THE SUBMARINE REVIEW
OCTOBER 1997

A Quarterly Publication of the Naval Submarine League

THE SUBMARINE REVIEW IS A PUBLICATION
OF THE NAVAL SUBMARINE LEAGUE

NAVAL SUBMARINE LEAGUE • Box 1146 • Annandale, VA 22003
(703) 256-0891 FAX (703) 642-5615 E-Mail: subleague@aol.com

EDITOR'S COMMENTS

Four themes important to the submarine community are treated in the featured articles of this issue of **THE SUBMARINE REVIEW.**

The **potential of the modern nuclear submarine** is portrayed in terms of the Cold War's development of submarine advances and their accomplishments by Admiral Bruce DeMars in his farewell to CAVALLA and his charge to submarine sailors and families. The very real concern for the **continuity of our industrial base** is expressed by Mr. Don Tarquin, President of Sargent Controls and Aerospace, in his discussion of what the Submarine Industrial Base Council is doing about the problem.

The third issue concerns the problems to be faced should a further downsizing of the Strategic Submarine Force take place. Mr. Bill Norris of Sandia Corporation outlines the situation which will arise from a possible START III treaty and the very likely budgetary actions which can be taken as a result. His concern with further downsizing, of course, is **for SSBN Survivability in a small, single-ocean force.**

These three discussions are followed by some advice **on telling the *Submarine Story***, given by Mr. Mac Carey of the Alexis de Tocqueville Institute, an experienced observer and practitioner of Washington communications. There is a lot to be gleaned from these four features and we are indebted to their authors for bringing them to us.

Dr. Fred Milford continues his series on U.S. Navy torpedoes with a description of lightweight and aircraft-delivered torpedoes, and Captain Ralph Enos expands and updates the torpedo saga with some thoughts and concerns on weapons testing based on his experiences as a program manager in BuOrd. Those following **THE SUBMARINE REVIEW**'s compound history of torpedo development and employment should turn to the LETTERS section also for another view of the data by CDR John Alden.

Russian submarining also rates a paired treatment in this issue with a description of the Akula class by Dr. George Sviatov, a retired Captain in the Russian Navy. The quieting of Russian (Soviet) submarines is also discussed in the translation of a piece from a Russian language publication.

The former curator of the Royal Navy's Submarine Museum,

and noted author of many books and articles about British undersea warfare, Commander Richard Compton-Hall, has given us another in his series about RN submariners who won the Victoria Cross, and it is a must read for anyone considering the problems of penetrating a closed harbor. For a completely different slant on *Submarines and Their Effect on History*, do not miss the article by Mr. Jaime Bisher about a World War I scheme to offer a base in the Americas to the Kaiser's U-Boats.

As one can readily appreciate, this magazine is very proud of the articles we can print from the Junior Officers actually out there on the boats and doing the job. The leading piece in the ARTICLE section of this issue is a case in point. Lieutenant Carlson has seen a situation which all operators have discussed at length, but he has attempted to describe it in an even-handed manner and to illustrate what he believes to be specific short-comings in the system and then he has offered some concrete suggestions. Management by Inspection is worth reading and commenting upon its strengths and weaknesses. We look forward to receiving the thoughts on this subject from all those who have ever said *"There must be a better way".*

Jim Hay

FROM THE PRESIDENT

As always there have been many activities effecting the Submarine Force and the Naval Submarine League over the last couple of months. The Appropriations Bill was passed and the President signed it; you, no doubt, saw in the press that he used his line item veto on the MILCON bill but I think not on the Defense Appropriations Bill. I am led to believe that the Submarine Force did relatively well; of course, that does not mean that we got all we either desired or even needed.

SEAWOLF has continued to operate at the high level of capability we expected and even more than most thought possible. On 9 November, a superb three part mini-series will begin on The Learning Channel (TLC) entitled, **SUPERSTRUCTURES OF THE WORLD**. Episode One will be **NUCLEAR SUB** and will feature USS SEAWOLF (SSN 21). Many of us had the opportunity to see the initial screening at the Naval Museum in DC; and it is indeed inspiring, especially for those many people who put their entire energy into the birthing and building of that ship. However, I think all submariners will find the TV show most interesting because the subject is much broader than just one ship. The times and dates for Episode One are: Sunday, November 9, 8-9PM (ET) or 11-12PM(ET); repeated on November 10, 10-11PM (ET) or November 11, 1-2AM (ET).

Admiral Hank Chiles has assumed the position of Chairman of the committee for commemoration of the Submarine One Hundredth Birthday. The events will be planned and orchestrated by the active duty submariners; but we will assist in every way possible. One of our goals is to work closely and fully with the U.S. Submarine Veterans of WWII and the United States Submarine Veterans, Inc. Admiral Bill Smith is communicating with their leadership to ensure we are fully aware of each others desires and abilities.

For those of you interested in the classified symposium at APL, the plans are well under way with the Call for Papers out. The dates for the symposium are May 13 to 15, 1998. Let there be no doubt it will maintain the same high standard which it has established over the 10 years of its existence.

As many of you know, Jim Collins will relieve Jim Hay as the Executive Director of the Naval Submarine League in December. Jim Hay has done a superb job over the last two years as he jumped right in during John Will's illness and continued the dynamic changes John was in the process of instituting. Jim will remain as Editor of **THE SUBMARINE REVIEW**. Jim Collins has stepped right in and the turnover is proceeding well. I expect no diminution in the quality of work we have seen.

Dan Cooper

THE DECOMMISSIONING OF USS CAVALLA (SSN 684)

Remarks by ADM Bruce DeMars, USN(Ret.)
Pearl Harbor 29 August 1997

I am most honored to be your speaker here today. When asked if I would come to this historic submarine base to commemorate this brave boat, it brought back a flood of memories, all good. I am most proud to speak for all the sailors, chiefs, officers and their families and loved ones that have served this gallant vessel for the past three decades.

All of you have served during a momentous period in the history of our country—the Cold War. A war we won. I have a message for you—each and every one of you made a difference in this long struggle. Because of the nature of submarining—everyone is involved; each of you can be proud of your contribution to this historic victory. If you remember nothing else that I say today, remember that—and I want you to tell your children and your grandchildren.

The submarine was the backbone of our enemy's navy and their strategic nuclear force. We countered that submarine force's every move. They were a formidable opponent and it required intense, sustained effort on your part.

As they got quieter, we invented a towed array sonar and changed our tactics. When they went deeper and faster to compensate for lack of stealth, we modified our torpedoes to go deeper and faster—and let them know we did it!

When they deployed to the Mediterranean in the '60s, we followed. When they went to the Indian Ocean in the '70s, we followed. When they went under the Arctic ice pack to escape detection, we increased our Arctic deployments from one sub per year to three or four per year and conducted torpedo exercises under the ice!

The Soviets made the submarine force the centerpiece of their post-World War II naval expansion. But we hounded them unmercifully. They always came out second best. Reacting to the pressure of our Submarine Force, the Soviets had to commit vast resources in the pursuit of undersea superiority, or at least parity. Both goals eluded them. Finally their system went broke financially and politically. You significantly contributed to that victory. CAVALLA was in the forefront of one of the country's most

successful Cold War competitive strategies. This is a hard earned lesson that our island nation should not forget in these uncertain times.

Well, is today's ceremony symbolic of the passing of an era? Are our submarines now a Cold War relic? I think not! The nuclear powered submarine revolutionized naval warfare when it burst upon the scene over four decades ago. That revolution continues under the impetus of fundamental world change. A smaller navy and continued difficulty with foreign basing favors the lower cost mobility of nuclear submarine operations. The proliferation of relatively low cost space-based sensors and precision guided weapons increases the value of the inherently stealthy nuclear submarine. There is a shift away from historic norms for the acceptance of casualties and prisoners. These changes have fostered a new understanding of the economics of stealth warfare and precision weapons. All this favors submarine operations.

We are, whether we fully understand it or not, at one of the historic points in the continuum of submarine warfare evolution. Today is not unlike the post-World War II period some 50 years ago. Then we faced a large dormant Russian Navy. We had a large Submarine Force with no recognized missions and we were at the beginning of a realization of what a new technology—nuclear power—might offer. From those circumstances and with the enlightened support of the entire Navy, came preeminence in submarine warfare and strategic deterrence.

The submarine's long term future is secure because our submarines are virtually undetectable and are relatively inexpensive to operate, due, in large part, to the submarine's traditionally small crew.

Submariners have known for a long time the deadly mix of stealth, audacity and perseverance in the face of seemingly overwhelming odds. On 19 June 1944 the first USS CAVALLA (SS 244) took on an aircraft carrier, two cruisers and three destroyers on her first war patrol. With boldness and great courage she pressed that attack home to 1200 yards and launched six heavyweight torpedoes. Four hit and sank the huge aircraft carrier SHOKAKU. CAVALLA was attacked with over 100 depth charges for three hours but remained secure in the ocean depths. The same ocean that protected the first CAVALLA has for three decades protected this CAVALLA during many perilous missions.

This submarine advantage will only increase with the inexorable march of technology which favors the deep ocean submarine.

This is not to imply that surface forces are obsolete and will be unable to continue their valuable contribution to the protection of the nation's interests worldwide. It is simply a recognition of the ever changing nature of naval warfare. New roles are opening and old roles reopening for the submarine—a warship whose offense to defense ratio remains unmatched.

As all CAVALLA shipmates can attest, the submarine can lurk unthreatened, deep in hostile waters, in disciplined communications, reporting all that's happening and ready to respond with an array of precision weapons effective against land and sea targets. The submarine can remain secure even if the mission is unsuccessful. And the mission need not be carried out under the glare of worldwide media coverage. The submarine margin will only widen in the future. I say to you young submariners here today—the future looks great!

CAVALLA has for three decades performed extraordinary service in the defense of our country—witness the Unit Commendation pennants that fly behind me. She has steamed over three quarters of a million miles, 90 percent of it submerged. This is the equivalent of 30 times around the world. But CAVALLA is an inanimate object only achieving its reputation because of the people who have devoted a significant part of their lives to her operation. In addition to the crews, we must recognize the shipyard designers and constructors, the repair and logistics people, the training and oversight groups and the special operations riders to name a few.

A special recognition goes to the wives and families. You here today are surrogates for many others and I want you to listen carefully because this is heartfelt. Few other branches of our armed services saw such sustained, unrelenting operational service during the long Cold War. The submarine service placed demands upon young wives and families that have rarely been adequately expressed or fully appreciated.

The seagoing Navy has always presented family challenges that differ significantly from the rest of the armed services. But for the submarine wife the critical difference lies in the amount of sea duty, the nature of the extended deployments, and your husband's necessary preoccupation with his profession. You tolerated but never grew used to the long deployments. These were, and remain

the most difficult of separations; totally cut off for months at a time—no messages, no phone calls and no letters. That is the nature of submarine operations. On return home he can never completely get away from the boat. The exigencies of deep submergence and nuclear propulsion, incorporated into the magnificent complex that is a submarine, demand his continued attention. Submarine wives have understood how to balance these competing demands and mold families that are the envy of any group in this country. But I know it was never easy. And so, for CAVALLA wives, past and present, I salute you all. Thank you and God bless you.

Finally, the crews. The bedrock that sustained me during my long naval career was the submarine crews—officers, chiefs and sailors. Those arrayed before you today are typical, remarkable young people—idealistic, industrious and intelligent. We can all be very proud of them.

The crew here today is the end of a long CAVALLA tradition. They are smart and they are tough and they have sacrificed much for their country. Being a submariner is not an easy business—cramped living, absolutely no privacy, hot bunking, everyone stands watch, no idlers, drills, studying, qualification, no mail, bad movies, no fresh vegetables, to mention a few. So why do they do it? Because there is so much satisfaction in belonging to a small, elite group, dependent on one another and engaged in a demanding business that is of great importance to the country.

So it is my proud duty to remember all our CAVALLA shipmates—those here and those not here today. You are all members of a fraternity of only some 2000 men who each, for a period of several years, devoted your very best to CAVALLA and gave her the preeminent reputation she enjoys today—young, hardworking, idealistic men who performed nobly under difficult conditions. We can all be proud. So, on behalf of a grateful nation, I salute each and everyone of you for your faithful service.

God bless you all.

Thank you.■

THE SUBMARINE INDUSTRIAL BASE COUNCIL

by CAPT Donald C. Tarquin, USN(Ret.)

Captain Tarquin is a retired submarine officer who is currently President of Sargent Controls and Co-Chairman of the Submarine Industrial Base Council. He is a member of the Naval Submarine League Board of Directors.

I joined Sargent Controls in January 1991. At that time, the company had a long history, since the early 1950s, of supplying hydraulic hardware for the U.S. nuclear submarines. In January 1991, Sargent Controls had a healthy $40 million backlog which consisted of the final four 688s, two of the last three Tridents and USS SEAWOLF (SSN 21). The future looked bright, since the Navy planned to build several Seawolfs before the turn of the century. The total number was in question at that time; anywhere from 12 to 29 ...enough business to feel secure in my new job.

Then came President Bush's State of the Union address a year later, and suddenly this booming business turned into a disaster overnight. The President announced cancellation of the Seawolf Program with only one ship authorized. Since Sargent was a company with one product line (quiet hydraulic components) and one end user, U.S. Navy submarines, it did not take a brain surgeon to understand the nature and extent of the problem. We could not export—technology too sensitive—and we could not commercialize—there is no market for hydraulic valves that produce a noise level below background! So, I did the only thing I could do—I updated my resume.

As it turned out, there were many other companies that faced the same situation. They are, in general, all manufacturers of submarine-unique equipment and all faced extinction by the President's decision. Without even considering the shipbuilders themselves, **the nation's capability to build submarines also faced extinction.**

With this scenario in place, and out of necessity—not only for individual company survival, but for the survival of a **national resource**—the Submarine Industrial Base Council (SIBC) was founded. To be more exact, the original name was the Submarine Industrial Base Preservation Council (the word *Preservation* was

removed in 1995 after the second and third Seawolfs had been authorized and the New Attack Submarine Program initiated). The initial meeting occurred in April 1992, and we have met annually, each Spring ever since.

The SIBC provides a platform for its members—more than 250 companies nationwide—to tell their unique and individual stories to U.S. policymakers and the American public. The council represents the more than 3,000 businesses, large and small, that make up the nation's submarine industrial base.

This ad hoc organization of contractors and subcontractors that design and manufacture a broad range of components for nuclear submarines educates policymakers about the necessity of preserving the nation's ability to design, build, and maintain submarines—a unique and vital part of the nation's overall defense structure. If Congress had canceled the Seawolf Program, critical technology and industrial capability would have perished.

Operating under the umbrella of the SIBC, individual companies launch joint efforts that reinforce the message that we must not allow short-term considerations to weaken our long-term defense capabilities.

The council serves as a forum for arguing, in practical terms, that continuing to build nuclear submarines is essential to the maintenance of the defense industrial base, and that the cost of terminating or reconstituting those programs exceeds the cost of continuing production.

Council membership is ongoing and open to individuals and companies, including submarine contractors and subcontractors committed to or concerned about the preservation of the submarine industrial base. Member businesses range from the smallest specialty shops to Electric Boat Corporation of General Dynamics, which provides funding for administrative support. All activities are voluntary, there is no membership fee, and expenses are borne by each individual company.

Advancing positions through the news media and interested third parties, the council issues media statements and other documents and encourages dialogue with decision and policy makers.

At the local level, council members in key states and congressional districts serve as spokespersons, meet with the media and public officials, and solicit support from local business and civic

groups.

In short, the SIBC achieves its goals through a program of public policy advocacy, development and distribution of educational and policy materials, and facilitates debate on defense priorities in the post Cold War era. Based on the fact that submarine construction continues, I believe we have been successful in achieving our goals. But, since this will be an issue with each budget before Congress, the need for this organization continues into the future.■

DOLPHIN CARTOON CALENDARS

The 1998 Dolphin Cartoon Calendars are now available. This year marks the 35th Anniversary of the calendar's publication. This special edition is highlighted with two color photographs on the large calendar's cover and a sampling of cartoons on the inside pages of the pocket-sized version.

The talent and humor displayed in the anniversary issue highlights aspects of submarine life ranging from rough seas tribulations to a child's view of Dad's comings and goings. The cartoons continue to be a quirky window into the unique life we all lead as members of the submarine community.

As always, proceeds from calendar sales benefit the 100 sons and daughters of current and former submariners and support personnel who have been selected as Dolphin Scholars. Currently, The Dolphin Scholarship Foundation provides a total of $250,000 in annual assistance to these bright and talented student.

The wall-sized calendars are $5.75 and the pocket-sized calendars are $2.55 which includes shipping. Checks should be payable to Dolphin Calendar Fund and mailed to:

National Calendar Chairman
Dolphin Scholarship Foundation
1683 Dillingham Blvd.
Norfolk Naval Station
Norfolk, VA 23511

START III
Do We Need Bangor?

By CAPT William Norris, USN(Ret.)

Captain Bill Norris is a retired submariner who commanded USS MEMPHIS (SSN 691) and Submarine Squadron THREE. He also served as Chief of the Nuclear Policy Branch, J5, on the Joint Staff. Currently he is a Professional Member of the Technical Staff at Sandia National Laboratories.

Many would argue that worrying about START III is a non-starter since the Russian Duma will never ratify START II. And even if they do, will the U.S. Senate agree to reratify START II with extended *entry-into-force* times promised to the Russians at Helsinki? The present Senate has been very balky about Treaty ratification (e.g., the Chemical Weapons Convention) and may not take kindly to the Administration tinkering with a treaty they had already approved to get the other party to ratify it (and tacitly assuming U.S. Senate ratification). But for argument's sake and to continue the progress down the Arms Control road, let's presume that START II will be ratified by both nations and a START III will be negotiated.

Most insiders are predicting that START III will have a warhead limit of 2000-2500 warheads. It would not be unrealistic to assume that, as in START II, a submarine launched ballistic missile (SLBM) warhead sublimit of one-half of the total, or 1250, will be set. Since the Administration has also set as a requirement for the negotiation of START III, the entry into force of START II, the Nuclear Posture Review (NPR) force level can be expected to be the baseline for the START III force levels.

The options that would generate from this hypothesis are 14, 12 or 10 Trident ballistic missile submarines (SSBN) equipped with the Trident II, D-5 missile. As evidenced by the very premise that half of the treaty weapons will be SLBM warheads, the U.S. places great stock in its survivable systems. Thus the determinants in deciding on SLBM force level will come down to an argument of platform preservation versus dollar savings.

According to the START treaties' language there are only two ways that an SSBN can be made to not count against a nation's warhead limits: either the missile compartment must be cut out or

the missile tubes, their supporting structure, and the superstructure in way of the missile tubes must be removed. Since we have not yet reached entry-into-force of any START treaty, the counting of those SSBN warheads on platforms such as USS KAMEHAMEHA and USS JAMES K. POLK have never been an issue. They will be soon, as they must be deactivated, per the START Conversion or Elimination Protocol, by 5 December 2001 or they will count against the START II accountable weapons numbers. One would be a little naïve to believe the Russians would accede to any excesses in the weapon system they most fear and it also will be very hard for the treaty lawyers to allow the U.S. to convert Tridents to cruise missile launchers from the same or slightly modified tubes as now exist (doubly hard if those missiles also are nuclear capable). In fact, such a proposal would require renegotiation of the Agreed Statements and Conversion and Elimination Protocols of START.

The next thing to examine is where the money shows up to back-fit those Trident I submarines to be converted, as a result of the NPR decisions. The conversions were split to coincide with nominal overhaul planning, two early (2000, 2001) and two late (2004, 2005). Deleting the first two is getting harder every day as the money spent on advance planning and equipment increases. Deleting the second two would be very easy and would represent a significant out-year savings for the budgeteers. Also saved would be the cost of the D-5 missiles for those two boats, a significant windfall to go against the shortfalls in other areas, especially naval aviation. Although there are compelling reasons for the larger force, the decision is probably going to be made above the Navy's level for a force between 10 and 12, based on the savings to be realized in the short term.

So the savings are high. How can the platform preservation issue be waged by the other side in the debate? Since the 1250 warheads sublimit can be met easily with any of the three options, that is not a deciding factor. The total force loading at 10, 12 and 14 varies between about 1200 and 1250 and the daily at sea total in today's nominal patrol cycle varies between about 570 and 650. Those variations are not enough to sway many decision makers.

The NPR, when looking at these matters in 1995, recommended that if only 10 Tridents were selected, then all should be homeported in Kings Bay. That allowed infrastructure savings as well as

platform savings. Since the Secretary of Defense selected the 14 option, that recommendation never came into play. At the lower warhead loading per missile that will result under START II and III, the D-5 missile range approaches the upper half of its capability. That was enough to reach most Russian targets from patrol areas south of the Greenland-Iceland-United Kingdom (GI-UK) Gap.

But the one base recommendation should bother submariners, and anyone else who believes that the survivability of the submarine leg of the Triad should be protected. Since the same range for the D-5 missile allows coverage of targets throughout Russia from the Pacific, the use of a second base does not lessen our ability to hold any Russian target at risk. And there is probably a preponderance of belief among submariners that covert egress from the Bangor base is more likely than at Kings Bay in the face of an increasingly competent submarine foe, not to mention that patrolling in the Pacific far more than doubles the ocean area that must be searched by such a foe.

The second thing we should not lose sight of is that Russia is not and may not be our only threat. The emergence of the growing capability of Chinese nuclear forces cannot be ignored. *(Ed. Note: See "China's Strategic Seapower" in the July '97 SUBMARINE REVIEW.)* They were the last of the five major powers to forego testing. Their national stature is growing with the acquisition of Hong Kong and their forces are operating regularly in waters adjoining the mainland, causing concern amongst their nearby neighbors. They have made subtle suggestions to us about their ability to hold the continental U.S. at risk as a reason for us to watch them less closely.

Our national policy was stated to Congress by this Administration as follows, "A key conclusion of the Administration's National Security Strategy is that 'the United States will retain a triad of strategic nuclear forces sufficient to deter any future hostile foreign leadership with access to strategic nuclear forces from acting against our vital interests and to convince it that seeking a natural advantage would be futile. Therefore, we will continue to maintain nuclear forces of sufficient size and capability to hold at risk a broad range of assets valued by such political and military leaders.'"

While the D-5 range is enough to hold Russian targets at risk

from the Atlantic, it cannot hold all Chinese targets at risk from nominal patrol areas. Therefore, for the same SSBN to be able to continue to hold all sets of targets in both Russia and China at risk, it must be in the Pacific. To sustain such a posture clearly requires a Pacific base, several SSBNs, and hence the longevity of Bangor. This fact remains true even if the force level decision is 10.

Another reason to have the SSBN (or SSBNs) holding Chinese targets at risk in the Pacific is over-flight. To cover any Chinese targets from the Atlantic using a polar route would require the missiles and warheads to over fly Russia, possibly providing the Russians with an ambiguous flight path or indication of attack. Even a *hot line* call might not be sufficient to allay their xenophobic fears or national security concerns. To cover these targets from the Atlantic without over-flight of Russia would require a launch point near the Horn of Africa, preventing the SSBN from holding both Russian and Chinese targets at risk simultaneously.

A fourth benefit of a two base policy is the quality of maintenance. In a nominal patrol cycle, it is much easier for a maintenance facility, such as our Trident Refit Facility, to provide a higher completeness and quality for fewer ships. Second, since with two SSBNs always nominally in overhaul, at least one base, probably Bangor, would be operating below capacity.

With the demise of tenders and the downsizing of the San Diego Submarine Base, Bangor could also support several SSNs and thus provide better services to our Navy brethren on the West Coast as well as security for our SSBNs. Also, just as in the SSBN case, this would preclude home porting all our SSN assets in the Pacific in one port, providing both better security and maintenance for our SSN forces.

So, yes we do need Bangor. Continuing to base SSBNs in Bangor makes infinite sense and should more than justify the sunk costs to date, as well as those necessary to make it D-5 capable.■

THE SUBMARINE MESSAGE

by Merrick Carey
Alexis de Tocqueville Institution

Merrick Carey is President of the Alexis de Tocqueville Institution and a former senior aide to Congressmen Jack Kemp and Jim Courter. He also served seven years in the Navy Reserve, including active duties as a FOSIC Watch Officer for CINCUSNAVEUR and as an Air Intelligence Officer for Operation Decisive Edge over Bosnia.

I spent much of the 1980s as a congressional aide to two popular Republican legislators who believed strongly in President Reagan's efforts to rebuild the nation's defenses. Working on Capitol Hill doesn't always expose one to the most uplifting features of human nature, but it is just about the best education available in American political culture and process. Since my job often involved dealing with the press, I received daily lessons in how messages should and should not be communicated in our political system. Some of these insights have direct relevance to the current status and future outlook for the Navy's Submarine Force. In this essay, I would like to suggest what general themes are likely to be most successful on Capitol Hill and with the general public in creating a positive environment for the always difficult deliberations on submarine funding.

The Congressional Context

The first thing to understand about what it means to be a Member of Congress is that there is never enough time. Not enough time to become conversant on the issues, not enough time to build coalitions, not enough time to meet with constituents. The number of voters, activists, lobbyists, contributors and so on who want to meet with you is always more than your schedule can accommodate. And the array of issues you are expected to vote on is always beyond the capacity of any normal person to keep up with, ranging from farm policy to foreign policy, from warfare to welfare. Worst of all, your two priorities—doing your job well and getting reelected—often seem to be in conflict. If you don't spend enough time campaigning, fundraising, and meeting with

constituents, you may not be reelected. But most of the time spent on those activities must be subtracted from the time available for becoming knowledgeable on the issues (unless an issue has particular political salience in your home state or district).

Given such tradeoffs, it is not surprising that most legislators' schedules become a daily exercise in triage, trying to determine which people and issues most urgently require attention. The people and issues that don't fall into that category must either be deferred, delegated to staffers, or resolved on an intuitive basis. As a result, even on the most important votes it is seldom the case that more than a handful of Senators or Representatives grasp all the intricacies and nuances of pending legislation. The majority must be content to understand the broad outlines and follow party or caucus leaders in casting their votes.

Lobbyists and activists who work the Hill on a regular basis understand the tremendous pressures of public life, and are skilled in making their points quickly and convincingly. One of the most common tools is the *elevator speech*, an enumeration of key points so succinct that it can be conveyed to a legislator during the brief time he or she is in an elevator moving between floors. That may be the only time a lobbyist gets to make a case for some program or policy. Since congressional office buildings only have five or six floors, the elevator speech must be very concise indeed. But experienced lobbyists know that in thirty seconds, the right theme can significantly influence a legislator's view of an issue. It may be a specific fact the legislator has never heard, or a novel way of thinking about an issue. On arcane subjects such as antisubmarine warfare, that thirty seconds may be the first thing he or she heard on the subject all month. The same dynamic often applies to journalists and average citizens, who may be willing to listen for no more than a few seconds. The typical *sound-bite* on network news programs seldom exceeds twenty seconds.

A Submarine *Elevator Speech*

Submarines need an elevator speech. They need a concise series of themes that can quickly convey why submarines are critical to our nation's security. The context of those themes must be very general—easy to understand and easy to embrace—because most Members of Congress, like most members of the press and the

broader public, have little experience or interaction with the military. Even among the minority of legislators and opinion leaders who are broadly knowledgeable about military affairs, relatively few will have a detailed knowledge of undersea warfare.

My guess is that only about five percent of Congress—maybe two dozen legislators—can legitimately be termed knowledgeable about submarines. You need ten times that number to get to a slim majority. The number of journalists reporting in the national media who know subs is probably even lower. That means that the themes used to try to influence most prospective supporters must be very general—so general that practitioners steeped in the intricacies and lore of submarines may have difficulty taking them seriously. But the purpose of an *elevator speech* is not to preach to the converted; it is supposed to win over the vast majority of people who think they don't care. To be effective, the themes must be so accessible that people who know virtually nothing about submarines can grasp and like them.

Submariners have a hard time framing such themes for one simple reason: like all professionals, they know and love their jobs too well. After a few years of duty, submariners become so immersed in the technical language and operational challenges of undersea warfare that the prosaic way in which outsiders think about subs seems unbearably simple-minded. The same sort of professional culture has evolved among specialists in other fields, whether they be doctors or lawyers, astrophysicists or clergymen. In the case of submariners, though, professionalism can become a barrier to communication with other members of a body politic whose support they desperately need. When the scale of a profession shrinks by half in little more than a decade, as the Quadrennial Defense Review apparently portends for the attack-sub force, it is a clear indication that a dramatically expanded public outreach program is needed. The Silent Service seems to have learned the lesson that, as LCDR Michael Baumgartner observed in the January 1993 issue of **THE SUBMARINE REVIEW**, "Silence Is Not Golden." In recent years, the submarine community and ONI have produced a number of excellent briefings that persuasively make the case for a robust Submarine Force. Several contractors, most notably Electric Boat and Lockheed Martin, have also done a very good job of conveying key support themes in their advertising. But, to be successful an *elevator speech* needs to be

repeated over and over again to various audiences, and their willingness to listen carefully or for any length of time cannot be assumed. Thus, there must be agreement on a few simple themes. What should they be?

What Is the Message?

For reasons that I will shortly explain, I believe that four themes should be the core of the submarine community's outreach efforts. Those themes are:

- Submarines are stealthy.
- Submarines are versatile.
- Submarines are a bargain.
- Submarines are essential.

