THE SUBMARINE REVIEW
JULY 1996

A Quarterly Publication of the Naval Submarine League

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LOCKHEED MARTIN

EDITOR'S COMMENTS

Three disparate subjects are addressed as Features in this issue and perhaps some sense of conflicting emotions in the submarine community can be inferred from that very diversity of interest and activity. In a cautionary note taken from his opening of the May '96 SubTech Symposium the Chairman of the Submarine League warns us not to count on valid requirements making it through the pipeline to usable hardware on their own merits. With all that is on the table for us in the Pentagon and in Congress, those are words to take note of and plan actions accordingly.

COMSUBLANT, on the other hand, reports on a current Submarine Force that is second to none in today's operations and in preparing for tomorrow's. A third note is sounded with an address given at the Navy Memorial on Pennsylvania Avenue in DC on the occasion of the Submarine Birthday in April. Shipmates still on eternal patrol were the honorees and all of us owe a lot to all of them. These three themes of knowing where we come from in the past, working hard and being successful in the present, and wanting to do something about our concern for the future characterize this issue of **THE SUBMARINE REVIEW**, as they may well reflect the dominant mood of the entire submarine community.

A separate section of this issue deals with the major concern for the future. The issue of status for the New Attack Submarine is treated for several viewpoints. The Submarine League insured the Secretary of the Navy had the advantage of senior expert opinion on the subject of possible delay. There is also a report from the Submarine Technology Assessment Panel, convened by the Secretary and chaired by Vice Admiral Al Baciocco, which validates the lack of any reason to delay production based on the imminent availability of some potentially significant technology.

Two addresses given at the Submarine Technology Symposium round out the section on New SSN status. Both are must reading because they come from outside our own community and are offered by very knowledgeable observers. Assistant SecNav John Douglass is really the driver of the train which will get the new submarine through the remaining stages of its authorization and funding. We have to pay great attention to his views and recommendations. The other commentator, whose work has been reproduced frequently in these pages, is Mr. Ron O'Rourke of the Congressional Reference Service. He is called upon early and

often by the Congress for his objective reporting on the issues involved in the acquisition of naval forces, particularly submarines and aircraft carriers.

Another subject of great interest to the submarine community is treated in an article by Rear Admiral Tom Brooks and Captain Bill Manthorpe, both highly respected and retired Naval Intelligence officers. In their Setting the Record Straight they take on both the general tone and various specifics of a recent book which purports to cover the fall from glory of the U.S. Navy.

Jim Hay

FROM THE PRESIDENT

The last couple months have had two very successful symposia. The NSL/APL Johns Hopkins classified Submarine Symposium was very well attended (up 20 percent) and the presentations were superb as has been the custom.

Similarly, the June unclassified Symposium was well attended and the program very well received. As a matter of fact, for both symposia a larger percentage than usual stayed until the end each day—attesting, I think, to the quality of programs. At the June gathering, Vice Admiral Eugene Wilkinson was recognized as the Submarine Hero for his time in diesel submarines in WWII and his being the first CO of NAUTILUS, as well as his distinguished career being the first CO of USS LONG BEACH (CGN 9), COMSUBLANT, and the first chairman of the Institute of Nuclear Power Operations (INPO) for the civilian nuclear power industry. Senator William Cohen (R-ME) spoke at our lunch and Congressman Curt Weldon (R-PA) at the banquet.

Unfortunately, two untimely deaths have occurred in just the last month; Rear Admiral Dwaine Griffith, USN(Ret.) who built NR1 and spent much of his career in the deep submergence world, and Captain John Will, USN(Ret.) who built USS PUFFER (SSN 652), after retirement rose to be a Senior VP at Sonalysts, Inc., and who had become the Executive Director of NSL less than a year ago. Both of these superior submariners and their wives have been extremely strong supporters of the League. We will miss the greatly.

In addition, as this issue goes to press we have received word that Admiral *Chick* A. Clarey, USN(Ret.) has passed away. This famous submariner and outstanding naval officer has left to us all, and to me in particular, a rich heritage and astute guidance for the future.

The House Committee on National Security (HNSC) chaired by Representative Duncan Hunter (R-CA) which last year (FY96) directed several actions by the Navy in the submarine program, this year (FY97) authorized:

- $804.1M for the final increment of procurement of the third Seawolf (SSN 23)
- $997.2M for advanced procurement and construction of the next two nuclear attack submarines
- Added $116.M for advanced submarine technology programs that will explore higher risk technology options, generate wider involvement of industry in submarine research programs, and provide additional design options for the Navy's next generation for nuclear attack submarines.

Additionally, as a result of both SecDef's report and the Submarine Technical Assessment Panel Reports, the committee recommends authorization of the following:

- $60M to mature and transition the technologies recommended by the Navy's own independent assessment panel, which include: hydrodynamics, alternative sail designs, advanced arrays, electric drive, external weapons, and active controls and mounts. Of this amount **$10M is to be provided to each of the shipyards** to ensure that they are principal participants in this process;
- $38M to fund development and testing of additional technologies described in the Secretary of Defense's March 1996 Annual Report to the President and the Congress;
- **$40M, equally divided between the two shipyards,** to fund design improvements proposed by them for incorporation into the four transition submarines; and
- **$50M, equally divided between the two shipyards,** to initiate the design of a completely new next-generation nuclear attack submarine.

The Board of Directors and the Advisory Board had the opportunity, just prior to the June Symposium, to have breakfast with Congressman Hunter and for over an hour a very interesting exchange of ideas and opinons.

Captain Jim Hay, USN(Ret.) has accepted the position as Executive Director, NSL and with his broad experience in the submarine community and as a member of several ongoing Defense studies will be a superb addition.

