with us for the remainder of our trip. The sailboat or *kumpit* as the natives call them was typical of the type used by the *Moro* tribe of natives. The Sailor was a Moro trader and they were the type of people who we were told to avoid meeting if we were ever shipwrecked.

This kumpit had a wooden hull about sixteen feet long, a six-foot beam, pointed bow, a four-foot wide square stern, and a smooth round bottom. The hull was flush decked over from the stern to the mast. Forward of the mast was just enough space for a jug of water and two native boys. It was from here that the native boys did the rowing. A split bamboo mat could be stretched overhead to give shade and hold off the rain. It had a large oversize gaff rig with a tiller and a detachable rudder. We sat on the decking. Below this was the cargo area of the sailboat where everything was carried: bags of rice, cooking utensils, a gun and everything else a person needed to live. For more storage space they had racks built out on both sides of the kumpit, which ran about three quarters of the length of the

boat. It was surprising that the kumpit would even float when we had twelve people and all the stores in it, let alone make any speed under sail. However, with hardly any wind, we moved along at a fair speed.

About 1800 we shoved off and started down the river. The river was so narrow and sheltered that we were not able to sail. Therefore we took along two small boys who would do the rowing. We rowed down the river for about three miles and reached the mouth of the river just before dark. As we were leaving the river, the guide who was acting as lookout started to make a lot of noise and pointed towards the beach. They turned the kumpit towards the beach and we naturally began to worry. However, we were glad to find out that all he was pointing at was some kind of seaweed that a doctor had told them was a good medicine. So, whenever they found it, they would eat it. It tasted like a bitter sweet pickle and contained a form of iodine.

By now it was dark, which was what we wanted. It was only safe to sail at night and the next island was about twenty miles away. To get to it, we needed to pass through several reefs. The night was pitch black; but the sailor and Kim-Jon knew the waters so well that they sailed in and out of the hidden reefs with very little strain, having to pole themselves away from the coral only a few times. The wind died down when we were about half way across, which made it necessary to row the rest of the way.

We arrived at Cape Ballilugan on the southern end of Palawan Island at about 0300. The members of the regular organized guerilla outpost greeted us. They had received word that we were coming, and were down in full force to greet us. They then took us to their hut and introduced themselves by showing us their official papers. This outpost was made up of Filipinos, all of whom had some kind of formal education. They were schoolteachers or the equivalent. They were full time guerrillas, and devoted their whole time to this outpost.

It was here that we met Sergeant Pasqual de la Cruz USA FFE, who was in charge of this outpost. Pedro turned us over to him. We then went to their barracks, and were given bunks, which were merely tables and were fed more rice and sugar cane.

The Captain asked if they had any medicine. Sergeant Cruz went to the shelf and brought down a jar of white salve, full of bugs and

dirt, so the Captain politely refused the offer. The Sergeant said that he was sorry, but that was all they had. So we continued to let Mother Nature heal our sores.

We talked for quite a while for these were the first people who understood English and could explain the situation to us. We now found out that we would have to go about seventy miles up the island to the main guerilla headquarters. It was also decided that we could sail only during the night, but we would leave that night, so we were to spend the day around there. We went to sleep, awakening at about 0930.

The guerillas rounded up enough clothing so that each of us had a pair of pants and some of the luckier ones were able to get a shirt. My shirt was about three sizes too small, but was very much welcomed.

Sergeant Cruz told the Captain that about two weeks before the Japanese were transporting four prisoners from Balabac City to Puerto Princessa prison camp on Palawan. They were on a submarine that was sunk near Camiran island, six got off and two were killed on the island. Sergeant Cruz wondered if we were off the same submarine. The Captain told him we were sunk nine days ago, so they were not from our submarine.■

Part III will appear in the January 2008 issue of THE SUBMARINE REVIEW. It will conclude with the rest of the story about the survivors' time with the Philippine guerillas and their ensuing rescue by a US submarine.

REMEMBERING: THE SOUND SURVEILLANCE SYSTEM (SOSUS) PART II

by Mr. John Merrill

Mr. Merrill is a frequent contributor to THE SUBMARINE REVIEW and is a published author of several books on the history of undersea technology. He is a retired engineer with lengthy experience at the New London Lab of the Naval Undersea Warfare Center. He currently lives in Waterford, CT.

Mr. Merrill was recently awarded the JOHN GARDNER MARITIME RESEARCH AWARD by the fellows of the G.W. Blunt White Library at Mystic Seaport.

Part I appeared in the July 2007 issue of THE SUBMARINE REVIEW.

Caesar First Steps

In June 1952, with the successful LOFAR detection of submarines at Sandy Hook and Eleuthera and long experience with SOFAR, the Chief of Naval Operations (CNO) directed Bureau of Ships to acquire six stations under CAESAR, increasing to nine stations in September. Three contracts were implemented to include equipment, installation, and construction or expansion of a cable-manufacturing facility. The Simplex Wire and Cable Company in New England was expanded to manufacture the miles of cables needed for Caesar installations.

In a 1952 letter to CNO, the Commander in Chief of the Pacific Fleet indicated interest in the system and offered suggestions regarding Pacific Ocean locations for future sites. By May 1954, ten more stations were planned with six on the West Coast. An unclassified cover story was created for the new system and the low frequency passive detection development was designated SOSUS.

During the next five years, SOSUS facilities were installed and commissioned along the eastern Atlantic Ocean. "They form a huge semicircle from Barbados to Nova Scotia, opening toward the deepwater abyss west of the mid-Atlantic Ridge. This provided both

excellent coverage of the deep ocean basin off the eastern seaboard and the opportunity for contact correlation among arrays with widely separated vantage points."[23] Likely Soviet submarine routes to gain access to the United States eastern seaboard provided a basis for the location of SOSUS hydrophone arrays.[24] The results of Lt. Cmdr. Joseph Kelly's efforts during the first years of the project are shown in the table.

Project Caesar Stations Commissioned 1954-59
1954 Ramey, Puerto Rico-Grand Turk-San Salvador
1955 Bermuda, Shelburne, Nova Scotia, Nantucket, MA, Cape May, NJ
1956 Cape Hatteras, NC, Antigua
1958 Point Sur, CA, Centerville Beach, CA, Pacific Beach, WA, Coos Head, OR, Argentia, Newfoundland

Caesar Cable Fleet Ships

WHOI, SOI, and Columbia University's Hudson Laboratory under Project Michael dealt with finding answers to questions regarding cable placement. The Navy cable ships and AT&T accomplished the actual laying of the hundreds of miles of cables in depths up to 1000 fathoms. Initially the cable ships NEPTUNE and MYER were assigned. Later, ships THOR, AEOLUS, MIZAR, HUDDELL, ZEUS and USNS WATERS made up the cable fleet. They became known as the Caesar Fleet. Some locations where deep water was available needed ten or twenty miles of cable while others required a hundred miles. At some point in the SOSUS years, 30,000 miles of undersea cable and more than 1000 hydrophones were maintained.[25,26]

NAVFACS

The shore station facilities located along the coasts with their hydrophone arrays, buildings, and instrumentation came to be identified as NAVFACS. Sites were chosen where the continental shelf break came closest to land. Upon the completion of the

installation and in operation, sufficient manpower for the daily 24-hour operation placed a requirement of 100 or more personnel at each facility. The unique skills for reading and interpreting the LOFAR analyzer's black and grey paper printout made training and education important requirements.

The number of LOFAR analyzers at each NAVFAC was quite large "A Lofar analyzer was associated with each beam of each array served by a NAVFAC, and typically, the large watch floors were filled with hundreds of these "gram-writers: busily turning out Lofargrams on 'smoky paper 24 hours a day.'"[27] Equipment maintenance, data collection and its transfer to centers for analysis and operational commands provided continuing challenges. Eventually more than twenty stations were in operation and met a manpower requirement of several thousand.

Continuing SOSUS Expansion and Operational Example

With the above clusters of stations in 1956 and more to follow, the concept of regional SOSUS Evaluation Centers was adopted to correlate contact information and provide reacquisition data concerning the target for use by patrol aircraft, surface ships and submarines. Later, the Centers were called Naval Oceanographic Processing Facilities (NOPFs). The first two were in Norfolk and New York. Combined with other intelligence, the resulting target position estimates and probability areas were provided to local and regional ASW commands.[28]

At the end of the 1950s, "SOSUS cables and hydrophones, separated by intervals of five to fifteen miles, were also laid off Denmark, Iceland, Norway, the North Cape, Italy, Spain, Turkey, and around the British Isles."[29]

Expansion of SOSUS stations was modest in 1961 with one NAVFAC placed in operation at Adak, Alaska, not far from the western tip of that state. On the operational side, as a demonstration, East Coast United States SOSUS arrays successfully tracked the first Fleet Ballistic Missile submarine, USS GEORGE WASHINGTON (SSN 598) on its first transit from the United States across the North Atlantic to the United Kingdom.

1962 Soviet Submarines and SOSUS

The Cuban Missile Crisis (July-November 1962), provided opportunity for the Atlantic SOSUS stations to have an important role in the naval blockade. The heightened time was during October. In June, the SOSUS NAVFAC at Cape Hatteras identified the first Soviet diesel. The following month, NAVFAC Barbados made the first detection by SOSUS of a Soviet Nuclear submarine as it crossed the Greenland-Iceland-UK gap. "...

SOSUS was able to exploit the fact that both propellers and rotating machinery mounted directly to a submarine's hull generated, predictable narrowband tonals at source levels high enough for large LOFAR arrays to detect them and track them on an ocean wide basis."[30] From SOSUS data, Neptune naval aircraft (P2s) were able to broadcast in the clear the exact locations of Soviet Submarines and were heard by the Soviet submarines as well as blockade members.[31] ASW aircraft, in addition to the cueing advantage by the long range SOSUS detection data, were further enhanced by the use of their aircraft launched sonobuoys in the pursuit of the Soviet submarines.

During October at the peak of the crisis, Soviet Foxtrot submarines (nuclear torpedo equipped), in transit to and in the Cuban area were detected by SOSUS and closely trailed. The tracking data was passed to the Navy blockade participants. After the crisis was resolved, the observed SOSUS effectiveness led to the expansion and upgrading of the network. A SOSUS array was placed to cover the Greenland-Iceland-United Kingdom (GIUK) Gap with NAVFAC Keflavik established in 1966. One path for Soviet Submarines to the Atlantic and the United States from the northern Soviet submarine base was through the Gap.[32]

Data from these widely-distributed arrays brought attention to new uses for the underwater surveillance. In 1965-66, the Norway SOSUS array detected and tracked Soviet Bear-D bombers flying over the Norwegian Sea. Surface ship detection as well as detection of nuclear explosions occurring near oceans or underwater was included in SOSUS capability. With 55 Soviet nuclear submarines deployed between 1958 and 1968, opportunities for SOSUS detection were increased.[33]

1962 USS THRESHER (SSN 593)

On Sunday April 9, 1963, THRESHER was lost with all hands at a depth of 8400 feet 260 miles off the New England coast. Nearby oceanographic ships and others were able to identify an area of interest. A chronology of SOSUS for the year of the tragedy cites "SOSUS plays critical role in pinpointing the location of the incident."

Strong interest in determining the cause of the submarine loss was directed at the obvious to prevent future similar events. In this regard, resolution of the question of whether the loss might be due to deliberate enemy action was critical.[34] Was the loss from an explosion or implosion? The Navy's Deep Submergence Rescue Vehicle (DSRV) development was one of the results of the loss of the THRESHER.

1968: Soviet K-129

In 1968, SOSUS Pacific operations included a new operational NAVFAC at Midway Island and the commissioning of the Guam, Mariana Islands NAVFAC. First SOSUS detections of Victor and Charlie Class Soviet nuclear submarines occurred at the Keflavik, Iceland station.[35]

SOSUS involvement occurred with the April loss of the Soviet ballistic missile, first Soviet submarine with underwater launch, diesel electric GOLF (K-129) submarine in the Pacific northwest of Hawaii and a few weeks later on May 27 with the loss of the USS SCORPION (SSN 589) in the Atlantic in water with depths of the order of 15,000 feet.[36]

The mid-Pacific SOSUS array (code-name Sea Spider: a 1,300-mile-long circular array surrounding the Hawaiian Islands) has been cited as the array that monitored and localized the breakup of the Soviet submarine K-129.[37]

In both submarine losses, sound surveillance data contributed to the overall effort to determine the location of each lost submarine. The United States search for SCORPION was undertaken with reasonable public exposure while the Soviet search was extremely classified. The United States search for the K-129 included careful security measures. Searching for the submarines at great depths and, in the case of the Pacific location, of the order of 15,000 feet or

greater made the searches extremely difficult and complex. Developing accurate information concerning the reasons for the losses provided a broad number of challenges.