Sounds pretty simple-minded, right? Well, that's the point. Every one of these themes is understandable to a non-expert, every one is positive, and every one can lead to a broader discussion of submarine virtues if the audience is so inclined. Let me briefly explain why these four themes are the most persuasive.

Submarines are stealthy. This theme is really a shorthand way of saying that modern attack-subs are high-tech—that they are an unparalleled integration of numerous advanced innovations into a unified, effective machine of war. Simply saying subs are *high-tech* is too nebulous and trivializing to influence perceptions, but referring to stealth invokes a mystique so powerful that a major automobile company appropriated the term as a name for one of its sleek sports cars. Any system that is stealthy is by definition high-tech, but in an intangible way that has been shaped by the popular media, it is also much more. It is something really special. Focusing on stealth also directs the audience's attention to the fact that submarines are the Navy's most survivable weapons platform, a feature well-attuned to the on-going revolution in military technology and operations.

Submarines are versatile. This theme is important because most Members of Congress and the media probably associate submarines with a handful a traditional missions such as nuclear deterrence and control of the sea lanes. That's not necessarily bad if legislators understand the enduring importance of these missions. But some audiences will inevitably regard them as Cold War missions that are losing their relevance. Given the predominant

thrust of Navy and Marine Corps doctrinal pronouncements toward littoral warfare, it is important to be able to articulate a role for submarines in coastal and land conflicts. The versatility theme does this by raising the numerous littoral application of subs such as mine operations, reconnaissance, precision strike and special-operation's force insertion. It is important for audiences to understand that submarines are the only survivable warships that can be covertly deployed to littoral areas of operation and assist in the preparation of the battlespace from the first moments of hostilities. Many legislators and journalists are unaware of this major selling point.

Submarines are a bargain. At over a $1 billion each, nuclear-powered submarines may not seem cheap by everyday standards, but their combination of stealth, versatility, range and autonomy will make them the best warfighting bargain the Navy can find in the years ahead. Moreover, most legislators and journalists have no idea how minuscule a portion of the federal budget is consumed by submarine acquisition and operations. Because of the myopic way in which some national media cover procurement programs such as SEAWOLF, a portion of the body politic undoubtedly has a greatly exaggerated notion of the claim that subs exert on federal resources. The entire acquisition cost of thirty New Attack Submarines will be about $50 billion spaced out over several decades. The federal government spends that much on Medicaid every six months; WalMart does about that much business in the same amount of time. When the program is put in these terms, it is clear that in the context of a $1.7 trillion federal budget and an $8 trillion economy, subs really are pretty cheap.

Submarines are essential. This is the requirements part of the message, the part that asserts a pressing need for submarines. In military circles a requirements discussion normally would precede an exchange on cost or characteristics. But in talking to non-military audiences it probably is better to first make the case that subs are stealthy, versatile and inexpensive before proceeding to the climactic point, which is that trends in the threat create a clear need for a robust Submarine Force **today**. In the current environment it is probably more convincing to base such threat assessments on technological trends such as the proliferation of reconnaissance satellites and diesel-electric subs rather than attaching the threat to a particular country. Discussions of the Russian or

Chinese or Iranian *threat* are too easily diverted into unresolvable debates over intentions. It is better to use Iranian Kilo purchases or Chinese maritime claims as examples of a broader trend that justifies preservation of robust submarine forces—a trend that demonstrates the end of the Cold War was neither the end of history nor a turning point in human nature.

Conclusion

Clearly there are other themes that are more complex or challenging that can be easily invoked in any discussion of undersea warfare programs and requirements. But the first step in any communications strategy is to get the attention of the intended audience, so it is important not to overestimate that audience's enthusiasm for the subject. My advice is to start at sea level with the most important, the most positive, and the most accessible themes. If they are still listening, you can always dive deeper into wake-homing torpedoes, photonic masts, or whatever. But don't ever lose sight of your basic goal: to persuade policymakers that submarines are a bargain because they are survivable, versatile, inexpensive and essential to American security in the next century.■

WORLD WIDE WEB FOR NSL

The Naval Submarine League now has its own home page.
Please join us at:

www.navalsubleague.com

Comments are always welcomed.

MANAGEMENT BY INSPECTION

by LT William E. Carlson, USN

Lieutenant Carlson's article won The Naval Submarine League Essay Prize for Submarine Officer Advanced Course.

Onboard ship, a division conducts training on casualty procedures for a critical piece of gear. The petty officer conducting the lesson shows the sailors the best way to perform the task, and then shows them a different method, explaining "the inspectors like to see it this way, so make sure you do this whenever they are looking".

In a submarine tactics class for junior officers, the instructor teaches the required subject matter and NWP guidance, but then adds "but the TRE team will look for this".

During a crew certification, a ship is downgraded on a procedure they thought they had performed in accordance with the instruction. When questioned, the inspector admits the method used was within the boundaries of the guidance, but that it was "not the way I'm used to doing it".

Anyone who has served in the Submarine Force for more than a few hours recognizes these examples. There seems to be a certain dichotomy of thinking: normal operations, and the inspection. SSBN's call their cycles ORSE and TRE patrols. Crews train on what the inspectors are *looking for*, and run the latest drills from other ship's exams. We improve our level of knowledge based on deficient areas of the last round of inspections, and skew our training plans accordingly. We accept these methods as normal, part of a proven record of success.

But what kind of success have we achieved? Are we adept at warfighting, or filling out checklists? Can we adapt in rapidly changing battle situations, or do we just conform to the latest set of lessons learned? Will we be ready when Murphy's law asserts itself, or fall apart because it was not part of a well rehearsed and practiced scenario? As our force structure shrinks, and we commit ourselves to missions that will likely involve non-traditional adversaries, it is high time the Submarine Force takes a hard look at its devotion to the inspection as a means of management.

Management by Inspection

To take advantage of the inspection mentality, many commands have adopted a principle I call *Management by Inspection*, or MBI. Simply put, MBI involves centering all actions around performing well on the next exam cycle. Some ships follow it wholesale, while others just in part. A master checklist can be used that specifies what to do and when to do it, incorporating lessons learned, recent deficiencies and command preferences. Such a checklist could be provided by higher authority; if not, units generate their own. As soon as the inspection concludes, the checklist for the next inspection is pulled out and the cycle repeats. If the checklist is well thought out and religiously followed, things usually go well; if not, the laundry list of deficiencies is examined, and the checklist is upgraded to eliminate the weaknesses. With MBI, the next inspection determines everything from how many and what kind of drills to run to watchbill assignments and whether extra underway time is needed.

The reason for the widespread use of MBI is not a mystery: it produces results. Forty years of nuclear powered ships with no reactor accidents; guns hit their targets; planes land on carriers; adherence to higher authority directives is checked and maintained. Checklists have allowed us to perform complicated procedures without getting lost in the process, and provide operators with straightforward instructions for their gear. There are of course the occasional glitches, but these are few and far between considering the dangerous nature and awesome complexity of running a modern Navy. It is no surprise then that some ships simply coordinate operations, port calls, manning requests, inventories and all manner of paperwork around being ready for the next exam cycle.

A more subtle reason for the popularity of MBI is the fact that *we inspect everything*. TRE, crew certification, INSURV, ORSE, admin inspections, NTPI: MBI provides a structure to handle the myriad rules and vastly different requirements of these exams. MBI provides a straightforward method: each inspection has its own checklist, common deficiencies and routines of examination. To succeed, commands can simply *train* for the inspection, focusing on running the **right** drills, conducting and documenting required training, and beefing up level of knowledge according to the last set of published deficiencies.

MBI works because the exam structure is known; when each event occurs, how long it should take, what order, etc. We even go so far as to practice the exam itself, giving ourselves a *mini ORSE* or *practice TRE*. We have become experts in both giving *and* taking exams. The coveted Battle E goes to those that do it best, and medals and commendations to those that help get us there. The resulting message, intentional or not, is clear: MBI equals success.

The Advantages of Inspections and MBI

Why use inspections in the first place? What is gained? The answers are very simple:

Ensure compliance. Whether it is operation of a reactor plant or how service records are maintained, the inspection allows higher authority the opportunity to make sure its guidelines are followed. If a checklist is published, it becomes even simpler, since both examiner and examinee are using the same scorecard. MBI assists in this goal as well, since commands can gear their efforts toward showing and documenting compliance with higher authority directives.

Uniformity. In the Submarine Force, the inspection has been widely used both formally and informally to ensure uniform standards and practices. If a type commander wants business conducted in a certain way, the inspection team need only begin focusing in those areas; the word will get around fast about the new *gouge*, and ships will scramble to ensure they are up to speed. Additionally, the use of an officially promulgated checklist within a governing instruction can help by providing a standardized list of requirements, thus helping to ensure commands are looking at the same things. The more precise the checklist, the more specific the conformity. Again, the MBI method also drives commands towards meeting these standards, real or perceived, in order to do well.

Documentation. In the case of ensuring statutory compliance, such as with radiological controls or funds management, the inspection is a key means of reporting and documenting adherence to requirements. The inspection can be used to document required monitoring and adherence to required standards and to illustrate proactive self evaluation.

It is an alluring package. Higher authority gets the uniformity and compliance it desires, and is able to use the results as evidence that statutory requirements are being met. Use of MBI at the command level means self monitoring efforts will focus on meeting those requirements, with equal concern for providing a written record they were met.

Predictability. Outside the occasional surprise exam, most ships generally know when their next inspection will be. They can then plan accordingly, running the necessary drills and prepping their paperwork. The crew has a goal to shoot for, and has a deadline for getting its act together. More importantly, the known timeline allows for a week-by-week, ___ *days until the inspection* checklist, so that every effort and review can be choreographed to the last detail. The checklist's main utility in inspection preparation is predictability.

The Price of MBI

Despite these apparent advantages, Management by Inspection is no panacea. There can be significant drawbacks to overuse of such a method:

Tunnel vision. The first problem with MBI is precisely what its name implies: the tendency to operate around an exam cycle instead of tailoring efforts towards what actually may be needed. The most obvious question: do other areas of readiness suffer when one area alone becomes the focus? If such efforts are used to correct noted weaknesses, it makes sense; but it is unlikely that deficiencies rotate around a set schedule.

Just because the ORSE is the next exam, does it follow that only engineering drills need to be run? If engineering casualties are a viable part of a ship's overall readiness should they not be run during a TRE? Does a ship's drill and training program reflect the level of knowledge and operational deficiencies of *that ship*, or does it only reflect what everybody else is doing? The use of MBI can sometimes make the mission seem like an obstacle, just another hurdle to clear so we can get to the next inspection.

Overzealous use of MBI leads a ship to focus on the latest *gouge* instead of focusing on its overall needs, especially if it wants to do well in the exam. If not careful, commands may inhibit proactive identification of their deficiencies in favor of being ready

for the *likely scenario*. Such actions can hardly be blamed; professional reputations live and die on inspection grades. Such is the reality of the inspection system.

False Results. The obvious question surrounding scheduled inspections is to what degree actual preparedness is being measured. The logic goes that a ship that does well on an exam is, by definition, probably doing well when not being inspected. Certain *trip wires* are examined to determine if closer scrutiny is needed, allowing inspectors to cover a lot of ground in a short time. But are such results valid? Just because a ship does well on ORSE, is it because the ship is proficient at running an inspection, or proficient in engineering? Management by Inspection definitely assists in the former, but in no way guarantees the latter.

The Heisenberg Uncertainty Principle applies: the mere observation of an event changes that event. Inspectors never see the actual level of readiness because the ship knows it is being looked at, and prepares accordingly; this is no secret. While pure observation is impossible, the present system falls far short of providing a true snapshot of day-to-day operations by giving a ship months of advance notice.

Creating the double standard. MBI may be good for passing exams, but it has serious disadvantages. Unless a ship is careful, it can teach its crew that things are done for the inspection and the inspection only. If a sailor is told over and over to do something because the TRE team wants to see it and not because it is the right thing to do, will he do it when the team in not onboard? What motivation has he been given to do it this certain way? Does the method have any validity beyond the inspection? Crews that train for the inspection can easily create a difference between their perceived *normal* operations and the expected behavior for an exam.

The inspectors themselves have a huge impact on generating this difference. We may read the NWP and get squadron's opinion on the meaning, but when it comes down to the wire, we concern ourselves with what the inspectors want to see. In a perfect world, this should be the same as what the published standards are, but it is often not the case. It is not uncommon to argue a point on an inspection only to find out the inspector was going off *old boat knowledge* vice the current guidance. If the inspectors are well versed in the guidance, it minimizes such problems, but what if

there is room for interpretation? Is the ship graded on *in situ* application, or against what the inspector likes? Does the team take time to teach the crew the proper way and the *whys and hows* behind it, or just drop off a list of hits and leave?

Solutions and Alternatives

As has been discussed, the current inspection system has many advantages for dealing with the complex business of operating a modern Submarine Force. But there are many ways we can improve the system, and help it to work for us.

Assist vice inspect. There is no argument that the inspection teams that run the exams are experts in their areas. But why not put that knowledge to work for the ships, rather than in some adversarial situation? Inspection teams see a wide variety of methods from ship to ship in solving problems common to all units. They are in a unique position to see what works and what does not; they are in an equally unique position to pass this knowledge directly on to the fleet. Instead of waiting until the debrief to find out our deficiencies, let the teams work with the ship *as the inspection happens*, pointing out the good as well as the bad. What have other ships done that made this better? Is the ship doing something the rest of the fleet could benefit from? The team could then brief the squadron, allowing a single point of dissemination of the latest trends, both good and bad. Boats could still receive a grade, but would have received invaluable training from the fleet experts in the areas of importance. Innovative inspectors have done this for years; it is time to make it standard practice.

Abolish the double standard. The tendency to train for the inspection is not only wasteful, it can be dangerous. When USS STARK was hit by two Exocet missiles in May 1987, it was generally blamed on confusion in CIC, failure to inform the CO of important data and a failure of a few key officers to recognize a dangerous situation. But less advertised is that the ship had just completed a full day's worth of engineering drills—even though it was enroute to an area of mines, contested airspace and a hot war between Iran and Iraq. Rather than resting the crew or running scenarios that mirrored the mission at hand, STARK was training for their upcoming OPPE, or Operational Propulsion Plant Evaluation. In other words, training for the inspection, not the

mission. Devotion to MBI, while not the primary cause of this tragedy, certainly contributed to a lower awareness to potential danger.

Inspections must begin to focus on what the ship will actually be doing in its mission as well as in battle; proficiency in one does not mean adequacy in the other. Is it really likely that an SSBN will need to be well versed in a post SIOP role? Is it heresy to state that it would be a better use of inspection time to ensure it can do its primary mission, and not focus on such an unlikely scenario? Such an approach is being contemplated presently; it should be implemented immediately.

Randomize Exams. Inspections must abandon *gouge* in favor of frequently rotated scenarios. Ships could be given a standard list of drills and evolutions, which could be changed as common weaknesses are identified. Random exam cycles, coupled with random scenarios, would give commands less of a motive to plan for the next inspection by focusing on *gouge* and more on their total readiness. Not knowing when the next exam would come would force commands to find ways of monitoring their performance at *all* levels on a consistent basis. The type commander should then task group commanders with coming up with generalized standards that recognize this goal of overall readiness; exam grading would be geared to recognize such readiness, instead of the ability to make slick binders and pretty displays. More importantly, random exams would give the type commander a truer measure of how the ship performs, vice how it performs after horsing itself up and performing *battlestations field day* to get ready. Such a system would retain the type commander's ability to re-focus the fleet when and where ready.

Reduced the exam burden. Our current cycle of exams requires, on average, one major inspection per area per year. SSBN cycles, even though reduced in length, still provide ample time to prepare for such a schedule; the same is not true for the fast attack fleet. The continued reduction in numbers of subs, the pressure to maintain current mission tasking, and the commitment to a 50 percent *pers* tempo has resulted in less and less operational time in already limited schedules. A recent innovation in submarine operating schedules now allows one POM training and certification cycle to cover two overseas deployments, in order to allow more underway time to be devoted to mission coverage.

Such a system could be easily adopted for inspections. A relaxing of the ORSE and TRE exam cycles to 18 months would fold directly into this new model allowing for extended mission tasking as well as the proposed three crew/two submarine rotation cycle, should it be adopted.

Provide clear standards. One of the most frustrating elements of an inspection is predicting how the inspectors will interpret guidelines and standards. We have all heard of, or been part of, arguments with inspectors as to what means what and if the guidance means one thing or another. Why should the debrief be the first time we hear how the inspection team interprets the NWP? Why do Sub School instructors have to speculate about what the TRE team wants to see, especially since this often changes? It makes even less sense that this information is obtained second hand from debriefs and exam results; why not let the teams inform training centers directly when information becomes important? By not making expected standards and lessons public as soon as possible, the inspection system merely delays their distribution.

This is not to say that higher authority must explain every detail of every facet of operations. But where there has been a clear misinterpretation, or where multiple interpretations exist, a clear explanation is prudent. As stated earlier, the inspection teams are in a unique position to identify such situations and provide immediate feedback to the ships, as well as to the parent Group and Squadrons so that other ships may learn. Such a method still allows ships to experiment with different methods, test their utility, and then pass along that knowledge to the fleet via the exam board.

Summary

The CO of my last ship shocked us all when he came into the wardroom for officer's call and announced that were to conduct all business from now on as if we were going to war. No TRE run, no ORSE patrol—all aspects of operations were to be evaluated for preparedness for battle. We were skeptical at first, until we saw just how different we had to view our efforts. Did we really need to run another loss of Engine Room Fresh Water, or was figuring out how to run welding cables to likely problem areas more important? Practice TMA, or ensure we could assign trackers to every trace? How could we sustain battlestations for a week? How

would our mission be affected by the loss of critical gear, not for an hour, but for a week? For many of us, it was the first time we had truly faced how we would operate, continuously, at war. No inspection had ever prepared us for our duties in such a manner. The present system still cannot.

The fact that such an approach seemed so innovative should sound alarm bells; training for war should not be a novelty. The inspection model and the mentality that it engenders represents a disproportionate percentage of the energy spent by the Submarine Force, robbing us of valuable time and energy needed to focus on ever increasing mission requirements. Are adversarial *us against them* inspections necessary for a well prepared and battle ready fleet? Maybe so, but they soon may become a luxury we can no longer afford. It is time we re-think our devotion to Management by Inspection, and take the next step toward managing what will soon become the smallest Submarine Force we have had in 50 years.■

IN MEMORIAM

LCDR George E. Brown, USNR(Ret.)

CDR H. Collins Embry, USN(Ret.)

LCDR Everett W. Faith, USN(Ret.)

CAPT Harold S. Lewis, USN(Ret.)

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, accompaning a submission with a 3.5" diskette is of significant assistance in that process. The content of articles is of first importance in their selection for the **REVIEW**. 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. Annually, three articles are selected for special recognition and an honorarium of up to $400.00 will be awarded to the authors. **Articles accepted for publication in the REVIEW become the property of the Naval Submarine League.** The views expressed by the authors are their own and are not to be construed to be those of the Naval Submarine League. In those instances where the NSL has taken and published an official position or view, specific reference to that fact will accompany the article.

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

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

MIDGETS AND THE MONSTER (1943)

by CDR R. Compton-Hall MBE, RN(Ret.)

The Victoria Cross, Britain's highest military award, has been won by a total of 14 Royal Navy submariners in both world wars: four of them operated in X and XE-craft—midget submarines. The VC, a bronze cross simply inscribed For Valour, compares with the Congressional Medal of Honor. This is Part 4 of an eight-part series on British submariner VCs.

The memory of General George Washington, Commander-in-Chief of colonial forces from 1775, is rightly revered; but he should be offered two more posthumous credits—one unfamiliar outside the United States, and the other seldom recognised within.

First, George Washington succeeded in beating the British despite his suffering from a raging toothache in battle: by 1776 he retained but one tooth of his own—a lower premolar which lasted him, solitarily, to the age of 64. Before that, though, he resorted to spring-loaded dentures, like a rat-trap in reverse. (Created for $15 a set by Mr. Greenwood, dental practitioner of New York, four doors down from the theatre, towards St. Paul's Church, an elk furnished the upper set but the lower teeth were human. The false teeth were damnably uncomfortable: when Gilbert Stuart painted George Washington in 1796—the cherished portrait on dollar bills today—cadaverous facial hollows were filled with rolls of cotton[1].) Submariners who have endured oral abscesses on patrol will especially admire the fortitude of the *pater patriae* in this respect.

The second credit, more directly relevant to underwater affairs, is that George Washington fathered the concept of submarine warfare by his enthusiasm, albeit somewhat distant and belated, for David Bushnell and the one man TURTLE. Most history books are nonsensical in their accounts of the midget submarine's abortive attempt on HMS EAGLE at New York on 5th or 6th September 1776, but myths are unimportant[2]: it was the President's publicised description of Bushnell's wooden underwater warfare device as "an effort of genius"[3], some 11 years after the event, that helped to spur inventive engineers (with a few weirdos on the side) to engage in submarine designs during the succeeding century.

Washington evidently understood the idea of deterrence linked with covert attack by an economical little submersible—*a machine for the annoyance of shipping*—against a vastly more powerful foe. In this instance TURTLE was intended to annoy Admiral Lord Richard Howe by sinking his flagship, and thereby frighten the British fleet out of New York harbor where the close blockading Royal Navy fleet was itself a great annoyance to the Revolutionary Army.

The admirable scheme did not work, and *Black Dick* Howe was not frightened: British warships continued to blockade; and, indeed, they soon shifted their anchorage even closer to the New York shoreline. But spindoctored versions of TURTLE's brave attempt, with Sergeant Ezra Lee in the lonely cockpit, helped to inspire a coming generation of more or less real submariners; and it gave substantial food for thought to supporters of both intrusive and defensive submarine warfare—Fulton, Hunley and Holland amongst them.

In turn, it is quite likely that echoes from 1776 eventually reached the Italian Navy which, from 1918, continually took the lead in producing tiny underwater craft, and gallant crewmen, for making clandestine assaults on enemy shipping in defended ports.

On 21 December 1941 the explosive charges placed by three Italian two-man SLC *human torpedo* (Maiale) crews heavily damaged the 30,000 ton British battleships VALIANT and QUEEN ELIZABETH, the valuable tanker SAGONA and the destroyer JERVIS inside the port of Alexandria. Investigation revealed a hole 40 feet square under the foremost boiler room of QUEEN ELIZABETH: all steam was lost for 24 hours, and submarines had to be secured either side of the stricken battleship to provide electrical power. VALIANT's damage extended over 80 feet and included the keel.

Six brave men had reversed the naval balance of power in the Mediterranean by means of a daring raid lasting a few minutes.

Prime Minister Winston Churchill was justifiably upset by these and other sneak assaults submerged: after all, British propaganda insisted that Mussolini's navy was cowardly—which most assuredly it was not, albeit disastrously hampered by lack of fuel.

In fact, it is pleasant to record that in March 1945, when the war was over for Italy, TV Luigi de la Penne, who had led the raid in Alexandria, was awarded the Medaglio d'Oro, the Italian VC:

it was pinned to his chest by none other than the former captain of VALIANT, by then promoted to be Vice Admiral Sir Charles Morgan. A type of international chivalry, rather more than simple camaraderie, has often been apparent amongst midget submariners, human torpedomen, assault swimmers, British SBS, USN SEALs and equivalents in other navies: to an even greater extent than the community of standard submariners, they share exposure to the constant, implacable and most dangerous enemy of all—the sea.

In a memorandum to the Chiefs of Staff dated 18 January 1942 Churchill irritably demanded: "Please report what is being done to emulate the exploits of the Italians in Alexandria Harbour and similar methods of this kind...". But the Royal Navy had already done a great deal in this downward direction—principally due to the intolerable threat posed against vital Russian convoys by the giant German TIRPITZ holed up in a Norwegian fjord, where no regular forces could strike her, ready to pounce at any moment on shipping sailing up and down the Norwegian Sea.

Chariots, virtually duplicating Italian *Malali*, were a possible answer; but the eventual solution for eliminating "The Beast", as Churchill called the battleship, was a small flotilla of midget submarines.

Styled X-craft to maintain secrecy, the first midget was launched into the Hamble River, leading to Southampton Water, on the night of Sunday, 15 March 1942. HMS X3 (the names X1 and X2 had previous unconnected owners) was short, fat and ugly—the ideal shape for a submarine, never mind the appearance, as J.P. Holland had proclaimed half a century earlier.

Tests and evaluation quickly led to production models: the Twelfth Submarine Flotilla, based thenceforward in Scotland, was in business.

About 52 feet long, an X-craft, with a crew of four, was shorter than the U.S. Navy's first submarine USS HOLLAND, and less in diameter at 5.75 feet. Displacement was 29.7 tons submerged with 2.7 tons reserve buoyancy (10 percent) on the surface. Strapped to the sides were two streamlined *side-cargoes*—delayed action mines, each holding 4,480 pounds of Amatol—for releasing beneath a moored or anchored target. Limpet mines were available *ad hoc* as a secondary weapon system; but of course these required a diver to exit (and hopefully re-enter) the craft via an abominable *Wet and Dry* chamber which also housed the head: designed to avoid

upsetting the extremely delicate trim the upright coffin was pumped full from an internal seawater tank below, and subsequently drained thereto. The pump, at the moment that the compartment filled, abruptly exerted full force on the body of the occupant whose tender appendages amidships, to say nothing of his eardrums, suffered correspondingly. The phenomenon was known, without affection, as *The Squeeze*.

The diver/swimmer—not the most envied of midget personnel—could also cut a way through anti-submarine nets using a compressed air or hydraulic chisel gun. The technique, together with other relevant midget submarine hardware, is readily available to intruders today; but the long training, historically proven to be crucial, may not be so easy to come by.

The British X-craft crews trained arduously and realistically against alerted targets for the best part of 18 months, and critiques of these exercises were detailed and unsparing. (The training of German and Japanese midget-men took short cuts which were demonstrably counter-productive in the event).

The difficulties and dangers of the task that lay ahead were daunting: they involved threading a passage through a known German minefield and then up 50 miles of narrow fjord to a target whose defences were considered by the enemy to be impregnable—all that before commencing the actual attack. But the typical irreverence of special forces everywhere showed through, in the 12th Flotilla, with dry, understated humor. For example, the report by Cameron, captain of X6, on the final workup included:

> "Night entrance to Port HHZ [codename for Loch Cairnbawn advanced base] in the face of 'stiff' opposition. We did this on the surface trimmed down, sitting on the casing...with water up to my middle, very damp but good fun...
>
> "Sunday morning attack on MALAYA [battleship] with Flag Officer Submarines on board [X6]. This was quite funny as the gyro was misbehaving, but it gave the old boy a thrill and his signal to MALAYA 'Inspected your bottom at 1000 today' made the captain of MALAYA [O'Donnell] a trifle annoyed.
>
> "Operation Landing Agent by day in Lock Nigg.....the sight of Willy Wilson in his birthday suit, carrying his gear

on his head and floundering through the shallows to the beach amid the cheers of the female population in surrounding crofts, the scouts sent out to intercept him wiling the hours away in the pub at Drumbeg."

Lieutenant Donald Cameron, RNR, was older than his colleagues and arguably more mature. Moreover, a canny Scot, he was sensibly prudent; and he had the great advantage of knowing, from his years with the Merchant Navy, how to navigate: it may be difficult to believe today, but ordinary submarine officers (not only those in the Royal Navy) were quite remarkably lacking in navigational skills until around the 1960s—one of the reasons which can be conjectured for so many wartime out-of-position blue-on-blue incidents, missed RVs and groundings, whatever sundry politically tactful courts-martial may have concluded. (Anti-submarine aircraft were even further off track, often enough; but that is for Air Forces to comment.)

It is impossible to tell, in a short space, the full story of the X-craft raid on Germany's mightiest battleship; but we can look at the scene from Cameron's perceptive viewpoint, which has been thoroughly checked with official records on both sides.

On 11 and 12 September 1943, six T and S-class submarines separately took X5-10 in tow for the long passage to Northern Norway. Each craft was manned by three-man *passage crews* which would exchange with the operational crews, embarked in relative comfort in the towing submarines, when nearing the destination. Sympathy was extended, by all concerned, to the passage crews who had none of the glory, but most of the appalling discomfort. Towing speed averaged between eight and ten knots: a craft remained dived throughout, at between 100 and 200 feet, except for a *guff through* on the surface to change stale air by running the (ex-London bus) engine for a few minutes every six hours—and rolling sickeningly in the process. Time ceased to have any real meaning; tins of food, occasionally heated in a carpenter's glue-plot, rapidly lost their charms; and the cold, a damp gray almost tangible variety, was such that no kind of clothing could protect against it. Yet there was much work to be done to ensure that all equipment and machinery was in perfect order for the operational crew when they took over.

Cameron had insisted on a nylon tow-rope for X6 (towed by

Robbie Alexander in TRUCULENT), suspecting the cheaper Admiralty hemp lines might part. He was right. The ropes for X-8 and X-9 both parted. X-9 was never seen again: the long, heavy hemp rope dragged her down to the bottom.

The four remaining craft arrived off the fjord on 20 September, and the operational crews paddled across in rubber dinghies to their craft. Between 1830 and 2000 tows were slipped; and the craft set off on their own across the mine-strewn Soroy Sound for what Godfrey Place, captain of X-7, described as *The Great Adventure*.