Please plan now to attend one or both of our symposia next year: Sub Tech Symposium, 14-16 May; Annual Symposium 4-5 June.

Dan Cooper

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IN MEMORIAM

CAPTAIN JOHN M. WILL, USN(Ret.)
Executive Director

Captain John M. Will, Jr., USN(Ret.), Executive Director of the Naval Submarine League, died of pancreatic cancer June 7 at the Malcolm Grow Medical Center, Andrews Air Force Base.

John began three decades of naval service upon graduating from Cornell University in 1954. His tours of sea duty included the destroyers HENRY N. TUCKER and RUPERTUS; the submarines WAHOO, SCULPIN and SEADRAGON; and culminated in the command of PUFFER and CANOPUS. John's distinguished career as a submariner followed in the footsteps of his father, Admiral John M. Will.

Interspersed with tours of duty afloat, he served on the staff of Commander Destroyer Division 32; as Director of Enlisted Training, Nuclear Power School; and, in the Office of Chief of Naval Operations, as Head of the Submarine Research and Development Branch, Deputy Director of Systems Analysis Division, and Deputy Director of Strike, Amphibious, and Mine Warfare. He also was the Military Assistant to the Director of Naval Warfare in the Office of the Secretary of Defense.

His naval service was characterized by the high degree of professionalism and performance he elicited from his men and especially by the tremendous loyalty he and his men shared.

Following retirement from active duty in 1982, John was a Principal Analyst at Sonalysts, Inc., becoming a Senior Vice President of the firm. Always returning to the submarine service he loved so dearly, John became the Executive Director of the Naval Submarine League in 1995, a position he held until his death.

His military awards include the Legion of Merit, Defense Meritorious Service, Navy Meritorious Service, and Navy Commendation Medals.

He is survived by his wife, Linda; four children, Eric, Mark, Lisa, and J. Alex; and seven grandchildren.

A memorial service was held on June 28 at the Fort Myer Chapel, Virginia.

by Eric Will

REQUIREMENTS AND THE R&D PROCESS

by ADM W.D. Smith, USN(Ret.)
Chairman, Naval Submarine League
from his Welcoming Remarks
at the May 1996
Submarine Technology Symposium

It is important that we reflect on the requirements generation process within the Navy, particularly as it impacts on high priority R&D programs for submarines. I could have entitled my very short remarks, From MREs to the New Attack Submarine and I will try briefly to give you a couple of vignettes to make a few points.

I would submit that the requirements generation process hasn't been working very well in the Navy staff. I believe the last reorganization reduced the visibility of that requirements process considerably. So what do MREs have to do with it? Well I recently had the opportunity to talk to a Navy medical officer who served in Somalia whose job was to check on the support being provided to troops. One of the big issues was MREs. *[Editor's Note: Meals, Ready to Eat.]* Every one out of two MREs was considered to be unsatisfactory from a standpoint of taste and quality. They brought a team in and after interviewing a number of Marines and soldiers and SEALS, decided that they needed to figure out a solution to this problem. They observed the people eating these MREs and found out that the solution was very simple from the troop standpoint; they just added Tabasco sauce to the MRE. They thought about this for a little while and further noticed that the Marines made a lanyard to carry the little bottle of Tabasco sauce so that they had immediate response to it. They also checked around on the other MREs in the area and found that the French were making some that were very tasty. So tasty in fact that the troops would trade five U.S. MREs for one French gourmet meal. They said, "I think we've got the corrective action for this problem". The solution as recommended by this team of experts was to make a little packet (like we do with mustard and ketchup these days) of Tabasco sauce and add it to the MREs. So that being the solution, they went away and patted themselves on the back for solving another critical problem. But they never got to the root cause of what was wrong with the MRE.

Let me jump off a little bit. That's a case where the French

did one better than us in MREs. But our reputation for MREs is on the bottom in the world stacking order of meals for troops. The Dutch do better, the Norwegians, the French obviously, and even the Swedes. A couple of years ago the French were having a problem cleaning blood supplies. The U.S. had developed this process. They could clean the blood supplies. particularly with the HIV virus and there were serious problems in France because of the blood supply being contaminated. The French R&D community in effect refused to use the U.S. process. They could not convince themselves that they couldn't come up with a better way of doing it. So for about 15 months, they worked on it until they developed their own internal process—during which time a lot of people died. When this came to light, the Minister of Health was forced to resign and a few other people got fired. There was a good example of the *not invented here* syndrome. But I wonder to what extent the *not invented here* syndrome applies at times within our own community. The French, for example in their new SSBN, are using high strength alloy steel that replaces HY130 at about half the price and it is easier to fabricate. I wonder if any of us have looked at that. There are certainly advanced welding processes which exceed what we use commonly in the United States. We are now 1 percent of the shipbuilding industry in the world, so it isn't surprising if our industry is not in the forefront of these technologies. If you ask, the type commanders would say they had a requirement for a less expensive hull, one that might even have a double hull capacity. We now have automated welding in Japan, Korea and Sweden, that can do double hull welding easier than was ever imagined in some time past. I think the type commanders would say, "Yeah we have a requirement." So I'd submit the requirements process, to some degree, is broken. There are other examples of the problem.

An advanced concept technology demo these days is, in effect, a vehicle to bypass the R&D process. It is driven by the R&D and the acquisition communities, but it bypasses the normal processes because the normal processes take too long. We now have the CINCs, the five regional CINCs, and the four functional CINCs in the requirements process. They're warfighters; they're supposed to do the day-to-day business, but why are they in the requirements process? Because the process doesn't appear to be working well enough at the normal level. If we put all of that together we can see we've got some problems.