USS SCORPION (SSN 589)

Regarding SCORPION loss on a return trip to the United States, it was realized that during a three thousand mile track from southern Europe, the sounds of its collapse and the implosions at collapse depth might have been recorded. A Naval Research Laboratory (NRL) research station in the Canary Islands equipped with a hydrophone found about five separate trains of acoustic events that could have been associated with a submarine breakup.

In addition, "Kelly (now a Captain) came to the rescue with his awareness of a super-secret hydrophone installations in the hands of another government agency. The sounds of SCORPION's death might be buried in this organization."[38] Captain Kelly's resourcefulness led to additional Scorpion acoustic signatures. Collectively the signatures and using triangulation identified a location for SCORPION. The following year, the deep submergence vehicle Trieste II provided further details of SCORPION's sinking. The SCORPION was 400 miles southwest of the Azores at 10,000 feet.

Continuing interest in SCORPION recently in the 2006 book Silent Steel brings further revelations regarding the search for the submarine.[39] The author points out that it was the additional acoustic signal picked up by the Air Force's Technical Applications Center (AFTAC) facility in Argentia, Newfoundland. The facility's purpose was monitoring Soviet nuclear weapon tests. AFTAC's implosion data coupled acoustic data from the SOFAR operation on La Palma, a small island in the Canary Islands that identified the submarine's location.

High point

Under Captain Joseph Kelly, SOSUS grew in size, improved its operations and methods, and more than met its purpose. At the time of his retirement in April 1973 after more than 20 years as SOSUS Project Manager, there were a total of 22 SOSUS installations along the East and West Coasts of the United States.

SOSUS success in the 1970s and the availability of effective air-dropped homing torpedoes and more intensive use of the P3 Orion patrol squadrons allowed the U.S. submarines to adopt a barrier strategy in the Norwegian Sea, along the Greenland-United Kingdom line, and at chokepoints in the North Pacific.[40] In summary, "By 1981, unclassified depictions of SOSUS described it as having 36 installations, including facilities located in Continental United States (CONUS), the United Kingdom, Turkey, Japan, the Aleutians, Hawaii, Puerto Rico, Bermuda. Barbados, Canada, Norway, Iceland, the Azores, Italy, Denmark, Gibraltar, the Ryukyus, Panama, the Philippines, Guam, and Diego Garcia."[41]

SOSUS Eclipsed

The mid-1980s brought several technology changes that challenged SOSUS's role. The Soviet submarine ballistic missile range changed from the early days of SOSUS. The Soviet initial range of 350-1600 nautical miles (nm) increased to ranges of the order of 4900 nm. This enhancement placed Soviet ballistic missile submarines closer to the USSR, typically further from SOSUS locations.[42] Soviet SSBNs no longer needed to pass through the SOSUS barriers to reach their targets. Soviet SSBN patrols could be conducted in the marginal ice seas of the Soviet Arctic littoral, including the Norwegian and Barents Seas and later under the permanent ice of the Arctic Ocean, and be provided with support by the rest of the Soviet Navy.[43] SOSUS was beginning to be perceived as an aging system and not capable of covering large mid-ocean areas.[44]

During the period 1967 to 1985, John A. Walker, a U.S. Navy warrant officer and career submarine communication expert watch officer in Norfolk, VA, continuously shared submarine information with the Soviets until 1976 when he retired and afterwards. In 1985, he was taken into custody. Soviet knowledge of SOSUS success contributed to the rapid quieting of Soviet submarines, making them more difficult noise sources to detect and localize.

Towed Sonar Arrays

In the late 1960s, there was significant and growing interest in the use of towed sonar arrays for ASW. As a result, by September 1970 systems were installed on three Dealey class destroyers in the

Mediterranean. Demonstrations of these arrays were eminently successful. "During their stay in the Mediterranean, they accounted for over 50% of all submarine detections by any method, including visual sighting."[45]

The comments of Rear Admiral J. R. Hill, RN, regarding towed arrays in a 1984 assessment of ASW was one of the many statements that emphasized the significance of towed array development. "The passive sonar towed array...may well be the most important single development in ASW sensors since 1945."[46]

Surveillance Towed Array Sensor System (SURTASS)

Gradually quieter Soviet submarines of the 1960s and 1970s created a need for mobile towed array detection. In the mid-1970s, the Navy contracted with the Hughes Aircraft Company to develop the equipment for mobile surface ship detection. The latest computer technology for the computer-based sonar was expensive and required long development time. As a fixed system, SOSUS presented a wartime target and restriction to operate in certain areas. With its mobility SURTASS complemented SOSUS. Further enhancement for the undersea surveillance came from active and passive sonobuoys.[47]

Ships

Towed array ships required special design to accommodate the equipment, long arrays and extended patrols. In 1984, the first SURTASS ship of 18 United States Navy Ships for the Hughes developed equipment and arrays was commissioned. It was a monohull design and manned with a civilian and military crew. The ships are 224 feet long, beam of 43 feet displacing 2,262 tons, with a speed of 11 knots, and capable of ASW patrols of 60-90 days.[48] SURTASS ships require stability at low speeds and in rough waters.[49]

The towed linear array of 8575 feet was deployed on a 6000 ft neutrally-buoyant cable. SURTASS ships are manned with civilian mariners under contract to the Military Sealift Command and are designated United States Naval Ships (USNS). Ports of operation include Glasgow, Scotland; Rota, Spain; Yokohama, Japan; Pearl Harbor, Hawaii; and Port Hueneme, California. At this time,

SURTASS joined SOSUS, and the combined name for these two systems became the Integrated Undersea Surveillance System (IUSS).

SURTASS vessels send, via satellite, the gathered data on ocean sound signals and other target information to East and West Coast shore-based processing stations for transmittal to numbered fleets. These ships improved the Navy's ability to locate Soviet submarines and monitor their fleet bases, but a wartime environment would restrict them to deep ocean areas.[59]

End of Cold War and New SOSUS Users

The official date for the end of the Cold War, December 26, 1991, brought a lessening of the need for SOSUS, and the system mission was declassified after forty-one years of secrecy. That year, Federal scientists in Newport, OR began to use SOSUS to listen to seaquakes, quickly detecting thousands of them. In 1993, the scientists monitored the explosive fury of a deep-sea volcanic eruption and sent a small flotilla of research ships, robots, and submersibles to explore the site.

SOSUS BUDGET	
Year	Amount (million)
1991	$335
1994	$165
1995	$ 60 (estimate)

The status of SOSUS is reflected in the budget table. A steady reduction occurred in the manpower assignments with 2500 for 1993, 2000 for 1994, and 750 for 1996. SURTASS technology and the end of the Cold War eclipsed SOSUS's position. It diminished the need for global surveillance while the SURTASS technology offered mid-ocean coverage and mobility.

New uses for SOSUS began. In 1992, the Navy, the National Marine Fisheries Service and the Coast Guard used SOSUS to track fishing vessels in the Pacific to explore possible enforcement of

international bans on drift-net fishing. Over a two-year period (1992-93), biologists used SOSUS to track the migrations of whales including a single blue whale as it swam southward from Cape Cod to Bermuda to Florida and back to Bermuda. All told, for about 1700 miles it was closely monitored.[31]

To accommodate downsizing, SOSUS hydrophone arrays in both the Atlantic and Pacific became involved in shutdowns and closings. To reduce manpower requirements and realize other efficiencies, most of the original arrays were re-terminated at alternative shore sites or remoted to central processing facilities that allowed a reduction in the number of operational NAFACs. These transitions were completed in 1997 and 1998.

As mentioned previously, IUSS (formed in the mid-1980s to bring SOSUS and SURTASS under one head) is made up of fixed, mobile, and deployable acoustic arrays that provide vital tactical cueing to ASW forces. It is the Navy's primary means of submarine detection, both nuclear and diesel, continuing as an effective force multiplier, and in the post-Cold War period provides mobile detection, tracking, and reporting of submarine contacts at long range.[32] IUSS claims more contact holding hours since 1997 than all other anti-submarine warfare (ASW) platforms combined.

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BRITISH ASTUTE CLASS NUCLEAR ATTACK SUBMARINES

by Dr. George Sviatov
Naval Architect
Captain 1 Rank (Ret. Russian Navy)

I would like to present my net assessment judgment just from the beginning. Recently I finished the manuscript of my book Reflections of a Maverick. Nuclear Submarines and Defense Policy in my Destiny, and, by my opinion, the British ASTUTE class nuclear attack submarine is the Best in the World at least from the point of view of naval architecture. Let me try to prove such a statement.

First of all, I will discuss her creation and building history and then her comparison with two American and one Russian newest nuclear attack submarines: Seawolf and Virginia and Acula classes.

The Astute class submarines are the next generation nuclear attack submarines of the Royal Navy. When completed, they will comprise the largest nuclear-powered attack submarines the service has fielded.

As the Swiftsure class submarines aged, the Royal Navy began to plan their replacements. The original design called for large blue water submarines. Feasibility studies began in 1986 and were completed by 1989. A design contract was placed with Vickers Shipbuilding and Engineering Ltd (VSEL) in 1987, but with the end of the Cold War the project was cancelled in 1992. Emphasis switched to the production of a second batch of Trafalgar class submarines. However the development was very slow and initial tenders received from VSEL in June 1995 were too expensive.

Meanwhile, the Royal Navy has changed its submarine strategy and tactics from the Cold War emphasis on anti-submarine warfare to the concept of *Maritime Contribution to Joint Operations*. The proposed replacement subs were redesigned. The primary mission of the Astute class submarines became direct support of surface forces.

Original plans were for seven boats of the Astute class to replace

five Swiftsure class submarines and the two oldest Trafalgar class boats. Plans, however have been scaled back. The Swiftsure class will be entirely decommissioned by 2010, when only the first of the Astute class subs will be coming into the service. HMS Trafalgar is to be decommissioned in 2008, followed by HMS Turbulent in 2011.

On March 17, 1997 The British Ministry of Defense announced that it was to place a 2 billion pounds order for three submarines and further that they would be called the Astute class. On March 26, 1997, the contract was signed with CEC-Marconi Limited for the first three subs: ASTUTE, AMBUSH, and ARTFUL. CEC would build the submarines at its VSEL subsidiary (BAE Systems Submarines).

As it is known at this time, the Astute class submarines will have the following tactical-technological characteristics:
Classification: Nuclear-powered attack submarine.
Displacement: 7,800 tons submerged.
Length: 97 m (323 ft.)
Beam: 11.3m (37 ft.)
Draft: 10 m (33 ft.)
Power plant: Rolls-Royce PWR2 reactor to provide 30,000 h.p. with full submarine life core. MAN (Paxman) 1900 kilowatt diesel generator.
Speed: 29 knots (54 km/h) submerged - official, probably some 35 knots (65 km/h) - actual.
Test depth: 300 m - official, probably some 600 m - actual.
Complement: 98 officers and men normally, with full capacity of 109.
Armament: Six 21 inch (533 mm) bow torpedo tubes, 38 Spearfish torpedoes, UGM Harpoon and Tomahawk Block III cruise missiles, naval mines.
Sensors: Thales Underwater Systems Sonar 2076, Atlas Hydrographic DESO 25 depth-finding echo sounder, Two Thales Optronics CM010 periscopes, Raytheon Systems Ltd Successor IFF system.

For our further analysis it is necessary to return to existing British nuclear attack submarines of the Trafalgar class. Delivered in 1983, HMS Trafalgar (S-107) is the ultimate expression of British SSN design. With an American-designed 15,000 h.p. reactor PWR-1, it

was the lead unit of a seven ship class.

The Trafalgar class was originally designed for Cold War operations in the Mediterranean and North Atlantic. Their design was a follow on from the successful Swiftsure class but incorporated many improvements. A class of eight boats was originally envisaged but seven were ordered from VSEL.

The principal role of these submarines is to attack an enemy's surface ships and submarines. In this capacity they could support and protect a convoy or task force, as demonstrated by earlier classes of fleet submarines during the Falklands Campaign. Additionally these submarines can be used in surveillance role and they are fitted with cameras and thermal imaging periscopes for these kinds of operations. Since the class is being fitted with Tomahawk cruise missiles they will be capable of a land attack role.