We can now glimpse what goes on in a brave man's mind at such moments. Don Cameron kept a very private diary which, of course, omitted anything that might be of use to the enemy if captured. It was a way of communicating, albeit by thought alone, with his adored young wife Eve, soon expecting the birth of a first child.

The entries in that diary are brief but telling: "If I were a true Brit the job would be the thing, but I can't help thinking what the feelings of the next-of-kin would be if I make a hash of it." From time to time he felt in his pocket for Bunjy—a little wooden dog, Eve's first present to him—and was reassured. He admired John Lorimer, the First Lieutenant at the hydroplane and trimming controls; Dickey Kendall the diver at the helm; and Edmund Goddard the Engine Room Artificer who had learned his engineering with Rolls Royce. They appeared so confident; but for himself he admitted (for Eve alone) a *just-before-the-battle-mother* feeling.

As *Piker 11* (Don and Eve's pet name for X6) surged up Alten Fiord towards Kaa Fjord at her full speed of six knots on the surface, Cameron watched the moon rising above the mountains, brushing them with silver: he wondered if Eve would be watching the moon too, far away in Lee-on-Solent. He "felt very homesick indeed...the elation of sitting in the middle of the enemy's fleet anchorage vied with the feeling of a small boy very much alone, wanting to go home and be comforted. Was not conscious of fear, just of waiting someone to talk to..."

By early morning on 22 September X-6 was submerged and nearing the lair of *The Beast* at the head of Kaa Fjord. But things were going wrong. Lieutenant Ken Hudspeth, RANVR, had selflessly retired lest defects in his X-10 jeopardise the whole operation. That left X-5, 6, and 7.

The periscope in *Piker 11* was of little use: despite stripping it

down half-a-dozen times Cameron "might as well have had a beer bottle" to look through. When the target eventually appeared around the top corner of Kaa Fjord, TIRPITZ was "fuzzy and indistinct", looking "like a great haystack".

Nearing the nets protecting the inner fjord at 0445 Cameron, nearly blind, seized a chance and boldly surfaced, in the broad light of a new day, to pass through the narrow net-gate astern of a small supply vessel. The risk —unimaginable if planned in cold blood—paid off, and it was probably less than sending Kendall out to cut a laborious way through the barriers of steel mesh while time was growing short. Miraculously, there were no indications that the craft had been sighted: the boom was shut as soon as Cameron had passed through.

Only three hours remained, in accordance with the Operation Order, before all *side-cargoes*—laid by all craft that reached the objective—were timed to explode simultaneously. It would not be healthy to hang around.

Cameron dived again, thankfully, at 0505; but confronting him was a double row of anti-torpedo nets, closely surrounding the battleship. A mere 20 metre gap on the port bow was guarded by hydrophones and a dedicated guard-boat; but, unwisely, the Germans stood down the watch at 0600.

At 0700 Cameron, by expert dead-reckoning, navigated through the slim entrance, keeping just shallow enough to see the surface through the 5-inch glass cuttles in *Piker's* pressure hull. Seven minutes later he ran onto a rocky shoal and briefly broke surface. German lookouts thought the craft was a porpoise; but they did not make the same mistake at 0715 when the craft hit a net and Kendall was unable to prevent X-6 shooting fully to the surface out of control.

Disregarding the grenades and hail of bullets ("sounding like a rivetter's shed") Cameron carefully manoeuvered to scrape his craft alongside B turret while Goddard and Kendall spun the mine-release wheels. Four tons of high explosive, with time-clocks ticking, sank beneath the target. The job was done: quickly the crew scuttled X-6.

Cameron and his team "baled out just in time. Lost my pipe and tobacco—most annoyed...taken on board [TIRPITZ] to meet reception committee. Reception lukewarm..."

Meanwhile Godfrey Place, in X-7, had an equally exciting

approach, but also let slip his two massive mines in the right position. Sadly, when the order was given to scuttle, only he and one of his crew escaped drowning: the pair were brought aboard the doomed target to join the crew of X-6—all a trifle fidgety and apt to glance at their watches. The big bang came at 0843; and the side-cargoes did everything expected of them.

The fate of X-5 is not known: Cameron, from an extraordinary vantage point on the quarterdeck of TIRPITZ, sighted her, soon after the explosion, 650 yards off the stricken battleship's bow "showing lots of periscope". The craft, commanded by the Australian Henty-Creer, then disappeared, following gunfire from TIRPITZ and depth-charging by a destroyer.

TIRPITZ never again put to sea for action. The well-named Operation *Source* was not just a tactical win by eight men in two fragile craft (each costing £30,000—about $150,000 at the time) against a 42,000 ton monster sheathed in 15 inch armour and with a crew of 2500. The removal of a deadly menace to Russian convoys allowed the British Home Fleet and two USN battleships to redeploy where their heavy armament was urgently needed: that constituted a major strategic victory for midget submarines.

Doubtless Washington, Bushnell and Lee looked down with approval when the Victoria Cross was awarded to Cameron and Place.■

Notes

1. The Strange Story of False Teeth, by J. Woodforde, Routledge and Keegan Paul. London: 1968, pp 98-108.
2. Inter alia Submarine Warfare, Monsters and Midgets, by Richard Compton-Hall. Blandford Press, UK and Sterling Publishing Co., USA, 1985, Ch 7.
3. Ibid, with references.

A full spectrum technology services company

- complete range of engineering services, including rapid prototype development
- information technology services
- interactive multimedia training systems development

Analysis & Technology

Corporate Headquarters
North Stonington, Connecticut

U.S. NAVY TORPEDOES
Part Six: Post-WWII Air Launched/Lightweight Torpedoes

by Dr. Frederick J. Milford

Post-WWII lightweight and air launched torpedo development was subject to constraints similar to those that affected the development of submarine launched-heavyweight torpedoes. Changed defense economics and a changed world political scene led to changed policy and changed requirements. In addition, however, an objective review of the use of air launched torpedoes during WWII showed that fewer than 1500 torpedoes had been launched by U.S. Navy aircraft against surface vessels. Increased and more effective antiaircraft armament had made attacking surface warships with air-launched torpedoes a risky business. About 350 torpedoes were, however, dropped in October 1944, primarily during the Battle of Leyte Gulf, with considerable success. Furthermore, new aircraft were not tolerant of large heavy external loads and moved in the direction of smaller fuselage cross sections that did not readily accommodate torpedoes with the Mk 13 envelope.[1] A few hundred homing torpedoes with the 22.5 inch x 161 inch Mk 13 dimensions were, however, produced after WWII. These new torpedoes were not used to any appreciable extent as service weapons and there were, in any case, large stocks of the venerable Mk 13. Most heavy air-launched programs were terminated at the end of World War II. The air launch requirement for the Mk 35 was eliminated and only 200 Mk 41 (a 1327 pound simplified Mk 35) air-launched 21 inch torpedoes were produced for evaluation.

With the added stimulus of the major U.S. Navy focus on anti-submarine warfare, post-war air launched torpedo development focused on lightweight, generally less than 1000 pounds, acoustic

---

[1]This oversimplifies. The Grumman AF could carry 400 pounds in an internal bomb bay, one, or stretching possible two, Mk 13 size torpedoes. The Douglas AD could carry 8000 pounds on external hard points. Two of these hard points apparently could handle Mk 13 torpedoes. In the early post World War II years attack squadrons trained to drop Mk 13 torpedoes against surface targets. During the Korean War eight Mk 13s were dropped by Skyraiders (ADs) against the Hwachon dam. From the mid 1950s on there have been no heavy air-launched torpedoes in the fleet.

homing, anti-submarine torpedoes. Although modern lightweight and heavyweight torpedoes had their respective origins in the very similar Mk 24 and Mk 27 Mod 0 torpedoes of WWII, they have become very different not only in size and weight, but also in their attack paradigm. A heavyweight torpedo is launched thousands of yards from its target, well beyond the acquisition range of the homing system. It must then travel to the vicinity of the target, acquire the target and then attack. A lightweight torpedo is normally delivered to the near vicinity of its target by the launch platform (aircraft, surface vessel, CAPTOR mine or ASROC). In early weapons, no provision was made for a straight run; helical search began on water entry or after a large angle dive to an initial search depth. Current torpedoes, however, typically provide for a preset straight run up to about 1000 yards. A concomitant of the smaller size and weight as compared to heavyweight weapons is that the endurance at maximum speed is typically smaller, less then 10 minutes for most U.S. lightweight torpedoes.

The passive homing Mk 24, which has been discussed in an earlier part of this series, was available at the end of WWII and continued in use into the 1950s. It deserves to be called the first lightweight homing torpedo. Development of a modestly improved, heavier version, Mk 34, continued. Mk 32, the successful GE active homer with the same envelope as the Mk 24, was resurrected, improved and put into production as an air or surface vessel launched ASW torpedo. Other active homers Mks 43, 44 and 46 followed. The last of these still serves with U.S. forces and the Mk 44 survives in many navies and possibly as reserve stock for the U.S. Navy. Mks 50 and 51 were competitors to replace Mk 46. In the swim-off Mk 50 was chosen but only very limited quantities have so far been procured. Production ended in 1996.

Mk 34

Development of an improved air launched passive homing torpedo began in 1944 as the Mine Mk 44 project at Mine Warfare Test Station, Solomons, Maryland. The torpedo that was developed and designated Mk 34 was 19 inches in diameter and 123 inches long. It weighed 11120 pounds, not really lightweight, and carried a 116 pound HBX warhead. It was thus substantially larger than Mk 24. The homing system of the first version of the Mk 34, Mod 0 (1945), had a passive acoustic homing system which was

essentially identical to that used on the Mk 24. Propulsion was improved with a larger battery, but the same motor, which increased the maximum speed to 17 knots. The new propulsion system also provided a two speed capability, with the switch to high speed triggered by the acoustic signal. These improvements were accommodated by using two Mk 24 cylindrical sections joined by a mating ring. Both sections contained lead acid storage batteries for propulsion. The forward section contained the hydrophones and the after section the control panel. Since there was no control panel in the forward cylinder, a significant volume was available for an auxiliary high explosive charge. In retrospect, it would have been easy, and possibly more appropriate, to designate this torpedo Mk 24 Mod X. The Mk 34 Mod 0 was produced in limited quantities. Its development was completed too late for it to be used in WWII. In 1948, with growing U.S. Navy concern about the Soviet submarine threat, a program was initiated to improve the Mk 34 and issue it as at least an interim ASW weapon. With major contributions from the Penn State Ordnance Research Laboratory, the design was improved and prepared for production. Over 4000 Mk 34 Mod 1 torpedoes were produced by American Machine and Foundry; the Naval Ordnance Plant, Forest Park, Illinois; and the Naval Mine Depot, Yorktown, Virginia. Beginning in 1948 the Mk 34 supplemented the Mk 24. It remained in service until about 1958, when the first post-WWII lightweight torpedo, the Mk 43, began to see service with the fleet.

Mk 43

Beginning in 1950, the truly lightweight Mk 43 was developed against a weight limit of 350 pounds. Two competing versions of this torpedo were developed, the 12.75 inch Mod 0 General Electric design, of which 500 were produced for evaluation, and the 10 inch Mod 1 (and later Mod 3) which was selected for full scale production. The Mod 1 torpedo drew on the experience of Brush Development in developing the 10 inch Mk 30, which, as noted earlier, was the successful, but not procured, backup for Mk 24. The Mk 43 Mod 1 torpedo weighed only 260 pounds so that even the small helicopters of the 1950s could carry one or two of

them.[2] There was no need for specialized torpedo bombers to carry torpedoes of this size. Active acoustic homing was used. The 54 pound warhead could accomplish mission kills, but actual sinkings would probably have been fortuitous. Two other limitations of the Mod 1 were its 15 knot maximum speed and 650 foot maximum depth. Both of these were remedied in the Mod 3 which had a maximum speed of 21 knots and a maximum operating depth of 1000 feet. Mk 43 Mod 3 also had fins that did not extend beyond the body, so it could be launched from Mk 32 tubes on surface vessels. Inserts were, however, required to accommodate the 10 inch diameter. There was little overlap between the Mk 43 torpedo and the Mk 32 tubes in the U.S. Navy, so this launch mode was not of major importance. The Mk 43 entered fleet service in 1951 and Mod 3 remained in service together with the Mk 34 until 1957 when the Mk 44 began to rather quickly replace both.

Mk 44[3]

Post-war evaluation of the German Type XXI submarine had made it abundantly clear that anti-submarine weapons, including lightweight ASW torpedoes, would have to deal with submarines capable of 20 knot submerged speeds and diving depths close to 1000 feet. These requirements were beyond the capabilities of the Mk 43 torpedoes and posed significant technological challenges. Consequently, about 1952, very soon after the Mk 43 entered production, projects designated EX-2 were started to deal with these requirements. The weight limit was relaxed to 450 pounds and somewhat larger, but much more capable torpedoes resulted. The EX-2A developed at NOTS Pasadena was a 12 inch diameter by 98.5 inch, 415 pound, passive homing torpedo. The General Electric EX-2B, which was selected for full scale development and

---

[2]Even modern U.S. Navy helicopters, for example, the SH-60, carry only two 500 to 600 pound torpedoes. Much of their lift capacity is taken up by detection equipment, sonar, sonabuoys etc. In an alternate allocation of payload, the Royal Navy has loaded Sea King helicopters with up to four torpedoes.

[3]The most useful unclassified material on the Mk 44 torpedo is found in E.W. Jolie "A Brief History of U.S. Navy Torpedo Development", Newport, RI: NUSC, 1978, pp. 50-51 and 116 and Norman Friedman "World Naval Weapons Systems 1991/92", Annapolis: U.S. Naval Institute Press, 1991, p. 710.

production as the Mk 44 Mod 1 lightweight torpedo, was a pure active homer and marked a return to 12.75 inch diameter that GE had used in the Mk 43 Mod 0. The increased diameter and a slightly greater length, 101.3 inches, accommodated a 75 pound HBX-3 warhead and a greatly improved propulsion system consisting of a seawater activated battery, a 30 hp motor and contra-rotating propellers. This propulsion system gave a range of 6000 yards at 30 knots. Major improvements were also made in the homing system and search programming. The acquisition range was increased to a maximum of 1000 yards, about 25 percent better than the Mk 43. Mk 44 Mod 0 had only a helical search pattern, but the initial search depth could be preset to any one of six levels between 50 feet and 900 feet. Similarly, the search floor could be set to any one of five depths between 150 feet and 900 feet. Later Mods had preset gyro controlled runout up to about 1000 yards. After selection of the EX-2B, final development was undertaken at the Ordnance Systems Division of the General Electric Company at Pittsfield, Massachusetts. NOTS Pasadena was responsible for technical direction. Production began in 1956 and the Mk 44 began to replace the Mk 43 in 1957. Eventually over 10,000 Mk 44 torpedoes were produced at GE, NOP Forest Park and American machine and Foundry for U.S. and foreign navies. Additional torpedoes were produced in the United Kingdom, Canada, France, Italy and Japan. Mk 44 became the NATO standard lightweight torpedo. It could be launched from helicopters, fixed wing aircraft, or Mk 32 torpedo tubes on surface vessels and it was the payload for which ASROC was designed.

Mk 46

Successful as it was, the Mk 44 clearly lost effectiveness as target speeds increased towards 30 knots, and, of course, only rare good fortune would enable it to deal with nuclear submarines capable of 30 knots submerged speed. In response to this threat, the RETORC I program led to the Mk 46 lightweight torpedo[4], much as RETROC II later led to the Mk 48. The final Develop-

---

[4] Norman Friedman "World Naval Weapons Systems, 1991/92", Annapolis: U.S. Naval Institute Press, 1991, pp. 710-12, provides an extensive discussion of the Mk 46 torpedo.

ment Characteristic issued in June 1956 specified, in addition to the ability to attack a 30 knot submarine (roughly 45 knot torpedo speed), an operating depth range from 50 to 1000 feet and a size that would fit the external racks and bomb bays of existing ASW aircraft, i.e., about the same size as the Mk 44 torpedo, 12.75 inches by 100 inches. A competitive bidding process that involved an initial set of 14 competitors resulted in a development contract being awarded to Aerojet General Corporation in May 1958. Under this contract the Mk 46 Mod 0 was developed.

Mk 46 Mod 0 was 12.75 inches by 102 inches and weighed 568 pounds. It was powered by a solid propellant which produced hot gasses to drive an 84 hp axial piston swash plate engine. Unofficial reports credit this torpedo with a range of 9500 yards at 45 knots and 50 foot depth (7000 yards at 40 knots and 1500 foot depth). The warhead carried 96 pounds of H-6 high explosive.

The solid propellant propulsion system of the Mod 0 apparently suffered from maintenance problems which were solved by replacing it with a new, but conceptually similarly system. The new engine was also of the axial piston configuration, but used a sinusoidal cam, rather than a simple swash plate, to double the number of power strokes per revolution. The solid propellant was replaced by a liquid monopropellant called Otto fuel. This fuel is burned in an external combustion chamber and the combustion products used to power the engine. The shroud ring steering of Mod 0 gave way to conventional fins and the first major production version, Mk 46 Mod 1, emerged. The first production contracts for Mod 1 were awarded in 1965. The propulsion system has remained essentially the same for a series of upgrades and modifications (through Mods 5A(S) and 6) which may extend the life of the Mk 46 in U.S. service to 50 years. These improvements have mainly affected the control system, but it may be noted that the high explosive was changed to PBNX-103, which is about 25 percent more powerful than H-6 in underwater use. Also, Mods 4 and 6 were developed for use in CAPTOR mines.

Less visible were enormous improvements in the sonar and control systems. Transistorized electronics[5] reduced size and

---

[5] It is easy to overlook the chronology of postwar electronics development. The transistor was invented in 1948, integrated circuits appeared in the 1970s and the first microprocessor, logic and arithmetical processor on a single chip,

weight, reduced power requirements and improved reliability to the point that the Mk 46 could be designed with elaborate control logic and an enhanced acquisition range within the size and weight limits. Even Mod 0 had sufficient acquisition range to make wide vertical apertures possible. These wide apertures made helical search modes unnecessary and greatly reduced search time. A simple circular search at 750 feet was sufficient. In later Mods such a search will, with high probability, acquire a submarine target in a cylindrical volume 3000 yards in diameter and extending from 50 to 1500 feet below the surface. Alternatively for attacks on distant targets a snake search can be set. Sonar characteristics can be set by onboard logic, which also provides attack mode control and reattack capability. Some aspects of the improvement can be seen in Table I which compares Mk 46 with its predecessor Mk 44 and its successor Mk 50. The Mk 46 Mod 5, NEARTIP (Near-Term Improvement Program) was an almost completely new and greatly improved lightweight torpedo that has taken advantage of further developments in electronics to improve onboard logic, signal processing and the seeker. Propulsion was also modified to provide a second speed for slow, quiet, long endurance search. Over 20,000 Mk 46 torpedoes have been built and delivered to the U.S. and over 20 foreign navies. It is the current NATO standard lightweight torpedo.

Mk 50

The final U.S. lightweight torpedo developments through 1996 are: the Mk 50, named Barracuda by Honeywell; and the Light Hybrid Torpedo (LHT). The Mk 50, for which some characteristics are given in Table I, originated as a response to the high speed, deep diving threat presaged by the Soviet Alpha submarine. Development of the Advanced Lightweight Torpedo (ALWT), as it was finally called, began in 1972 shortly after the first Alpha was completed. A convoluted acquisition process began with a six year technical assessment phase. Four teams participated in a concept

---

appeared in 1971. In each case it required some years for the devices to achieve characteristics that were fully suitable for severe military applications, but the electronics revolution that took place in those years and which continues today has had an enormous impact on military hardware, including torpedoes.

development phase. Two of the four were selected to produce prototypes, Ex-50 and Ex-51, for a swim-off. The Honeywell-Garrett Ex-50 was selected in 1981 and became the Mk 50. Full scale development began in 1983, but it did not go smoothly. In the FY89 SecDef Annual Report dated 18 February 1988 (p. 198) we read "Design difficulties, however, have dictated a restructuring of the Mk 50 torpedo program. We now anticipate cost increases and a 21 month delay in the Mk 50's full scale development program. The restructured program will ensure that the torpedo is reliably designed and vigorously tested prior to entering production." The program did, however, survive, but only a few hundred, rather than the initial goal of almost 8000, were produced. Production for the U.S. Navy ended in 1996 and there are currently no torpedoes of any kind in production for the U.S. Navy.

Table I: Post WWII Lightweight Torpedoes

	Mk 44 Mod 1	Mk 46 Mod 1	Mk 50
Threat	Post WWII Diesel SS	SSN	Alpha/Mike
Development started	1953	1956	1972
First procurement	1957	1965	FY 87
Diameter/Length	12.75" x 101.3"	12.75" x 102"	12.75" x 111.5"
Weight	433 lbs.	508 lbs.	770 lbs.
Range/Speed/-Depth	6000 yd @ 30 kt depth independent 500-1000 ft	12,200 yd @ 45 kt @ 50 ft; 10,100 yd @ 45 kt @ 1500	20,000 yd @ 55-60 kt depth independent
Propulsion	electric, seawater battery	Otto fuel, five cylinder axial	SCEP-turbine
Homing	active	active/passive	active/passive
Acquisition Range	800 yd (est.)	1300 yd (average)	
Warhead	75 lb HBX	96 lb H-6 later PBXN-103	shaped charge

Acquisition problems not withstanding, the little detail that has been released about the Mk 50 reveal some novel and interesting technology. The Stored Chemical Energy Power System (SCEPS) was one of the most innovative. The basic idea, which is to use an exothermic chemical reaction as a source for heat to drive a thermal power plant, was explored and discarded by the U.S. Navy in the 1920s. The SCEPS, which was developed at the Penn State Applied Research Laboratory, was an entirely new start on this

mode of propulsion. It uses the exothermic reaction of lithium with sulphur hexaflouride as a source of heat to generate steam. The steam drives a turbine equipped with a condenser so the water is recycled. A unique feature of this cycle is that the combustion products from the combination of lithium and sulphur hexaflouride are solids, rather than gasses, that occupy less volume than the original components. Thus there is no overboard discharge and no decrease in performance at large operating depths (Note that the Mk 46 Mod 1 has 15 to 20 percent less range at 1500 feet as compared to 50 feet). Also interesting is the apparent use of a shaped charge and follow-through warheads in an attempt to disable double hulled submarines.

The LHT is a combination of elements from the Mk 50, the Mk 46, the Mk 48 and ADCAP with improved electronics to make a high performance torpedo with minimal development costs. Reversion to the Mk 46 axial cylinder reciprocating engine combined with the new fuel control valve developed for the Mk 48 rather than continued development of SCEPS is interesting and might reflect cost or maintenance problems with the latter or an effort to establish commonality with the Mk 48/ADCAP torpedo[6]. LHT is expected to enter production around 2001[7], this, however, may now be wishful thinking.

Torpedoes for Surface Vessels

As we have noted in other parts of this series, no U.S. Navy torpedoes have been developed and issued to the fleet specifically for surface vessels since the Mk 17 Navol torpedo. Quintuple mounts disappeared from U.S. destroyers as the anti-surface vessel role of destroyers diminished and it became necessary to reduce topside weight and provide space for increased anti-aircraft defense. There were, however, attempts to reintroduce heavy-

---

[6] A June 1996 unclassified business opportunities briefing at NUWC Newport indicated that their vision for the next generation of undersea vehicles, specifically including torpedoes and mobile mines, featured common prime mover and guidance and control sections with a variety of interchangeable energy (fuel and oxidant) and payload sections.

[7] Naval Institute Proceedings, Vol. 121. No. 5, May 1995, p. 155; Sea Power, July 1995, p. 17.

weight ASW torpedoes in destroyers. Fixed 21 inch tubes, usually Mk 25, were mounted on the O-1 level, in deckhouses and in the transoms of various destroyer type vessels in attempts to adapt Mk 37 and Mk 48 torpedoes to such platforms. The Mk 2 launcher could also launch the Mk 37 torpedo, but this combination was little used. None of these attempts was a great success and heavyweight torpedoes are not, at the present time, part of the standard armament of U.S. Navy cruisers, destroyers or other surface vessels. Lightweight torpedoes have, however, become standard armament for frigates, destroyers and cruisers, but as ASW weapons replacing depth charges rather than WWII types of torpedo armament. The first move in this direction was to use Mk 32 torpedoes launched by Mk 2 launchers which tossed the torpedo over the side much as the WWII PT boat launchers did with Mk 13 torpedoes. Since the late 1950s Mk 32 torpedo tubes, most commonly in trainable triple mounts with Mk 43, Mk 44, or later, Mk 46 torpedoes have been standard ASW armament for surface vessels.

Whither the Torpedo?

We have now looked at essentially all U.S. Navy automobile torpedoes from the 1871 Newport *fish* torpedo through the Mk 50 and Mk 51. It is perhaps worthwhile adding a few words of speculation about the future of the torpedo as a U.S. Navy weapon. First of all torpedoes have a future, if for no other reason, because they and mines are for all practical purposes the only ASW weapons in service and probably the only ones even on the horizon. Certainly torpedoes that are in some sense *better* than the existing Mk 46, Mk 48/ADCAP and Mk 50 could be designed and built and improvements in existing torpedoes are possible. One obvious and frequently mentioned improvement would be quieting and efforts in this direction appear to be underway. Shallow water performance of torpedoes has been substantially improved and it will probably be further improved. With current austere budgets, it seems likely that such improvements as are made will be made by modifying existing torpedoes rather than by entirely new designs. Mks 46 and 48 may well have 50 year service lives.■

THE TROUBLE WITH TORPEDOES

by CAPT Ralph Enos, USN(Ret.)

Captain Ralph Enos was the Mk48 Project Officer from 1974 to 1977. He is currently with the Naval Undersea Museum in Keyport, Washington.

In the era of satellites, AAVs, stealth aircraft, and C4I, it is difficult to accept that the humble torpedo is arguably the most sophisticated weapon of all. A modern torpedo is like a miniature submarine, minus the life support systems. It is, in effect, an autonomous underwater vehicle masking as an expendable weapon.

Torpedoes are difficult weapons to test realistically, and failure to test them realistically during peacetime caused great difficulties for American and German submarines during the Second World War. Stung by that failure, the United States Navy's torpedo development and deployment communities went to extraordinary lengths to test torpedoes thoroughly and as realistically as possible in the postwar years, in the process erecting extensive and expensive test facilities and underwater ranges. Since the historical record of terrible German and American torpedo performance in the early years of WWII may have faded in the minds of a couple of generations of undersea warriors—who have not had to fire a torpedo in anger in more than a half century—I think it would be useful briefly to review that record, and what has happened since that bears remembering.

To begin with, the history of poor underwater weapon performance during wartime due to inadequate peacetime testing began in the First World War. British mines were unreliable when deployed. The British Elia contact mine was fitted with a mechanical detonator, rather than the German-designed Hertz-horn chemical-electric detonator. When these mines were planted, the mechanical linkage tended to seize due to marine organism encrustation. Two years passed before the British discovered these mines weren't working. A program of mine stockpile surveillance, routine in the U.S. Navy today, would have revealed this defect well before the war. But the pre-war Royal Navy had become complacent after nearly 60 years of peace (its last major combat was the 1854-56 Crimean War), and mine warfare was a low priority.[1]

Mines are simple devices to test compared to torpedoes. Torpedo speed does not greatly exceed target speed, which puts a premium on estimating target movement and precise aiming. Modern torpedoes use homing to correct for aiming errors, but an acoustic-homing torpedo is susceptible to all the vagaries of sound in the sea—thermal layers, bottom or surface interference, counter-measures—as well as a target evading at high speed in three dimensions. On the other hand, torpedoes are recoverable after firing if they are programmed not to smash into the target.

Probably the most serious problem in test firing torpedoes is that they must not strike the target. This can damage the target and destroy the expensive torpedo. In the days of straight-running *dumb* torpedoes, this was avoided by setting the torpedo to run deeper than the target's keel. Since all torpedoes before WWII were air or steam driven and left wakes, observers had no difficulty in determining a torpedo's path. Practice firing of torpedoes was concerned with aiming accuracy in azimuth, not in depth. No one knew, or cared, how deep the torpedo ran in practice firings. Depth control in torpedoes had been one of their most reliable features.

Testing a warshot torpedo entails its destruction and probably that of the target as well. This is a very expensive business and in peacetime years was avoided if at all possible. Components of the warshot weapon were tested separately and their sequential functioning assumed.

Between the wars, most navies developed magnetic exploders (called "pistols" in Germany and Britain) for their torpedoes. These devices promised to increase greatly the effectiveness of torpedoes by causing them to explode **underneath** a target's hull. Such an explosion set up a huge gas bubble in the water which lifted the target's hull; when the bubble vented into the atmosphere, the now unsupported hull underwent *whipping* which caused major structural damage, and for smaller ships, broke them in two. The magnetic pistol was set off by the change in the earth's magnetic field sensed by the torpedo as it passed beneath the target's steel hull. Depth of run now became crucial: too shallow and the torpedo would strike the target's side, setting off the contact pistol but doing less damage; too deep and the magnetic distortion might be too feeble to detect.

Testing the magnetic exploder meant destroying a ship large

enough to set off the device. In the U.S. Navy one such test was made—successfully—and the design was put under lock and key for security reasons. In the German Navy there were a couple of tests made; none was successful, but the device nonetheless was issued to the U-boats after the torpedo directorate had *fixed* the indicated problems. Neither navy tested their magnetic exploders in latitudes where the earth's magnetic field differed greatly from the homeland.