Four or five years ago, when I was in the job that Vice Admiral Cooper had before me and that Admiral Owens has had since me, a commission was set up headed by Admiral Al Whittle, whom many of you know. That commission was to look at the R&D process and say how well do we do R&D within our community. The answers weren't particularly welcome. Whittle's group said we go out and look at a problem; we identify something that we really need to do, (for which there is a valid requirement) and then we write up this solution and we throw it over the transom, (those were his exact words) and we wait for an answer to come back. Many times the answer doesn't come back.

The question I would leave you with in this Technology Symposium (and clearly we are talking about being responsive to the type commanders' requirements in this new age when the recycle time of R&D efforts is getting quicker and quicker) is "How can we do this thing better once we have the new ideas?" A lot of the new ideas will be talked about in various forums, but we need to do more than produce good reports and an aggressive R&D cycle. We need the products for our type commanders to use. The Submarine Force, although we are leading in the paradigm shift from the Cold War, has a lot of competition out there. That competition is from the other services as well as within the Navy for the limited amount of procurement dollars that are going to be around. I think that's a great challenge for all of us and I welcome the participation of all members of the submarine community in its solution. Thank you. ■

REMARKS AT THE ANNUAL NAVAL SUBMARINE LEAGUE SYMPOSIUM

by VADM George W. Emery, USN
Commander Submarine Force
U.S. Atlantic Fleet
June 6, 1996

Let me start by recognizing this fraternity. The Naval Submarine League is one of the finest organizations in the country. You have build a solid reputation as a dedicated and professional organization—one that includes both retired and active duty submariners, private citizens and leaders of industry and government. You do great service with your hosting of this symposium, along with other forums such as the Submarine Technology Symposium at Johns Hopkins Applied Physics Laboratory. We all share a common interest in keeping our Submarine Force the premier force in the world and your role as our unofficial ombudsmen is invaluable and greatly appreciated by those of us on active duty.

In a couple of weeks, I will be relieved by Rich Mies, as he takes over the helm of the Atlantic Fleet's Submarine Force. This is my last opportunity, at least in uniform, to address the league's membership.

What do I say this morning about the Submarine Force that will have some lasting meaning—that will capture my feelings for a subject about which I feel so passionate. My gut feeling tells me I should spend my time wisely and leave you with a personal sense of the status of the force and the challenges the submarine community faces in the years ahead.

I don't intend to dwell on the operations of our submarines. You were briefed yesterday by Jerry Ellis on operations in the Pacific—much of which takes on the flavor of what we do here on the East Coast. You heard from Captain Harry Sheffield, who commanded USS MARYLAND, and Commander Steve Jones, CO of USS NEWPORT NEWS. Who better to tell you of what we are doing in the Atlantic Fleet, than the commanding officers of our submarines.

I will start, however, with a few comments that summarize what has taken place since we last met. Last year at this time there were 49 SSNs in the Atlantic Fleet—today that number stands at 47; a small reduction compared to the precipitous decline

ahead. Our Trident submarine numbers grew by one with the addition of USS MAINE in Kings Bay. We christened CHEYENNE, the last of the Los Angeles class, and WYOMING, the next to the last of our Tridents, and SEAWOLF. Three new attack submarines were commissioned—TUCSON, COLUMBIA and GREENEVILLE. We also said a sad farewell to WHALE, GATO, FLYING FISH and BERGALL.

Overall, our personnel numbers are down slightly—with approximately 20,000 officers, sailors and civilians assigned to our ships, staffs and shore activities.

In terms of our operational tempo. we are averaging around 42 percent underway time. That number has risen only slightly over the past few years. We have had a steady diet of submarines deployed to the Mediterranean, Eastern Atlantic, Persian Gulf and Caribbean. As the COs indicated yesterday, it's safe to say our submarine crews have been very busy.

The best part of this job is getting a chance to roam around the waterfront and to go to sea from time to time. Every time I do, I leave refreshed and invigorated, feeling extremely proud of the dedication and professionalism of the men and women I meet. I can reaffirm Jerry Ellis' observation that the Submarine Force is manned by a great bunch of sailors.

While these experiences are great for our subs and for our egos, what we should really be concerned with these days are more sobering issues. **First, we need to keep asking ourselves the basic question, are submarines still a relevant and necessary component of our military?**

I'm convinced that this question will continue to be the most important question we ask ourselves. And I'm also convinced that the answer to that question, and **our ability to articulate the answer, is the number one variable in determining future support for submarine programs.** A second, and lesser included two-part question we must ask ourselves is, how many submarines are needed to support the national defense and what number can this nation afford?

Let's work on the *why* question first.

I would be the first to admit, that at times, it can be very difficult to be heard in Washington. There are many voices and many divergent messages. But up to this point, the submarine community has fought a pretty good battle. Navy, Joint Staff, Defense Department and Congressional leaders are aware of what

submarines bring to our undersea warfare capability and have supported us well. I wish Rear Admiral Bob Natter could be here to run down for you what was overall a very successful 1996 legislative year and what appears to be a promising commitment by Congress for submarine programs in next year's fiscal budget.

By the way, Bob Natter has been superb as Chief of our Legislative Affairs Office. He has been totally objective, professional and supportive of the Submarine Force.

There is no one person, or group, who can take credit for our success in educating key decision makers on why it is vital for this nation to maintain and modernize its Submarine Force. However, in my New Year's message to the Force, I gave a lot of the credit to the officers and sailors of our submarines. By their hard work and their commitment to getting the job done, they continue to prove that our submarines directly contribute to the nation's security every day of the year.