Trafalgar class submarines displace 5,208 tons submerged and measure 85.4 m in length and 9.8 m in beam. They are powered by a single pressurized water cooled PWR1 reactor providing 15,000 h.p., can travel at a speed 32 knots and dive to more than 985 feet. They have a complement of 97 men, including 12 officers and with three decks they are more spacious then previous submarines. Five 21-inch torpedo tubes are located at the side bow. These can fire the Spearfish and Tigerfish torpedoes, sub Harpoon missiles and Tomhawk cruise missiles or deploy mines.

Below there are some comparative characteristics of modern American, British and Russian SSNs:

Tactical-technical characteristics of some American and British nuclear attack submarines and one Russian SSN

	Astute	Trafalgar	Seawolf	Virginia	Acula
Submerged displacement, t	7,800	5,208	9,125	8,000	13,000
Length, m	97	85.4	99.4	115	110
Beam, m	11.3	9.6	12.2	10.4	13.6
Number of torpedo tubes	6	5	8	4	8
Number of VLS tubes	0	0	0	12	0

Number of tons of displacement on one weapon	205	208	183	210	325
Number of weapons	38	25	50	38	40
Underwater speed, knots	35	30	37	35	33
Diving depth, m	600	500	600	500	600
Complement, officers and men	98	97	133	113	73
Cost, $ billions	1.0	0.7	2.5	2.6	2.0
Cost per weapon, $ millions	26.3	28.0	50.0	68.4	50.0

Now it is reasonable to return to my initial statement that the Astute class submarines are the best in the world from a naval architectural point of view. Why?

First. By general naval architectural appearance she is the most proximit to the American VIRGINIA (almost equal displacement, but significantly shorter and by that reason - more maneuverable).

Second. A little less displacement per one weapon in comparison with VIRGINIA (205 and 210), but more than SEAWOLF (183). That is the inherent advantage of the latter.

Third. The advantage of VIRGINIA is a possibility to launch a 16 weapons missile salvo simultaneously in comparison with a 6 weapons salvo of ASTUTE, but after that the advantage goes to ASTUTE (6 weapons in the next salvoes in comparison to 4).

Fourth, and probably the most important, by this authors opinion, both Virginia and Astute class submarines must have significantly more weapons (for VIRGINIA it should be 22 weapons increase up to 60 and for ASTUTE - 32 weapons increase up to 70). It could be easily done in both cases by moderate increase of their displacement with huge increase of their cost-effectiveness.

Such a development will double the cost-effectiveness of American and British new nuclear attack submarines and/or will provide a multibillion reductions of the corresponding programs cost.

Is it a taste business to solve what sub is better, VIRGINIA or ASTUTE? By my opinion, ASTUTE is a little bit better, and both of them much better than Russian ACULA.

But the really important problem is a significant increase of their weapons payload.■

RUSSIA'S NAVY GETS AMBITIOUS

Reprinted with permission from RUSSIAN NEWS AND INFORMATION AGENCY of 31 JUL 07.

by Nikita Petrov

MOSCOW—The Russian Navy will become the world's second largest in 20 years' time, said its Commander-in-Chief, Admiral Vladimir Masorin, speaking ahead of Navy Day.

He said the Navy's core would consist of the newest strategic nuclear-powered submarines and six squadrons of aircraft carriers.

For Russia's Navy, this will be its third modernization program, said the Admiral. The previous two, although giving it a boost, were never completed. Now, said the Admiral, there is such a chance.

Recently approved, a rearmament program until 2015 for the first time in Soviet and Russian history puts the development of the Navy on an equal footing with strategic nuclear forces. Out of 4.9 trillion rubles ($192.16 billion) allocated for military rearmament, 25% will go into building new ships.

"We are already building practically as many ships as we did in Soviet times," First Deputy Prime Minister Sergei Ivanov said during a visit to Severodvinsk. "The problem now is not lack of money, but how to optimize production so that the navy can get new ships three, not five, years after laying them down."

Ivanov said Russia has a strategy for shipbuilding until 2030 under which warship production is to increase by 50%. For the first time in 15 years, a series of 40 frigates has been laid down, with no less than ten each for the Northern and Baltic fleets. In February 2006, after a 16-year break, the frigate Admiral Sergei Gorshkov had its keel laid down, a surface ship intended for long-range operations in distant seas. The Navy has plans for about 20 such ships.

Admiral Vladimir Kuroyedov, a former Commander of the Navy, outlined their concept and the strategy for naval development they are to fit into: "We should abandon the existing multitude of ship and aircraft classes. Compact-sized fighting blocks going to make up ships should increase their fire power and reduce research and development costs."

The idea is to drop the use of specialized ships capable of fighting only submarines or aircraft carriers and to go over to multi-purpose fighting units meant to carry out a wide range of missions away from home. Such ships will be assembled from modular units, and their weapons and equipment will be unified for all types of combat craft. In the future, this will not only facilitate the provision of spare parts and ammunition, but also simplify maintenance, repairs and modernization.

Of special note are plans to build six aircraft carriers, which would make the Russian Navy the world's second in terms of combat capability. The government program, however, does not provide for their construction before 2015. Nor is there mention of them in plans for the period until 2030. But during his recent trip to Severodvinsk, Ivanov was shown plans for a new $500 million dock designed to build large-tonnage ships at the Zvyozdochka ship repair yard. Earlier such large ships could only be built in Nikolayev, Ukraine. The dock, the Russian shipbuilding agency said, is needed to build gas carriers—ships to transport Russian liquefied natural gas to Western partners.

The same dock could also build aircraft carriers. At any rate, the project is already on the drawing board. Masorin said the craft would be a nuclear-powered ship not less than 100 (sic) meters long and would carry an air wing of 30 combat fighter jets and helicopters. But this is not going to be soon.

The outlook is best for submarines. Recently two Project 667BDRM boats have been modernized, and two more submarines are being repaired and upgraded at Severodvinsk. A new sonar system is being installed to enable them to *see* and *hear* better. Other equipment includes new fire fighting systems, nuclear reactor protection devices, and the RSM-54 Sineva strategic missile system. Unlike its predecessor, the Skif, the Sineva carries 10 independently targetable re-entry vehicles instead of four. The new missile has a longer range and a modern control system.

It was a Sineva intercontinental ballistic missile that was fired in the summer of 2006 from the North Pole by the submarine YEKATERINBURG commanded by Captain Sergei Rachuk. An underwater launch, especially from under the ice, is a challenging task. The jumbled magnetic fields render ship and missile navigation

instruments inoperable, and the crew needs special training for working under ice. But there are also advantages–under a thick icecap the submarine remains invisible to hostile observation satellites till the last moment. As a result, a retaliatory nuclear strike would be sudden and unavoidable. Many submarine commanders who managed to do this were later made Heroes of the Soviet Union and Russia. Sergei Rachuk also received the Gold Star of the Hero from President Vladimir Putin.

But modernization of existing vessels is only part of the rebuilding program. The Sevmash engineering plant at Severodvinsk is currently building a series of new fourth-generation submarines. These are Project 955 Borei boats. It is for them that the new Bulava sea-launched ballistic missile is being developed.

"Three nuclear submarines of the fourth generation are currently under construction," Masorin said. "They are the YURY DOLGORUKY, ALEXANDER NEVSKY and VLADIMIR MONOMAKH. In comparison with previous boats, they will have much better armaments and equipment."

A Project 885 Yasen-class multi-purpose attack nuclear-powered submarine is preparing to hit the water at Severodvinsk. It is another new fourth-generation submarine able to replace several classes of submarines used in the Russian Navy. Professionals say this ship will cause a revolution in submarine building. Russia's third-generation Project 971 Akula submarines are already undetectable in ocean depths. The Yasen will outperform even the latest American Sea Wolf in the underwater noise level. In addition, it will be a multi-purpose boat. Thanks to its armaments (several types of cruise missiles and torpedoes), it will be able to carry out diverse missions. It will be able with equal ease to chase enemy aircraft carriers and deliver massive missile strikes on coastal targets.

Experts believe the new nuclear submarines and *floating airfields* will mean a quantum leap for the Russian Navy and its combat capabilities.■

SUBMARINE NEWS FROM AROUND THE WORLD

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From the June 2007 Issue

AUSTRALIA (The Future)—
Defense Capability Plan 2008-18 Projects Future Construction Programs

In mid-June 2007, AMI received information that the next Defense Capability Plan (DCP) 2008-2018 is currently being drafted at the Department of Defense. Sources indicate that DCP 2008-2018 does include plans for a follow-on to the Collins class submarine as well as a follow-on to the Armidale class patrol boats. Details suggest that the first of the new class of submarines could enter service in 2025 and the first of the new patrol boat class in 2020. Although not specifically mentioned in DCP 2008 - 2018, a frigate to replace the eight ANZAC class frigates will probably appear in the next iteration of the DCP expected to be released in 2010.

Indications are that the Royal Australian Navy (RAN) will continue to maintain its current force structure and replace its units at the end of their effective service lives (30 years for submarines and surface combatants and 15 years for patrol boats). This replacement schedule also demonstrates the Australian Government's support to the Australian Shipbuilding industry in its efforts to maintain at least two major shipbuilding yards in order to domestically produce its own submarines and major surface units.

As an example, with the completion of the six Collins class submarines and through life support, ASC was able to remain open and will now build the three AWDs through 2014 as well as providing through-life support, ASC believes that through life support for the Collins submarines and the AWDs will carry the yard through until the new submarine program begins construction around 2018.

Unfortunately, the same cannot be said with Tenix in Williamstown. Following the delivery of the last ANZAC in 2006

and now with just the partial construction and through life support for the LHDs, it will be difficult for the yard to remain viable until a new surface combatant begins (likely 2020).

The decision on indigenous builds for the AWD and LHD programs indicate that Australia is determined in keeping its naval shipbuilding industry employed at or near current levels. This level of activity seemed unimaginable a few years ago. Whoever was the architect of this plan should be applauded!

UNITED KINGDOM —
Project Team Established for Future SSBN

In early June 2007, AMI received information that the United Kingdom Ministry of Defense (MoD) had established a project team to develop the concept design for a new class of Nuclear-Powered Ballistic Missile Submarine (SSBN) as well as co-ordinate associated work for the successor nuclear deterrence (missiles).

The establishment of the project team follows the 14 March House of Commons vote that endorsed the government's plans to retain and renew the country's strategic nuclear deterrent. Simply put, to replace the Royal Navy's (RN) four Vanguard class SSBNs that were commissioned from 1993 through 1999. In addition, the project also includes the successor missile, which is currently envisioned as the US Navy's Trident D-5 with its life extension program.

Established on 30 April 2007, the Future Submarine Integrated Project Team was formed within the MoD Defence Equipment and Support (DE&S) organization's Nuclear Submarine Cluster. The team that is expected to deliver the future nuclear deterrent is currently lead by Director General Submarines, Rear Admiral Andrew Matthews. The mission of the team is to coordinate and deliver a politically acceptable, affordable and assured system for continued deterrence. Initial gate approval is currently scheduled for late 2007. The first replacement SSBN is due to enter service with the RN in 2024. A decision is pending on whether the existing four-unit Vanguard class will be replaced on a one-for-one basis or if a three-unit force could maintain a continuous at sea deterrence.

Perhaps some synergies could be gained by a joint US-UK Future

SSBN design effort in that the USN is also beginning to consider the replacements of its own Trident SSBNs.

CHINA

SSBN Program Moving Forward

According to the Pentagon's China military report of May 2007, the People's Liberation Army-Navy (PLAN) has surprised the West once again by the pace of development of the Type-094 (Jin class) SSBN.

AMI International reported the development of the Jin class since its inception as follow-on to the Xia class (Type-092) SSBN. The first unit of the Jin class launched in 2004 and commissioned in 2006. It is continuing sea trials and is expected to be fully operational by 2008. The Jin class SSBN is to be equipped with the longer-range JL-2 submerged launched ballistic missile as opposed to the much shorter range JL-1s of the Xia class. The JL-2 gives the Type 094 an effective strike range of 8,000 km (4,320 miles) with a total of 80 warheads on sixteen missiles per unit (5 warheads per missile).

AMI anticipates a total of six units of the Type-094 will be built vice the five stated in the Pentagon report. By the time the last unit is completed around 2016, the single Xia SSBN will be beyond its service life and will be decommissioned.