Immediately after war broke out in September 1939, U-boat commanders began reporting torpedo failures, particularly torpedoes equipped with magnetic pistols. In April 1940, all U-boats deployed for the invasion of Norway and immediately experienced torpedo failures on a massive scale. At first the problems pointed to the magnetic pistol which may have lost sensitivity in northern waters where the horizontal component of the earth's magnetic field is relatively weak, a problem exacerbated by close proximity to iron-rich rock along the fjords. The boats were ordered to use only contact pistols in Norwegian waters, but soon U-boats in the open seas also experienced magnetic pistol failures. Then, reports cascaded in of torpedoes running deeper than set and of contact pistols failing to detonate when they clearly struck the target.

U-boat commander Admiral Dönitz was furious and in despair. He seriously considered withdrawing U-boats from combat until the torpedoes were fixed. He got navy chief Grand Admiral Raeder to convene a board of inquiry to look into the torpedo *scandal* and if culpable negligence was suspected to court martial the apparently guilty parties. The board convened within a week of the beginning of the campaign and found that both the magnetic and contact pistol designs were defective, and that the torpedo establishment had some knowledge of these deficiencies before the war. They also found that the depth measuring gear used in test firings had given misleading data and torpedoes' depth-settings should be recalibrated. However, deep running torpedoes continued to plague the U-boats and it was not until two years later that the real problem was identified. A fix for the contact pistol was rushed into service, and the problem quickly faded. The magnetic pistol fixes didn't work well at all, and in time, Dönitz ordered them deactivated.

The most serious finding of the board was that the prewar

torpedo establishment had not sufficiently or realistically tested new torpedo designs before the war. Senior officials were tried and condemned by court martial, served time, and humbled and chastised, were returned to duty.

This pattern of torpedo failures repeated itself in the American submarine campaign in the Pacific. Reports of torpedo failures began to trickle in as soon as submarines returned from patrol in December 1941, most of them complaints that torpedoes ran deeper than set. Torpedo failures contributed significantly to the failure of American submarines to do much to thwart Japanese landings in the Philippines—much as German torpedo failures had vitiated U-boat defense against British landings in Norway.

For reasons that are not completely clear, submarine command reaction to these reports was muted. Torpedo failures were viewed as excuses for poor aiming or unaggressive attacks, admittedly serious problems in some early American submarine patrols. It took awhile to shake down the submarine community and weed out cautious skippers, a not unexpected phenomenon in a navy that had not fought a major campaign on its own in 43 years.

The Bureau of Naval Ordnance rejected contentions that the Mk 14 torpedo was deficient, and did not run tests. Fleet submarine commanders, citing a severe shortage of torpedoes, also failed to test the Mk 14 for depth reliability, although the weapon is recoverable from such exercises. Such tests had to wait for Rear Admiral Charles Lockwood's arrival at Fremantle in June 1942 as Commander of Southwest Pacific submarines. Lockwood arranged simple depth tests by firing dummy warshot-weight torpedoes at fishing nets. These showed that Mk 14 torpedoes ran an average of 11 feet deeper than set!

BuOrd quibbled about the validity of the tests, so Lockwood repeated them with much greater care. Same results! After more than a month of quibbling, BuOrd admitted the Mk 14 ran an average of 10 feet deeper than set, and recommended fleet units make appropriate adjustments. Much later, the Bureau discovered its depth-recording exercise equipment had been miscalibrated when depth was tested before the war.

Fixing the depth-setting problem did not quiet reports of malfunctioning torpedoes. Suspicion pointed to the Mk 6 exploder, which had been designed and tested in so much (unnecessary) secrecy before the war. Fleet commanders felt that once the depth

problem was solved, the magnetic exploder would begin to pay great dividends, particularly in economy of torpedoes expended to sink a target. A single Mk 14 (with a relatively puny warhead) could sink a large ship if detonated under the keel, whereas three or four torpedoes might be required to sink the same ship if detonated by the contact detonator against its side. In 1942, a shortage of submarine torpedoes was a most serious problem. Under these circumstances, submarine operational commanders—including Lockwood—refused to allow disconnecting the Mk 6 magnetic feature. Nonetheless, some skippers did so anyway.

The magnetic exploder slowly but steadily betrayed its advocates. By early 1943, with Lockwood now commanding at Pearl Harbor, its unreliability was generally conceded, and ComSubPac ordered its use discontinued. BuOrd—turned on to the problem to some extent by Lockwood's private correspondence with Bureau Chief Admiral W.H.P. Blandy—worked very hard to discover the magnetic exploder's design flaws.[2] The problem was assigned to several naval and academic activities, to little avail. The fleet never was issued a fully tested, reliable magnetic exploder during the war.

Disconnecting the magnetic exploder was not the end of it. Throughout 1942 and the first six months of 1943, submarine skippers filed disconcerting reports of torpedoes that failed to detonate when impacting the target in the contact mode. The issue came to a head when USS TINOSA, commanded by LCDR Dan Daspit, on July 24, 1943 fired 15 torpedoes at the dead-in-the-water 19,000 ton whale factory ship TONAN MARU III, in broad daylight. Eleven of the torpedoes were observed to hit the target and fail to detonate. When Daspit returned to Pearl Harbor with his evidence, it was clear to everyone that there was a big problem with the contact feature of the Mk 6 exploder. Again, Lockwood arranged tests and discovered that the contact firing pin mechanism was insufficiently robust to strike the firing cap before the warhead was crushed in a dead-on 90° impact, supposedly the ideal situation. At shallower impact angles the number of duds decreased. A fix was *kluged* in the fleet and by October 1943, U.S. submarines—finally—deployed with decent torpedoes (albeit without a magnetic feature).

Similarities in German and American torpedo experience in World War II are remarkable. Torpedoes running deeper than set,

malfunctioning contact exploders, magnetic exploder designs that did not work although tested and accepted before the war, one problem masking another, torpedo development establishments that insufficiently tested their designs before issuing them to the fleet—these were present in both navies. The principal difference between the two was the prompt German response to the crisis of April 1940, although this did not necessarily assure timely fixes. In contrast, American operational commanders were slow to react.

One of the most egregious aspects of both American and German pre-war torpedo establishments was that there was no independent test and acceptance organization. The same organization designed, tested, and accepted the weapons. We see now how this kind of system can breed complacency, arrogance, uncritical confidence in tested designs, a tendency to cut corners, and an incestuous insularity. Mindful of that, the post-war American Navy established an independent operational test and evaluation command.

BuOrd had little to do with fixing the bad torpedoes. They stonewalled admitting there was a problem and when this tactic was no longer realistic, were slow to provide a workable design. The fleet took the lead in operational testing and in designing a contact exploder fix. The magnetic exploder was simply bypassed. BuOrd's poor response to a real fleet problem was felt keenly by Bureau Chief Blandy. In an often quoted *mea culpa*, he wrote:

> "Even with the relatively meager funds available in time of peace, much of the work now being done after more than a year and a half of war, could and should have been accomplished years ago...That the work was not accomplished during peace or earlier during this war, or, so far as the Bureau's records disclose, that no one either in the Bureau or at Newport apparently questioned the inadequacy of the design without such tests, shows a lack of practical appreciation of the problems involved which is incompatible with the Bureau's high standards, and reflects discredit upon both the Bureau of Ordnance and the Naval Torpedo Station, Newport. The Chief of the Bureau therefore directs that as a matter of permanent policy, no service torpedo device ever be adopted as standard until it has been tested under conditions simulating as nearly as possible those which will be

encountered in battle."[3]

The legacy of our WWII torpedo troubles has been a generation of mistrust between submariners and BuOrd and a proclivity for massive testing of torpedoes at all stages of development and production.

This massive testing became extraordinarily complicated when acoustic-homing torpedoes appeared late in WWII. Shallow, basically two-dimensional, test ranges—adequate (with a reliable depth recorder) for testing straight running, anti-surface torpedoes—don't work for homing torpedoes. These torpedoes home in three dimensions, demanding much deeper water for testing and complicating recovery of heavy units. Their post-launch trajectories, even when the torpedo is functioning normally, are unpredictable. In the mid 1950s, the torpedo community began to build three-dimensional underwater test ranges, using torpedo and target transponder sound signals tracked by hydrophones in fixed bottom-mounted arrays. The first such range was installed in 1955 at Dabob Bay in the Hood Canal, near the torpedo test station at Keyport, Washington. In time, the need for greater operational area and depth, fleet training, and varied water conditions stimulated building additional underwater tracking ranges elsewhere.

An acoustic tracking range tests the homing performance of a torpedo fairly well—provided the dynamic behavior of the exercise weapon matches that of the warshot. But this test—as done in the overwhelming majority of peacetime torpedo firings—merely determines that an exercise-configured torpedo is able to acquire and home to a certain stand-off distance from a mobile torpedo-like target that acoustically and dynamically emulates a submarine. The torpedo is not tested as to whether it homes close enough to actuate its warhead detonator, nor whether that would set off the warhead charge, nor whether a warhead so detonated would destroy the target. This is where the pre-WWII German and American torpedo communities singularly failed to do their jobs. We have done better since WWII—influenced in no small way by that failure—and SINKEXs are regularly held that evaluate the condition of our torpedo weapon inventory. Is this enough?

Sinking a stationary surfaced hulk with a noise-emitting source to attract a torpedo (a typical SINKEX scenario) is fine. It exercises the explosive train and one not particularly important

acoustic mode. But it is far from a realistic test. The target is not underway, not evading, not using countermeasures, and most particularly, not submerged. The exclusively ASW torpedo Mk 46 can't be tested realistically against a surface target at all. So how do we test an ASW torpedo "realistically" as Admiral Blandy decreed so long ago?

The short answer is that we can't test it in a way that simulates actual operational conditions that its users would encounter in battle. We must test the weapon system piecemeal. The best we can do is test those aspects of a weapon's performance that we can observe directly and simulate those aspects where we cannot economically observe performance directly, being very careful to validate these simulations wherever we can.

We must rigorously and skeptically evaluate the results of these tests and simulations. We must continually ask "What if?" We must set conditions where our simulation can be extended to other situations—which the German torpedo designers did not do with their magnetic pistol. We must not assume one success validates a design—which the Americans did do with their magnetic exploder.

We should not be afraid of failure. No weapon design team is going to produce a perfect weapon straight off the drawing board. A weapon has to be shaken down in fleet operations for some time before its little flaws are revealed. The German depth-keeping balance chamber design was flawed because its seal permitted build up of pressure over time as the boat cycled its internal air pressure, biasing torpedoes so exposed to run deep. This defect was discovered accidently in January 1942, nearly two and a half years after the torpedo design first went to war.[4]

In the U.S., post-war Navy, there is a tendency—driven by politics and funding issues—to bias test and evaluation for success. Failures are unwelcome. Any technical program manager knows how to rig tests to be successful, but do we learn anything that way? It is a truism, but we really learn through failure. If a weapon performs as predicted, we've learned nothing new. Only if it does the unexpected do we break new ground.

All this rigor, skepticism, simulation, validation, and testing increasingly sophisticated weapons against realistic targets on elaborate underwater ranges costs a great deal. The cost of building and maintaining test and evaluation ranges and testing

torpedoes on them is large and some budget analysts question whether we can afford it, especially in an era when military downsizing is rampant and undersea warfare is in decline.

This was the situation in the 1930s when German and American torpedo designers were getting ready for WWII—on a shoestring. They scrimped on expending torpedoes on destructive tests; they extrapolated equivocal results in the most favorable way; they were not skeptical about their own testing gear; the same people who designed the torpedoes tested them and later proclaimed them fit for issue.

The early WWII torpedo troubles of the German and American navies is a cautionary tale of the problems that can arise when a navy takes its combat weapons for granted during peacetime. **I suggest that the conditions for a repeat of this experience are growing in our undersea magazines.** *(Editor's Note: Emphasis added.)* We haven't used torpedoes in combat in more than 50 years; virtually every other kind of non-nuclear ordnance has been combat tested during that time. I don't think we can afford to make these mistakes again.

ENDNOTES

1. Bacon, Admiral Sir R.H., *The Concise Story of the Dover Patrol* (London: Hutchison & Co., Ltd, 1932), pp. 65-66; Sims, Rear Admiral William Sowden, *The Victory at Sea*, Classics of Naval Literature (Annapolis, MD: Naval Institute Press, 1984), p. 26.
2. Clay Blair, Jr., *Silent Victory: The U.S. Submarine War Against Japan* (Philadelphia and New York: J.B. Lippincott Company, 1975), pp. 277, 403-404.
3. Cited in: Buford Rowland and William B. Boyd, *U.S. Navy Bureau of Ordnance in World War II* (Washington, DC: Bureau of Ordnance, Department of the Navy, 1943), pp. 105-106.
4. Clay Blair, *U-Boat War: The Hunters, 1939-1942* (New York: Random House, 1997), p. 485.

AKULA CLASS RUSSIAN NUCLEAR ATTACK SUBMARINES

by Dr. George Sviatov
CAPT I Rank, Russian Navy(Ret.)

Introduction

In the 1984-1996 period the Soviet and Russian shipbuilding industry built 16 Akula class (Project 971) nuclear attack submarines. They were built in Severodvinsk and Komsomolsk-on-Amur shipyards and were commissioned to the Northern and Pacific fleets of the Russian Navy. These submarines and four Project 945 titanium submarines *(Ed. Note: NATO designation is Sierra)* are the most advanced Russian SSNs and they are approximately comparable to the American Improved-688 class attack nuclear submarines. These submarines together with 26 Project 671 RTM and seven Project 671 RT submarines (Victor classes), which are comparable to the initial 688 class U.S. submarines, are the backbone of the Russian SSN force.

The Project 971 submarine is earmarked, first of all, for sweeping, detection, and shadowing of an adversary's ballistic missile nuclear submarines and aircraft carriers and destroying them with beginning-of-war actions. She also can destroy other submarines and surface ships by her torpedoes, missiles and mines. The second very important mission, which was really first implemented on this SSN, is her ability to strike land targets on ranges up to 3000 kilometers by her 533mm caliber Granat cruise missiles.

The submarine was designed by the St. Petersburg's Central Design Bureau Malachite which designed the first Soviet attack nuclear submarine November class (Project 627A), first serial production attack submarines of the Victor class (Projects 671, 671RT, and 671RTM) of the second generation and some other submarines. The Chief Designer of Akula was Georgy Tchernyshev; the Chief Navy Supervisor was Captain 1 rank Igor Boganchenko.

Weapons

In principle, weapons of the Project 971 submarines are similar to weapons of Project 945 titanium attack nuclear subma-

rines which were designed and built in Sormovo (Nizhny Novgorod).

The submarine has eight bow torpedo tubes (four 650mm and 4 533mm) with a total number of 40 torpedoes and cruise missiles (12 650mm and 28 533mm). Torpedo tubes are installed in two horizontal rows: 533-650-650-533mm in the upper part of the first compartment.

She also has six bow 400mm outside tubes for decoys.

It should be noted that Russian submarine torpedoes and missiles have a number of sizes and weights. Their lengths are up to 8.2m for 433 and 12m for 650mm caliber. Until recently Russian submarines had no wire guided torpedoes.

The main category of Russian 533mm torpedoes are of the homing variety with electric batteries and propulsion. The newest of them are: 53-65 KE anti-ship wake homing (speed 45 knots, range 19 km) and TEST-71M anti-submarine acoustic homing, wire guided (speed 24 or 40 knots, range 20 or 15 km) and also rocket-propelled Shkval torpedo (speed 200+ knots, range 7-10 km). Torpedoes have several warheads—the largest a high explosive one of up to 500 kg. Nuclear warheads are also fitted; submarine torpedoes having been the first Soviet naval weapon with nuclear capability.

Anti-ship 650mm torpedoes entered service in the 1980s. They have an advanced closed-cycle thermal propulsion system (speed of 50 knots with a range of 50 km and 30 knots with a range of 100 km), warhead weight up to 1000 kg and the guidance is wake homing.

The first Soviet anti-submarine, submarine-launched missile SS-N-15 was deployed in 1972 and is fired from standard 533mm torpedo tubes and carries a nuclear warhead (like the U.S. Navy Subroc) with a range up to 50 km.

A further development of the SS-N-15 was the 650mm caliber SS-N-16 missile which carries an anti-submarine 500mm homing torpedo in lieu of the nuclear warhead. A parachute lowers the torpedo into the water for the torpedo to home in on a target. Its range is up to 100 km.

The first Soviet advanced land-attack cruise missile SS-N-21 (Granat) is launched from standard 533mm torpedo tubes, much like the U.S. Navy Tomahawk Land-Attack Missile (TLAM). Deployed in 1988, on 671RTM, 945 and 971 Project submarines. Its weight is 1700 kg and length is 8.1 m. The propulsion is turbofan with a speed of Mach 0.7, and a range of up to 3000 km.

The warhead is nuclear at 200-300 kt, and guidance is inertial with Terrain Contour Matching (TERCOM). It is possible to install a conventional high explosive warhead.

Readiness of an Akula class submarine to fire torpedoes and missiles in a duty condition is 15 seconds. The fast recharge device lets it fire the next salvo after six minutes.

Instead of torpedoes and missiles, the submarine can carry mines of 533mm caliber with one to one ratio.

The submarine has a storage and reloading system which allows automatic transfer of any torpedo or missile from a torpedo tube to any storage place in the torpedo compartment and back.

She also has 18 air defense portable Strela missiles.

Hydroacoustics and Other Electronics

For illumination of underwater and surface situations and targeting, the submarine has the newest hydroacoustic complex, SCAT-3, with digital information processing which has several full spectrum modes:

- passive regime
- active regime
- regime of hydroacoustic signal detection
- regime of hydroacoustic communication
- infrasound passive regime
- regime of target classification
- passive regime of target range measuring

The main passive hydroacoustic antenna (cylindrical with a height approximately 4.5m and diameter up to 7m) is placed under the torpedo tubes. The active antenna is also in the bow part. They have fiberglass fairing.

In addition to this antenna, there are two side passive antennas in the area of the first compartment with sizes approximately 10m vertically and 6m horizontally and also a stern towed passive infrasound hydroacoustic antenna in the capsule on the vertical stabilizer.

Owing to reduction of noise levels and hindrances to the hydroacoustic complex work, the range of target acquisition was increased more than three times in comparison with submarines of the second generation.

The submarine's other electronic equipment includes a battle

information control system (BICS), automatic radio communication, radar systems and a navigational complex.

Power Plant

The main power plant (MPP) of the submarine is almost identical to the MPP of Project 945 submarines. It consists of one 190mw pressured water reactor with pressure in the first contour of 1150 atmospheres, and one turbine with 50,000 shp, one 7 bladed propeller (6m diameter, maximum 200 rpm) with extensive mechanism reservation.

The steam generating system has one reactor, two steam generators, two pumps of first contour, three pumps of third contour and two pumps of fourth contour.

The steam turbine plant consists of one turbo-toothgearing agregate and two autonomous turbo-electro generators of alternating current (each 3000 kwt, 380 v, 50 hz), two feed water pumps and two condensers with two circulation pumps. The last ones on this submarine are in the reactor compartment. Steam pressure is 32 atmospheres.

In case of a withdrawal of the MPP from action and for putting it into operation, the submarine has emergency sources of electric energy and reserve propulsion means. For users of direct current there are two reversible convertors and two groups of storage batteries.

The submarine has two submerged electric motors of alternating current (each are 400 kwt) with two propellers which are retractable from their niches between the pressure and light hulls. With these propellers she can sail with speeds up to four knots underwater and on the surface. In the latter case, electromotors get energy from a diesel generator (800 hp). Fuel reserve for it provides for 10 days of power.

Naval Architectural Elements

Submarine designers put special attention to increasing her propulsion qualities. The outer hull is made as a body of revolution with a slightly elliptical bow. All of its holes are covered by automatic drain hole covers. The submarine's speed is up to 33 knots with a propulsion coefficient of 0.8.

The submarine has classical stern empennage with horizontal and vertical stabilizers and planes. The bow planes are retractable.

Speed-of-depth change at 30 knots with a 30 degree angle is up to 8m/sec. The turning circle in a horizontal plane is about 5.5 times the submarine's length.

The test diving depth of an Akula is the same as that of a Sierra: 600m. Collapse depth is 840m. Operating depth is 480m. The pressure hull has a simple form (cylindrical in the middle parts and cones at the ends). The maximum diameter of the pressure hull is 10.9m with a thickness of 46 mm. The bow and stern bulkheads are spherical. Intercompartment bulkheads are flat (10 atmospheres) except the second compartment's bulkheads which are also spherical (20 atmospheres). The material of the pressure hull is steel, Ak-32, with a yield strength of 100 kg/sq mm.

Damage control surface unsinkability is provided for flooding of any one of six compartments with two adjacent ballast tanks. The submarine has 26 percent reserve buoyancy having 17 main ballast tanks with kingstons.

A new measure of the submarine's surfacing from underwater is the system of emergency blowing up of the three middle main ballast tanks by products of solid fuel burning in addition to usual blowing of ballast tanks by high pressure air. For rescuing the whole crew from test depth, the submarine has a life-saving chamber.

Owing to a high degree of automatization, the submarine's crew consists of 73 officers, petty officers and men.

General Arrangement

The submarine has six compartments plus a bow part, a stern part, 17 ballast tanks, a superstructure and a sail. For unsinkability, the first compartment is divided into two parts by the horizontal 10 atmospheres watertight deck. In the bow part there are torpedo and decoy tubes and a hydroacoustic antenna. The first compartment has torpedoes, hydroacoustic and storage batteries; second compartment-control room and living accommodations; third compartment-radio, radar, navigational, some electrical equipment and diesel generator; fourth compartment-reactor and its equipment; fifth compartment-turbine, turbogenerators and their components; sixth compartment-thrust bearing, rudders and planes machinery and the device for the retractable towed hydroacoustic antenna. In the stern part-propeller, stabilizers, planes and rudders and reel for the hydroacoustic antenna. The surfacing escape chamber, bridge, retractable masts and towed radio antenna are in

the superstructure and sail.

Tactical-Technological Characteristics

Surfaced displacement, t	8,140
Submerged displacement, t	12,770
Length, beam, draft, m	110.3x13.6x9.7
Torpedo tubes bow,	4-650mm and 4-533mm
Weapons	12-650mm and 28-533mm torpedoes and missiles or 40 mines
Sonar/fire control	SCAT-3 and BICS
Test depth, m	600
Speed, submerged, knots	33
Reactor	1 OK-650, 190 mgwt
Turbine	1 50,000 shp
Complement	73
Builders	Komsomolsk and Severodvinsk Shipyards
Cost	300 million rubles in 1984

Conclusion

In comparison with the Project 945 submarine, the increasing volume displacement of the Project 971 submarine reduced her speed but allowed the implementation of the newest weapons and electronics that broadened the spectrum of submarine missions. The most important of them was the installation of new cruise missiles (Granat) to strike land targets from 533mm torpedo tubes at ranges up to 3000 km and new hydroacoustic complex SCAT-3 with digital processing.

But the main test was providing for minimum noise of the submarine. It was done by arranging of all that is on a submarine on intermediate rafts which are fixed to the pressure hull and bulkheads on pneumatic shock absorbers. It is the second cascade of noise insulation. The first one is on rubber struts and mechanism foundations. Thick anti-echoing coating (64mm) on the outer hull and thin anti-noise coating on the pressure hull also play their role. As a result, this submarine is the quietest in the Russian Navy.■

GUARDING THE DECIBELS

by CAPT 1 Rank V.N. Parkhomenko, Russian Navy
Doctor of Technical Sciences, Professor

Translated from the Russian Naval Journal "Morskoy Sbornik", No. 6, 1996, pp. 64-67. Submitted by A.H. Skinner, Marblehead, MA.

If we don't dig too far into history, when the *first sonarman*, Leonardo da Vinci, put into the water the end of a tube, and placing the other end in his ear, "heard the sound of far away ships moving", we can consider that, with us, the beginning of systematic work on the quieting of ships was the decision of the Chief Military Council of the Navy dated 21 October 1940 entitled *On the Quieting of Submarines*. At that time, the Council, noting the unsatisfactory state of "matters concerning the listening to, and quieting of, submarines", directed as follows:

> "To the Chief of the Main Naval Staff:
> 1. Prepare and deliver to the Directorate of Shipbuilding by 15/11/1940 the operating tactical standards for the audibility of submarines.
> 2. Prepare and deliver to Naval Communications by 15/11/-1940 an order for the equipment, for all fleets, to set up trials areas for listening to submarines and establishing their levels *[pasportizatsiya]*.
>
> To the Chief of Communications of the Navy:
> In accordance with data from the main Naval Staff, in 1941 equip trials areas in each fleet for listening to submarines and establishing their sound levels..."

But the Great Fatherland War (WWII) somewhat delayed the carrying out of that order. Right after the end of the war, in the First Institute of the Navy, an Acoustic Department was formed in 1946. Here it is necessary to state that the research departments of the various industrial and defense-related institutes are the primary structural organizations specifically set up to solve complex scientific problems of vital importance. And under one of these departments, undoubtedly, came the panel *Nondetectability and protection of warships with respect to their acoustic field* created 50 years ago. Subsequently it took on other names, but essentially

its function always correspondent to the title *Department of Acoustical Protection and Nondetectability (Otdel Akusticheskoy Zashchity i Skritnosti, OAZiS).*

"People who have mastered the technology...solve everything." In that old slogan there is a grain of truth, because well prepared specialists actually can solve a whole lot. Therefore the leadership of the department was always chosen with great care. The responsibility for heading up this department was vested in (sequentially): G.N. Bogdanov-Katkov, V.S. Dobrodskiy, Ye. Z. Grigoryev, V.A. Tkachenko, Ya. F. Sharov, V.D. Boyarskiy, A.V. Avrinskiy, V.N. Parkhomenko, P.F. Tomchuk, and V.M. Seleznev. Also, the problem of finding highly qualified personnel was very difficult. This was because measures for ensuring nondetectability, or quietness covered many fields of technology, and the responsibility for carrying this out in the navy was lodged in several subsections, but the most competent scientific organ for this problem as a whole was, always, the Acoustics Department of the First Central Scientific Research Institute of the Ministry of Defense. Therefore, with its relatively small number of personnel, the department strove to find people who were specialists in hydroacoustics, ship structural mechanics and hydrodynamics, competent in modern physical-mathematical methods of research, having shipboard experience, an adequate knowledge of operational procedures, and familiarity with the actual capabilities of onboard equipment and naval weapons.

Another factor was that, until recently, there existed neither military nor civilian educational institutions having program or staff that could provide the training necessary for specialists in ship acoustics, the science of the quieting of ships. We began to solve this problem by creating, with the active help of our Institute, a faculty called *Physical Fields of Ships* at the Dzerzhinskiy and Lenin Naval Academies: a faculty *Development and Operation of Systems for the Protection and Masking of the Physical Fields of Ships* at the Naval War College; and a faculty *Marine Acoustics and Hydrophysics* at the St. Petersburg National Marine Technical College.

Experience with these faculties has shown that specializing in the education of young officers has been very worthwhile. In particular, we should introduce into the Dzerzhinskiy Academy's existing Shipbuilding Faculty, a new one entitled *Development and*

Operation of the Technical Means of Protecting Ships with Respect to Their Physical Fields. In making the application for that, which was prepared by personnel of our Institute for the Commander-in-Chief of the Navy, we have had the help of the leading scientific naval constructors and designers: I.D. Spassky, I.G. Zakhrov, D.M. Rostovtsev, V. Ye. Yuknin, and others. In this speciality it is proposed to train hydroacoustics officers for appointment to the following duties: Engineering personnel for naval ship repair yards, research and test ranges; vibration and noise laboratories; sections for overseeing the corresponding activities in submarine fleet staffs; naval shipyard inspectors; naval personnel at Central Design Bureaus; and finally, scientific personnel of the specialized departments and laboratories of the scientific organizations of the Navy.

It is probably not necessary to add that, for effective participation in quality control and overseeing the design, construction and acceptance of naval ships; for providing competent assistance in solving operational problems with new technology; and also for a deep understanding of scientific research work, personnel of high qualifications are required. And officers can become so, generally, at an age of around 45 or 50, which corresponds to the maximum age for remaining in the service. Not belaboring this thought further, we may note that, in our view, the retirement into the reserves, in a single year, of five PhDs of age 50 who had completed their service in our Institute was most regrettable. But the nuances of service politics must be laid aside in this paper.

Being the only large scientific unit in the navy of its kind, the OAZiS from the beginning supplied the solutions to fundamental problems in the area of the physical fields of ships, namely:

- determination of their priority from the point of view of importance for the protection and nondetectability of ships by hostile systems for detection and destruction;
- controlling the characteristic parameters of those fields both during the ship design process and during operational deployment;
- measuring and maintaining certain standardized values for those fields.

Historically, noncontact systems for guiding naval weapons (mines and torpedoes), which react to the hydroacoustic field or other fields of a ship, were developed earlier than systems for

detecting ships by their physical fields. Therefore, initially, in the work on protection and nondetectability of ships, the hydroacoustic field was not emphasized. The direction of the work, which was determined in the first phase by members of OAZiS jointly with scientists of other institutes and industry specialists, in the main, coincided with studies that had already been conducted aboard.