While I patted them all on the back for a job well done, I asked for their continued support and laid out three objectives—actually mandates, that I view as key to continued support for submarines and submarine programs within the Navy, the Defense Department and the Congress.

First and foremost, we must continue to remain relevant to the needs of our war fighting leadership. My job, and Rich Mies' job soon, is to ensure that our sailors have a clear picture of what is being asked of them. Our commanding officers must be able to clearly translate war fighting objectives into realistic goals supported by an effective training program, both ashore and at sea.

Training is the number one objective by which we characterize what constitutes a good command. When we take care of training our people, all other areas fall into line.

If training is our number one objective, then the safe operation of our submarines whether at sea or in port mst be a primary goal of our training program. The confidence of the American public in our abilities to safely operate nuclear powered warships must never be shaken. Our safety record has been superb, but it only takes a lack of attention on the part of a few to destroy the enviable record we have garnered.

The highest **potential** impact of our training program, and the one that for the purpose of this discussion most directly answers the *why* question, is the training aimed at honing our war fighting

ability. That's what we get paid for. We must be a ready and able force; we must be able to execute whatever mission is assigned, at anytime, and in any of the world's oceans. If we fail to be ready to launch our weapons or deliver special forces to the beach, even once, we risk jeopardizing our standing. Every mission that is assigned to the Submarine Force is critical and often without redundancy or flexibility of execution. We have very specific missions that we train for every day...some that only submarines are capable of doing...there is no room for error or misjudgment.

As critical as training is to our ability to successfully meet our war fighting requirements, we must also balance these demands with the very important task of ensuring that folks outside of the Submarine Force know and understand what we do for a living...which goes back again to the *why* question.

We work extremely hard at educating the rest of the Navy on what it is we do, and in the case of our Battle Group and Joint Task Force Commanders, we show them what the submarine can do.

As Steve Jones highlighted yesterday, visibility within the battle groups extends to assigning post SSN commanding officers and two or three submarine qualified junior officers to serve on Submarine Advisory Teams. These officers are making a real impact and are a voice at the table as the Task Force Commanders decide how to employ their forces.

We have continued to demonstrate the potential of the submarine ashore and at sea to a large portion of our Congressional membership and their staffs, and to hundreds of business, academic and community leaders since we last met. In fact, during 1995 nearly 30,000 Americans visited Atlantic Fleet submarines; over 150 Congressional members and their staffs; over 300 folks from OSD, JCS and the Navy Secretariat, and more than 125 media representatives came aboard. But this is a new year, as will be the next year, and the year after that. We cannot rest on our laurels and ignore the demands of constantly opening up our fleet to those who will influence our destiny.

With the election cycle this fall, there may be many new faces appearing on the political front, as well as within the Defense Department. Our story will have to be re-told with equal candor and objectivity if our programs are to continue their present level of support.

Now, what about the second question: how many submarines do we need and what number will this nation be willing to invest in?

The answer to these questions are dependent on many diverse factors, such as war fighting requirements, forward presence, and shipbuilding industrial base requirements to name a few. There are no simple answers. As taxpayers, we clearly don't want to buy any more defense than we really need.

If you ask various so-called experts, you get a wide range of answers. Part of the problem is that the missions assigned to submarines are more widely varied than ever before. Couple that fact with the increased worth of each unit in a reduced force and it becomes apparent that too few submarines may leave us unable to meet future national security requirements. Our fleet and OPNAV leadership are well aware of this issue, but the number of submarines, like the number of other Navy platforms is more influenced by current budgetary concerns than future international instabilities.

Nevertheless, working together the SUBLANT and SUBPAC staffs have put together a superb study of the impact of reduced force levels on the ability of the Submarine Force to respond to peacetime and wartime demands, and although I can't discuss the details in this forum, I can tell you that I have taken that briefing to every level of Navy leadership including the new CNO.

Whatever sized force we have will be a busy one. The Submarine Force of the future will be involved in all that our Navy does, and therefore all that our joint forces do.

Let's examine what the Submarine Force is doing today—the 6th of June. Of the 47 fast attack submarines assigned to the Atlantic Fleet, 17 are at sea—that's 36 percent. We have five subs in the Mediterranean. We have units participating in North Atlantic operations, in Joint Task Force counter-drug operations, in exercises with UK, Norway, France, Sweden, Spain, Italy, Poland and the former Czechoslovakia, and several conducting battle group workup training. We are asking more and more of our submarine crews than ever before.

We want our submarines to be key tools for Joint Task Force Commanders when they execute operational warfare from the sea. We want them trained, armed and equipped to attack an adversary's critical vulnerabilities, whatever and wherever they may be.

In addition to joint task group support, deterrence will continue

to be a core requirement for the Submarine Force. It has classically been spoken of in terms such as "strategic" or "nuclear". Call it what you will, the policy of strategic deterrence has been empirically successful in that it has indeed deterred nuclear war.

Because today and in the future, potential adversaries could still hold us at risk with considerable arsenals of weapons of mass destruction, we need to continue to deter any temptation to use those weapons to our disadvantage.

In turn, the strategic submarine will remain the backbone of our nuclear deterrence. We will commission our 17th Trident, USS WYOMING, in July. Our last Trident, USS LOUISIANA, will follow next year. Subject to ratification of START II in Russia our current plan is to transition to a force of 14 Trident during the next decade.

No decision has been made as to what role, if any, the four Ohio class submarines removed from the strategic force structure will perform. My guess is the Navy will find a conventional role that makes sense and is affordable.

Conventional strike warfare, particularly precision strike, i.e., strike without collateral damage, will become an even more important capability with which we must remain proficient. The requirement to deliver tons of ordnance on target will continue, and there is no way a submarine will replace an Air Force or Navy attack squadron in that regard, but in precision strike we can and will play a major role.