Additionally, it is likely that some of the new SSBNs will be stationed at a base on Hainan island that is currently under construction. This will allow the submarines easier passage to the open ocean without traveling through choke points, and therefore making them harder to detect and track.

The Type-094 provides the PLAN with a very credible nuclear deterrent as well as a potential first strike capability. Details regarding the JL-2 follow:

Dimensions					Performance				
	JL-2					JL-2			
	Metric	Standard	Metric	Standard		Metric	Standard	Metric	Standard
Length m/ft:	11.8	38.66	0		Range Max km/NM:	8000	4319.65	0	
Diameter m/in:	200	78.8	0		Range Min km/NM:	2000	1079.91	0	
Span	0		0		Speed:				
Weight:	28000	44092	0		Trajectory-Altitude:	Exoatmospheric			

Various Did You Know?

GERMANY— On 02 May 2007, the German Navy took delivery of the fourth Type 212A class submarine (U 34) in Eckernforde, Germany.

UNITED KINGDOM — On 08 June 2007, the first Astute class nuclear-powered attack submarine (SSN) was launched at BAE Systems Shipyard in Barrow.

SOUTH KOREA — On 13 June 2007, the second Republic of Korea Navy (ROKN) Type 214 class submarine (JEONGJI) was launched at Hyundai Heavy Industries (HHI) Shipyard in Ulsan, South Korea.

UNITED STATES — On 23 June 2007, the USS MINNEAPOLIS-ST. PAUL (SSN-708) was decommissioned at Norfolk, Virginia.

From the July 2007 Issue

RUSSIA

Expanding Export Opportunities in the Submarine Market

Press releases in June 2007 by Russia's arms export agency, Rosoboronexport, indicate that Russian-designed submarines may once again be gaining popularity on the international market. Reporting by Rosoboronexport indicates that up to 40 submarines could be exported through 2015, making Russia the largest exporter of submarines in the world over the next decade.

With the end of the Soviet Union in 1990; so went the Russian submarine export market only maintaining historical strongholds in China, India and the Russian Navy itself. However, since 2002, it appears that the latest Russian submarine designs may have again gained popularity on the international market. The mainstays appear to be the Kilo 636 and Amur designs with at least 33 units either delivered, ordered or being negotiated since 2005. The orders and prospective candidates that are known by AMI include the following:

- Eight Kilo 636s ordered by China in 2002, six delivered with the final two in 2007.
- Two Kilo 636s ordered by Algeria in 2006.
- Two Kilo 636s being negotiated with Libya as of mid-2007.
- Five Kilo 636s and four Amurs being negotiated with Venezuela as of mid-2007
- Four Kilo 636s and two Amurs being negotiated with Indonesia as of mid-2007.
- Six Amurs (with VLS) being considered by India.

Russia may also be considering prospects in Iran and Bangladesh.

The recent upswing in exports may be the sorely needed injection that is required to revive the Russian shipbuilding industry. Relatively idle for the past 15 years, only three major naval units have been delivered to the Russian Navy over the past decade, one Borey class SSBN, one Akula class SSN and one Saint Petersburg class SS (Amur is the export version). Since the breakup of the Soviet Union, the shipbuilding industry in Russia has suffered catastrophic losses with a workload that is now non-existant due to critical funding shortfalls in the Russian Navy. Although the Russian sea service has plans for carriers, frigates, corvettes and amphibious ships; it appears that all are progressing extremely slowly due to funding shortfalls with the only program showing appreciable forward momentum being the high priority Borey class nuclear-powered ballistic missile submarine.

A spike in international submarine work is probably just what the doctor ordered for the Russian shipbuilding industry, more specifically in order to maintain its submarine design and construc-

tion capabilities. Surface ship construction is another story with only Sovremenny class cruisers being built for China with several small surface combatants under construction for the Russian Navy as well as the Gephard class corvette for Vietnam.

PAKISTAN

Submarine Selection in 2008

In late June 2007, AMI received information that DCNS would offer the Scorpene class submarine to Pakistan as its candidate for the Pakistani Navy's (PN) Air Independent Propulsion (AIP) Submarine project. DCNS (formerly DCN) originally offered a new Marlin design (based on the Scorpene) to Pakistan in 2006. However, the French Commission on Exports (interminsterielle pour l'Etude des Exportations de Materiels de Guerre) objected to the sale.

Early indications are that the French Exports Commission will not object to the export of the Scorpene design, which was also sold to Pakistan's neighbor, India. Industry sources indicate that Pakistan has requested DCNS to officially submit its design in order to move the program forward in what appears to be a two-candidate race, the Scorpene and ThyssenKrupp's Type 214 design.

Pakistan hopes to move the program along and has expressed an interest in announcing a winner by the end of 2007 although 2008 looks more realistic. Regardless of which design is chosen, Pakistan wants to get the estimated €1.1B (US$1.5B) program underway as soon as possible as the last Agosta 90B has already departed the building ways at Karachi Shipyard and Engineering Works (KSEW) and additional work is needed in order to keep the shipbuilding base intact. Additionally, the sea service desperately wants to replace the two Hashmat class submarines that have been in service since the late 1970s as well as increase the overall size of its Submarine Force as a counter to India, which is also expanding its Submarine Force.

The AIP Submarine project calls for the delivery of three submarines with the first unit entering service in 2013. All three of the submarines will be built at KSEW with highly technical components being provided by the designer.

Politically, it is most likely that India will protest to DCNS if the Scorpene design is chosen by Pakistan. However, the fact remains that France has supplied submarine designs and construction assistance to Pakistan and India; the Agosta 90B to Pakistan of which the last unit will commission by the end of 2007 and in 2006 the Scorpene design to India of which the first Indian-built unit is already under construction at Mazagon Dock in India.

From the August 2007 Issue

BRAZIL

Upgrades for the Submarine Force

In early August 2007, the United States (US) Defense Security Cooperation Agency (DSCA) notified Congress of a potential Foreign Military Sale (FMS) of six Integrated Combat Systems (ICS) for Brazilian submarines along with other related equipment. The total value of the potential sale is estimated to be around US$58M.

The Brazilian Government has requested the sale of five ICSs for the five submarines currently in service with the Brazilian Navy (BN) as well as one ICS for a shorebased training facility. The BN currently operates one Tikuna class submarine (commissioned in 2006) and four Tupi class submarines (commissioned between 1989 and 1999). The ICS is Lockheed Martin's fire control and weapons control suite for the Mk-48 Advanced Technology (AT) torpedo, of which the BN procured 30 units under a separate US$60M contract in 2006.

Other equipment requested by the Brazilian Government include software and systems integration for interface with the Mk-48 AT torpedoes, weapon system software, support equipment, spare and repair parts, publications and technical data, training, contractor engineering and technical support services, and other logistics support.

A final agreement is anticipated by the end of 2007 with delivery of the ICS units taking place by mid-to-late 2008. The sale of the Mk 48 torpedoes and ICS will upgrade existing inventories and improve overall Brazilian anti-submarine (ASW) and anti-surface warfare (ASuW) capabilities to confront future coalition challenges as well as maintaining a regional military balance.

Various Did You Know?

MALAYSIA — On 24 July 2007, the fore and aft sections of the second Royal Malaysian navy (RMN) Scorpene class submarine were joined at Navantia's Cartagena shipyard in Spain.

From the September 2007 Issue

INDIA - Swimmer Delivery Vehicles (SDVs) for Submarine Fleet

In late August 2007, AMI received information that the Indian Navy (IN) was moving forward with plans to acquire four Swimmer Delivery Vehicles (SDVs) under a US$320M program. In July, the IN sent Requests for Proposal (RfP) to the privately owned yard Larsen & Toubro, which designed and tested the new midget submarine in 2006.

The SDVs are around 9 meters (29.5ft) long with a diameter of 1.5 meters (4.9ft) and able to carry up to 250 kilograms (500lbs) of explosive charges. The vehicles will be primarily used for the transport of personnel and equipment from a mother ship to attack targets such as ships at anchor and coastal installations as well as the ability to conduct covert surveillance and attack operations in shallow water. The IN has also levied the requirement that the SDVs be able to operate from its entire fleet of submarines which will consist of the French/Spanish designed Scorpene, the German designed Type 209s and the Russian designed Kilos.

AMIs sources indicate that the internal components and electronic systems for the SDVs will probably be provided by Atlas Elektronik and Zeiss of Germany as well as several Italian companies (possibly Selex and COSMOS).

With the release of the RfP in July 2007, a construction contract could be in place by 2009 with the first unit beginning construction in 2010. All four units are scheduled to be completed five years after the date of contract around 2014.

INDONESIA—Deal Signed for Two Russian Submarines

In early September 2007, AMI received information that Indonesia had finalized a US$1.2B deal with Russia for the procurement of Russian military systems. The package includes the

purchase of 22 helicopters, 20 tanks and two submarines that will be financed through an export credit offer. Circles within Indonesia have previously stated that the financing method offered by Russia (15 year loan at 5.6% interest) was the best available and helped lead to the decision to buy Russian. The September 2007 agreement follows Indonesia's October 2006 announcement to pursue the Russian solution.

In regard to the submarines, the agreement is for the procurement of two Kilo 636 class submarines immediately with options for up to eight additional units over the next fifteen years. The optional units will consist of six additional Kilo 636 and two units of the Amur class for a total procurement of ten units over the long-term. Although the first two Kilos were procured through a credit offer, it is uncertain how the eight follow-on units will be financed. AMI believes that the additional units may also be procured through the same type of arrangements. The Russian Government will probably favor the financing initiatives in order to help the Russian submarine export market. Submarine exports are Russia's strongest suite and extremely important to Russian shipyards.

With a construction contract now in place, both units could be delivered to Indonesia by 2010. The timeline for follow-on units will depend on how flexible Russia is in regards to pricing and financing negotiations. As mentioned earlier, AMI believes that Russia's submarine export market is crucial to the shipbuilding industry and Russia may try to finalize the options portion of the contract as soon as possible to keep the submarine line open.

From Indonesia's perspective, the nation has made it clear over the past several years that it intends on developing several supply chains in order to reduce any future risk due to military embargoes. Under this new policy, South Korea is providing the IN amphibious vessels, the Dutch are providing new corvettes and Russia the future Submarine Force.

RUSSIA—New Submarine Being Developed

In late September 2007, AMI received information that Russia was possibly developing a new type of submarine that can patrol longer than the existing diesel submarines currently in service with

the Russian Navy (Rosiyskiy Voennomorsky Flot—RVF). The internet posting where the information was received has since been terminated, indicating that the information may have been released inadvertently. The posting made mention of Project 20120 along with vague design characteristics, which indicates that the submarine may be similar to the Kilo design. Related information indicates that the city of Sarov official website posted information that the commander of the submarine SAROV had visited the city and quoted the submarine commander as saying "the Chief Commander of the Navy has set the task of finishing work by the end of the year" indicating that the project may be well underway with completion scheduled for December. According to the online posting, SAROV was still at the shipyard in Severodvinsk.

According to the information received, it appears that Project 20120 (SAROV) is similar in design to the Kilo class of submarines (Project 877) with the exception that SAROV displaces approximately 3950 tons versus 3000 tons of the Kilo class. There has also been speculation that Project 20120 is a diesel submarine with a small nuclear reactor as a backup energy sources. However, AMI is skeptical of this and believes that the submarine could possibly be Air Independent Propulsion (AIP) capable vice diesel-nuclear even though the former USSR has in the past experimented with diesel submarines with nuclear backups.

It must be noted that Russia is involved in the development of AIP technologies with Fincantieri of Italy in the joint development of the S1000 submarine design. Russia's Rubin Design Bureau has also developed a liquid oxygen and hydrogen fuel cell AIP system as an option for its latest Kilo models and is available for export.

If in fact the submarine in question has a nuclear reactor, it could be for one of two reasons. The first is that institutional politics could be at play with research being conducted even though there is not much utility for this type of power plant arrangement in the naval arena. Even though the USSR dissolved in 1990, there still appear to be many programs that continue to be funded due to purely political reasons rather than making any fiscal sense. Secondly, it is possible that the diesel-nuclear arrangement could be for commercial use, which Russia has utilized in the past.