Without doubt, the basic scientific accomplishments and the orientation and direction of the work carried out by OAZiS in the field of the acoustical protection and nondetectability of ships is well reflected in the dissertations presented by its members. Seventeen masters and five doctoral dissertations prepared by members constitute a weighty contribution to the development of ship acoustics. Research carried out for our audience by A.P. Golovnin, V.G. Savitskiy, N.V. Kaspustin, V.C. Boyarskiy, Ye. M. Mikheyev, A.I. Trilesnik, M. Ya. Pekel, A.K. Kvashenkin, V.N. Parkhomenko, V.B. Mironova, and others from 1952 to 1978 was devoted to the investigation of the acoustical and vibrational characteristics of the basic noise sources that create the acoustical field of ships, and also to constructional methods of lowering its level. The incorporation of the results of those researches in the designs of submarines and surface ships is reflected by specific values in decibels.

And one must say that, having noted very evident *acoustical defects* in our ships that were built in the 1950s and '60s, we took urgent measures to quickly and relatively inexpensively reduce their noise, even as they were being serially constructed. As the years progressed, however, further success in quieting them came at a higher and higher price. For example, the cost of noise reduction measures as a percent of the total cost of an SSN was approximately as follows: in the 1960s, five percent; 1970s, seven percent; 1980s, 10 percent; and in the 1990s, 20 percent. And present estimates are showing a very real growth in the *cost of lowering the decibels [stoimost'umen'sheniya'detsibelov]*. Additional evaluations made by our acoustics specialists at that time confirmed the impermissible excess of noisiness of Soviet SSBNs over the U.S. Navy's SSBNs, when compared by year of construction. The solution of this problem, in the main, came to depend upon the introduction into the production process (principally in machinery building plants and the shipyards) of the most modern technology, which required a very large financial outlay.

Even though at that time enormous sums were being spent for defense, there was still not enough for the quieting of nuclear submarines. In this situation, the navy finally got its way, and the problem of the acoustic nondetectability of SSBNs was made a national objective *[obshchegosudarstvennaya]*. Nevertheless, a sharp divergence arose between the fleet's requirement for the elimination of the lag in noise levels with respect to the U.S. Navy's nuclear submarines along with the achievement of levels corresponding to background levels in operating areas on the one hand, and the capabilities of our industry on the other. At this juncture, shipyard personnel made attempts to secure a review of those critical numbers, claiming that the navy's requirements were without basis. But thanks to the persistence of the navy specialists, this only resulted in placing the wishes of the Navy on such a high level that in the 1980s, to talk about their unattainability became not only unthinkable but downright dangerous.

One positive result of this *victory* of the naval acousticians over their colleagues in industry was that now they were both directing their energies toward finding the means and methods for solving the superproblem facing them. As is well known, in our country we have the tradition of finding a way to employ secret reserves and obtaining optimum solutions when faced with the absolute necessity of achieving the impossible. As a result, the noise levels of our ships were reduced by 30 times (!) *[emphasis in original]*, which was objectively proven by the results of full-scale trials. Moreover, the latest research showed, in the opinion of specialists, that it would be possible to increase that number, i.e., to reduce the noise of ships by 100 to 300 times.

Such very significant results were achieved at the initiative of the Navy. To solve the problem a search for nontraditional technical approaches was begun, with more and more active participation of the leading scientific research institutes of the country, including the academic. In 1981, a special seminar was held at the Institute of Machine Studies of the Academy of Sciences, under the leadership of the President of the Academy and the Commander-in-Chief of the Navy. Basic presentations by the Navy were made by Fleet Admiral S.G. Gorshkov, and the Director of the First Central Scientific Research Institute of the Ministry of Defense, Vice Admiral V.N. Burov. In the papers presented by officers from our Institute and the Navy's Chief

Directorate of Shipbuilding (V.M. Solovyev, D.A. Gidaspov, V.A. Dobrodeyev, O.N. Maslov, A.V. Avrinskiy, V.V. Sorokin, A.V. Romanenko, and others) the foundation was laid for a transition to the acoustical designing of submarines as a solution to the problem of making them undetectable.

In this kind of a design approach, it was proposed to use a type of systems design in which there is established a relationship between the desired values of the acoustical parameters of machines as complex noise-radiating systems, and the physical-technical characteristics of such systems. In practical terms, the solution to the problem of the optimization of the system *sources of noise--means of acoustical detection--radiated acoustical field of the ship* was investigated with respect to the criterion of maximum nondetectability. When considering the optimum combination of the tactical-technical characteristics of the ship, priority was given to noise.

But even after this seminar, there remained quite a few who were hostile to the acoustical designing of ships, including some of the leading specialists of the Navy. However, the basic features of this methodology, worked out in our Institute and in the Kyrlov Central Scientific Research Institute, were persuasive in demonstrating the necessity for Central Design Bureaus to adopt the recommendations for acoustical design procedures. In the development of the bases for the methodology and the recommendations for designers, the contributions of our associates: PhDs Ya. F. Sharov, A.V. Avrinskiy, V.N. Parkhomenko, V.I. Dorofeyev, V.N. Shchegolikhin, and MSs A.A. Gorshkov, P.F. Tomchuk, Ye. A. Zavgorodnyy, Yu. I. Zakonov, V.V. Yemelyanov, and V.M. Seleznev played a leading role. V.P. Balashenko and V.M. Kriyltsov of the Navy's Scientific-Technical Committee provided significant support in approving the concept.

This new approach to the design of nuclear submarines and its actual initiation signaled a departure from the mere repetition of western technology which had condemned us to the necessity of catching up, by repeating technical solutions that had already been adopted abroad. Our method envisaged primarily a search for nontraditional designs and structures suitable for ships, that would eliminate the highly undesirable low-frequency vibrations, as well as a complex approach to the application of design concepts and methods for *acoustical protection*, thereby obtaining the additional

effect of compensation *[kompensirovaniye]*. The solution of optimization problems, in which we took as the target function the minimized noise levels in local frequency zones with subsequent search for a global minimum, were made a part of the design process for the acoustical protection of ships. We also developed new types of propulsion systems, external and internal acoustical coatings, waveguide isolation mounts, and suspensions of a new design for unsupported members, as well as methods and whole new systems for active compensation. The use of these on our nuclear submarines (taking account of their unusual architectural features) was more pronounced than in foreign submarines. The technical tasking and the thematic programs for developing these new designs, as well as those who carried out the work, were prepared and trained by the members of our Institute.

The scientists of OAZiS demonstrated that considerable potential for increasing the effectiveness could be found in the rational combining of traditional design measures on the basis of the Aristotelian principle, which says that "the whole must be greater than the sum of its component parts". Tuning out or tuning in elements of vibrating systems, taking account of the kinds of selective conductivity of acoustic signals through different mechanical structures and creating acoustic filters, synchronizing the rpm of machines and propulsors, and the mutual compensation of the vibrations of the various sources can, by several times, increase the effectiveness of acoustical protection over the traditional methods of vibration isolation, vibration damping, and sound absorption.

And just a word about another important direction taken by the acousticians of our Institute—proving a technical presence during industrial operations. That, in essence, is the creative participation of Navy specialists in shipbuilding when developing and constructing new ships, during which the carrying out of the technical policies of the Navy is ensured. To achieve this end, as applied to the acoustical protection of ships, the following approach was developed and approved by the acoustic section of the First Central Scientific Research Institute of the Defense Ministry. In the ship design stage, the naval Supervisor concentrates his attention on pointing out any deficiencies in the measures adopted by the design bureaus for meeting the specifications in the technical tasking. This becomes the basis for the necessity of further work to introduce additional technical solutions into the ship's design. In

the construction and delivery stages, on the other hand, we seek convincing evidence of the capability to ensure conformity with the specifications within the framework of the design solutions that were adopted. This stimulates design bureaus and shipyards to eliminate constructional and technological defects as well as small design errors.

The approach has had the result that, in individual cases, the effectiveness of one or another shipyard solution for acoustical treatment has been evaluated differently by us, depending on what stage of construction the ship is in. Although both designers and the authorities of the Chief Directorate of Shipbuilding of the Navy have not failed to notice this, nevertheless, in the main, the approach we have chosen fits the needs of the matter and has become standard for us.

Speaking of customs and traditions, we shouldn't forget that we are on the eve of the 300th anniversary of the founding of our Navy. This significant date is falling in a period of extreme difficulty in our Navy's history. But those who now see only the decline of our country's naval power are deeply mistaken. Paradoxically, it is especially after great economic crises that Russia's Navy has been reborn. The commissioning this year of the nuclear powered guided missile, heavy cruiser PETER THE GREAT stands as a symbol of the preserving of our state's naval power. The work of many of our scientists, engineers, workers, and naval personnel has assured its high combat capabilities. And indeed, the members of the Acoustics Department of the First Central Scientific Research Institute of the Defense Ministry made their own contribution to the improvement of the very important tactical/technical element of this cruiser--reducing its noise.

In conclusion, I would like to congratulate the members of OAZiS on the occasion of its 50th anniversary. Over those years they worked with distinction in the interests of the Navy. May they have further creative successes.■

AGING RUSSIAN NUCLEAR SUBMARINE PROBLEMS

by Daniel A. Curran

Daniel A. Curran, a former nuclear submarine officer, is a Senior Research Fellow at the Marine Policy Center, Woods Hole Oceanographic Institution.

According to a recent report from the U.S. Embassy in Norway[1], the potentially catastrophic nature of radioactive waste and pollution in northwest Russia, mainly from aging nuclear submarines and spent reactor fuel, has prompted several bilateral and multilateral cleanup programs, now underway.

The programs are focusing on:

1. Cooperative cleanup efforts among the U.S., Norway, and Russia.
2. Increasing the processing and storage capacity for various types of nuclear waste.
3. Attacking certain high priority project areas, such as the scrapping of Russian nuclear submarines and cleaning up specific problems including the rusting, nuclear fuel laden cargo ship known as LEPSE.

Key efforts in the region include:

- Six initial projects to be done under the trilateral (U.S., Norway, and Russia) framework of the Arctic Military Environmental Cooperative Declaration (AMEC).
- A trilateral Murmansk initiative (the U.S., Norway, and Russia) addressing an increased processing capacity in northwest Russia for low level liquid radioactive waste.
- Joint Russian-Norwegian efforts to remove the radioactive waste and spent nuclear fuel from some 70 decommissioned Russian nuclear submarines.
- Multilateral efforts (France, the European Union (EU), and Norway) to clean up LEPSE (a rusty cargo ship in Mur-

[1] Message from the American Embassy, Oslo, 1996, "An Updated Guide to Environmental Projects in Northwest Russia", 11 October. Much of the material in this article is taken from this report.

mansk harbor containing hundreds of spent nuclear fuel rods and other radioactive waste).

On September 27, 1996, then-U.S. Secretary of Defense Perry, Defense Minister Kosmo of Norway, and then-Defense Minister Rodionov of Russia signed the AMEC Declaration in Bergen, Norway. AMEC pledges cooperation among the three countries to address nuclear and non-nuclear environmental problems and pollution prevention in the Arctic region of military origin.

Six projects in northwest Russia with a total estimated cost of $17.3 million have already been agreed upon by all sides for implementation. They are:

1. Development of a prototype container for interim storage of special nuclear fuel.
2. Development of technology for the treatment of liquid radioactive waste.
3. Review and implementation of technology for solid radioactive waste volume reduction.
4. Review of technology and procedures for interim storage of solid radioactive waste, and development of a storage facility.
5. Remediation of hazardous waste sites on military bases.
6. Review and implementation of clean ship technologies.

Together with the U.S. and Russia, the Government of Norway is upgrading a low level liquid radioactive waste treatment facility in Murmansk to provide an alternative to the previous Russian practice of dumping low level radioactive waste into Arctic waters. The hope is that the increased treatment capacity will allow the Russians to create an environmentally sound *cradle to grave* approach to managing low level waste from its civilian icebreaker and military nuclear fleets in the northwest region. This increased capacity should allow them to sign the London Convention (the international dumping treaty).

As a result of the START Agreements, Russia has decommissioned numerous nuclear submarines from the Russian Northern Fleet. About 90 decommissioned submarines are rusting at the docks and could eventually sink, of which an estimated 72 still have their nuclear reactors inside. The number of decommissioned

submarines is expected to rise to 125 by 2010. According to Russian estimates, they currently have the capacity to scrap just two to four submarines per year in the region.

A feasibility study to determine how best to dispose of these decommissioned nuclear submarines was recently completed by a Norwegian firm and a Russian company. Based on this report, the submarine scrapping program, sponsored by Norway, will focus on seven projects:

1. Constructing a container vessel for special nuclear fuel.
2. Constructing special railway cars for transporting special nuclear fuel.
3. Constructing a temporary storage facility for liquid radioactive waste.
4. Establishing a mobile facility for concentrating liquid radioactive waste.
5. Constructing a temporary storage facility for solid radioactive waste.
6. Emptying and shutting down an unsafe facility for special nuclear fuel in Andreev Bay.
7. Possible assistance in the completion of an intermediate storage facility for special nuclear fuel from submarines at the Mayak Plant in the Ural mountains.

LEPSE is a cargo ship sitting at the Murmansk docks filled with special nuclear fuel (much of it damaged according to the report) and other nuclear waste. An EU financed study of how to remove the special nuclear fuel and other waste safely and place it in proper storage containers is now finished.

While overall financial responsibility for the project is still Russian, several other sources including France, Norway, and the EU are pledging funding for the LEPSE cleanup effort. In addition, the Nordic Environment Finance Corporation has indicated it will make a substantial contribution to the project.

There is also assistance provided under the AMEC framework by using LEPSE as a training site to teach Russian military personnel how to safely remove damaged special nuclear fuel, and by development of interim storage containers for the special nuclear fuel once it is removed.

Meanwhile, the Russian Pacific Fleet is not without its prob-

lems.[2] On May 30, 1997, a Charlie I class submarine, part of the Project 670A (decommissioning and dismantling of the Charlie class submarine in the Pacific Fleet) sank at the Russian submarine base in Avachinska Bay on the Kamchatka peninsula. According to a Russian Navy Pacific Fleet press release, the submarine, reportedly defueled, lost its buoyancy due to a hole in its rusty hull. A salvage effort began on June 2, 1997 to recover the sub from about 60 feet of water. The submarine should not present a danger to the environment according to the fleet press center.

There are 11 Charlie I class submarines, each with a pressurized water reactor, stationed in the Pacific Fleet. The class was constructed at the Gorky shipyard in the late '60s and early '70s. All are reportedly out of service.

These efforts are bound to be hampered by the continuing budget problems in the Russian military and the recent sack of the top two Russian defense officials by Russian President Boris Yeltsin. Information on the state of the Russian Navy, particularly the problems with the submarine fleet, are detailed on at least two web sites. The best, in my opinion, is a web site produced by the Bellona Foundation in Norway. The URL is: <http://www.-ngo.grida.no/ngo/bellona/ehome/russia/nfl/index.htm>. The site is upgraded regularly. The site can be reached via the Yahoo search engine, then Government, Countries, Russia, and Military. Another site is called State of Russian Navy Data Page, URL: <http://www.webcom.com/~amraam/rnav.html>. The site was last updated in January 1997. This site was reached from the Bellona URL. I can be reached at dcurran@whoi.edu if there are any questions.■

[2] Igor Kudrik, 1997, "Nuclear Sub Sank in the Pacific", Bellona Foundation, June 10.

NR-1 RETURNS FROM DEPLOYMENT

"Groton, Conn. (NWSA) - Naval Research Vessel (NR) 1, the Navy's smallest and only research submarine, returned home to Naval Submarine Base Groton, Conn. Sept. 20.

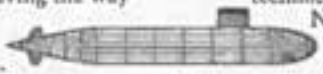
During a five month deployment to the Mediterranean Sea, NR-1 and a research team from the National Geographic Society discovered a large concentration of ancient shipwrecks while exploring off the northwest coast of Sicily.

The discovery was a major breakthrough in marine archeology. Eight sailing ships, spread over 20 square miles, were lying 2,300 feet beneath the surface of the Mediterranean. The oldest ship, dating from about 100 BC, is one of the earliest Roman shipwrecks ever discovered.

Three of the ships were of relatively modern origin, including two from the 19th century and an Islamic ship from the 18th."

VISIONS BECOME REALITY WHEN YOU TEST THE WATERS FIRST

The success continues with NSSN. We are building the best for today and paving the way for tomorrow. The team and systems approach for improving capability and maintaining superiority carries forward. Linking ideas and validating concepts in large scale is the low risk, timely and cost-effective way to insert technology with confidence.



Newport News is on the team and is committed to bringing affordable submarine superiority to the U.S. Navy now and in the future.

WORLD'S MOST ADVANCED SHIPBUILDER

www.nns.com

SUN TZU AND THE ART OF SUBMARINE WARFARE

by MIDN Fred Macri

Thus it is said that one who knows the enemy and knows himself will not be endangered in a hundred engagements. One who does not know the enemy but knows himself will sometimes be victorious, sometimes meet with defeat. One who knows neither the enemy or himself will invariably be defeated in every engagement.

-Sun Tzu The Art of War

The United States military is accustomed to training in preparation for the Russian threat. U.S. submarine crews have expected and anticipated the tactics of Russian submarine captains for over a quarter of a century. Today, with no Cold War, the U.S. is unsure of who the enemy is. Submarine crews must prepare for this by expecting the unexpected. It is essential that we know the enemy; even before we meet him. The only way U.S. submarine crews are going to prevail over those of foreign navies is if they never assume, and train for various scenarios. Submarine crews must never fall into the trap of making generalizations. In dealing with the Soviet threat submarine crews could assume that because all Soviet submarine captains were trained in the same manner, they would fight the same way. This may have been logical, but U.S. Submarine Forces may very likely face a different type of opponent in the future. This enemy may prey upon a weakness of making generalizations about our opponent by implementing unconventional methods of warfare. He may break in through our backdoor when we are expecting him to knock at the front. Every submarine captain in the enemy fleet could utilize different tactics and totally different methods of thinking to confuse us.

Warfare is the Way (Tao) of deception. Thus although [you are] capable, display incapability to them. When committed to employing your forces, feign inactivity. When [your objective] is nearby, make it appear as if distant; when far away, create the illusion of being nearby.

-Sun Tzu The Art of War

Submarines are fit for deceiving the enemy more than any other general warfare arm of the Navy. Deception involves attacking the enemy where they least expect it. As Sun Tzu wrote, "Attack him where he is unprepared, appear where you are not expected" Submarines are extremely difficult to detect, and therefore not very susceptible to attack from the air, land, or above the sea. Submarines have the potential to fight unconventionally by penetrating deep into enemy waters without being detected. Submarines can function with little or no help from outside sources. Submarines have catastrophic havoc-wreaking capability. They can insert and attack where the enemy is least expecting them.

Deception is a warfare technique which should be employed to the fullest extent by the U.S. Navy; and even more specifically by the submarine fleet. One of the five missions of the U.S. Navy is the **projection of power from sea to land**. This mission is not in accordance with Sun Tzu's belief that war is all about deception. In projecting power one may reveal the size of one's forces as well as their location; making one vulnerable to attack by a smart enemy.

Knowing one's enemy allows for the implementation of deception. If U.S. Submarine Forces were to realize an enemy's weak point, they could exploit this knowledge to conquer them. There are other ways to win a war than sheer force. Maybe submarines could be used to feign the location of U.S. naval forces by transmitting false radar images to the screens of the enemy. The enemy would then deplete their weapons supply, thus allowing for a U.S. victory. When the enemy expects an attack from one place, attack at another. Submarines can accomplish this by positioning themselves at or near a target without detection. It is possible that if the U.S. were to increase the submarine fleet and decrease the amount of surface ships, the enemy would be led to underestimating the size and power of the U.S. naval forces; giving the U.S. an advantage. Measures such as these could lead to the saving of American lives during a time of war.

Thus the wise general will concentrate on securing provisions from the enemy. One bushel of the enemy's foodstuffs is worth twenty of ours; one picul of his fodder is worth twenty of ours.

-*Sun Tzu* The Art of War

The intricacy of the U.S. military's method of packing and shipping supplies lends itself to sabotage. Supplies are packed in containers and marked with bar codes. Because of the immense size of the military, the process is computerized and planned down to a science. A bit of tampering could throw the whole system off. What if an enemy were to gain access to our shipping information and interfere with it? He could change the meaning of each barcode, change the final destination of the supplies, or booby-trap them. In the end this would cause mass confusion to U.S. forces.

Submarines have the potential to aid the U.S. in gathering important information concerning the location of enemy supplies. Covert insertions of special forces (SEALs) behind enemy lines has always been executed primarily by submarines. By utilizing submarines to insert SEALs with missions primarily concerned with locating enemy supplies, we can act in accordance with Sun Tzu's teachings. By cataloging the location of provisions of potential enemies, we will have the edge in the time of war. We will be able to destroy or capture the enemies supplies. An army without supplies isn't an army.

> *Hence to fight and conquer in all your battles is not supreme excellence. Supreme excellence consists in breaking the enemy's resistance without fighting.*
>
> -*Sun Tzu* The Art of War

Submarines can be used to wage psychological warfare. In doing so the enemy's morale would break, allowing for a U.S. victory. Psychological warfare could be waged by various means. Periscopes could emit signals to jam radar, as well as interfere with enemy communication signals. U.S. Naval Intelligence could then tamper with and reroute the messages. This would lead to mass confusion among the enemy.

The enemy's morale could also be broken by the implementation of highly unconventional submarine tactics by U.S. forces. If U.S. submarine tactics were highly unpredictable to the enemy, fear would prevent the enemy from challenging us. If our submarines appeared where the enemy least expected them, then the U.S. would win without fighting. Sun Tzu wrote, "Just as water retains no constant shape, so in warfare there are no constant conditions. He who can modify his tactics in relation to his

opponent and thereby succeed in winning, may be called a heaven born captain." Sun Tzu reveals that tenants of unconventional warfare include adaption and flexibility. There cannot be set guidelines for submarine warfare. If the U.S. wants to reap the benefits of unconventional warfare, then a balance must be struck between structure and flexibility. There must be structure and discipline within the body of the army; yet commanders should be encouraged to develop unique strategies. Commanders shouldn't be sent to a school which teaches specific submarine tactics, but to one which gives them ideas and encourages varied thought on tactics. This way U.S. Submarine Forces will act unconventionally, and gain the edge.

Winning a war without fighting has many advantages. Primarily, American lives can be saved. With no need to wage war, there will be no American casualties. By conquering without fighting, the enemy's country and provisions are left intact. The U.S. could exploit the land by building bases on it; and use the provisions by adding them to U.S. supplies or selling them.■

QUICK METHOD FOR ESTIMATING TARGET ANGLE ON THE BOW

by LCDR Butch Bornt, USNR

Introduction

When estimating a visual surface target's angle on the bow (AOB), the periscope operator relies upon experience. The more quantitative method described in this article is based upon the ranging methods described in NWP 71-1-1 and NWP 77, and may provide a quick sanity check for the periscope operator. All information taken from these NWPs is unclassified.

Method

The range (Rh) of a visually observed surface contact is determined using the formula:

$$Rh = K \times MHH/\#DIVv \quad (1)$$

where MHH is the estimated masthead height, #DIVv is the number of vertical division, and K is a constant. However, this equation is also valid for the horizontal divisions:

$$Rh = K \times MHH/\#DIVv = K \times L_{eff}/\#DIVh \quad (2)$$

where the relationship between estimated length (L_{est}) and effective length (L_{eff}) is shown in Figure 1. Mathematically,

$$\sin(AOB) = L_{eff}/L_{est} \quad (3)$$

Equation (2) can be rearranged and solved for L_{eff} as follows:

$$L_{eff} = MHH \times \#DIVh/\#DIVv \quad (4)$$

Equation (4) is solved to determine L_{eff}, which is then used in equation (3) to find the sine of AOB. The sine thumb rules of NWP 71-1-1 are then used to find AOB.

Estimated Target Length

You will need to know the masthead heights and lengths of surface ships you may encounter in your OPAREA. Based on intel, you should know what to expect, and the ship dimensions are available in your handy-dandy copy of Jane's Fighting Ships. In the absence of this information, use the estimated combatant dimensions in Table 1. These dimensions are based on a quick perusal of Jane's Fighting Ships, so do not treat them as gospel.

Over-estimating target length leads to a smaller estimated AOB, which is conservative, as shown in Figure 3.

Surface Combatant Type	L_{est}
Cruiser	~600'
Destroyer	~500'
Frigate	~400'
Coastal Patrol	~150'

Application

You are the periscope operator and you see the surface target, I mean, contact shown in Figure 2. MHH and L_{est} are 100' and 300', respectively. Thus,

L_{eff} = 100 x 12/5 = ~240'

sin (AOB) = 240/300 = 0.8

Using the sine thumb rules, AOB = ~55°

References

Jane's Fighting Ships

NWP 71-1-1, "Target Motion Analysis (TMA) Techniques" (CONFIDENTIAL)

NWP 77, "Submarine Electronic/Optic Sensor Employment (U)" (SECRET)

(If you have any questions, comments, suggestions, or insults, please feel free to e-mail me at **Error! Bookmark not defined.**)

Figure 1

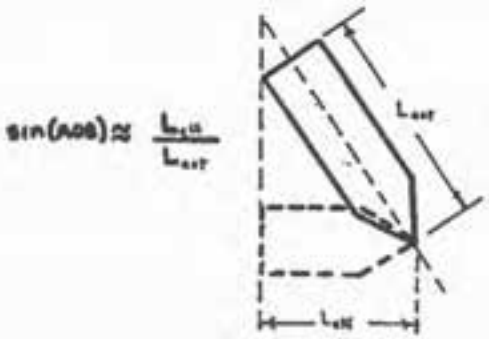


Figure 2

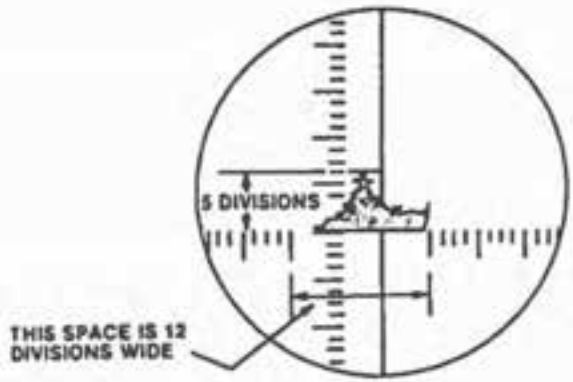
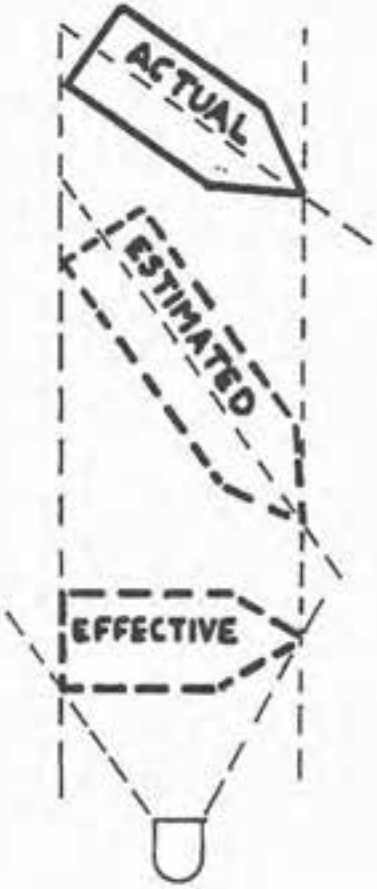


Figure 3



THE FANTASTIC PROPOSAL FOR A U-BOAT BASE IN BRITISH HONDURAS

by Jamie Bisher

By 1918, Guatemala had cowered under the oppressive rule of President Manuel Estrada Cabrera for 30 years. While the Indian population toiled in medieval serfdom and squalor, the balding, bulbous-headed tyrant Estrada Cabrera looted the national treasury and raked off all the country's wealth into personal bank accounts. Small cliques of toadying military and police officials and an elite oligarchy shared the booty. Provincial bosses enforced worship of Estrada Cabrera; his and his mother's birthdays were made national holidays. The Boston-based United Fruit Company and other foreign investors were welcome to make lucrative sweetheart deals with the government as long as Estrada Cabrera and his cronies got their cuts. Scattered pockets of opposition, made up of disgruntled military officers and businessmen who labelled themselves Liberals, only coveted Estrada Cabrera's riches and absolute power.

Similar corrupt, iron-fisted dictatorships lorded over the other Central American nations of El Salvador, Honduras, Nicaragua and Costa Rica. The only area free of tyranny was the colony of British Honduras--the present day nation of Belize, which flanked Guatemala's eastern border. Belize's meager population consisted of fiercely independent logcutters, smugglers and subsistence farmers descended from pirates, slaves, fugitives and Mayan warriors. British colonial officials dreaded postings to this sleepy Caribbean backwater, and dubbed it "the slum of the Empire". Maps printed in Guatemala City persisted in including this Vermont-sized parcel within Guatemala's national boundaries. Guatemalan demagogues regarded Belize as part of their country's inheritance from Spain's colonial empire. Whenever they wished to divert the Guatemalan people's attention from their own dismal conditions, they would demand the territory's return or even call for an invasion.