My bet is that mines and countering mines will play an expanded role in the future. These simple, deadly, yet cheap and readily available devices enable any littoral nation, even those with limited resources, to disrupt commerce as well as military operations. We must develop, and are developing, improved mine detection and avoidance systems.

The widely accepted role of the submarine as a covert surveillance platform will remain unchanged in the predictable future. Whether supporting joint operations in the Caribbean or NATO embargo operations, the submarine's ability to provide indication and warning to combined or joint forces as their covertly positioned eyes and ears remains one of their most valued missions.

The ability to covertly insert and extract special warfare forces into hostile territory will grow in importance. Small scale operations, out of the public eye, will factor into our emerging

policy of conventional deterrence.

Anti-submarine warfare remains a vital war fighting requirement for the Navy. Whether the issue is the continued Russian production of quieter nuclear submarines or the worldwide proliferation of diesel submarines—all of which you will hear a great deal more of this afternoon when Naval Intelligence discusses foreign submarine development—the submarine threat will remain a primary responsibility of the Submarine Force. We are expected to be good at it—we are the only platform fully capable of dealing with an adversarial submarine—and in the fleet, a larger share of ASW has shifted to the Submarine Force.

As Rear Admiral Ed Giambastiani articulated yesterday, the proliferation of submarines and submarine technology poses one of the greatest risks to our Navy's ability to operate with impunity in the world's oceans. The diesel submarine provides Third World countries with an affordable weapon to wield superpower influence. We must be the force ready and able to deal with these threats.

Last month I spoke at the League's Submarine Technology Symposium at Johns Hopkins University. At that seminar, I said that anti-submarine warfare is really about undersea warfare. In other words, it is about undersea superiority. Dominating the undersea environment for submarines means that we must be better trained, must operate superior submarines and be more technologically advanced than our adversaries. By the end of this decade, in just four short years, we will be attempting to dominate the undersea environment with approximately half the number of submarines once envisioned—and with a number 60 percent of what it is today.

The responsibility for ensuring our success in the undersea environment weighs heavily on all of us as we plan for that eventuality.

So what are we doing?

ASW superiority is the number one focus of the attack submarine force today. There has been a tremendous amount of work done in this area in just the past 12-14 months. A great deal of promising research has actually made it to the fleet and the results are promising. Let me share one example with you.

A little over a year ago, we began to address how we were going to recover ASW superiority. An ASW panel made of representatives from N87, SUBPAC, SUBLANT and elsewhere

got together to set the baseline of where we were and where we needed to be. We then reached out to the technical and academic communities and laid out the challenge of providing both long term and near term solutions.

In June of last year the technical community responded with the introduction of advanced development modules of two systems: the Automated Fleet Towed Array Sonar (AFTAS), and the Real Time Transient Processor (RATTRAP). Both were converted for fleet use and the first installation was completed in just six months. The first at sea evaluation, currently under way, commenced three months later. This very positive experience demonstrates that, with proper discipline, commercial off-the-shelf (COTS) technology can be used in a broad spectrum of military applications.

AFTAS and RATTRAP moved from the concept stage, to installation on front-line submarines—a process that would normally take years, in nine short months. This is an amazing turn around and everyone involved—NAVSEA, OPNAV, fleet and industry have, I believe, been awakened by the potential of these two systems as models for program development.

The use of low cost COTS and rapidly upgradable equipment to provide rapid transition of technology to the fleet is necessary today, and will be absolutely **critical** in the future.

While this new found technology shows significant promise, there are several other developments underway to address passive acoustics and they look equally promising.

One outcome of AFTAS and RATTRAP is the recognition of the savings that are possible in research and development when using COTS technology. As procurement reform sweeps the entire Defense Department and as industry is asked to pick up a greater share of the cost for research and development, such savings can mean the difference in a program getting past the concept stage or dying on the vine. The competition for the Navy's scarce R&D dollars is intense. The days of unlimited monies for submarine research are gone.

Our challenge is to define the areas that need attention most and to search for technologies that show the greatest promise. We then must work closely with academia, research scientists and industry to design and build systems that offer affordable and significant improvements. While we can no longer afford to gamble on risky, low payoff technologies, we also can't afford to become so conservative that we limit ourselves and lose the

opportunity to exploit untested technologies.

The bottom line is that the United States must maintain technological superiority over potential adversaries to give our numerically smaller force the undersea advantage.

Okay, let me climb down off that horse and leave you with some remarks about the state of the force.

I mentioned early on that the Submarine Force is in good hands. Our people programs are generally in good shape; despite the force being manned at 96 percent of authorized billets. Our senior enlisted rates (E6-9) are taking up the slack created by reduced recruiting quotas. They are manned at 116 percent and our junior rates are currently manned at 85 percent. There are some specific problem areas:

- We have a shortfall of Fire Control and Sonar Technicians due to accessions in '93 and '94 that were about half that required to maintain healthy communities. FTs are currently manned at 83 percent (at sea), with the most critical shortfall in the junior rates. Sonarmen are slightly lower with 82 percent.
- We are still experiencing insufficient junior officer retention, but with plans for increased bonuses, permanent spot promotions for our engineers, and improved XO/CO opportunities, the future appears brighter.

In the material world we are also generally in good shape, but we do have problems with our towed array systems, which directly impact our ability to do our **prime job**. Systemic problems with our vertical launch Tomahawk tubes impact our strike capability. As a comparison, we have 156 torpedo tubes in the fleet (counting only COR SSNs) and none out of commission. On the other hand, we have 228 vertical launchers and seven are out of commission. The answer to solving this problem lies in design issues, better logistics support and improved training for our maintenance folks. We're working the problem!