It is AMI's assessment that if this submarine is for naval use, it

is more likely an AIP submarine vice a diesel submarine with a nuclear back up. Reporting has indicated that Project 20120 will be capable of remaining underwater for approximately 20 days vice the 4-5 days of conventional diesel submarines, which is indicative of most AIP submarines that are already on the market. Furthermore, constructing an AIP submarine would allow Russia to capitalize on its presence in the diesel submarine export market and allow for Russia to replace the aging Kilo class submarine design as its primary export.

INDIA—Subsurface Version of BrahMos Ready for Submarine Testing

In mid-September 2007, AMI sources provided additional information regarding the press reports discussing India's development of a submarine launched BrahMos missile.

Earlier in the year, India's Defense Research and Development Organization (DRDO), along with Larsen and Toubro, succeeded in launching a submerged missile canister utilizing Nife Life underwater batteries. Indian sources have indicated that the canister launched could have two possible uses; the first being for the Dhanush, solid-fueled missile and the second for the BrahMos missile.

Early indications are that the canister will first be fitted with the Dhanush missile and fired from the Akula class submarine that will be leased from Russia early in 2008 and the missile being launched from the torpedo tubes. Later, when India receives its first ATV or another suitable vertical launch (VL) capable platform, the canister will be used for the BrahMos missile that has been confirmed by industry sources to be VL only in its sub-surface configuration.

Prior to outfitting either the ATV or another VL capable platform, multiple tests will need to be performed on the sub-launched BrahMos. These tests will likely be conducted from either a sub-surface platform (as was the canister test) or from a suitable Russian submarine as there are no VLS capable units currently in Indian naval service. Russian candidates for performing the tests include the OSCAR II and YANKEE Notch SSGNs.

It is likely that the second conventional submarine line, that India is currently receiving bids for, will be the Russian Amur with the hump-back design and ten VL missile tubes as it is probably the only

candidate for this program that has VLS tubes. This unit will be suitable for firing the VL BrahMos and will probably be in service much sooner than the ATV, which is continuing to face production and design difficulties.

In any event, multiple tests will need to be conducted on the submarine-launched VL BrahMos and Dhanush prior to a full rate production and in service contract. It can be anticipated that neither missile will reach full rate production until at least 2012.

Specifications for the BrahMos missile are as follows:

Dimensions					Performance				
	Yakhont		PJ-10(BrahMos)			Yakhont		PJ-10 (BrahMos)	
	Metric	Standard	Metric	Standard		Metric	Standard	Metric	Standard
Length m/ft:	8.4	27.58	8.9	22.64	Range Max km/NM:	300	161.99	290	151.19
Diameter cm/in:	60	23.64	60	23.64	Range Min km/NM:	50	27	50	27.00
Span cm:	140	55.16	140	55.16	Speed:	Mach2.8-2.9		Mach 2.8	
Weight kg/lb:	3000	6613.8	2900	3511.3	Trajectory-Altitude:	Cruise at 14,000m, attack at 5-15m; max altitude 20 km See below			

Specifications for the Dhanush missile are as follows:

Dimensions					Performance				
	Dhanush				Dhanush				
	Metric	Standard	Metric	Standard		Metric	Standard	Metric	Standard
length m/ft:	8.55	28.05			Range Max km/NM:	250	134.99		
Diameter cm/in:	110	43.34			Range Min km/NM:	0			
Span cm/in:	Unk				Speed:				
Weight kg/lb:	4000	8818.4			Trajectory-Altitude				

THE SUBMARINE COMMUNITY

JOHN BORGLUND AND THE LAST WAR PATROL OF USS SALMON SS-182

by TMC(SS) Patrick Meagher USN(Ret.)

TMC(SS) Patrick Meagher USN RET, qualified and served on USS CUSK SS-348, USS ANDREW JACKSON SSBN-619B, and USS BARBEL SS-580. Chief Meagher served on active duty with the Submarine Force from 1960 through 1977. He is a Life Member of USSVI and an Associate Member of USSVWWII.

I was fortunate to be trained by and to have served with a number of our WWII Submariners and in particular John Borglund. Most are gone now. And so I decided to tell his story, and pass on his legacy along with his shipmates onboard USS SALMON SS-182 during her 11th war patrol, to be remembered and honored by our current generation of submariners.

I first heard about the last war patrol of USS SALMON SS-182 (October 1944) and near fatal depth charging from a former member of her crew while I was onboard USS ANDREW JACKSON SSBN-619B. That person was John Borglund. Lt. John Borglund, SC, USN reported onboard ANDREW JACKSON (Blue) during our off-crew period in the fall of 1965. Those of us that first saw him when he reported in at our off-crew office were impressed by the rack of ribbons from WWII service capped off with a Presidential Unit Citation, Silver Dolphins, and a WWII Submarine Combat Pin on his dress blue uniform. John turned out to be a quiet and somewhat reserved Supply Corps officer about five foot seven, older, our guess he was probably in his mid to late 40's, with former enlisted service on submarines. No one onboard ANDREW JACKSON had served with him previously or knew anything about him, however given the impressive display of WWII submarine service decorations he wore on his left breast, we were pretty sure he was a man who drew *deep water*. Those familiar with SSBN off-crew routine know you try to

spend as little time around the off-crew office as possible and for that reason I didn't see much of Mr. Borglund during off-crew. The Storekeepers couldn't tell us much other than he knew his business and was working a couple of special projects for the skipper, CDR Alfred J. Whittle Jr.

Following New Years we flew to Rota, Spain to relieve the Gold Crew after their fourth patrol. Following change of command we moved aboard the boat and continued the upkeep period that had commenced upon arrival. As was the custom for the Weapons Department we were standing port and starboard duties. About a week into the upkeep, on my duty night, I was sitting in the crews mess after the movie, it had to be after 2200 I think, and Mr. Borglund walked into the mess in civilian clothes. We assumed he had been *out the gate* as he was wearing a coat and tie (in Spain during Franco's era, you had to wear a coat and tie ashore after 1800) and had obviously had a few drinks. He pulled a coffee cup from the rack, and drew a cup of coffee, turned to us seated there and asked, "How you guys doing tonight?" Following some small talk, it was obvious he was in a talkative mood, he asked, "Any of you ever hear about the SALMON in WWII?" None of us seated there knew anything about the *old* SALMON although several of us told him we knew about her latest incarnation as USS SALMON SS-573 home ported in San Diego and on the way to receiving the only *Golden* E ever awarded to a submarine. He then asked if we would like to hear about SALMON's last war patrol which of course we did.

John was quite animated as he told us about SALMON's last attack on a tanker on October 30, 1944 off the coast of Kyushu Japan.

What followed was a near fatal depth charge attack that drove SALMON, a thin-skin 250 foot test depth boat, down to nearly 600 feet. Unable to remain submerged due to flooding and damage, John told us SALMON *Battle Surfaced*, manned the deck guns, while the crew below decks started repairs, got the engines started and on propulsion, the ballast tanks blown dry, and the list off the boat. The Japanese escorts apparently didn't see SALMON when she surfaced and she got about a 20 minute reprieve before she was finally spotted. John went on to tell us how SALMON shot it out in a three

hour running gun battle with three Japanese escort vessels. Around midnight one of the escorts headed for SALMON attempting to cut off her escape into a rain squall. SALMON in turn headed directly for the escort and they ended up passing bow to bow about 50 yards apart at a closing rate of over 25 knots. He told us that all the deck guns unloaded on the escort as they passed her by. The 20MM gunner on the sponson forward of the bridge shot the entire drum of sixty rounds of mixed High Explosive, Incendiary, and tracer into the bridge of the escort. The .50 and .30 Cal machine gunners swept the decks of the escort, and the four inch deck gun got off several shots as they passed by. SALMON left the escort astern and smoking and escaped into the rain squall.[1]

SALMON was escorted to Saipan by two American submarines, passed on to the Pearl Harbor Naval Shipyard, and passed on again to the Hunters Point Naval Shipyard in San Francisco where inspectors determined she was too badly damaged to repair. The entire crew was then transferred to the new construction submarine USS STICKLEBACK SS-415 at Mare Island Naval Shipyard.

John told us that about the time SALMON surfaced, most of the crew thought they were going to be killed or captured and the boat sunk. As the Chief Pharmacist Mate he broke out all the medicinal alcohol, you know, the brandy in the little bottles, and passed it out throughout the boat. When the boat finally got to Hunters Point and the crew started to transfer off John realized that the medicinal alcohol was title *B* for accountability and so he just wrote it off as destroyed during the depth charging.

What a story! I had served with a number of WWII submariners in the Steam Torpedo Shop, Submarine Base Pearl Harbor in 1960, and onboard USS CUSK SS-348 in 1961-62. At that time our COB, a Chief Quartermaster, the Chief Engineman, and two First Class Electricians had made war patrols. One of the Electricians by the name of McGee had even served on an S-boat. We would occasionally hear war stories from them, and as a young Non-Qual TM3 on the CUSK, I certainly looked to them as the leaders in tight spots we got into occasionally. Mr. Borglund was no different. Our skipper, CDR. Al Whittle Jr., assigned John as Battle Stations Diving Officer. Not something you would typically do with a Supply Corps officer, however given John's submarine experience, it made perfect

sense. Reports from the battle station planesmen indicated he was an excellent diving officer and never got rattled or excited if things started going bad with depth control during Battle Stations. I left the JACKSON after two more patrols and returned to the Pacific Fleet. I never saw John Borglund again however his story has stayed with me all these years.

In 1988 I purchased John Alden's *The Fleet Submarine in the U. S. Navy, A DESIGN AND CONSTRUCTION HISTORY* and discovered in appendix 6 the actual war damage report of SALMON. I knew the general story about SALMON, however the detailed report of her damage contained in appendix 6 astounded me the first time I read through it. The fact that she survived and came home with her crew is a testament to the strength of those boats and their crews.[2]

In 1993 I met another SALMON sailor, a *Motor Mac*, at a *Skippers Night Dinner* hosted by the USSVWWII San Francisco Chapter. We shared our experiences of sailing with John Borglund on different boats with over 20 years between them. My new friend was quite surprised to learn that John had gone on to a commission in the Supply Corps. Having lost contact with him many years before he was unaware that John had passed away in 1982.

As far as SALMON was concerned, she was decommissioned on September 24, 1945 and stricken from naval records on October 11, 1945 and sold for scrap minus her conning tower. SALMON's conning tower went on to have a key part in Operation Crossroads at Bikini Atoll in 1946 during Test Shot Baker, the shallow underwater burst against a fleet of ships at anchor. The bomb named *Helen of Bikini* was contained in a steel caisson made from SALMON's conning tower and was suspended ninety feet below the hull of LSM-60 for detonation.[3] Quite an ending for a tough old boat!

ENDNOTES:

1. QM1(SS) John Stallings first hand account of SALMON's last dive and subsequent shoot out and escape from the Japanese escort vessels can be found at http://www.subvetpaul.com/Her_last_dive.html. Stallings manned a .30 Cal. Machine gun on the bridge during the shoot out and expended several boxes of ammunition during the engagement. His loader was wounded by Japanese shell fire and was attended to by "Doc" Borglund in the crews mess. Stallings account of events onboard SALMON that day over 60 years ago tells us how those submariners in an extremely bad situation survived.

Editor's Note: It is important to read all of Appendix 6. All submariners have to be prepared to fire extensive, multiple casualties.

2. Appendix 6. WAR DAMAGE REPORT OF THE SALMON contained in John Alden's *The Fleet Submarine in the U. S. Navy, A DESIGN AND CONSTRUCTION HISTORY*, runs over five pages, far too detailed and lengthy to be included in this article. However, a summary of her major damage is in order.

SALMON was going down at a steep angle and passing 300 feet when she was blasted by about 30 depth charges in four separate patterns. At the time of the close depth charge detonations the boat experienced several flexural vibrations. The Captain reported, "The conning tower vibrated up and down so violently I thought the ship was going to shake herself apart." The first two patterns did most of the damage. One or more detonated close aboard or over the engine rooms. This led to the collapse and flooding of the engine air induction piping, flooding of three deck access hatch trunks, and displacement of 7000 gallons of diesel fuel by sea water through a ruptured vent riser for number 7 Fuel Ballast Tank. This made SALMON heavy aft and heavy overall by about 24,000 pounds. The stern planes were jammed on dive due to a shattered stern plane drive shaft coupling and binding of the hand tilting shaft due to pressure hull indentation. There was leakage of sea water from numerous locations in the engine rooms and pump room, and a number of air leaks throughout the boat. All four main engines were partially flooded due to leakage through the engine exhaust systems. Auxiliary power forward and lighting throughout the boat was lost for a short period until electrical breakers were reset by hand.