A Rebel Guatemalan Exile's Fantasy

In times of despair, even the ramblings of the inebriated get a hearing. With divine intervention and healthy doses of good

fortune, the secret proposal laying before Heinrich von Eckhardt, the German Minister to Mexico, might reshape the map of Central America. By some unprecedented miracle, it might also somehow relieve beleaguered German troops on the Western Front by diverting American and British resources to the Caribbean. During the desperate summer of 1918, the German Minister had to consider any proposal that could possibly aid the Fatherland's faltering war effort.

The secret proposal called for a "revolution in the colony of *Belice...*" created by rebel Guatemalan and Honduran forces backed up by German U-boats. After victory in Belize, the secret proposal strategized that German long-range submarines could establish a base there to conveniently assault American ships in the Caribbean and the Gulf of Mexico. A popular revolt would then spread spontaneously from Guatemala and Honduras into El Salvador, Nicaragua and Costa Rica, installing new *revolutionary* governments that would withdraw support from the Allied cause. This was the scenario outlined by the proposal's author, *General* Isidro Valdez.

Isidro Valdez, a native of Jalapa, Guatemala, graduated from Guatemalan national military academy, in 1893. He served four years as an instructor at the academy before Guatemala was torn by a violent political struggle. The young officer cast his lot with power-hungry plotters of an ill-conceived *coup d'etat*. In 1898, Valdez and his fellow revolutionists were driven out of Guatemala by pro-government troops. Guatemala fell under the iron hand of dictator Manuel Estrada Cabrera and Valdez was branded a traitor.

An exile at the mere age of 23 years old, Valdez dedicated himself to the overthrow of Estrada Cabrera. Yearning for his homeland and, even more so, fueled with an unsated hunger for power, an oversized ego and, quite often, liquor, Valdez took an active role in several attempts to depose the tyrant Estrada Cabrera. While in exile in Mexico, Valdez associated with expatriates from other Central American nations and joined these fellow *liberals* in their insurgent intrigues. When the turmoil of civil war swept Mexico in 1911, Valdez and many other Central American *liberals* took up arms with the Constitutionalists. Valdez picked a winner this time: after several years of bitter bloodshed, Valdez and his fellow *liberal* legionnaires found themselves in the prevailing camp of Mexican President Venustiano Carranza.

Through his many years of persistent, aggressive opposition to Estrada Cabrera, Valdez gained a good many underground followers, particularly in his native Jalapa. Of course, so dire was the peons' plight that they would have followed the devil himself had he appeared to lead a rebellion. Nevertheless, a failed revolt against the Guatemalan dictator in 1917 convinced Valdez to seek foreign assistance.

In Veracruz in July, 1918, *General* Valdez carefully composed his secret proposal to the German Minister in Mexico City. Casting all modesty aside, Valdez bestowed upon himself the grandiose title of *Liberal Leader of the Revolutionaries of Central America*. He began by falsely asserting that the U. S. "...urges the Governments of Guatemala, Honduras and Nicaragua to send large bodies of troops to the Western Front to oppose the offensive of the Prussian Armies..."

Valdez cited his own patriotism, expounded upon the superiority of Teutonic culture, and conjured up fanciful bonds between the German and Guatemalan peoples. The *General* reminded Minister von Eckhardt of Germany's commercial ties to Nicaragua and Costa Rica.

He lambasted Estrada Cabrera and the other Central American heads of state for "...declaring war on Germany..." and "...bending the knee before the Government of the White House". Valdez wrote, "Do they perhaps believe that the situation of Cuba, Santo Domingo and unfortunate Nicaragua which form feudal states under the Yankees does not deeply wound the dignity of our sovereignty which is due us as Central Americans?" Valdez raved on that the Central American dictators' "...permanence in power is due solely to the government of the United States" and that they were "...mere machines of Mr. [Woodrow] Wilson."

"The first thing which we propose," boldly declared Valdez' blueprint for insurrection, "is to overthrow the government of Guatemala..., which has greater resources and more elements to contribute to the development of our cause against the other tyrannies of the Isthmus..."

Valdez' next step would be Honduras. "[When] our revolution is in the [Guatemalan] Departments of Petén and Alta Verapaz, we shall carry revolution to Honduras where the leaders [of revolt] are identified with us." During the aborted 1917 revolt against Estrada Cabrera, Valdez claimed to have 5,000 Salvadorans massed in

Honduras, waiting to invade Guatemala from the east. After conquering Honduras, Valdez pictured his little army rolling through El Salvador, Nicaragua and Costa Rica, and installing new governments until "...the [Central American] union which is the desire of the Liberal Party" can be achieved. This union would pursue a "close *entente*" with Mexico, "...forming a block of nations which will check the tendencies of Yankee Imperialism." This block of nations could have been enough to rally South American governments into the formation of a powerful, anti-U.S. *Latin League*. For the past few years American diplomats had winced at each rumor that this diabolical *Latin League* was in the making.

Belize was the pawn in Valdez' fantasy. He wrote:

> "There will be a revolution in the colony of *Belíce* which will declare itself independent from Great Britain and enter into an alliance with Germany, and in order that this revolution may be effective, it will be made with the assistance of German submarines. In order that independence may be obtained while the German submarines are in action, the revolutionary Governments of Guatemala and Honduras will furnish their contingents, with the necessary reserves."

General Valdez graciously offered Belize to the Germans to show thanks for their support in installing him in Guatemala's *Palácio Nacional*. Valdez suggested, "With the revolution of *Belíce*, the German government, with the help of Guatemala, can establish a naval base and install points of supply."

Reality and the Realm of Possibility

Although the *General* probably did not realize it, the Germans did possess the basic ingredients of the *Valdez Proposal*. An extensive, if corrupt, network of German spies, orchestrated by *businessman* Georg Vogel in Guatemala City, extended into the highest levels of Estrada Cabrera's government. The tentacles of Vogel's espionage service stretched even into isolated Belize. Regardless of political leanings, the numerous Germans living in Guatemala could be relied upon for support since Estrada Cabrera

had recently confiscated their properties; Valdez promised to return it all when he took power.

A superb new class of German long-range submarine--the *unterseekreuzer*--could supposedly be provisioned for a ten-month cruise. The prototype boat (originally designed for commercial pursuits), the *Deutschland*, had accomplished a Trans-Atlantic crossing amidst great fanfare in 1915. During summer, 1917, the central post office in Mexico City openly hinted that a *special postal service*, presumably via German submarine, would soon be available for communications with the Central Powers. Rumors were already circulating of *regular bi-monthly mail service* between Mexico and Germany. In early April, 1918, French intelligence advised the U.S., "According to information from a very reliable source a submersible cruiser belonging to the class of transformed merchant submarines will leave Germany soon for Mexico to transport there a military mission and arms." None of these rumors ever materialized into fact.

Then in April and May, 1918, the German Navy's *unterseekreuzers* pulled off some daring long-range exploits. On April 10, 1918, *U-154* terrorized the West African republic of Liberia. The huge (213-foot long, 1,800-ton (submerged)) ocean-going predator destroyed the Liberian *fleet*--the auxiliary schooner R.L. PRESIDENT HOWARD, bombarded a French wireless radio communications station, and spread panic through the capital city Monrovia, where four civilians were killed by stray shells. Meanwhile, sister boat *U-153* laid mines off the port of Dakar, French West Africa (now Senegal), and cut Allied communications cables on the ocean floor near the Bijagos Islands of Portugese Guinea. On May 24 and May 26, 1918, *unterseekreuzer U-151* mined the United States' Chesapeake and Delaware Bays.

Weeks later, reports reached the U.S. Legation in Mexico City of a "German submarine base near Port Zapotitlan, Vera Cruz, between the reefs or bars of Coatzacoalcos and Santa Comapan," where a "German submarine of large type took on fuel oil and food stuffs." At the same time U.S. military attaches in Argentina forwarded rumors of a covert German submarine base open for business around Tierra del Fuego. Investigations of these reports never produced evidence of genuine U-boat activity, and post-war examination of the records never revealed any Latin American war cruises. Nevertheless, spectres of *unterseekreuzers* continued to

surface. On July 9, 1918, the little Mexican port of Progreso, Yucatan was abuzz with stories that a U-boat had visited the night before to load gasoline and lubricating oil. The captain of the steamship MONTEREY, which was sailing in the vicinity, gave the tales the benefit of the doubt and steered 45 miles out of his way to avoid meeting the phantom submarine.

In spite of Germany's interest in Latin American intrigue, *General* Valdez' German-Central American alliance and conquest would remain a drunkard's fantasy. Some German submarine crews had reportedly mutinied before sailing out of Kiel harbor. And although Georg Vogel's Central American espionage network worked efficiently enough, many of his agents pursued smuggling and other assorted vices with much more ardor than they did spying. The tainted reputation of Isidro Valdez was no plus for the proposed operation either.

According to the files of Major Louis O'Donnell, U.S. Military Attache in Guatemala, Valdez had "...the reputation of being a drunkard and a Soldier of Fortune. It is said he will oppose any faction whatever if the reward is propitious financially." As if that were not bad enough, O'Donnell added, "He has been shot in the head [probably in Mexico], as a result of which some people claim he is mentally unsound." Regardless of German Minister von Eckhardt's opinion of the matter, the Armistice on November 11, 1918, not only ended the world war but shelved any idea of overt German participation in Valdez' plan.

About a year and a half later, on April 8, 1920, President Manual Estrada Cabrera's 22-year reign ground to a halt when the Guatemalan National Assembly declared him insane, and an enraged mob looted his mansion and ran him into a prison cell. *General* Valdez surfaced to be appointed a member of the *Constituyente*--a representative member of the constitutional committee from Jalapa.

Around Christmas that year, one of Major O'Donnell's Guatemalan informants passed him a copy of *General* Valdez' secret proposal. Major O'Donnell's superiors at the Military Intelligence Division in Washington, D.C. forwarded a translated copy of the proposal to the U.S. State Department. Valdez' strong anti-American views and radical schemes aroused paranoia among State Department bureaucrats. Undersecretary of State W. L. Hurley pressed the U.S. Legation in Guatemala for more informa-

tion on Valdez in January, 1921; Hurley wondered if Valdez "...may occupy a position of prominence there."

Major O'Donnell replied, "The present Government do [sic] not give him any consideration at all, and say that after he completes his duties in the *Constituyente*, which will be very shortly, he will go back to Jalapa and become a *nobody*. No one says anything good about him. However, he is the kind of a man who has very strong influence with the peon, and he would probably be able to muster to his banner a respectable command of men in Jalapa to fight for and with him, no matter what the principle involved was."

Despite the presence of German spy chief Georg Vogel among the inner circles of *Unionistas* that deposed Estrada Cabrera, Isidro Valdez, die-hard foe of the deposed dictator for two decades, was rewarded with no prominent role in the new government. The ambitious *General* felt short-changed by both the *Unionistas* and the Germans.

In June and July of 1921, the *Unionistas* returned all property confiscated during the war back to its' German owners.

Undaunted by nearly a quarter-century of setbacks, *General* Isidro Valdez led an armed revolt against Guatemala's new government in early August, 1921. The revolt "...was immediately suppressed." But Isidro Valdez was not. On December 5 that same year, *General de División* José María Orellana led the Guatemalan Army in a relatively tranquil *cuartelazo*—a *shifting of allegiance*"—against President Carlos Herrera. Isidro Valdez had learned his lesson in 1898, and followed the shift of power to Orellana. *El Presidénte* Orellana rewarded Valdez with the post of *Jéfe Polítíco*—Political Chief—of Petén, the isolated, jungle province adjacent to Belize.

REFERENCES

1. National Archives and Records Administration, War College Division, Record Group 165, Military Intelligence Division File 10987-679/2, "Memorandum Which General Isidro Valdez, Engineer, Liberal Leader of the Revolutionaries of Central America Has the Honor to Present to Minister Eckardt [sic]," dated 18 July 1918, Veracruz, Mexico.
2. National Archives and Records Administration, War College Division, Record Group 165, Military Intelligence Division File

10987-679/4, Letter UH from W. L. Hurley, U.S. Undersecretary of State, to Brigadier General Dennis Nolan, U.S.A., Military Intelligence Division, War Department, dated 29 January 1921.
3. National Archives and Records Administration, War College Division, Record Group 165, Military Intelligence Division File 10987-679/8, Letter No. 425 from Major Louis A. O'Donnell, U.S. Military Attache in Guatemala, to The Director of Military Intelligence, dated 23 February 1921.
4. National Archives and Records Administration, War College Division, Record Group 165, Military Intelligence Division File 10987-679/11, "Guatemalan Revolt Quickly Suppressed," Brooklyn Eagle [newspaper], 7 August 1921.

REUNIONS

USS BARRACUDA (SST 3)
USS MACKEREL (SST 1)
USS MARLIN (SST 2)
Submarine Squadron Twelve Staff
September 17-21, 1998 in Indialantic, FL. Contact: Richard E. Coupe, 3004 Lord Bradford Ct., Chesapeake, VA 23321-4514, (757) 484-0113.

USS GUARDFISH (SSN 612) - July 1-5, 1998 in San Francisco, CA. Contact: Richard E. Armstrong, 1626 Encinal Avenue, Alameda, CA 94501, (510) 521-5781; e-mail: nicedad1@-earthlink.net

USS TRITON (SSRN/SSN 586) - June 26-28, 1998 in Mystic, CT. Contact: Ralph A. Kennedy, 89 Laurelwood Road, Groton, CT 06340 (860) 445-6567.

WHY THE U.S. SHOULD SHIFT TO A TWO-CREW SSN FORCE RIGHT NOW

by LT Barry Gittleman, USN

What Needs to be Done

There exists both advantages and disadvantages of manning U.S. fast attack submarines with two crews, as we do with our SSBN force. This paper provides a submarine officer's perspective on why the two-crew SSN is the right choice for America as it approaches the 21st century. The financial reasons alone are sufficient, and it is also the right decision for mission accomplishment, safety, quality of life, morale, training and overall readiness to fight and win conflicts of any scale. This paper also identifies why the decision to adopt a two-crew SSN force is a decision which must be made quickly, in the next two years.

The missions for U.S. submarines today are many, varied, and crucial to the national security interests of the United States. Submarines remain the best platform for performing anti-submarine warfare, and while the Cold War may be over, the proliferation of diesel submarines to Third World nations continues at a rapid rate. Submarines also continue to train and demonstrate proficiency at anti-surface warfare, mining, strike warfare, and special forces insertion and extraction. For covert intelligence, indication, and warning, there is no better platform than a submarine. Despite the continued demonstrated need for, and abilities of, nuclear submarines, senior submarine officers still find themselves faced with a *train wreck* about to occur in 1999 when the declining number of SSNs are unable to meet the many commitments required.

Why It Needs to be Done Soon

There is a pressing need to solve the problem of a Submarine Force which is rapidly declining below the ability to accomplish assigned missions. According to Rear Admiral Fages, Commander, Submarine Group Two, we had 79 active SSNs as of April 1997. Most experts agree that will be down to 55 SSNs by fiscal year 1999, and level out at the 45-55 recommended by the Bottom Up Review (BUR), shortly after 2000. Rear Admiral Fages also stated that 72 SSNs are required to accomplish all present

missions.[1] Assuming the final level reached is 50 SSNs (the middle of the BUR recommendation), in just a few years, we will either have a shortage of 22 SSNs, or we will have to eliminate many of the currently assigned missions.

To accomplish SSN missions within current fiscal constraints becomes even more difficult when considering the CNO's guidance to the fleets regarding *quality of life*. Admiral Johnson has stated that he is just as committed to *quality of life* as his predecessor, Admiral Boorda, was. This commitment includes three scheduling requirements which shall be adhered to whenever possible:

- Deployments will not exceed six months.
- Turnaround ratio will not go below 2:1. (This is the time after a deployment before the next deployment, meaning that crews returning from a six month deployment will have 12 months before their next deployment. For most SSNs, the maintenance schedule has necessitated a turnaround ratio of approximately 3:1).
- Fifty-five percent of a crew's time should be spent in homeport.

With these constraints, it is becoming increasingly difficult for the Submarine Force to meet requirements. Admiral Fages stated that many options are being considered, including:

- Re-evaluating missions to determine if some could be turned over to NATO commitments.
- For the SSNs scheduled to deploy with a battlegroup, reduce the work-up time that SSNs spend with the battlegroup prior to the deployment.
- Take the fat out of the work-up process by eliminating or combining inspections.
- Making all deployments five to six months so an SSN does not do a 24 week work-up for a 45 day operation.

All of these options will result in minor improvements to the

---

[1]RADM Fages, USN, Commander, Submarine Group Two. Speech to SOAC Class 97020. April 8, 1997.

ability of the SSN force to accomplish assigned missions. No combination of these options can reasonably be expected to bridge the huge gap between the requirements a 50 SSN force can perform and the requirements which 72 SSNs can be expected to handle.

How Much We Will Save Financially

The savings from going to two-crew SSNs are substantial, and they are not difficult to estimate. The Navy's average personnel costs are approximately $70,000 per year for enlisted personnel, and $120,000 per year for officers. These numbers include not only salary and bonuses ($40,000 for enlisted and $70,000 for officers), but also housing, medical, dental, Morale Welfare and Recreation Funds, and all other personnel related costs. With a crew of 15 officers and 120 enlisted personnel, total annual personnel costs amount to approximately $10 million per crew. Historically, costs have run about $1 million per year for food and $4.5 million per year for an SSN crew, not including the additional personnel related expenses.[2] These costs are minor compared with the construction costs for modern SSNs. The first New Attack Submarine (NSSN) is expected to cost $3.5 billion, with costs declining to $1.5 billion for each NSSN by the fifth platform.[3] Some quick multiplication of annual crew costs, by the 50 SSNs expected at the turn of the century, yields approximately $500 million per year for 50 additional crews. These 50 additional crews, for 25 years (a nominal submarine lifetime), would cost just $12.5 billion. By comparison, an additional 22 NSSNs (even at the bargain price of $1.5 billion each), would cost $33 billion, almost three times as much. This does not even consider the many savings which can reasonably be expected in other areas, which will be discussed later.

There would be additional costs incurred by adopting a two crew system, and they would be minimal compared with the savings. For example, if each submarine spends 70 percent more

---

[2]CAPT Kirk Donald, USN, Commander, Submarine Development Squadron Twelve, Speech to SOAC Class 97020. March 31, 1997.

[3]Scott C. Truver, "Tomorrow's Fleet: Part I", U.S. Naval Institute *Proceedings*, June 1995, p. 92.

time at sea, it is reasonable to assume that periodic maintenance items would be required more often, and the reactor core would not last as long. Maintenance costs should not, however, go up by a full 70 percent, since the majority of Navy maintenance performed is preventive, rather than corrective maintenance. These maintenance costs are also minor compared to the $33 billion calculated for an additional 22 SSNs (the difference between the 50 expected and the 72 needed), since an entire overhaul (which may be required only once in the lifetime of a NSSN) has nominally cost just $250-300 million. With respect to the reduced reactor core lifetime, much of a submarine's fuel is expended transiting oceans enroute to deployments. Fuel savings could be significant by having crew turnovers take place in overseas bases and by having more submarines forward deployed, which would reduce the need for high-speed (fuel inefficient), long distance transits when crises arise.

How the French Did It 15 Years Ago

The French Navy decided to go to two-crew SSNs 15 years ago, when they realized that they were facing many of the same cutback issues that the U.S. faces today. The French recognized in the early 1980s that, as they reduced the size of their navy for budgetary reasons, they would not have enough platforms to accomplish all of the missions that they wanted to accomplish. They determined that to do so would require having each SSN at sea for more than 250 days per year, which could not reasonably be accomplished with single crew SSNs. As a result, they developed the two-crew system currently in place.

Blue Crew	Red Crew
13 weeks at sea	6 week rest
4 wk analysis	7 week shore training
6 week rest	4 week maintenance
7 week shore training	13 weeks at sea
4 week maintenance	4 week analysis

This system permits the SSN to be at sea for 26 out of every 34 weeks, or 76.5 percent of the time. This equates to 270 days per year, a feat which could not reasonably be accomplished with a

single crew SSN.[4] The challenges faced by the French submarine force in the 1980s were almost identical to those faced by the U.S. Submarine Force today.

Using the schedule the French navy adopted, one can see that a 50 SSN force with two crews per sub would be equivalent to an 85 SSN single-crew-per-sub force. This is greater than the present day U.S. force. Since the CNO is committed to sailors having 55 percent time in homeport, this limits a single crew SSN to an average of 164 days at sea per year. The French schedule provides for each crew to be at sea just 13 of every 34 weeks (38.2 percent or 139.5 days per year). At the same time, the SSN hull is at sea for 26 of every 34 weeks (76.5 percent or 279 days per year). The 279 days is an increase of 70 percent above what a single crew SSN can accomplish, limited by the CNO's directive. This 70 percent increase is the equivalent of turning our projected 50 SSN force into an 85 SSN force, six more than the 79 active SSNs in the fleet today, and more than enough to accomplish all assigned missions.

How We Did It in World War II and How We Do It Today

America has experience with two-crew submarines. We have seen the benefits in our past, and we continue to see them today. During World War II, special maintenance crews would actually relieve the operational crews during refit periods, so the operational crews could rest before their next patrol. Today, we have Blue and Gold crews assigned to each SSBN, just as we have since the first SSBN, GEORGE WASHINGTON, was commissioned in 1959.

> To get maximum use of these massive ships [the first SSBNs], two complete crews were assigned to each ship: two captains, two sets of officers, and two entire crews of 130 men each, one designated George Washington (Blue), and the other George Washington (Gold). At the end of each sixty-day patrol, there would be a thirty-day period for

---

[4]Captaine de Corvette Tantardini, French Navy. Speech to SOAC Class 97020. March 14, 1997.

resupply and a refit and short machinery readiness check, and then the alternative crew would take the ship to sea.[5]

The same requirements for *maximum use* of our SSN force are rapidly coming upon us as the number of platforms declines below the level at which mission requirements can be met. Today, we have fewer than 20 SSBNs and projections are for 14 by the end of the decade. With 14 SSBNs and 50 SSNs in 1999, our SSBNs will constitute just 22 percent of our submarines, yet they will spend nearly 50 percent of the total submarine-days at sea. This shows the large gains in capability which can be achieved by implementing the two-crew manning, with which we are already proficient.

Improved Maintenance

The annual maintenance costs incurred as a result of personnel error are significant, and could be reduced by going to a two-crew SSN force. With two crews performing the maintenance periods together, it is reasonable to assume that some of the personnel-related maintenance errors could be avoided. The workload on SSN crews during maintenance periods is astounding. With twice as many people performing and supervising the work, millions of dollars could be saved just be catching and preventing half of the mistakes that we have had in recent history. This could compensate for any maintenance which is required to be performed more often as a result of more time at sea.

Improved Retention

Another factor which would improve the Submarine Force, with two crews per SSN, would be the greater retention to top quality personnel. The tope five reasons to leave stated by submarine junior officers (JOs) who resign are:

1. Amount of family separation (consistently the number one reason at approximately 25 percent, with all other reasons

---

[5]Theodore Rockwell. *The Rickover Effect: How One Man Made a Difference*. Naval Institute Press. Annapolis, MD, 1992, pp. 257-8.

appearing less than half as often)
2. Poor promotion and advancement opportunity
3. Low job satisfaction
4. Unfair performance evaluations, and
5. Amount of sea duty.[6]

Based on such comments, one might suspect a greater percentage of SSBN officers would remain in the Navy, compared with officers from SSNs. In fact, the retention of submarine officers from three to seven years of service (most JOs who went on to department head tours) was essentially the same (30-32 percent for the years 1992-1996) for SSN and SSBN officers[7]. According to policy studies at the Bureau of Naval Personnel, this is a result of competing factors in the SSN and SSBN lifestyles. While the quality of life is clearly better for SSBN crews, the members of SSN crews cite greater job satisfaction and excitement. That being the case, shifting to SSNs manned with two crews should cause a rise in the retention of personnel from SSN crews.

The same benefits could be expected from top quality department heads and XOs staying in to serve as Commanding Officers. The Submarine Force has acknowledge that, due to cutbacks, a large number of top quality personnel who were selected, will never get command of a submarine due to the limited number of platforms available. These outstanding, post-XO Commanders, have been designated CO(SS), and they are looking for good jobs to fill. Adding 50 crews for the SSNs in the force at the turn of the century would be the best use of these qualified personnel who truly want to serve as Commanding Officers. The improved morale and retention of these senior officers who are currently *selected for command* but not given command, would certainly trickle down to the department heads and junior officers. Granted, this a short term problem of excess quality personnel, but it would be an additional benefit of shifting now to Blue and Gold crews for SSNs.

---

[6]Summary of Navy Retention/Separation Questionnaires, 1996. Fax dated April 25, 1997.

[7]PERS 24, Submarine Officer Community Status Brief, 1997.

Improved Morale

Directly linked to the greater retention numbers, crew morale could also be expected to be higher with a two-crew SSN force. *Low job satisfaction* and *amount of sea duty* were two of the top five reasons cited in resignations. With reduced feelings of being overworked for little or no credit, wardrooms and crews would likely perform better as individuals and as teams. SSN crews today have a strong, not unjustified, opinion that their time is spent rushing from one exercise, operation or inspection to the next. It is not uncommon for personnel to stand port and starboard (two section) watches underway. The Submarine Force has no mandatory sleep requirements equivalent the *crew rest* which applies to aviators, in spite of the responsibility submariners have for nuclear power plants and multi-billion dollar submarines. The USS JEFFERSON CITY grounding in November 1994 had, as one of the contributing factors, crew fatigue. The crew was rushing from one exercise to the next, and the quartermasters had been standing port and starboard watches. Expanding to a two-crew force could reduce this burden and improve morale. This improved attitude and performance could improve the force safety record, weapons and engineering proficiency, and overall mission accomplishment.

Obstacles to Overcome

While there is much justification for going to a two-crew SSN force, there certainly would be difficulties. The requirement for hundreds of additional personnel could not be met in a short period of time. Considering that officer training takes 15-18 months prior to reporting onboard a submarine (enlisted training can take almost as long), the decision to go to two crews must be made quickly, if new crews are to be created before the turn of the century. Some believe that creating an additional 50 crews would greatly reduce the quality of the personnel in the force. This, however, would only be a short-term effect. The task of recruiting and training more SSN crews in a matter of years is extensive, but worth it. With good, hard recruiting efforts in the short term, the better quality of life will result in greater retention of top quality personnel and an even better force in less than a decade.

Manning. The manning difficulties associated with such a

transition present even greater reason for such a decision to be made as soon as possible, while our SSN numbers are still declining from the 70s to the 50s. According to the Assistant Nuclear Officer Programs Manager, the most limiting factor would be getting enough department heads. Transitioning to this manning plan could take nine years, until enough department heads were available, assuming we could recruit and access the necessary officers. Our accessions have gone from 540 in 1991, to 319 in 1996, and are expected to be less than 300 in 1997. If we were to rapidly raise the number of accessions in the next few years, as these large year groups move towards the department head tour, there would be tremendous overmanning at the JO level on the single crew SSNs.[8] To avoid this problem of a nine year delay in personnel accession and training, there are two solutions. First, the decision to shift should be made this year, while our SSN numbers are still declining and we have the personnel to man more than 50 SSNs. Second, and more importantly, the transition to two-crew SSNs should be incremental. The decision could be made today that 10 SSNs are going to have two crews within a year. This method would make the transition possible with the limited number of bodies currently available, while maintaining our force capabilities. Every time an additional 10 SSNs shift to two crews, it will be equivalent to getting another seven SSNs in the force, for much less cost.

Training. The cost to train a nuclear qualified officer is not insignificant. Nominal training costs for any officer are $140,000. This number comes from the $250,000 to train a Naval Academy graduate, the $100,000 to train an ROTC graduate, the costs of other commissioning sources, and the ratios that each source provides to the force. For nuclear trained officers, another $100-200,000 is spent between Nuclear Power School, nuclear prototype training, and Submarine School.[9] These costs would total just $30 million for an additional 100 officers, just two percent of the $1.5 billion for a NSSN, but not a number that should be ignored.

Additionally, if too many personnel were brought through the

---

[8]PERS 24, Submarine Officer Community Status Brief, 1997.

[9]PERS 24, Submarine Officer Community Status Brief, 1997.

training pipeline at the same time, expanded training facilities might be required. Nuclear Power School could absorb greater requirements fairly easily, but re-opening another prototype facility or constructing a new one would incur substantial costs. For these reasons, an incremental program, in which 10 SSNs every five years shifted to the two-crew program, would minimize the impact upon our outstanding training programs.

Proficiency. Perhaps the most difficult obstacle to overcome would be maintaining the proficiency of our SSN crews. Our SSBN crews have certainly been able to maintain their proficiency with their two-crew system. SSNs, however, have many more missions than SSBNs, and for each crew to lose approximately 15 percent of the sea time they currently have (as would be expected going from 45 percent underway to 38 percent underway), it would be difficult to remain proficient in the wide variety of missions performed by SSNs. This could be overcome in several ways. First, develop and improve the shore training facilities used during off-crew periods to the extent our SSBN force has. Also, consider limiting each SSN to just some of the many missions of which it is capable. This would permit savings in the area of ship alterations and improvements, since each new tactical capability would not have to be installed on every SSN. This would also permit each SSN crew to concentrate training on the tasks and mission which will actually be assigned.