And a final material issue we need to work on is antenna reliability. We need to improve our communication and data throughput to enhance our relevance to strike warfare and task force commanders. Communications continue to be a limiting factor in our ability to fully integrate with the rest of the Navy.

Part of the good hands I spoke of earlier is with the leadership of this community. I am pleased as punch to be relieved by Rich Mies. He'll be a great asset. And the rest of the team, Jerry Ellis at SUBPAC, Ed Giambastiani in OPNAV, Dennis Jones at

STRATCOM, George Sterner at NAVSEA, Admiral DeMars followed by Skip Bowman at Naval Reactors and all the rest of the supporting cast, are alive with energy and dedicated to forging a future for the force. Give them all your support!

Last month, six former SUBLANT commanders, Admirals Bob Long, Hank Chiles, Steve White, Ken Carr, Arnie Schade and Joe Williams joined us at Headquarters in Norfolk to review a snapshot of current events, peer at our plan for restoring submarine ASW superiority, and evaluate our analysis of the impact of a future, smaller force structure and give us their thoughts.

Among the many offerings, and the crowd was not reluctant to offer their views, was the thoughtful observation that we used the term *ASW* a thousand times in our briefings and *undersea warfare* nary once! And that since there was much more at stake than ASW alone in our underwater world, we would be well advised to shed our blinders to ensure we didn't overlook the attributes which give the submarine such a broad contribution to sea-based warfare.

We acknowledge our focus on ASW and I don't apologize for it. It is job ONE. At the same time we are trying to keep our minds and eyes open to a 360 degrees picture. **Please feel free to help us.**

Thanks for all your support and all the great memories. God bless. ■

*****IN REMEMBRANCE*****

ADM Bernard A. Clarey, USN(Ret.)

CAPT Francis T. (Bud) Cooper, USN(Ret.)

RADM Dwaine O. Griffith, USN(Ret.)

CDR Robert H. Harris, USN(Ret.)

CAPT Eric E. Hopley, USN(Ret.)

CAPT William Rigot, USN(Ret.)

CAPT John M. Will, USN(Ret.)

SUBMARINE BIRTHDAY WREATH LAYING ADDRESS

by RADM E.P. Giambastiani, Jr., USN

Let me first recognize the U.S. submarine veterans of World War II, and the other retired and active submariners and their families, who have come here today. We are also joined by Michael Dinola, Jr., whose father was lost onboard USS THRESHER. Thank you all for being here on this special day—the 96th year of submarines in the United States Navy.

I would also like to extend a special recognition to Mrs. Jeanine McKenzie Allen who is in the final stages of a 10 year project to pay tribute to her father, Torpedoman's Mate First Class Lloyd Charles McKenzie, who was lost at sea on USS TRITON (SS 201) on March 15, 1943. Mrs. Allen has undergone an epic journey in researching historical submarine operations and her father's heroics in war. On April 22, she will be dedicating a plaque in his honor at Arlington National Cemetery and I know many of you here today will be there.

It is a real privilege for me to participate in the second annual wreath laying ceremony to honor those submariners on eternal patrol. Of course, now that we have done this more than once, we can call it an annual event.

Being new in my job as the Director of Submarine Warfare, I must commend those who have come before me—and many of you here today—who had the foresight to start this event on the birthday of the Submarine Force—to remember those who so valiantly gave their lives in service to their country.

In the hustle and bustle of our daily lives, we often do not stop and reflect on the people who have gone before us—or the thin line of fate which separates the destinies of the heroes assembled here today from those on eternal patrol.

John F. Kennedy said that, "A nation reveals itself not only by the men it produces, but also by the men it honors, the men it remembers". Today, our nation, our family, our spirit, is in your Submarine Force and your submariners. We have gathered here to honor them, to remember them, to reflect on their sacrifices and the sacrifices of their families, and what that means to us. Our reflection does not cast a shadow, but rather, it shines a light so that we might better learn from the past and see into the future.

Two weeks ago I was the guest speaker at the U.S. Naval

Academy's first annual Submarine Birthday Ball. The Ball was preceded by a Submarine Heroes' reception which honored many of the living legends. I took that opportunity in addressing the midshipmen—our future leaders—to give them a window into our past and how the rich heritage of the Submarine Force impacted my decision to become a submariner. It was those heroes in history—many of them there that night, from engineman to admiral—whose image burned in my mind. Their heroic deeds are a valuable party of our heritage and remain a cornerstone of the professional pride in today's Submarine Force.

While history does not always repeat itself, it does perpetuate a unity that glues the generations who have fought and overcome the challenges of the deep. That unity—that esprit-de-corps of our submarine people—draws us here today, to pay homage to those heroes whose faces we can't recall, whose dreams we have lived and whose spirits we have carried on.

These heroes in World War II accounted for 55 percent of all Japanese shipping sunk—an achievement accomplished with less than 2 percent of the United States Navy's personnel. But that did not come without a large toll. Fifty-two submarines were lost—almost one out of every five—and over 3500 men went down with their ships—about one out of every four men in the Submarine Force. No other branch of the armed services suffered so high a toll. Their courage, in the face of death, was the decisive factor in the outcome of the war in the Pacific.

Our shipmates in the Marine Corps have a special place for submariners, and the challenge of life under the sea, as accounted by General Holland *Howlin' Mad* Smith in his autobiography detailing his experiences in the Pacific in World War II:

> "Marines and submariners shared the same characteristics and the bond between them was stronger than between any other two branches of the naval service. We were both volunteers; to a man, we deliberately chose the most hazardous type of service...the Marine admired the submariner who cruised for months at a time in enemy waters, hundreds of miles from his home base...the lads who manned the underwater craft were not supermen and possessed no supernatural qualities of heroism; they were top notch American youths, well trained, well cared for and armed with superb weapons."