There were hydraulic leaks throughout the boat which necessitated securing the hydraulic plant until the leaks could be located and fixed, and there was much derangement of equipment in all compartments. The superstructure over the engine rooms was heavily damaged and much wood decking destroyed.

SALMON remained submerged for approximately 17 minutes after the depth charging. During this period the ship control party attempted to regain depth control by blowing Safety Tank and use of emergency speed. Unable to maintain depth control with a 1/3 bell, SALMON descended twice to more than 450 feet. SALMON's descent was finally stopped at approximately 600 feet when the decision was made to blow ballast tanks for a battle surface.

SALMON survived the depth charging due to installation of secondary boiler type *doubler hatches* on the lower end of all three access trunks during her last overhaul. During the depth charging the After Torpedo Room hatch was blown completely open to a 30 degree angle exposing the trunk and the doubler hatch to full submergence pressure (approximately 266 PSI) without leaking. Without the After Torpedo Room doubler hatch, SALMON would have been lost with all hands. In addition, installation of ShipAlt SS137 prevented tripping of the main motors and battery contactors during the depth charging and ensured uninterrupted submerged propulsion. If submerged propulsion had been lost SALMON would have been forced to surface immediately and undoubtedly attacked and sunk by the Japanese escort ships.

Upon surfacing it was discovered that Main Ballast Tank Master Vent Valves for MBT 1 and MBT 2A, 2C, 2E, 2F, 2G, and 2H were jammed open. All were

closed by hand from below decks or topside except for 2A, 2C, and 2E which could not be closed completely. The ballast tanks were blown dry with the Low Pressure Blower after the low pressure volume tank was dewatered, removing the list on the ship. Emergency Vent Valves were slowly closed and the flood gates on the bottom of the tanks were closed as the ballast tanks were emptied.

Through extraordinary efforts of the crew three of four main engines were dewatered, engine inboard exhaust valves opened with chain falls, and three engines started and put on propulsion. Auxiliary electrical power to equipment throughout the boat was restored. Bilge suction strainers were cleared and flooded bilges were pumped. Emergency communications were established, and deck guns manned during the twenty minute reprieve before *Salmon* was spotted by the nearest escort.

3.
www.seawolfproductions.com/shipwreck%20Museum/bikini%20wrecks/bikini/operation_crossroads

SECOND CHANCES: FROM TORPEDOES AND BOMBS

by ENC(SS) (DV) C. Mike Carmody, USN(Ret.)

Editor's Note: Chief Carmody accompanied this article with a note that he wrote this piece fifty-six years ago. He indicated that many WWII submarines went through much more but his intention was to highlight some of the reasons for the tensions and stress with which an ordinary submarine crew had to cope.

During WWII we had many second chances or close calls while serving on submarines. The following stories are about seven torpedo attacks against the two submarines I served on during the war. Fifty-two submarines didn't get a second chance and were lost. Some submarines, like SALMON, BLACKFISH, HALIBUT and BASS, returned so badly damaged, they had to be sent to the scrap pile. Their crews really got a second chance. The seven torpedo attacks I was involved with were all confirmed. Of course, there were many false alarms caused by porpoises or wave crest. Our Captain always said, "Take evasive action, better safe than sorry."

Torpedoes –First Attack

The first enemy torpedo attack took place in early 1942. I was a seaman lookout on the old submarine S-17 (SS122). We were patrolling the Anegada Passage in the Caribbean Sea and saw what appeared to be a fishing boat coming towards us. Unfortunately, we weren't equipped with radar. As we closed within a thousand yards of the target we realized it was a U-boat. We both dove. Once submerged, we fired one torpedo by sound. No detonation was heard. We then distinctly heard the high whining sound of a torpedo passing down our starboard side. German post war records revealed the U-boat we encountered was U-161. They further revealed the U-Boat's captain, Achilles, reported being fired on by another

submarine and he returned fire. The entry was dated March 5, 1942. U-161 was later sunk by a Navy PBY flying boat off the coast of Brazil on September 27, 1943. It was traveling on the surface when it sunk with all hands.

Second Attack

The second attack took place off the Carolina coast, USA, in January 1944. I was assigned to the newly constructed submarine, USS PAMPANITO (SS383). Shortly after completing sea trials we departed from New London Submarine Base, Groton, CT on January 15, 1944. Our destination was Panama. A few days into the voyage we were off the U.S. Carolinas. We were in the same vicinity where another newly constructed submarine, USS DORADO (SS248), was previously lost with all hands. She fell victim to friendly aircraft fire in October 1942.

Post war records revealed that in January 1944 U-boat 214 was operating in the same general area as PAMPANITO. PAMPANITO was running south at flank speed, twenty one knots, during the night. The sea was quite calm for January. The officer of the deck was Lt. Clifford Grommet. The lookouts spotted a torpedo wake approaching PAMPANITO's port side. Lt. Grommet took evasive action and called for full left rudder. He also requested the captain to come to the bridge. The torpedo missed PAMPANITO's bow by a few yards. Our soundman heard the torpedo props, the U-boat blowing its ballast to surface, and ahead away from the area. We sent off a quick radio report of the U-boat's location. Our sharp lookouts and quick evasive actions of Lt. Grommet definitely saved the boat from sure destruction. German post war records confirmed that in July 1944 the British Frigate HMS COOK sank U-boat 214 off th southwest coast of England. All hands were lost.

Third, fourth and fifth attacks

Three torpedo attacks took place off Japan. PAMPANITO's second war patrol, in June 1944, took us to Bungo Suido, Japan's largest submarine base. We were zigzagging in a moderate sea, with a full moon shining. At 0330, June 23rd, Lt. Davis and Gunners mate Tony Hauptmann, sighted a torpedo wake approaching our port side. Left full rudder and flank speed were ordered to parallel the

torpedo's track. Just then a second torpedo passed down our starboard side. The first torpedo detonated about twenty seconds after it passed us. It most likely sank and hit bottom. The captain attributed these misses to the alertness of the lookouts and fact we were zigzagging.

On July 5th we made a submerged attack on a convoy of four ships off the island of Nii Shima, south of Tokyo. A destroyer and very close air cover heavily guarded the ships. A spread of six Mark 18 electric torpedoes was fired at the convoy. Three hits were heard. No observation could be made because of the tight air coverage. The destroyer immediately retaliated by dropping eleven depth charges. They weren't even close, indicating the destroyer had no clue where we were. The soundman heard noises of a ship breaking up. Post war records gave us credit for sinking the TOYOKOWA MARU, a fifty one hundred ton cargo ship.

After sinking the TOYOKOWA MARU our patrol area was changed, taking us to an area off the island of Hachyo Shima. Just before dawn on July 16th a torpedo wake was sighted by lookout Hubert Brown. The officer on deck was Lt. Swain. He ordered an evasive turn to parallel PAMPANITO with the torpedo track. The torpedo narrowly missed us, crossing our bow by three to five yards.

Our Captain preferred to run on the surface at every opportunity. This enabled us to cover a larger area of patrol. A fleet submarine consumed about twenty gallons of fuel per mile when running on four main engines. We always ended up with a fuel shortage when it came time to return to base. Surface runs made the boat more susceptible to attacks by enemy submarines and planes. We certainly received our share of torpedo and bomb attacks.

Sixth Attack

The sixth torpedo attack took place at Exmouth Gulf, Australia. We had just terminated a very exciting and memorable fourth war patrol. We sank two ships with our replacement captain, Mike Fenno, a four striper. He was the hero who spirited the gold and silver bullion out of Corregidor aboard the submarine TROUT. He replaced our regular captain, Pete Summers. Captain Summers was relieved of command due to battle fatigue after completing 10 war patrols. We made a hairy rescue, during a storm, when Chief

Merryman was washed overboard. He was very fortunate to have been saved. We also survived a devastating typhoon named Cobra. Three destroyers were sunk in that storm while coming to the aid of a carrier in distress. A total of 804 destroyer men were lost. When the storm weakened we headed south and crossed the equator.

On Christmas Eve 1944, we entered Lombock Strait, a very dangerous passage between the islands of Bali and Java. Two American submarines were lost in this strait during the war. We had already logged sixteen thousand miles and were at sea for seventy days. At dawn, Christmas day, we entered the Indian Ocean. We were almost completely out of food and extremely low on fuel. We had two more days of travel to locate a secret fueling place in one of the wildest areas of northwestern Australia. It was known as Exmouth Gulf. On December 27th we spotted North West Cape, the entrance to Exmorth Gulf. We entered the channel that led to a small creek where a fuel barge was anchored. Naval convicts manned the barge. Most of our crew were topside when we entered the channel. To our amazement, a torpedo fired from sea, by a Japanese submarine, came parallel to us approximately eighty yards off our port side. It was a bad shot. We watched in awe as it ran aground on the creek's bank. This was the sixth torpedo miss for me. How many more second chances would we get? This completely exposed area was no place to dally. We took on 1,500 gallons of fuel oil and departed Exmouth under the cover of darkness, for our two-day trip to Freemantle, Australia.

Seventh Attack

On our fifth patrol we sank two ships in the Gulf of Siam. Our boat sustained damage. We were directed to Subic Bay, Philippine Islands. We followed the submarine tender, USS GRIFFIN, to Subic Bay on February 12, 1945. The town of Olongapo was still being liberated by U.S. troops. Our boat was the first to be refitted at Subic Bay. While there, we experienced two Japanese air raids per night. We had to maintain three men on topside watch at all times because of Japanese suicide swimmers. One night they blew up an anchored PBY patrol bomber anchored near us. The bomber's crew was sleeping inside when the incident occurred. During the night we

could see Manila being bombed and shelled. It looked like a large fireworks display.

On February 25th we departed Subic Bay to start our sixth war patrol. On this patrol we came the closest to being sunk by an enemy torpedo. We operated between Saigon and Singapore. This was our most boring patrol due to the lack of enemy targets. The only contact we had was with an enemy hospital ship. We had to let it pass unmolested. We sank some mines that were adrift. One surprise we got was when we received a radio message to rendezvous with the submarine SEA ROBIN on March 11th. It seemed our 34 bags of Christmas mail kept missing us. It arrived in Australia just after we left. The SEA ROBIN was elected to find us and deliver the mail. The mail was transferred to us by means of a hi-line between the two submarine. Sixty-eight transfers were made and took all night to complete. The bags were so heavy they all had to be divided in half to prevent them from hitting the water. Food, like fruitcakes, fried chicken and heavy presents caused the weight problem. At dawn we bid farewell to our good mail carrier. The crew was very happy to receive the mail and Christmas presents, even though they were three months late.

On March 25th we entered the Philippine sea and sailed for Saipan. Again, our orders were changed. We were ordered to Wake Island. We were to join three other submarines and ambush a Japanese supply submarine that was bringing supplies to Wake Island. While en-route, we met the submarine SNOOK (SS279). She was heading to her 9th patrol. We exchanged confidential information and departed. That night SNOOK failed to make her daily radio report to Pearl Harbor. She disappeared into the vast sea and her fate was never known. According to Japanese post war records, no enemy action was reported in that area.

The next day Signalman Second Class, Herman Bixler, was on lookout duty when he saw a torpedo wake approaching at an angle towards our stern. To avoid being hit, the officer of the deck rang up flank speed. The torpedo struck our stern and porpoised over the turtle back. The torpedo's warhead pointed skyward and sank stern first in our wake. All hands in the after compartments heard and felt the loud clank. I had just put number three and four engines on line when the torpedo struck. I too, heard the loud bang and felt the boat

jolt. Crewmembers who were aft and not on watch came running forward through the engine room. It certainly was luck that the torpedo failed to detonate. It must have been the glancing blow that prevented it from detonating, or it was a dud. This was PAMPANITO's 6th and closest second chance and my 7th second chance.

On April 16th the submarine SEA OWL radioed us that she had observed a Japanese supply submarine diving in her vicinity. That night, SEA OWL observed the same submarine surface and enter Wake Island via Peacock Point. Before dawn, she fired a spread of three torpedoes into Wake Island's lagoon. She got one hit on the submarine while it was unloading cargo and sank it. The Japanese captain had evaded the four American submarines that were blockading the island. God was definitely on our side. We figured we were living on borrowed time. We wondered if this Japanese submarine might have sunk SNOOK. No one will ever know. We departed Wake Island and pointed our bow north to Pearl Harbor. We then returned to San Francisco for overhaul and refit.■

2008 Submarine History Seminar
6:30 – 9:00 PM 10 April 2008
U. S. Navy Memorial

"Fifty Years Under The Ice"

A historical look at the scientific, strategic and operational aspects of submarine arctic operations.