How Slow We Are to Consider This Solution

It is a problem that the Submarine Force is only beginning to consider seriously the two-crew SSN force as an option. It is also a problem that the Submarine Force does not appear to be taking advantage of lessons already learned by our allies. Rear Admiral Fages stated that any study of multiple crews for SSNs is "really in its infancy", and a study was recently completed by a post-command submarine officer on the feasibility of three crews for every two SSNs.[10] Three crews for two SSNs is not a good idea because the crews would lose the great advantages that currently come from

---

[10]RADM Fages, USN, Commander, Submarine Group Two. Speech to SOAC Class 97020. April 8, 1997.

deep familiarity with the intricacies of their boat. The fact that the multiple crew idea is *in its infancy* indicates that we are not taking advantage of our French allies making the transition 15 years ago.

Dealing with a Fixed Budget Pie

Even assuming that the only money available will pay for 50 single crew SSNs and nothing more, shifting to two-crew SSNs is still the right choice. If the cost of an additional 50 crews for 25 years is $12.5 billion, and the money is not available, then the right choice is to go below 50 and still make them two-crew SSNs. No submarine officer wants to have the SSN force decline below the 50 used for this analysis and in the middle of the 45-55 recommended by the BUR. However, if the budget pie is fixed, going from 50 down to 40 SSNs with two crews would have zero net cost and improve our capabilities. The 20 fewer SSNs would save $1.5 billion each, for a total of $15 billion. The 40 two-crew SSNs would require just 80 crews, only 30 more crews for 25 years would be $15 billion. At the same time, the 40 two-crew SSNs would provide the same at-sea time and mission capability as 68 SSNs, much more than 50, and much more capable of accomplishing assigned missions.

Conclusion

The two-crew SSN force is the right option for the U.S. Submarine Service today. Financially, it will save money, while still permitting us to accomplish all assigned missions. It will improve morale, safety, quality of life, retention, and overall mission readiness. Since there is a lead-time required to develop SSN crews, however, the decision should be made quickly, in order to maintain our mission capabilities as the size of our force declines. Performing a gradual transition would permit such a plan to be implemented smoothly with the limited number of bodies currently available. The manning requirements will also be greatly simplified by shifting from single to double-crew SSNs while our force numbers are still declining. The leaders of our Submarine Force should recognize quickly that current efforts to deal with our declining numbers are useful, but will not be adequate to solve all of our problems. The two-crew SSN force will.■

SHOULD THE NAVY PLAN BLUE AND GOLD CREWS FOR THE NEW ATTACK SUBMARINE?

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

Recently I read a document that dealt with major weapons systems costs, and I noted that the New Attack Submarine (NSSN) is estimated to cost **$1.6 billion per copy**. At that unit cost, the likelihood of maintaining the currently projected force level of 50 nuclear attack submarines seems slim.[1] Having won the Cold War, the nation and Congress seem convinced that the world is now a relatively benign place. It is unlikely that the current mood to limit annual defense spending to the vicinity of $250 billion will change in the near future.[2] If that is a correct assumption, then the current new submarine building rate of one or two submarines per year is unlikely to increase. Assuming a useful SSN life of 25 years even given new technology insertion at regular intervals, that building rate will only sustain a force level in the 25-50 range. If we assume an average building rate of 1.5 SSN per year, the current force level will gradually be reduced to about 37 SSNs.

Submarine Force levels are significant not only from the point of view of overseas deployments in pursuit of foreign policy goals and for projected warfighting requirements if those goals are not met, but also because of the need to have enough submarines to provide an adequate level of ASW training for other forces. In the past there has been a shortage of those services, and submarine service time has had to be rationed. CNO-sponsored operations have had first call on submarine operational time, followed by submarine type training and fleet exercises—all these three arranged to take into consideration the requirement for maintaining a stated level of deployed forces to deal with possible contingencies in various theaters. These operation commitments revolved around the overhaul schedule, which was driven primarily by industrial

---

[1]Per QDR Report for 2003.

[2]Former ASD (PA&E) David Chu, now with Rand Corporation, is quoted in the May 19, 1997 edition of Aviation Week and Space Technology as indicating that even a level defense budget is unlikely five or six years from now. He estimates that it may go to the equivalent of $200 billion by 2001.

loading considerations. As a former force level submarine scheduler, working in the old days without benefit of a PC and scheduling software, I can recall struggling with changes required by overhaul extensions or by crises calling for unscheduled deployments. There was a cascading effect on submarine services to other forces, with the latter usually getting far fewer services than they needed to maintain an adequate level of ASW proficiency.

Despite the increasing use of simulators for training, the necessity for submarine time at sea for realistic training of ASW forces will continue to exist in the 21st century. True, the USSR is no more and we certainly don't have to continually plan and train for a second Battle of the Atlantic to resupply NATO forces in Europe. However, submarines seem to be multiplying like rabbits, even if they are the diesel variety. Air independent propulsion (AIP) packages are becoming available for insertion into new construction SS or for backfitting. The Swedish submarine GÖTLAND has an AIP package that will float the battery, and carry the hotel load while allowing the boat to motor around at speeds up to five knots for two weeks, without having to snorkel for recharging. The Germans have proved out their own version of AIP and their new 212 type submarine will be equipped with it. While none of the Third World submarine forces is very large, the availability of AIP packages and COTS combat systems, can combine to provide a real, if limited, submarine threat in those littoral areas in which we may choose to pursue our foreign policy goals. The presence of a small number of modern SSN (AIP), coupled with mines, and cruise missile launchers ashore, can provide our expeditionary warfare forces a certain amount of trouble. The presence or suspected presence of mines may discourage us from sending SSNs, arguably the best individual ASW platform, into shallow water to detect and destroy the SS threat. I believe it is safe to assume a continuing need for live submarine services for training of air and surface ASW forces.

The Navy has adopted operations tempo (OPTEMPO) and personnel tempo (PERSTEMPO) goals, and tries hard to meet those goals—recognizing the deleterious effect on personnel retention of constant deployment. The current OPTEMPO goals are 56 days underway for deployed units and 28 days underway for non-deployed units per quarter. With one crew per ship, OPT-

EMPO and PERSTEMPO are identical. For a non-deployed SSN, some 28 days per quarter are thus available for all operational employments, whether type training, participation in fleet exercises, or services to other commanders. However, if we choose to provide two crews for each NSSN, we can provide 56 days of operations per quarter per hull without exceeding PERSTEMPO goals. We will have increased operational time by 100 percent without the additional costs associated with acquiring another NAS hull.

The Blue/Gold crewing concept, approved by Admiral Arleigh Burke for Polaris submarine operations which commenced in 1960, and continuing today with Trident SSBN operations, shattered the traditional navy one ship-one crew concept. It was adopted to maximize SSBN OPTEMPO, while providing a reasonable PERSTEMPO to the individual crew. The increased OPTEMPO effectively reduced the size of the force required. In 1961, Regulus missile-carrying SSGs and the single SSGN were authorized about 120 percent of allowance to provide partial crew rotation during their deterrent patrols, although they still had only one crew assigned. During the early 1960s, a fourth section was supplied to each SS in order to provide additional training spaces for prospective SSN and SSBN crew members at a time when the forces were growing by leaps and bounds. In the early 1970s, assignment of a fourth Watch to SSNs was instituted to help with their retention and training problems. These manpower-related measures reflected the Submarine Force's and navy flexibility in the past when faced with significant problems.

If the Navy chooses to pursue two-crewing the NAS in order to ensure that an adequate amount of submarine services are available to meet fleet needs, it also should adopt the entire philosophy which was originated by SSP for Polaris operations. These include central crew homeports co-located with off crew training facilities. The key to a high level of OPTEMPO for the platform is a high level of training for the off crew, so that they can report aboard and conduct at sea operations smartly from the first day. Obviously, manpower costs for a two-crewed NAS would double. In addition, there would be costs for the training facilities and personnel involved in their operation.■

MOORING ALPHA—END OF THE LINE

By William Galvani

Mooring Alpha at Puget Sound Naval Shipyard is the last port of call for the U.S. Navy's nuclear Submarine Force; the place where nuke boats from both coasts and Hawaii come to finish their careers. On any day the long pier at the west end of the shipyard may berth as many as 25 to 30 submarines waiting their turn to be recycled in drydocks less than half a mile away.

As the Director of the Naval Undersea Museum at the Naval Undersea Warfare Center in nearby Keyport, I make occasional visits to the submarines at Mooring Alpha to look for artifacts from particular boats. I like these visits because they allow me to walk the decks of ships that have made naval history, and the visits have a positive aspect, for the items I find and have removed will be preserved to represent the U.S. Submarine Force to future generations. The downside is that only the few things that I and a few other visitors claim will survive, for the submarine here will, in time, be reduced to scrap metal.

One wet morning in the Spring of 1996, at the request of the Naval Historical Center in Washington, DC, I went to Mooring Alpha to look for exhibitable items from USS NATHANAEL GREENE (SSBN 636). The shipyard closely limits access to the area, so I made arrangements to be escorted through several vessels. Shipyard personnel were, in my previous visits, helpful and cooperative. I signed the visitor's log in the small office at the head of the pier and my escort gave me a hard hat, safety goggles, and a flashlight.

A chart on the office wall showed the location of all the submarines berthed there. I asked about PATRICK HENRY. My escort paused: "What's her hull number?" When I answered "599", he said, "Oh, the 599 boat. Right over here", and pointed out the window to a strangely truncated black hull. I realized then, and often later during the day, that shipyard personnel know these vessels only by hull number, not by their names. As the submarines mark time toward oblivion, they are losing their names and histories.

The black hulls glistened in the light rain as my escort and I walked through the security gate and onto the pier. The subma-

rines were almost anonymous: no in-port numbers, no name boards, no brow canvases. White graffiti-like numbers, spray painted on the sails, identified the boats. Despite the presence of so many ships, Mooring Alpha without submarine crews had none of the vitality of the submarine piers at Groton or Norfolk or San Diego. Seagulls and electronic monitors stood watch over what was, 30 years ago, the pride of America's Submarine Force.

My escort guided me across the spindly aluminum bows which bridged the gaps between hulls, The boats lay close together, bow to stern, tightly packed in, three deep and as many as eight abreast. We walked in the light rain among what is probably the world's third or fourth largest nuclear Submarine Force. Power cables and mooring lines snaked from boat to boat and twisted around the sails. The tops of the sails bore yellow lights never carried on active duty. "Towing lights?" I asked. "No," my escort said, "alarms in case of fire or flooding."

Some of the submarines looked out of kilter. I stared at the odd appearance of GEORGE WASHINGTON (SSBN 598), the nation's first nuclear fleet ballistic missile submarine; the bow didn't look like a bow, but it was too short to be the stern. My escort explained the reason for her strange appearance: both the reactor compartment and the missile compartment had been removed and the remaining bow and stern sections wedged together. The steel surgery was history with a vengeance. This submarine began construction as a fast attack boat, but during building the Navy inserted a compartment to house 16 Polaris missiles and sent the renamed submarine to sea as GEORGE WASHINGTON. Now the recent amputation had left the decommissioned GEORGE WASHINGTON smaller than the original attack boat ever would have been.

As we walked through the fleet, I could see pigeons roosting on the sails and in the sails and in any recess that provided shelter. Seagulls strutted unconcernedly where, I felt certain, Admiral Hyman G. Rickover had once grilled nervous commanding officers.

We reached NATHANAEL GREENE and my escort hung a sign topside indicating people were onboard. He plugged in the interior lights, and we went below, clambering down the ladder into a compartment where no one greeted us. We were warmer there, out of the wind, and the sea provided some warmth to the

hull. Strings of work lights illuminated the passageways. Our hard hats bumped on ventilation ducting as we ranged from deck to deck, our flashlights searching the dark corners of compartments. Much of the boat's equipment had been removed, making the interior seem larger than it was on active service. The absence of the crew contributed to a feeling of spaciousness, and compartments that once sounded with orders to the helm or the throb of machinery were quiet. I paused, listening for the echoes of diving alarms, trying to feel any residual tension of ORSEs or SPECOPS, but they were gone. When the crew left, they took the life of the vessel with them.

I looked for artifacts that represented the essence of the submarine and its mission, but I didn't find much. I was surprised that so much equipment had been removed. The diving stands and periscopes were gone. So were the missile launch panels and sonar equipment. And the numbers on the torpedo tubes. Anything with the ship's name or hull number had been removed, either by the decommissioning crew or later visitors--perhaps people like myself.

I pointed to a console and asked if the History Center could have it. "It's not hatchable", my escort said. Hatchable meant a shipyard worker could unboat it and take it up through the hatch we climbed down. Parts were free, but their removal cost money. Not hatchable meant impossibly expensive for museum budgets. We continued to look. Growlers and dial telephones littered the decks, apparently the only thing left behind when equipment was removed. We left them too, for a beige wardroom telephone said nothing about the mission of this vessel or the accomplishments of the men who drove her through the deep. Finally, back between the main turbines I found the main steam valve wheel, the only hatchable item onboard which remotely suggested the purpose and efficiency of these mighty vessels. We tagged it for removal later.

We went onboard ex-USS TRITON (SSRN 586), the only U.S. submarine with two reactors. In 1960, under the command of Captain Edward L. Beach, TRITON followed in the track of Magellan and became the first submarine to circle the globe submerged. Time and the Navy have treated her with dignity and respect, and though she was some 20 years out of commission, her interior remained clean, dry, and well preserved. Walking through TRITON was akin to entering a hole in time and emerging in the

first decade of nuclear submarining. I scribbled a long list of equipment as antique as anything I had seen, including a sonar set that looked like a shoestore fluoroscope. Some equipment was hatchable and could be removed soon. Most was not, but within a few years TRITON will take her turn in the breaker's yard and hatchability will cease to be a concern.

My escort and I left Mooring Alpha and went to the nearby drydocks. From the edge of the dock I peered down into the pit at four submarines in various stages of recycling; the word sounds more genteel and productive than scrapping, but the results are equal. Ignoring the light rain, shipyard workers in hard hats, safety shoes, gloves and badges were working methodically and skillfully. The reactor compartments go first. Then workers with cutting torches carve into the hull, lay bare the ribs, and expose the innards like medical students dissecting a cadaver. Torches seared through HY 80; the process was strangely fascinating—like watching a cow being torn apart in slow motion by piranhas. Cranes lifted metal from the bottom of the drydock to waiting railcars; some of the pieces were recognizable, but most were only chunks of steel.

I returned my hard hat and gear to my escort when we finished. Mooring Alpha's population will have changed by the time I next return; recently decommissioned submarines will have arrived and some of the boats there during my visit will have moved through the recycling process. The submarines there, and those that have gone before them, provided sea control and security to the United States in a dangerous era. They and their crews accomplished their mission during thousands of patrols and operations. Now they have steamed their final mile and are disappearing in the mists of a Puget Sound spring.■

1945 IMPRESSIONS OF SUBMARINERS' VIEWS ON THE DROPPING OF THE ATOMIC BOMB

by CAPT Robert Gillette, USN(Ret.)

As the post World War II years passed, there was a gradual but persistent growth of doubt by some who questioned the morality of having used the atomic bomb. This doubt continues to increase the further away we move from the World War II era. In recent years, this concern has resulted in the accusation that those who made the decision to use the bomb, particularly President Truman, were guilty of bypassing the will of the people, resulting in great harm to this country's image. The foregoing attitude of course, ignores the time frame of the use of the bomb. More importantly, those that hold to this attitude have little understanding of the situation or of the attitude of those who were actively engaged in the bloody business of fighting the Japanese and of those who had to make the decision to drop the bomb. Those of us who survived the War as a result of the decision to drop the bomb believe that such a decision was justified. I think the following tribute *In Memoriam*, quoted in part and written by Captain John Gore, SC, USN(Ret.) To those who were lost in WWII, indicates that they too would have been in accord with that decision.

"It is not likely that they would consider themselves heroes. They, and we who knew them so well, have heard the term used so loosely or so inadequately that it hardly has a true significance.

No one will ever know what was in their minds when they checked out—those who had the time to think. If they had any thoughts regarding the purpose or merits of their end, it was probably just an acknowledgment, an acceptance of complete participation.

If they gave any thought to the impact that their death would have upon the nation, it probably never embraced more than a community. It most probably was focused upon a patch of countryside, a single house, or a single room that would never again be the same without them—and which a part of them had never really left.

It really did not pay to spend much time thinking of such

things. A game of acey-duecy, a long round of poker, a second rate movie—all of this, in spare time, was better than thinking.

If there was any thinking along such lines done, it was probably done when the letters were opened—or being answered or maybe during the services—or just after turning in. There were tumultuous oceans of sweetness or bitterness that stained to flood these few moments. Occasionally, the dikes went down and the mind was engulfed in torment and sweet remembrance, in faith and fear. But usually, the dikes held and only pin-prick holes were allowed—and those not often. Or maybe they broke for good—just at the last when there was no reason for their strength.

There will be many occasions in our future when a remembrance of their sacrifices will contribute to a wise decision, or constitute an inspiration in a moment most needed. How important such decisions and how significant such moments may be, no one can foresee, but it is possible that they may be a decisive or critical as any experienced in the history of this country. Perhaps, in this way, we—and the nation, through us—can perpetuate the value of their sacrifices beyond the sweetness of victory and liberty we now enjoy, and for which their lives were paid."

Such were the men whose lives hung in balance awaiting the decision as to the justification of dropping the bomb.

The above tribute first appeared in *Nine Years After*, the class of '39.

My assessment of the reaction of World War II submariners to the dropping of the atomic bomb was derived from on the scene conversations with quite a number of submariners, including enlisted and officer crew members of a number of submarines, in addition to senior staff officers. I believe my assessment is shared by all veterans of World War II.

In my case, the first specific knowledge that a new devastating weapon had been used and the notification of the surrender of the Japanese was received by radio. The message was received by the submarine USS BLACKFISH of which I was the commanding officer. We were steaming up the channel at Guam, returning from

a war patrol, with 14 rescued aviators onboard. The receipt of the message was marked by whistles blowing, flares being fired and ship's bells being rung.

At that time the major topic of conversation concerned itself with what manner of weapon had expedited the surrender. Later at the rest camp, discussions shifted to "When do I go home?" and "What system of computing a discharge date was going to be utilized?" Many of the submarine crews were reservists who had volunteered for submarine duty and were anxious to go home.

As time went by the discussions concerning the devastating weapon finally identified it as the atomic bomb. The discussions never involved the morality of using it but rather the fortuitous fact that the U.S. had the bomb first as the Japanese would have wiped us out if they had it first. The morality factor was of little interest how one was killed, just so it came quickly and cleanly. These opinions were usually accompanied by the conviction that if the Japanese or Germans had developed the bomb first, they would have had no reservation or constraints on its use. These feelings were reinforced by the experience of witnessing Japanese sailors drowning themselves to prevent being captured. All hands were convinced that this philosophy would have prevailed in the defense of their homeland. The result would have been massive casualties being incurred in the course of an invasion.

I have thought about the morality issue involved in the use of the atomic bomb from several aspects and time frames. In 1945, I was the commanding officer of a combat submarine returning from a war patrol. The mission of the submarine at that time was to sink ships in response to orders to carry out unrestricted warfare. During the war patrol we had rescued six aviators who had been shot down just off the coast of Kyushu, Japan's southern most island. We later received an additional 18 aviators rescued by various submarines as we returned to Guam. All of the rescued personnel had been shot down by enemy anti-aircraft fire. When we were informed of the early surrender of the Japanese as a result of dropping of the bomb there was unanimous approval expressed on the decision to do so. In my opinion, at that time it would have been considered immoral not to have used the bomb. Any rationale developed by apologists to support not using it would have been incomprehensible to our fighting men. The argument of the apologists, that, for all intents and purposes the war was going to

be over in a matter of days, so there was no reason to drop the bomb. This rationale would have been categorized as complete idiocy by men who faced the prospect of storming the beaches of the Japanese homeland. Their experience in fighting the Japanese had convinced them that the Japanese fighting man was a fierce warrior, but also was fanatical in protecting his homeland and saving face. One only has to observe the use of Kamikaze aircraft, Kaitan human torpedoes and Banzai charges to realize the fallacy of expecting the Japanese to lay down their arms because of attrition. One aspect of theorizing about the morality of using the bomb that seems to be lost to present day apologists is the consideration of the possible consequences of not using it. One should always consider one's options in the light of whether catastrophic results are possible in not exercising any specific option. At the time in question, there was abundant proof that Germany and Japan were developing an atomic bomb capability. As to their intent to use it—I have no doubt that a man that could implement the Holocaust would have no reservations about dropping the bomb, probably on London and New York City. It was equally apparent that the Japanese were prepared to exercise every possible means to protect their homeland. The atomic bomb, either their own, or more probably that of Germany, would have been a welcome addition to their arsenal.■

SUBMARINE, SHIPMATE, SELF

by MIDN 1/c Chris Gavin
Rensselaer Polytechnic Institute

Submariners, without question, do not represent society's norm. They speak differently, with a rich, jargon-filled vocabulary. Their sense of humor is sharp, but with a macabre flavor. Most striking of all, however, is the submariner's selflessness. The submarine service, more than any other seagoing branch of the Navy, truly embraces the concept *Ship, Shipmate, Self.*

This degree of selflessness and simple civic virtue is missing from American society today. Submarine service brings out this virtue in all those who venture beneath the sea. A submarine is more than a 360 foot pressure vessel—it is an anvil against which men are forged into a team—a team without individuals. The first necessity of undersea life in close quarters is an ethos of unselfishness, so subordination of self to duty is inculcated in the submariner from the day he steps onboard. Here are the methods by which submarining instills such selflessness:

Team Recognition

Individual accomplishment is rarely recognized in day-to-day operations onboard a submarine. Instead, it is teamwork that is recognized. The Engineering Department is lauded for getting the ship underway, not just the Engineer or the Engineering Officer of the Watch. The Sonar watchsection earns praise for finding and classifying contacts, not just the Sonar Supervisor or the individual watchstanders. The time for individual recognition is traditionally reserved until the end of a deployment—just as is true for the surface and aviation communities.

Cross-Training

Submariners are cross-trained in all areas. Crew size simply does not allow the luxury of an ADP division, for example, and so the need might be filled by a mechanic who is a computer hobbyist. Nuclear propulsion plant operators often go *forward* to assist in target motion analysis (since there are no Operations Specialists).

Torpedomen (now Machinist's Mates) handle small arms, elsewhere the bailiwick of Gunner's Mates.

Crewmen are also cross-assigned to miscellaneous duties throughout the ship. Everyone, from department heads down, participates in stores loads. Damage control parties draw from the entire ship, not just from selected ratings. Every man onboard the boat feels he has a stake in the mission.

Furthermore, every bluejacket shares in the watchstanding duties. The rating for which men are trained becomes of little importance when there is work to be done. Since everyone is part of the team, there are fewer feelings of individuality and more of an urge to work for the team.

Close Quarters

The first thing outsiders notice about a submarine is how small it is, and the close quarters in which the crew lives. You can't get away from your shipmates onboard the boat. You work together, sleep together, and very importantly, eat together. There is much cohesion between groups that share meals. This closeness usually leads to inter-divisional friendships, and a furthered respect of each other's contribution to the ship's mission. A submarine crew's camaraderie is only rivaled (in the surface fleet) by that of the Chief's Mess.

This mutual respect breaks down barriers between divisions and dampens the elitism that can drive crews apart. Shipmates truly become *friends*, not just fellow passengers or co-workers. A man will give a lot more for a friend than he will for a co-worker.

Small Crews

In a similar vein, the size of the crew, although sometimes an operational disadvantage, is an asset in building a selfless team. Everyone knows everyone else. If an aircraft carrier is a city, and a destroyer a small town, then a submarine is an extended family. A submariner is on the boat with what feels like all his cousins and uncles.

Men will give up much for their family. When a crew is like a family, there is a certain synergy that is missing from the larger, more spread-out crews of the surface fleet. With a large crew,

there's always someone else to take your place—you don't feel as vital to the mission. With a small crew, you know how much everyone else counts on you, and feel pressure to perform.

Damage Control

Finally, every submariner knows how strongly damage control is emphasized. Every man onboard is required to get his dolphins; every man onboard undergoes rigorous damage control training. **Everyone.** Not just selected departments, or selected ratings, or those who choose to earn a breast insignia. Everyone onboard has a stake in damage control, and they know it.

When a fire is called away, everyone onboard responds. Again, every man feels a stake in the mission. The entire crew must at least wear emergency air breathing masks, and crewmen throughout the boat put on firefighting apparel and attack the fire. Contrast this scene with a fire aboard a large surface ship. A fire party is called away, and everyone else goes about their routine.

Summary

Submarine life is a life of constant stress. Sharing this stress, meeting challenges together, and depending on each other is what submariners do. Shared accomplishment is what makes a group of men into a crew.

The selflessness of a submarine crew is a rare commodity outside the Silent Service. Circumstances conspire to form an outstanding team-building atmosphere—where teamwork is literally necessary to survive. Individuality is unrewarded. Men are brought together to share meals and to share hardships, and this small close-knit group discovers that without each other, each man is nothing. These men truly live the adage, *Ship, Shipmate, Self.*■

HISTORY OF CHARLESTON NAVAL SHIPYARD

by Noreen E. Wagers

Land Plat Purchase

On 29 July 1900 John D. Long, Secretary of the Navy, appointed a military board to determine the feasibility of changing the location of the Port Royal Naval Station to Charleston.

The board found Charleston to be an ideal location because it was strongly fortified against attack, offered good protection from storm tides, had a channel well marked for navigation, plus it had plenty of anchorage and three railroads served the city.

On 11 January 1901 the board stated its findings. "We have the honor to recommend that it is expedient to transfer the Naval Station now at Port Royal, South Carolina to a point near the city of Charleston."

The city of Charleston lies at the end of a flat peninsula between the Ashley and Cooper Rivers. The site selected for the navy Yard was approximately seven miles from the tip, commonly known as the Charleston Neck. The main road in the interior ran through settlements and plantations known as Long Point, Marshlands, Retreat, and The Grove.

On 13 August 1901 the United States Navy, represented by Captain Lonnecker and Paymaster Skelding, took formal possession of 171 acres of Chicora Park, 258 acres of Marshlands Plantation, and 760 acres of marshlands to the south. Captain Lonnecker subsequently became the first Commandant of the newly formed Navy Yard.

Formative Period 1902-1915

In 1902 work had begun on the first drydock and it was completed in 1907. By 1901 the powerhouse was ready to supply electricity to the drydock pumps, the yard had five shops, an administrative storage building, a dispensary, officers' quarters, and four piers. The yard had one small suction dredge and a tug, SEBAGO.

In 1901 the Reserve Torpedo Flotilla was sent to Charleston from the Norfolk Navy Yard. USS BALTIMORE was the first station ship and in 1912 Admiral David Farragut's famous fighting flagship, USS HARTFORD, was made the station ship.

Also, in 1912 the Navy transferred a Machinist Mate School from Norfolk to the yard and in 1914 a clothing factory was relocated from the Brooklyn Navy Yard.

The yard's early mission was to repair small vessels, provide a limited amount of overhaul support, and provide ships with stores. By 1913, the mission was expanded to include serving as a docking and repair station, due to the large number of torpedo boats and destroyers on the Atlantic Coast.

In 1914 the floating derrick CREIGHTON was launched and in 1915 work had begun on the U.S. tug WANDO.

World War I Period 1916-1919

By 1916 the navy yard was building torpedo boats and other small craft, docking and repairing vessels, including the Coast Guard's, making major alterations to vessels, serving as a destroyer and submarine base, plus manufacturing machinery parts and producing naval clothing.

During World War I, considerable expansion took place which included the construction of barracks, a hospital, shop buildings, ammunition depots, and 12 storehouses. Locomotive cranes and motor trucks were also procured. Work had begun on an additional 1000 foot drydock but was halted after the war.

During this period repairs were made to 35 destroyers and small craft, plus minor work on 125 vessels. Five German vessels were repaired and converted to a transport and cargo carriers. Several English and French vessels were repaired and outfitted. A total of 18 new constructions were completed which included the yard's first destroyer, USS TILLMAN.

The clothing factory increased its daily output from 2700 garments to 11,000 and the enrollment at the Machinists Mate School increased from 300 to 600 men.

In 1917 Camp Bagley, a naval training center, was established at the yard on property which was leased from the city.

On 1 July 1919 the yard's post office was made a branch of the Charleston Post Office.

Peacetime Period 1920-1938

This period of the yard's history was marked by severe cutbacks and lack of development after World War I due to the Disarmament

Treaty of 1923, the Washington Naval Conference of 1922, and the London Conference of 1930 which had provisions for limiting the equipping and development of fighting forces of all nations.

Camp Bagley and the naval clothing factory were closed and the Machinists mate School was transferred back to the Norfolk Navy Yard.

On 10 July 1922, the Secretary of the Navy issued General Order No. 87 proclaiming that as soon as practical the Charleston navy yard would be considered closed to the repairing and supplying of naval vessels. A closure date of 1 September was in effect and later extended to 1 November of that same year.

The Charleston Chamber of Commerce appealed for maintaining the yard because it had done splendid service in assigned work, had a low percentage of operating costs, it would be extravagant and not economical to close, plus it was disadvantageous to the safety of the Navy to abandon the yard. Fortunately, the arguments were heard and General Order No. 87 was rescinded.

In 1933 the mission of the yard changed with the assignment of new construction work. An extensive build-up program began to make this a first class yard. Buildings were moved, extended, or replaced. Numerous work projects were made possible by the Work Project Administration (WPA) and the Public Works Administration (PWA). Streets were paved, railroad tracks laid, and numerous ground improvements were made.