And so it is today that we reveal ourselves, to honor those men who gave their lives, to speak for a grateful nation to those men whose gallantry preserved our freedom and who give us cause to reflect and draw strength from their sacrifice. Those of us who still serve, and all Americans alike, honor our heroes and remember their deeds.

Henry Wadsworth Longfellow wrote in his poem The Building of The Ship:

> "Our hearts, our hopes, our prayers, our tears, our faith triumphant o'er our fears, are all with thee—are all with thee."

May we never forget those who remain on eternal patrol. ■

DOLPHIN SCHOLARSHIP FOUNDATION
A Heritage of Promoting Knowledge Through Giving

Since 1961, countless numbers of the submarine force wives have heroically donated their energies and time to organize and raise funds to assist dependent children of Navy Submariners and Submarine Support Activities personnel to receive grants for a college education. The grant selection system was established to support a blind and independent process based solely on the information contained in the application.

Today, the Foundation sponsors 100 ongoing scholars with a grant of $2,000/year. The recipients may receive a total of $8,000 for up to four years of undergraduate studies. Approximately 25 new scholarships are awarded each year. The Dolphin Scholarship Foundation is proud to have awarded in excess of $2.7 million to over 570 students attending universities and colleges throughout the United States.

Currently the Foundation receives funds through: Navy Submarine Officer Wives Club fund raisers and Dolphin Stores, individual and corporate contributions, Foundation calendar and book sales, memorial donations, and bequests.

The Foundation is a tax exempt Virginia not-for-profit corporation. All donations are tax deductible.

VIEWS ON THE NEW SSN

29 February 1996

Naval Submarine League
P.O. Box 1146
Annandale, VA 22003

Honorable John H. Dalton
Secretary of the Navy

Dear John:

The U.S. Naval Submarine League maintains a strong and continuing interest in our country's submarine programs. In that light, a group of senior retired submarine personnel have prepared a white paper, which is enclosed. This paper articulates our concerns with the new attack submarine construction program. Specifically, we believe that while the incorporation of latest technology is desirable, we do not believe any emerging capabilities should be allowed to slow construction of the new SSN.

I hope you will read the enclosed white paper carefully and let me know ways in which we can help you achieve this objective. I also would appreciate any comments you might have on our approach.

I regret that your busy schedule did not permit an opportunity for us to present this paper to you in person so any questions you might have could have been answered face to face.

I look forward to receiving your reply.

Sincerely,
William D. Smith
Admiral, USN(Ret.)
Chairman

NAVAL SUBMARINE LEAGUE WHITE PAPER ON THE NEW ATTACK SUBMARINE

We, the leaders of the Naval Submarine League, an organization dedicated to support and promote the United States Submarine Force, believe that the New Attack Submarine (NSSN) is the right ship at the right time. The NSSN design achieves the proper

balance between affordability and capability, maintains a critical mass in the intellectual base, and most important, gets needed capability to sea.

In recent years the undersea challenge has steadily increased while U.S. submarine construction has stalled and our submarine force structure has declined dramatically. Russia continues to develop advanced submarines and has about a half dozen submarines at sea today as quiet as our newest Improved 688s. The quieter follow-on to the AKULA, the SEVERODVINSK, will become operational by the year 2000. The U.S. degree of undersea superiority has decreased to an alarmingly narrow margin versus our most capable competitor. Concurrent with Russian undersea advances, modern diesel submarines have improved and proliferated. Meanwhile, operations in the littoral regions have emerged as a major mission of the modern nuclear submarine.

Our nuclear powered attack submarines are multi-purpose warships that are flexible—able to transit at high speeds independent of weather and sea state, virtually unlimited in endurance, possess an impressive offensive payload, including precision land attack missiles, and, above all else, are the most survivable platforms in the U.S. inventory.

Stealth, more than any other characteristic, makes submarines uniquely valuable. Submarines provide our Nation its survivable strategic platform and the Navy its stealthy general purpose warship. These ships are immune to attack from cruise or ballistic missiles, biological or chemical weapons of mass destruction, and all but the most advanced undersea weapons. They provide the National Command Authority an ambiguous presence capability, unmatched anti-submarine warfare and anti-surface ship warfare prowess, robust strike capability, and unique intelligence collection ability around the world. While submarines certainly cannot do it all, they are of significant value when the mission is of a covert nature, or the risks to non-stealthy platforms and personnel are unacceptable.

Incremental improvement of the 688 class reached its cost and technical limits in the 1980s. The Seawolf program provides the technology leap that maintains U.S. superiority. When SSN 21 goes to sea in 1996, it will be the quietest and most capable submarine in the world. The Navy has been working for years to achieve a design for a follow-on to the Seawolf that has the attributes necessary to maintain undersea superiority at an

affordable cost. The NSSN design satisfies the Seawolf requirements for acoustic stealth, and carefully trades off top speed and payload to achieve affordability. NSSN's payload will be sufficient to accomplish any of her missions and her lesser maximum speed is adequate for weapon evasion. NSSN's state-of-the-art design will ensure our undersea superiority over all potential adversaries in the future.

The NSSN design is maintained in a state-of-the-art computer environment enabling rapid assessment of new technologies without the need for extensive and expensive mockups. A modular isolated deck structure incorporates shock mitigation and noise isolation technologies sufficient to allow the use of commercial-off-the-shelf (COTS) equipment. These advances achieve Seawolf acoustic stealth in a smaller hull providing significant cost benefit. The design and construction innovations for this ship will produce greatly enhanced capability for about the same cost as building an Improved 688 today.