"ETERNAL SLEEP"
Read at RADM Fluckey's Funeral

I slip beneath the dark blue sea
To keep my country safe and free.
My thoughts drift back to those who dare
To play the seas with loving care.

We took a bit, the ballast won't blow
To the bottom we surely will go.

Deep, deep deeper all the way down
Past test depth we're bottom bound.

Eternal sleep it comes so slow
We did our part so let us go.
Closer to God we're destined to go.

For those who died this very same way
On eternal patrol for us they do say.
The 52 boats they paved the way
Come now to heaven, I'll show you this day.
Where all lost boats are anchored at bay.

A slick of oil upon the sea
That marks the spot where we used to be
Goodbye shipmates, farewell to thee.
I pray some day you'll remember me.

All but gone is this boat of mine.
Guess the Lord said it's our time.

I speak for all that pass this way.
I'm proud to have lived in the USA.

Richard B. Mendelson 1999
United States Submarine Veterans,
Capitol Base

BOOK REVIEWS

AIRCRAFT CARRIERS AT WAR
By Admiral James L. Holloway III, USN (Ret),
Annapolis, Maryland
The Naval Institute Press, 2007, 479 pages,

Reviewed by Rear Admiral William J. Holland, Jr.

Jerry Holland is a frequent contributor to THE SUBMARINE REVIEW and the NAVAL INSTITUTE PROCEEDINGS.

While it may not be apparent from the title why this book would appeal to submariners and their related aficionados and supporters, Admiral Holloway's reflections provide a view from the other community that thinks it operates the capital ship of the Navy. Better than Flight of the Intruder or The Bridges at Toko Ri, arguably the two best fictional works about naval aviation, Admiral Holloway's first person narrative transports one into the exciting feel of flying from an aircraft carrier, on missions over enemy territory, pressing home an attack through heavy anti-aircraft fire. His descriptions reflect a professionalism that all operators can understand and admire. Additionally, Admiral Holloway's descriptions provide those who have not had the opportunity to serve in or visit carriers at sea an opportunity to relate to and an appreciation of the complexity of flight deck operations and the importance of the individuals' skills to the safe execution of those operations.

Three unique aspects recommend the book to a wide variety of readers who are not aviators. The excitement and danger of flying high performance aircraft in a dangerous environment provides every reader with a sense of why fighter/attack pilots see themselves as the closest modern replicas of medieval knights. The eleven-month deployment of USS ESSEX (CV-9) in the Korean War or the 241 days out of port of USS THEODORE ROOSEVELT (CVN-71) in the Indian Ocean serve as markers for those who consider strategic missile patrols the ultimate in prolonged deployment. And his

exploits during repeated tours in the Pentagon demonstrate how important matters are handled there; most by mid-grade officers sometimes with and sometimes without their seniors knowledge or approval. For all readers, this relaxed discussion of the Navy from 1945 through 1990 is akin to having an informal friendly conversation with a wise and experienced senior who lived through it all and relates it interestingly.

In regards to naval aviation, Admiral Holloway was a principal in nearly all the major naval aviation decisions after the Korean War and he relates clearly the background and execution of the various actions taken. Rarely does one get such an intimate and accurate glimpse of how and why decisions are made. Submariners, often accused of *by-the-bookitis* by the ignorant or ill-informed, will appreciate Fighter Squadron Commander Holloway's innovation in creating the Naval Air Training and Operating Procedures (NATOPS); arguably his most significant contribution to the safety and effectiveness of naval aviation. The perseverance of the naval aviation community in its commitment to nuclear power through the abject rejection of both carriers and nuclear power in the McNamara and Carter years is evident. Admiral Rickover's ability to *seize the moment* and his on-the-spot machination with Secretary of Defense McNamara in winning approval to build the carrier NIMITZ is a classic story not related elsewhere.

Admiral Holloway is an admirer of Admiral Rickover. As the OPNAV sponsor for the ENTERPRISE (CVN-65) and her second commanding officer, Admiral Holloway had many direct dealings with the *Kindly Old Gentleman*. Later as Carrier Program Manager for the NIMITZ class on the OPNAV Staff he interacted directly with Admiral Rickover. His relations with Admiral Rickover then and later as Vice Chief and Chief of Naval Operations are described admiringly with good humor though in one episode he does characterize Admiral Rickover as *cantankerous*. He openly admits to the nuclear power program's influence when he, as CNO, established the PCO Ships Engineering Course in Idaho for all officers going to command at sea who had not had a tour in an engineering department or were not nuclear trained. Admiral Holloway poignantly describes the need for such a course by quoting an otherwise respected officer, rejecting the need for such a course saying about

the propulsion plant of his hoped for carrier command, "I don't care...if its rubber bands".

Admiral Holloway's book contains a strong dose of humility for submariners who consider themselves then and now as at the point of the spear. There is no mention of attack submarines or their activities. This may be because of classification but even fleet ballistic missile submarines rate a scant few sentences. In a larger sense however his descriptions reminds us that, as Halsey said, "the fleet is like a poker hand". Every component provides a capability and even nuclear carriers are effective for only a short period without the logistic ships that provide their aviation fuel, ammunition and stores. Not everyone gets a front page; those who are on the front page need to remember what they are there for and who keeps them there; and all officers need a grasp of what the other parts of the fleet do.■

THE SECRET IN BUILDING 26

by

Jim DeBrosse and Colin Burke

Random House; 2005

Reviewed by Captain David G. Smith, USN (Ret.)

The title caught my eye, but then the subtitle really captured my attention: *The untold story of how America broke the final U-Boat Enigma code*. Using information not available to the public until the late 1990's, combined with interviews with numerous participants, the authors present the riveting tale of wartime codebreakers, how their successes enabled U-boat sinkings and the development of the *Bombes* that could decrypt both the German and Japanese communications. In the late 1990's, a change in British declassification policies resulted in a significant number of documents from WWII British Ultra projects appearing at the Public Record Office. This lead to an understanding of how we broke the German code used by Admiral Dönitz.

As with a number of my contemporaries, I graduated from the 101st submarine class in New London in 1955 and upon reporting to HARDHEAD was assigned as Communications and Crypto officer. For the next year, including a special operation off Murmansk, I spent a lot of time manipulating those rotors and rings on the crypto machine. This book presents in great detail the way in which the codebreakers of Washington and London were able to read the German transmissions, encrypted by their four-rotor Enigma machines.

In the early 1920's the Office of Naval Intelligence secretly financed "a series of break-ins at the Japanese consulate in New York City whose scope and daring make the Nixon-era burglary at the Watergate Hotel look like child's play. The entire Japanese fleet codebook was photographed, page-by-page, during repeated undercover operations never detected by the Japanese ..." It was during that time-period that Agnes May Driscoll began a career in codebreaking, eventually becoming the Navy's top cryptanalyst and working in the office of OP20G. Her counterpart in England, at Bletchley Park, was Commander Alastair G. Denniston. When they

met in Washington in August 1941, Denniston offered to share Britain's hard-won expertise but was rejected by Driscoll who was convinced she had already arrived at an old-fashioned paper-and-pencil solution to the German code system, the Enigma. Neither Driscoll, nor her boss (submariner Captain Laurance F. Safford) informed Naval superiors of the rejection—actions that not only were not recorded in Navy records but also "hampered British-American relations for the next four years."

In late 1941, OP20G recognized the limitations of their manual efforts and turned to National Cash Register (NCR) in Dayton, Ohio in order to utilize their expertise in the codebreaking efforts. By the end of 1942, Joseph R. (Joe) Desch, NCR's lead electronic engineer, was selected to head the project—to create electro-mechanical decrypting machines that would be called Bombes.

By mid-1943 the project had employed more than one thousand manufacturing workers and required material and components from thousands of different suppliers. President Roosevelt had given it the highest possible priority, the president's AAA designation. It was then that the Navy took over a 36,800-square-foot building at NCR. Erected just four years earlier, Building 26 (NCR numbered their buildings as they were constructed) was one of the first structures in the country to use steel-reinforced concrete floors. It was strong enough to support the 5,000-pound machines (we now call them computers) that were to be constructed and roomy enough with its 12-foot-high ceilings and wide hallways for moving the massive machines, which stood seven feet high, eight feet long and two feet wide.

Secrecy was paramount. Joe Desch was concerned that the building's name (the alphabet has 26 letters) might give a clue as to his project. Subcontractors could not be told the why of their work, and every effort was made to prevent them from guessing. For example, the number 26 was never used on parts specifications. The manufacturers of the commutators were told to number their contacts from 00 to 25. The cable manufacturers were told to make the cords in 28, not 26, different colors. Even Joe Desch's daughter did not know the nature of his work until after his death in 1987.

March 1943: "As the Spring U-boat offensive opened, the Germans changed some of their codes and tightened up their

procedures so that the Allies were again shut out of the submarine code systems. They remained blind for more than a week during what became the worst month for the Allies in the Battle of the Atlantic. More than twice as many Allied merchant ships (95) went to the bottom in March as in February."

The assassination of Admiral Yamamoto: On April 14, 1943, a Japanese message was intercepted and broken by OP20G, revealing that Admiral Yamamoto would be flying under escort of six fighters planes and would arrive on April 18 for an inspection tour on Ballale, a small island in the Solomons. Henderson Field on Guadalcanal hastily fitted 16 P-38's with long-range fuel tanks for the 1,000 mile round-trip journey. Three Zeros and both bombers were shot down, including the one carrying Yamamoto.

During the summer of 1943, the engineers and technicians at NCR struggled to perfect their machines. "In July the Navy's faith and insistence that Joe Desch could work out the glitches ...paid off, and the early production models began to show that they could do the job. By August, the machines scored their first useful break into Shark (the German code system), within a week of message transmission."

The night of September 11, 1943, Midshipman Torchon stood guard by a railroad siding behind Building 26. He kept watch as six huge wooden crates were rolled into a waiting baggage car. In an interview in 2001 he stated : "All I knew, it was NCR, and I thought they were cash registers. What did we know? Nobody knew—not for fifty years." The train transported its cargo to the Naval Communications Annex near Tenley Circle in Washington, where eventually 120 of the Bombes were operated, around-the-clock, by WAVES. The machines made a deafening noise, whirring and clacking as they raced through the millions of permutations possible on the Enigma machine. The Bombes were prone to sparks and short circuits that ruined decoding runs, and oil leaks that created maintenance nightmares. (The reader must appreciate the present-day computers, in comparing them to an assembly of 120 noisy, 2.5-ton Bombes)

The number and quality of the Bombes increased. "By the summer of 1944, hundreds of submarine messages were being read the same day, some within minutes of their transmission, giving Allied antisubmarine forces a fresh bead on the subs' whereabouts."

"Over the next three months that summer, the percentage of operating U-boats sent to the bottom reached a high of 76 percent." Although the German cryptologists had doubts about the security of their Enigma system, "many in the (German) military believed that the Allies' superior radar was the prime culprit for their U-boat troubles." Changes to Enigma were not implemented.

After the war, NCR missed its chance to get a head-start on the digital age, ignoring the rise of data processing and programmable computing. One of its young executives, Thomas Watson, left the company and started IBM.

On a secret ceremony at the Navy Department in 1947, Joe Desch "was awarded the National Medal of Merit—the highest civilian honor for wartime service—for his work in developing the Bombe." However he did not tell anyone of the nation's gratitude, not even his daughter. "The medal hung in the study of his home, without explanation, until his death in 1987. Two years later, his daughter rummaged through his desk, looking for anything that might help her ten-year-old son with a school assignment to write about his grandfather. She came upon two thick transcripts that she had never bothered to read previously. They were her father's interview with the Smithsonian's historian, dated January 1973. For the first time she understood what he did during the war years. When she contacted the Smithsonian she was referred to NSA. When NSA learned of the content, it was requested that the documents be brought to Fort Meade. After the brief NSA review, she was told: "You realize, of course, I can't let you take these out of the building."