During this period, nine vessels were constructed and Admiral David Farragut's famous fighting flagship, USS HARTFORD, was decommissioned and restored to its original condition so it could be retained as a relic.

World War II Period 1939-1946

In this period the Navy yard became a first class national defense activity. The yard constructed, repaired, overhauled, altered, converted, and docked destroyers and other vessels.

The outbreak of war in 1941 readied the yard for the construction of a second drydock, more piers, and the extensions and construction of several shops. Approximately 193 additional acres of land were purchased on the northern and eastern boundaries of the yard to be used primarily as storage space.

During World War II, the yard reached peak employment with approximately 26,000 civilians who worked in 1,359 vessels. The

largest new construction workload of the yard's history was also accomplished. Damaged ships were repaired, combat vessels overhauled, and over 253 warships were constructed and launched.

In 1941, due to the housing shortage, the United States Housing Authority authorized three apartment projects to be constructed: Tom McMillan, Ben Tillman and George Lagare Homes.

In 1942, drydock No.2, Piers F, G, and J were completed and by 1943 drydock No. 3 at the south yard was nearing completion and would be used for shipbuilding.

Until 14 September 1945, the Navy yard had been under the control of the Commandant, Sixth Naval District. General Order No. 223 created the Charleston Naval Shipyard, making it independent of the Naval Base.

At the end of World War II, the work load shifted from new construction to the decommissioning and preservation of vessels. The yard's last new construction, BRYCE CANYON, was started on 7 March 1946 and placed into preservation status.

Cold War Period 1947-1958

In 1947 the shipyard was commended by Forces Afloat and the Bureau of Ships for work performed on the German U-2512 which was surrendered to the Allies at Horten, Norway in 1945. In 1948 the shipyard was officially designated a submarine repair facility due to Charleston's mild climate, closeness to operating areas, and its waterfront accessibility. The first submarine to be overhauled at the shipyard was USS CONGER (SS 477).

In 1949 a board of admirals recommended that the shipyard be closed. Senators Burnet Maybank and Olin D. Johnson, and Congressman L. Mendel Rivers successfully convinced the Secretary of the Navy and the Chief of Naval Operations to keep the yard open.

The outbreak of the Korean War revived the construction of USS BRYCE CANYON (AD 36) and the reactivations of various vessels. However, by the end of the decade, approximately 100 vessels were worked and transferred to foreign flags.

On 1 March 1956, the shipyard reached a milestone by completing its 50th submarine overhaul, USS THREADFIN (SS 410).

During this period of the shipyard's history, conversions and design became an important part of the workload.

Nuclear Age 1959-1993

The shipyard was introduced to the nuclear age in 1959 with the conversion of USS PROTEUS (AS 19) which represented the largest job of this type since World War II. Also, eight ships were worked and turned over to foreign governments and 60 ship availabilities were completed that year.

The Electric and Electronic Shops achieved an all-time Navy record with three million man-hours worked without a disabling work injury.

In the 1960s the shipyard came of age in the Polaris and nuclear field with the completion of PROTEUS and the first drydocking of a fleet ballistic missile submarine, USS GEORGE WASHINGTON. Forty-eight availabilities were completed in 1960.

In 1961, Charleston began its first nuclear submarine overhaul, USS SCORPION (SSN 589). Three SSBN technical availabilities were completed and the first Polaris submarine post shakedown availability was started that year.

In 1965, the shipyard was assigned its first fleet ballistic missile submarine overhaul, THOMAS A. EDISON. The conversion of a Navy seaplane tender into a floating Aircraft Maintenance Facility was the first of its type. Another significant accomplishment was the first refueling of a nuclear submarine, USS SKIPJACK.

This heavy workload of refueling and overhauling nuclear submarines continued until the late 1980s, when the shipyard began nuclear submarine deactivations due to the aging fleet and the SALT Treaty Agreements.

Charleston Naval Shipyard was tasked with the conversions of Moored Training Ship (MTS) 1 and MTS 2 which are used to train ship's force in the operation of nuclear submarines.

On 22 September 1988 the shipyard was in the destructive path of Hurricane Hugo which caused an estimated damage of $89 million to the yard.

Base Closure 1993-1996

When the Charleston Naval Complex was unexpectedly placed on the Base Closure list, *Save Our Shipyard* became the cry of the day. It could be seen on bumper stickers, buttons, and T-shirts all over town.

A petition with 135,751 names was collected and sent to elected officials as well as phone calls and letters of protest which were circulated in the community to spotlight the economic impact of the shipyard.

A 4-1/2 mile march by approximately 2000 citizens was held, starting at the Spruill Avenue Gate and ending at the North Charleston Coliseum with a *Defense of Charleston Rally*.

Local representatives from each command on the closure list went to Washington, DC to plead their case before the Base Realignment and Closure Commission (BRAC).

Despite the best efforts of concerned citizens and elected officials, the Charleston Naval Complex could not be saved. In June of 1993, the BRAC sided with the recommendations of then-Secretary of Defense Aspen and voted to close the Charleston Naval Complex. These recommendations were upheld and signed into law by President Clinton. Charleston Naval Shipyard was given a closure date of 1 April 1996.

Jim Courter, Chairman of the BRAC, stated the situation well, when he described it as "nuclear warfare on Charleston". Although the shipyard had survived other closure attempts, downsizing, and natural disasters, she could not escape this last event. The closure of the Charleston Naval Complex directly affected the lives of 25,000 civilians and 15,000 military personnel.

Since its early conception, the shipyard and the presence of the Navy had been as natural to the Low Country as the lovely palmettoes, majestic oaks, and towering southern pines. It was unthinkable that any of these familiar sights would be here no longer.

Although the shipyard was torn apart and dismantled, she held her head high until 1 April 1996, the final day in what was once America's greatest naval shipyard. She will always be remembered for her many years of faithful, dedicated service to the fleet. Charleston Naval Shipyard had a glorious history and served our nation well.■

THE WASHINGTON POST—WHO THEY QUOTE

21 July 1997

The Washington Post
Letters to the Editor
1150 15th Street, NW
Washington, DC 20071

Dear Sir or Madam:

Please consider the following for either *Letters to the Editor* or *Free for All.*

As a means toward the end of more balanced reporting on naval matters, it would seem reasonable to seek the opinion of some other retired naval officers than Rear Admiral Eugene Carroll. This is particularly true of submarine related issues [*Navy Floats $2.4 Billion Attack Sub,* July 19].

While his background and credentials are impressive, as is his current position with a liberal (your descriptor) think tank, his sense of history and the lessons it teaches, over and over again, is misguided at best. It is safe to say that more than 90 percent of his fellow retired flag and general officers do not concur with his opinions on military matters.

History is replete with instances wherein military strength, which deters aggression and preserves peace, was reduced to the point where it became profitable for a potential aggressor to become an actual one. I believe Rear Admiral Carroll remembers Pearl Harbor and Korea, but has completely forgotten their lesson, or chooses to disregard all such lessons. What crystal ball does he use to predict the "foreseeable future" and its military requirements so precisely?

Let us not forget that the *peace dividend* won during the long, Cold War is just that—peace. Maintaining a credible military to deter would-be aggressors, including capable front line submarines, is far less expensive, in dollars and lives, than the alternative

Arlington F. Campbell
RADM, USN(Ret.)

THE WASHINGTON POST—WHAT THEY SAY

13 August 1997

On July 19th of this year an article appeared in the *Washington Post* regarding the recent commissioning of SEAWOLF. I wrote a Letter to the Post Editor in response, which, much to my surprise, the *Post* published prominently on Tuesday, 29 July.

I have enclosed a copy of this letter in the event you find it worthy to print in a future issue of **THE SUBMARINE REVIEW**.

Regards,

Jeffrey L. Adelman

"New Weapons Keep Us a Superpower

The statement that "there's no military requirement for new U.S. attack submarines in the foreseeable future" is a startling assertion from a former rear admiral of the U.S. Navy [statement of retired Rear Adm. Eugene Carroll, "Navy Floats $2.4 Billion Attack Sub," front page, July 19].

How much of the future is "foreseeable?" A month? A year? Five years? Unless a war is on, emergent weapons platforms rarely are intended to counter urgent, present-day threats. This is because such platforms—whether they be planes, tanks or submarines—are extremely complex, highly detailed systems that cannot be conceived, funded, designed and built overnight.

In the case of SEAWOLF, this process—from initial conceptualization of the design, through launching of the ship—has taken more than a dozen years. The stealth, intelligence-gathering and weapons-delivery capabilities provided by weapons systems like SEAWOLF not only send a message to potential adversaries that deters confrontation, but guarantees that we will prevail should those adversaries decide to engage us.

Ultimately, what is it about the United States that allows us to maintain our status as a "superpower"? Other nations (such as China) may have larger populations, faster-growing economies, larger armies, and/or access to nuclear weapons. Notwithstanding the internal budgetary, economic or social considerations that we must face, it is beyond ques-

tion—indeed, it is a fact of American life—that continuously improved weapons systems, including the introduction of vastly more capable and sophisticated ones such as SEA-WOLF, do no less than telegraph to friend and foe alike that we intend to remain a superpower.

And given the degree to which the United States has evolved into the model of political, economic and military stability among all nations, for us to do anything that jeopardizes the security that accompanies superpower status would be terribly foolish, short-sighted and dangerous for the entire world."

IT IS A VERY SMALL Mk 14 LOW POWER WORLD

12 August 1997

Captain Tom Maloney's letter printed in the July 1997 edition of **THE SUBMARINE REVIEW** asked if anyone could recall a Mk 14 torpedo firing with the low power setting **after** the Spring of 1965. Yes, Tom, regretfully I do.

About the time you were Weapons Officer in SWORDFISH (SSN 570), with Commander Frank Adams as your skipper, I had conducted a very successful Nuclear Weapons Inspection on that fine ship. As Chief Nuclear Weapons Inspector on the Staff of COMSUBPAC, and a former shipmate of Frank Adams' in USS TIRU (SS 416), I had considerable first hand knowledge of Frank's superior leadership, seamanship, and weapons acumen. Fortunately some of it had rubbed off on me by the time I became Commanding Officer of USS SEA ROBIN (SS 407) in the Atlantic Fleet. The result was that SEA ROBIN won the Fire Control E from SUBDIV 82 in FY 1967. We had launched over 100 torpedoes during that year, and obtained a very high percentage of *hits*. This leads me to your answer.

In mid-1967, SEA ROBIN was conducting the last of numerous torpedo firing exercises out of New London, CT, using an ASR as a target, as I recall. One of the Division or Staff officers was embarked in the target vessel as the observer, to ensure *honest* results. SEA ROBIN had fired every exercise torpedo onboard, with the exception of a unit in the forward room (which could later be used in next week's exercise) and a lone unit nesting aft in Tube #7, (which *had* to be offloaded for other reasons). The student

Approach Officer had regretfully *let the target get by* and it was time to return to port and commence the regular weekend routine. My thoughts turned to the extremely talented and hard working Torpedomen and Gunnery Officer in SEA ROBIN, as I thought of the hour or two drill that would be required to offload this single exercise torpedo upon return to port. I took the Conn, swung SEA ROBIN around to bring the after tube nest to bear, took a final bearing on the ASR at very long range, and fired the Tube #7 torpedo in low power.

The observer embarked in the target ship was astounded to observe the distant green firing flare. Much, much later, he reported an unbelievable *MOT* as the 31 knot fish, slowly cruised beneath the ASR. Range at *impact* 7,200 yards! SEA ROBIN surfaced, *rigged for race*, and headed for port—and liberty for the torpedomen—full on four engines. An *astounded* skipper tried to keep a straight face, but failed.

CAPT J. Denver McCune, USN(Ret.)

NAMING THE NEW SUBMARINE

July 10, 1997

I have been a member of the Naval Submarine League for many years. In addition, I have been a member of the U.S. Naval Institute since I was 13 years of age and am also a member of the Navy League.

I am wondering what input, if any, the Naval Submarine League has with the folks in Washington concerning the naming of the third ship of the Seawolf class (SSN 23).

The Navy got off to a great start with the naming of SEAWOLF. Politics entered into the naming of CONNECTICUT thereafter. I am wondering if we could have them consider naming the third ship after one of the famous World War II submarines such as TANG, WAHOO or any number of others. Unfortunately, *fish* don't vote, whereas the people of Connecticut and other states are registered voters.

Is the Naval Submarine League doing anything at all concerning the naming of SSN 23?

Thank you for your courtesy and cooperation.

Cordially,
Gerald J. Mullaney

NAMING THE THIRD SEAWOLF

August 20, 1997

VADM Dan Cooper
President
Naval Submarine League

Dear Sir:

The community of Manitowoc, Wisconsin, is engaged in an effort to have the third Seawolf submarine currently under construction, named USS MANITOWOC. Our community leaders and local political representatives are exercising the obvious channels, but I thought it would be worthwhile to also solicit your support and that of the Navy Submarine League.

During WWII, the community of Manitowoc and Manitowoc Company produced 28 submarines. Twenty-five of these saw action in the Pacific Theater. They were credited sinking 132 enemy ships with a total tonnage of 489,000 tons. An excellent account of this proud segment of Manitowoc history is contained in the book "Fresh Water Submarines, The Manitowoc Story" by Rear Admiral William T. Nelson. I am enclosing a copy.

The city of Manitowoc and Manitowoc Company no longer produce submarines but we have never forgotten our proud heritage. The Wisconsin Maritime Museum attracts thousands of visitors each year. During the summer months, many WWII submarine veterans hold reunions here. I believe that it would be very appropriate to christen one of the newest submarines, USS MANITOWOC.

Sincerely,
Jeffry D. Bust
2401 S. 30th Street
Manitowoc, WI 54220

ABOUT THE THREE SUBMARINE ORGANIZATIONS

September 11, 1997

I couldn't agree more with the letters from Denver McCune in the April and John Barrett in the July **SUBMARINE REVIEW**.

I think we should follow our leaders (when they're going in the

correct direction). I am pleased to be a member of The Submarine League, United States Submarine Veterans, Inc., and the local chapter of the United States Submarine Veterans of WWII. In Hawaii we also get to support the USS BOWFIN (SS 287) Memorial Park and Museum.

All of these submarine veteran organizations stand for a strong United States Submarine Force, and work to keep alive the traditions that made it great.

There may be others but I suggest we follow the lead provided by these well known distinguished submariners: Barr, Barrett, Beshany, Carr, Ellis, Flucky, Galantin and Lacy. Join all the submarine veteran organizations.

I should point out that the *Holland Club* of USSVI includes those submariners who have been Qualified in Submarines for 50 plus years and members of USSVI for five years, and Rear Admiral Carr, Admiral Galantin, Vice Admiral Fluckey, Vice Admiral Beshany, Rear Admiral Barrett and Captain Sweitzer are among the 117 current members. (And we add 18 members to the Holland Club roster next year.)

As for the submarine stamp issue. Whoever is pushing the stamp should point out, to the shame of the USPS, that Russia issued a 1500 ruble stamp with the *Podvodnaya Lodka S13* 1939 proudly displayed. If the number two submarine force gets a commemorative stamp, why not the number one Submarine Force?

CAPT John D. Peters, USN(Ret.)
98-1547 Akaaka Street
Aiea, HI 96701-3051

ONE RESULT OF DENVER McCUNE'S ARTICLE

September 12, 1997

Please allow me to give you a small portion of history about myself. I served aboard USS CUTLASS (SS 478) under Commander Lewis Sykes and Commander Herbert Tibbetts in 1966-68 as a TM2(SS). At present I am a member of The Naval Submarine League, United States Submarine Veterans, Inc., and an associate member of United States Submarine Veterans of World War II. I am also the *propulsion expert* of the 17 feet scale model of USS SEAWOLF (SSN 21) which our Sub Vets group has built.

In the April 1997 issue of **THE SUBMARINE REVIEW** there

is an article entitled "Silver Dolphins—Gold Dolphins" written by Captain J. Denver McCune. For the last two years I have wanted some type of vehicle with which we could bring the USSVI and the USSVWWII (there is no Naval Submarine League group) of the Houston area together for some type of joint meeting. Captain McCune's article was the much needed explosive to move me off dead center. I wrote to Captain McCune and expressed my thanks for his most well written article. I expressed my suggestion to him that he also send his article to both USSVI and USSVWWII for publication in their magazines. Captain McCune has since done this. I also expressed to Captain McCune my desire to bring the two Houston area groups together.

On 6 September 1997, at 1100 hours the first every joint meeting of the San Jacinto Chapter of USSVWWII and Triton Base of USSVI was held. We had 28 men in total attendance. We had as our guest speaker, Captain Zep Alford. Captain Alford, a member of the Naval Submarine League, gave a 30 minute slide presentation. After the meeting was over, I had over 10 men come up to me and tell me how much they enjoyed this meeting. We are now planning a joint Christmas dinner meeting.

Please allow me to thank Captain McCune for originally writing his article, and also I would like to thank you for publishing it.

John Fredricks
3113 Village
Deer Park, TX 77536

A DIFFERENT VIEW OF TORPEDO RELIABILITY

29 September 1997

With regard to the recent articles concerning the reliability of submarine torpedoes during WWII, and particularly the tables on pages 133-135 in the July 1997 issue, I believe the data are severely flawed and the percentages of hits reported are accordingly too high.

The data cited in the tables appear to have been developed from records compiled by the Submarine Operations Research Group (SORG) "based on task force commanders' assessments". A comparison of the SORG data with original patrol reports indicates that the patrol report claims were accepted almost 100 percent by the reviewing authorities (division, squadron, and force command-

ers) and by SORG. It is obvious that evidence obtained via highly classified Ultra intercepts was not used in compiling the SORG data.

Because Ultra did not make intercepts on all attacks, the records available today in the National Archives are incomplete. Therefore it is impossible to make a rigorous statistical comparison of Ultra records and postwar Japanese information versus patrol report and SORG data. However, the very small sample cited below will give some indication of the extent to which hits (and ships sunk or damaged) have been overclaimed. The examples are from the first 11 days of November 1943, showing torpedoes fired, hits reported, and ships claimed sunk (S) or damaged (D).

Date	Submarine	Hits/Fired	Ultra & Postwar Info.
1	Trigger (237)	2/3, 2 ships S	No evidence of any S or D
1	Haddock (231)	4/6, 2 ships S	Ultra report no damage
2	Haddock (231)	1/4, S	Ultra 3 torp seen, no D
4	Tautog (199)	2/4, 2 ships S	Ultra, no damage
4	Scamp (277)	1/6, D	Ultra, torp tracks seen
5	Cero (225)	3/6, 2 ships D	Ultra, tracks reported
5	Tautog (199)	2/9, 2 ships D	Ultra, tracks reported
6	Tautog (199)	1/2, D	No postwar evidence
7	Dace (247)	1/6, D	No postwar evidence
8	Bluefish (222)	8/9, 5 ships S/D	Ultra, no damage
9	Rasher (269)	1/4, D	Ultra, 2 torp seen, 1 passed under w/o expl
9	Seawolf (197)	1/2, D	Ultra, track seen, no D
10	Barb (220)	3/4, 2 ships S/D	Ultra, no damage
10	Crevalle (291)	1/10, D	Ultra, tracks reported
11	Drum (228)	2/6, D	Patrol report, 1st premetured Ultra, 3 exploded astern

There is no evidence that any of the above attacks sank or damaged a ship. In fact, in many cases Ultra actually identified the

ships attacked, and their ultimate disposition is known. The possibility that hits were made but never reported is extremely remote.

The overall results of all torpedo attacks during the first 11 days of November 1943 (not all of which are listed on the previous page) are as follows:

- 17 attacks resulted in confirmed sinkings or damage, in which 83 torpedoes were fired for 47 hits (65.6 percent)
- 27 attacks claimed 36 hits from 90 torpedoes fired (40 percent), but no evidence of sinking or damage has been found for any of these.
- 28 other attacks were made in which 85 torpedoes were fired with no hits claimed.

All told, 258 torpedoes were fired for 83 claimed hits (32.8 percent) but probably 36 of the claimed hits actually missed, leaving at best 47 hits (18.2 percent).

In any case, the claimed proportion of hits out of torpedoes fired cannot be used as a measure of torpedo reliability, because many of the misses were undoubtedly due to other causes than torpedo malfunction.

Sincerely,
John D. Alden

NAVAL SUBMARINE LEAGUE
HONOR ROLL

BENEFACTORS FOR MORE THAN TEN YEARS

ALLIED-SIGNAL OCEAN SYSTEMS
AMERICAN SYSTEMS CORPORATION
ANALYSIS & TECHNOLOGY, INC.
APPLIED MATHEMATICS, INC.
BABCOCK AND WILCOX COMPANY
BIRD-JOHNSON COMPANY
BOEING NORTH AMERICA
BOOZ-ALLEN & HAMILTON, INC.
DATATAPE, INC.
CAE ELECTRONICS, INC.
CORTANA CORPORATION
DIAGNOSTIC/RETRIEVAL SYSTEMS, INC.
EG&G, WASHINGTON ANALYTICAL SERVICES CENTER, INC.
ELECTRIC BOAT CORPORATION
GLOBAL ASSOCIATES, LTD.
GNB INDUSTRIAL BATTERY COMPANY
GTE GOVERNMENT SYSTEMS CORPORATION
HAZELTINE CORPORATION
ELIZABETH S. HOOPER FOUNDATION
HUGHES AIRCRAFT COMPANY
KAMAN DIVERSIFIED TECHNOLOGIES CORPORATION
KOLLMORGEN CORPORATION, E-O DIVISION
KPMG PEAT MARWICK
LOCKHEED MARTIN CORPORATION
LOCKHEED MARTIN/ELECTRONIC SYSTEMS
LOCKHEED MARTIN FEDERAL SYSTEMS COMPANY
LOCKHEED MARTIN OCEAN, RADAR & SENSOR SYSTEMS
LOCKHEED MARTIN TACTICAL DEFENSE SYSTEMS - AKRON
LOGICON-SYSCON CORPORATION
MARINE MECHANICAL CORPORATION
NEWPORT NEWS SHIPBUILDING
NORTHROP GRUMMAN CORPORATION
PRC, INC.
PRESEARCH INCORPORATED
PURVIS SYSTEMS, INC.
RAYTHEON COMPANY, EQUIPMENT DIVISION
ROCKWELL INTERNATIONAL CORPORATION
SAIC
SIGNAL PROCESSING SYSTEMS
SEAKAY MANAGEMENT CORPORATION
SIPPICAN, INC.
SONALYSTS, INC.
SPERRY MARINE, INC.
SYSTEMS PLANNING & ANALYSIS, INC.
TREADWELL CORPORATION
VITRO CORPORATION

BENEFACTORS FOR MORE THAN FIVE YEARS

HYDROACOUSTICS, INC.
LUCENT TECHNOLOGIES/ATS
PLANNING SYSTEMS INCORPORATED
RADIX SYSTEMS, INC.
RIX INDUSTRIES
SARGENT CONTROLS & AEROSPACE
TASC, THE ANALYTIC SCIENCES CORPORATION

ADDITIONAL BENEFACTORS

ADVANCED ACOUSTIC CONCEPTS, INC.
ALLIED NUT & BOLT CO. INC.
AMADIS, INC.
ARETÉ ENGINEERING TECHNOLOGIES CORPORATION
BATTLESPACE, INC.
BURDESHAW ASSOCIATES, LTD.
CUSTOM HYDRAULIC & MACHINE, INC.
DIGITAL SYSTEM RESOURCES, INC.
DYNAMICS RESEARCH CORPORATION
ELS INC.
EMERSON & CUMING, INC.
HAMILTON STANDARD SEA & SPACE SYSTEMS
HOSE-McCANN TELEPHONE CO. INC.
HUSSEY MARINE ALLOYS
JOHNSON CONTROLS
LOCKHEED MARTIN TACTICAL DEFENSE SYSTEMS
NOMURA ENTERPRISE, INC.
PRECISION COMPONENTS CORPORATION
RAYTHEON E-SYSTEMS/FALLS CHURCH
SYSTEM PLANNING CORPORATION
VEHICLE CONTROL TECHNOLOGIES, INC.
WESTINGHOUSE ELECTRO MECHANICAL DIVISION

NEW SKIPPERS

CAPT J.P. Keane, USN(Ret.)

NEW ADVISORS

R.A. Ransom

NEW ASSOCIATES

C. Detwiler
CAPT S. Gantt, USN(Ret.)
R.C. Januska
R.D. Moody
LCDR M.A. Zirkle, USNR

E-MAIL ADDRESSES

THE SUBMARINE REVIEW continues its list of E-Mail addresses with those received since the July issue. We can be reached at subleague@aol.com.

Baker, Bob, bobb@telebyte.net
Bardsley, George, george.bardsley@jhuapl.edu
Bastien, Dave, bastiend@juno.com
Burkhardt, Larry, lbiii@juno.com
Campbell, James, soupy@lmsc.lockheed.com
Carroll, Alf, alfcarrol@sippican.com
Doherty, Michael, dfs@uconect.com
Duchesneau, Robert, BobDuc@prodigy.net
Everard, Tim, teverard@anet.bna.boeing.com
Fletcher, Stephen, Fletcher.Stephen_P@Charleston.va.gov
Gillard, Jay, Jgillard@casde.com
Green, William, dattrome@earthlink.net
Gustavson, F.P., fgustavson@aol.com
Hardy, Paul, Paul.Hardy@jhuapl.edu
Kennedy, Jared, jkennedy@uscom.com
Kim, Duk-ki, d.k.kim@politics.hull.ac.uk
Lavender, Randolph, lavender_rc@nns.com
Ransom, Ed, earansom@pacbell.net
Rosenberger, Jerry, jrosenbe@ida.org
Steen, Stuart, stusteen@erols.com
Stephenson, Walt, wstephenson@cybernet.it
Stenberg, Pelle, per-arne.stenberg@kockums.se
Tonkin, Charles, cmtonkin@juno.com
Wessinger, David, dwessinger@pinhurst.net
Wright, Douglas, dwright@bayserve.net

Changes
Biesel, Doug, Biesel@aol.com
Buchanan, Richard, buchanar@stratcom.af.mil
Christian, George, chrigf@inel.gov
Goldberg, Marc, mdgoldberg@juno.com
Hack, Theodore, t.hack@lmco.com
Johnson, Carl, cljohnson@dsrnet.com
Lindsey, Robert, macropenn@bellatlantic.net

Mandelblatt, Jim, jmandelb@ewa.com
Potkay, Gary, Potkay.Gary@hq.navy.mil
Weaver, Royal, royalgul@gate.net
Williamson, George, gwilliamson@mail.snet.net

Corrections
Dietrich, Rolf, dietrich@prodigy.net

REMINDER
1998 SYMPOSIA

* * * * *

SUBMARINE TECHNOLOGY SYMPOSIUM

- May 13 thru 15, 1998
- Secret Clearance Required
- Johns Hopkins University Applied Physics Lab
- Invitation only: Contact Pat Cook (703) 256-1514

* * * * *

NSL SIXTEENTH ANNUAL SYMPOSIUM

- June 3-4, 1998
- RADISSON MARK PLAZA HOTEL
- Alexandria, Virginia

MARK YOUR CALENDARS AND SAVE THESE DATES!!

MEMBERSHIP APPLICATION

Individual Membership Rates:

Regular (including Retired Military)

- ☐ 1 year $25.00
- ☐ 3 year $68.00

Active Duty, students, and naval Reserve Active Status (Drilling)

- ☐ 1 year $15.00
- ☐ 3 year $41.00

Life Membership Rates: (ALL)

- ☐ 34 years and under $585.00
- ☐ 35-50 years old $475.00
- ☐ 51-65 years old $320.00
- ☐ 66 years and older $175.00

NAVAL SUBMARINE LEAGUE

Corporate Membership

1 - 50 employees	$ 400.00
51 - 100 employees	$ 800.00
100 - 500 employees	$1,200.00
over 500 employees	$1,600.00

Donor/Corporate Contribution

(in addition to dues)

- ☐ Patron $1,000.00
- ☐ Sponsor $ 500.00
- ☐ Skipper $ 100.00
- ☐ Advisor $ 50.00
- ☐ Associate $_____

Persons residing outside the U.S. please remit an additional $15.00 per year for mailing costs

The Naval Submarine League is a tax-exempt, Virginia not for profit corporation.
Two-thirds of Memberships Dues and 100% of donations are tax deductible

NAVAL SUBMARINE LEAGUE
P.O. Box 1146
Annandale, VA 22003
(703) 256-0891

MEMBERSHIP APPLICATION

Date _____

I hereby apply for membership in THE NAVAL SUBMARINE LEAGUE. I certify that I am a citizen of the United States or a citizen of an allied country _____

_____
Signature

Name _____
Rank, Service, if applicable

Address _____

_____

Phone (Business) _____ (Home) _____

Employer and Address _____

_____

_____

Position/Title _____

I was introduced to the Naval Submarine League by _____

ENCLOSED MONIES

☐ _____ Membership Dues

☐ _____ Donation

See Reverse Side for Rates

Your membership will bring you ....

- The Submarine Review
- Avenue to keep current on submarine issues
- Ability to contribute to public awareness of submarine capabilities
- Association with a dedicated group of people
- Invitation to Annual Meeting
- Forum for Exchange of thought on submarine matters


NAVAL
SUBMARINE
LEAGUE

NAVAL SUBMARINE LEAGUE
P. O. Box 1146
Annandale, Virginia 22003