The Secret In Building 26 presents in fascinating, historical detail the efforts of the US and British cryptanalysts in breaking the German and Japanese communication codes during WWII. The authors did a magnificent job of researching the facts and writing this book. The book is significant in that these details remained classified for over 50 years. It is worth the read.■

LOST SUBS: FROM THE HUNLEY TO THE KURSK, THE GREATEST SUBMARINES EVER LOST AND FOUND

by Spencer Dunmore, A Da Capo
Madison Press Book,
1000 Yongge Street, Suite 200, Toronto,
Ontario Canada, M4 2K2,$35

Reviewed By
LCDR Mark R Condeno, PCGA
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The reviewer is the Chief International Affairs Officer of Philippine Coast Guard Auxiliary District Palawan. He holds a BS degree in Architecture from Palawan State University. He is with the Class of 1999-B Philippine Coast Guard Auxiliary Officers Indoctrination Course and Class of 1997 Basic Naval Reserve Officer Training Course. His interest is Naval and Maritime and Military History.

Seven years ago, two different submarines from different timeframes captured world attention: the CSS HUNLEY and the RFS KURSK. The former dating back for over a century was finally found and raised while the latter suffered a fatal accident in the Barents Sea culminating in its sinking with all hands aboard.

In this heavily illustrated account of lost and found submarines, *In Great Waters* author Spencer Dunmore tells the story of these tragic accidents and their subsequent recovery operations. The book is divided into eight chapters respectively. It begins with an introduction by world known Oceanographer, author and Naval Reserve Officer Dr. Robert Ballard.

The opening chapter narrates the development of the submarine from David Bushnell's TURTLE and Robert Fulton's NAUTILUS. It would then take readers into the transformation of the Submarine as a weapon of war. This segment solely focuses on the Confederate States Ship HUNLEY from its beginnings, the attack on the USS HOUSATONIC to the day it was raised off the South Carolina Coasts.

By the 1870's, several improvements and designs were developed, from George Garret's RESURGAM, Simon Lakes's ARGONAUT I to John Holland's design. The advent of World War One put the submarine into a deadly weapon of war by the Germans. The peace that followed covers the loss, rescue, and resurrection of USS SQUALUS (SS-192) and HMS THETIS (N25) in 1939. The submarine rescue equipment developed during the time from the Momsen Lung to the Mcann Rescue Chamber and its operational use are well described. Both submarines would be refurbished, recommissioned and take part in World War Two as USS SAILFISH and HMS THUNDERBOLT.

The lethality of the craft was again proven by the Allied and Axis navies from the Atlantic to the Pacific, from the Mediterranean to the Indian Ocean during the Second World War. Subsequent submarine actions covered in this section are the attack on the Aircraft Carrier HMS COURAGEOUS to Operation Drumbeat to the surrender of the U-boats in 1945. Four pages are devoted to the discovery of the Japanese submarine I-52. Developments of Anti-Submarine Weapons and advances on German Submarine Design on the latter days of the war are also discussed.

The loss, search and discovery of USS SCORPION (SSN-589) form the core of Chapter Seven. The author covers the subject from the day the vessel lost contact to the latest evidence of what might have caused the torpedo warhead explosion. The penultimate chapter captures the saga of the Russian Submarine KURSK during its fatal accident in August 2000. Here, Mr. Dunmore narrates the days of the submarine tragedy from the day of the two massive explosions to its raising in 2001. The illustrations on how the submarine was raised is of importance.

The book is well written and researched. Noteworthy are the vignettes of information from HMAS AE2, to the actions of the USS WAHOO (SS-238) and USS TANG (SS-306) in the Pacific during World War Two to the sinking of the USS THRESHER (SSN-593) and the recovery of the bridge of Israeli Navy Submarine DAKAR in 2000 which was lost in the Med in 1968.

In assessment, apart from its coverage, Lost Subs provides an overview of submarine development and submarine warfare history. The book's gem is its vast array of photos (some of which were

never published before). The underwater images, paintings, diagrams and cutaway illustrations by notable artists are impressive. A bibliography and website list of submarines and submarine associations supplements the book. Lost Subs is a valuable addition in the library of anyone interested in naval and submarine history. The book is recommended.■

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NAVAL SUBMARINE LEAGUE
COMPARATIVE STATEMENT OF ACTIVITIES

For The Year Ended:	31-Mar-06	31-Mar-07
REVENUES		
Contributions	$ 177,320	$ 189,002
Dues	73,432	68,272
Annual Symposium	127,355	130,197
Submch Symposium	272,712	227,000
Bank Interest	101	29
Dividends	37,128	25,897
Advertisements	27,255	13,700
Rent	8,470	8,590
Realized & Unrealized Market Gain (Loss) On Investment	26,028	23,987
Royalties	3,034	3,993
CB Days Receipts	0	29,673
Other	2,633	1,608
Total Revenue	**$ 755,466**	**$ 721,960**
EXPENDITURES		
Awards and Grant	30,357	18,349
Publishing	70,887	76,712
Promotion	54,308	64,624
Annual Symposium	143,625	174,238
Submch Symposium	150,803	144,276
History Symposium	2,762	2,739
Chapter Support	11,729	2,487
Total	464,471	483,425
SUPPORTING SERVICE	199,061	185,735
Total Expenditures	**664,532**	**669,160**
INCREASE (DECREASE) IN NET ASSETS	**$90,934**	**$52,800**
NET ASSETS, BEGINNING OF YEAR	**$ 303,120**	**$ 394,054**
NET ASSETS, END OF YEAR	**$ 394,054**	**$ 446,854**

NAVAL SUBMARINE LEAGUE
COMPARATIVE STATEMENT OF ACTIVITIES

Detail of expenses for Supporting Services in the Statement of Activities follows:

For The Year Ended:	31-Mar-06	31-Mar-07
SUPPORTING SERVICES		
Accounting/auditing	$ 6,312	$ 6,211
Bank Charges	5,733	9,293
Depreciation	8,207	8,155
Equipment rental & repair	18,333	6,176
Miscellaneous	481	
Office Supplies	13,803	7,796
Payroll Taxes	12,474	12,639
Other Taxes	142	32
Postage	6,130	6,749
Printing	644	82
Fees	8,730	9,015
Telephone	2,990	3,180
Transportation	879	1,005
Wages	100,436	95,431
Memberships & Subscriptions	1,061	1,397
Office occupancy	6,041	5,403
Computer install/Training	1,366	6,450
Investment expense	2,385	
Insurance	5,299	4,316
Total	$ 199,861	$ 185,735

NAVAL SUBMARINE LEAGUE
COMPARATIVE STATEMENT OF FINANCIAL POSITION
As of:

	31-Mar-06	31-Mar-07
ASSETS		
CURRENT ASSETS		
Cash	$ 89,409	$ 82,498
Cash Equivalents	26,098	164,744
Accounts Receivable	10,630	35,228
Investments i Market	303,934	355,830
Prepaid Expenses	8,136	6,396
Total Current Assets	638,207	644,096
FIXED ASSETS		
Furniture & Computer Equipment	36,359	36,359
Office Condominium	251,021	251,021
	287,380	287,380
Less Accumulated Depreciation	(127,844)	(145,999)
Total Fixed Assets	149,536	141,381
TOTAL ASSETS	$ 787,741	$ 785,477
LIABILITIES		
CURRENT LIABILITIES		
Accounts Payable	$ 42,407	$ -0-
Accrued Expenses	4,004	4,144
Deferred Income	90,502	66,132
Deferred Membership Dues	69,007	65,653
Rental Deposit	675	675
Total Current Liabilities	206,595	136,624
LONG-TERM LIABILITIES		
Deferred Membership Dues	187,094	201,999
TOTAL LIABILITIES	$ 393,689	$ 338,623
NET ASSETS		
UNRESTRICTED		
Undesignated	372,904	423,704
Board Designated or Equipment	21,150	21,150
RESTRICTED	-0-	-0-
TOTAL NET ASSETS	$ 394,054	$ 446,854
TOTAL LIABILITIES AND NET ASSETS	$ 787,741	$ 785,477

Benefactors for Twenty Years

American Systems Corporation
BAE Systems
BWX Technologies, Inc.
EG&G Technical Services, Inc.
General Dynamics Electric Boat
Kollmorgen Corporation, Electro-Optical Division
Lockheed Martin Corporation
Northrop Grumman Corporation - Newport News
Northrop Grumman Corporation - Sperry Marine Division
Planning Systems Inc.
Raytheon Company
SAIC
The Boeing Company
Thornton D. & Elizabeth S. Hooper Foundation
Treadwell Corporation
Ultra Electronics Ocean Systems Inc.

Benefactors for More Than Ten Years

Alion Science & Technology
AMADIS, Inc.
American Superconductor Corporation
Applied Mathematics, Inc.
Battelle (Returned in 2006)
Booz Allen Hamilton, Inc. (Returned in 2006)
Cortana Corporation
Curtiss-Wright Flow Control Corporation
Custom Hydraulic & Machine, Inc.
Dynamics Research Corporation
General Dynamics - AIS – Maritime Digital Systems
Hamilton Sundstrand Space, Land & Sea
Hydroacoustics, Inc.
L-3 Communications Marine Systems
L-3 Communications Ocean Systems
Marine Mechanical Corporation
Materials Systems Inc.
Northrop Grumman Corporation - Marine Systems
Northrop Grumman Corporation - Oceanic & Naval Systems
Perot Systems
RIX Industries
Rolls Royce Naval Marine Inc.
Sargent Controls & Aerospace

Scot Forge
Sonalysts, Inc.
Systems Planning and Analysis, Inc.
Vehicle Control Technologies, Inc.

Benefactors for More Than Five Years

Burke Consortium, Inc.
Business Resources, Inc
DRS Power Systems
Goodrich Corporation, EPP Division
L-3 Communications Corporation
McAleese & Associates, P. C.
Oil States Industries/Aerospace Products Division
Pacific Fleet Submarine Memorial Association, Inc.
Progeny Systems Corporation
SSS Clutch Company, Inc.
SUPERBOLT, Inc.

Additional Benefactors

Applied Physical Sciences Corporation
Burdeshaw Associates, Ltd.
Cunico Corporation (New in 2007)
Dresser-Rand Company
Drexel International Inc. (New in 2006)
Energy *Solutions*, Inc.
Ettem USA, Inc. (New in 2007)
Foster-Miller, Inc.
IBM Global Business Services, Sector (New in 2006)
L-3 Communications MariPro, Inc.
Lockheed Martin MS2 Homeland Security (New in 2007)
MICROPORE Inc.
Nekton Research, LLC
Nuclear Fuel Services, Inc.
Oceaneering International, Inc. (New in 2007)
OceanWorks International, Inc.
Patriots Landing (New in 2006)
Pinkerton Government Services
Prime Technology, LLC
TSM Corporation (New in 2007)
VeArd Computer Research, Inc. (New in 2007)
Whitney, Bradley & Brown, Inc.
WSI – Internet Marketing (New in 2007)

NAVAL SUBMARINE LEAGUE
2007 Award Winners

JACK N. DARBY AWARD
CDR Jeffrey T. Jablon, USN

FRANK A. LISTER AWARD
CMDCM (SS) William T. Mitchell, Jr., USN

CHARLES A. LOCKWOOD AWARD
LCDR Jasper C. Hartsfield, USN

CHARLES A. LOCKWOOD AWARD
ETC (SS) Nathan J. Russell, USN

CHARLES A. LOCKWOOD AWARD
MM1 (SS) Kirk T. Stafford, USN

FREDERICK B. WARDER AWARD
CMDCM (SS) Christopher Clark, USN

LEVERING SMITH AWARD
LT Jesse L. Hubbart, USN

GOLD DOLPHIN AWARD
CAPT John J. Litherland, USN

SILVER DOLPHIN AWARD
CMDCM (SS) Chris Shannon, USN

DISTINGUISHED CIVILIAN AWARD
Mr. Franklin C. Miller

DISTINGUISHED SUBMARINER AWARD
Submarine Medal of Honor Awardees

2008 REUNIONS

USS FLASHER SSN-613 May 14-18, 2008 Charleston, SC
Loc: Ramada Hotel POC: Tuppy613@aol.com

USS PICKEREL SS-524/SS-177 Sep 1-7, 2008 Fort Worth, TX
Loc: TBD
POC: West- Bill Staab E-mail: BillStaab@aol.com
East- Dick Helm E-mail: subvet66-ss524@yahoo.com

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 Perfect. If possible to do so, accompanying a submission with a 3.5" diskette 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.