The NSSN design and building plan has come under unprecedented scrutiny. Numerous studies from inside and outside the Navy have repeatedly validated the adequacy of the NSSN design. The New Attack Submarine Independent Characteristics Review was convened to "examine the ability of the NSSN design to perform its required military missions". The panel concluded that, "...the NSSN design is technologically robust and reflects the correct balance between cost and state-of-the-art technology. There is nothing on the horizon that justifies delay."

There are certainly technologies existing in various states of maturity which may have value and applicability to the Navy's submarine program; however, we believe that there are no new technologies mature enough to be allowed to lessen the NSSN program momentum and delay the building program. The innovative design incorporated into NSSN is flexible enough to enable insertion of new technologies into future hulls and backfit them into existing platforms.

The Joint Chiefs of Staff have stated a minimum of 10 to 12 submarines with Seawolf quieting are required by the year 2012. That means building seven to nine NSSNs by that time. Any delay in the construction of the NSSNs will increase the cost of each platform significantly, and will prevent the Navy from getting a required capability in the hands of sailors in the fleet.

We believe that the NSSN's stealth, sensor enhancements and balance between affordability and capability make it the right submarine for the Navy of the 21st century. Low rate production must begin within the framework of the current acquisition plan or the undersea superiority of the United States Navy will be put at unacceptable risk.

6 May 1996

Dear Admiral Smith:

Thank you for your letter and white paper on New Attack Submarine. A copy has been forwarded to John Douglass, the Assistant Secretary of the Navy (Research, Development and Acquisition). I share your concerns with submarine construction in bridging the gap from the 688 class to the New Attack Submarine. We have many challenges ahead, including the introduction of competition into the construction plan, but I am convinced that Navy will get the most capable submarine platform going into the 21st century.

As you are aware, my staff prepared a report to Congress, signed by Dr. Kaminski, which discussed the development and demonstration of new technologies that should result in an increasingly capable class of submarines. In addition, Vice Admiral Al Baciocco, USN(Ret.) just completed an independent panel evaluation of submarine technologies. His findings concluded that there are no revolutionary technological advances on the near horizon which would justify a delay in proceeding with the New Attack Submarine or warrant radically changing its design. I also agree with his conclusions that the design accommodates sufficient room for growth in new technologies.

I appreciate your efforts and those of the Naval Submarine League in supporting the New Attack Submarine. If I can be of any further assistance, please let me know.

Sincerely,
John H. Dalton
Secretary of the Navy

SUBMARINE TECHNOLOGY ASSESSMENT PANEL

by VADM Albert J. Baciocco, Jr., USN(Ret.)

The panel was charged by the Assistant Secretary of the Navy for Research, Development, and Acquisition to provide an independent evaluation of available and future submarine technologies, as well as an assessment of the feasibility, cost, and potential benefits or drawbacks with respect to their incorporation into the new submarine platform. We were also tasked to recommend a technology insertion plan for submarines. We accomplished this task by examining the proposed Submarine Program and the supporting Technology Program.

The panel was comprised of 14 members possessing strong technical and operational credentials and a depth of experience in government, industry, and academe. A complete listing of panel members and their affiliations is attached.

In December 1995, the Navy solicited papers on state-of-the-art technologies for our panel to evaluate. We met over a two month period, while we performed an on-going evaluation of these responses. Meetings over the two month period were devoted to gaining an understanding of the projected threat, the Navy's new submarine program, the missions for which it was designed, and the technology resident in the baseline design. We also met with distinguished submarine designers and managers to understand lessons learned from the past. Current and former operational commanders were consulted in an effort to understand their perspective of present submarine operations and future needs. We met individually with Dr. Wood, Mr. Battista, and Mr. Polmar, as well as with Mr. Ron O'Rourke and Dr. John Foster, all of whom testified before the House National Security Committee (HNSC) last September regarding submarine technology, in order to consider their perspectives on this subject. Finally, the panel considered technologies presently in the Navy's new submarine design, those submitted in response to the December solicitation, those presented by the shipyards, and those technologies presently funded by the DoD and Navy technology community.

We found weaknesses, but also strengths in both the submarine program and the technology program. We evaluated technology candidate papers received from the December solicitation. Finally, we explored several special topic areas. From the findings in the submarine and technology programs, the technolo-

gy candidate papers, and special topic areas, we derived conclusions and recommendations.

The Submarine Program

Strengths. The panel found several noteworthy strengths associated with the new submarine program. One was the ability to make the new submarine as acoustically quiet as SEAWOLF, but in a significantly smaller hull. This alone is no small technological feat and demonstrates a significant advance in quieting technology when compared with previous submarine classes. We found that the new submarine design incorporates new, higher performance systems. The elimination of penetrating masts, the change to an advanced DC electrical system, advanced Electronic Support Measures (ESM), and electromagnetic silencing are a few examples. The new submarine design also facilitates future mission reconfigurability. The design provides for insertion of mission specific hull sections during new construction. The panel noted that there is also flexibility inherent in the new submarine design as seen in the ability to reconfigure the torpedo room and the ability to changeout mast modules dockside.

One strength of the new submarine program was associated with the ability of the Navy to commit to the same shipyard for design and construction of the lead ship which allows the shipyard to commit to sub-tier vendors early, to incorporate producibility into the design early, and to work interactively with the Navy to produce a capable and affordable submarine. In addition, it was noteworthy that the Navy, in conjunction with both shipyards, achieved reductions in government unique requirements and specifications.

The new submarine program has been focused primarily on affordability while meeting stated missions. The panel noted a balanced approach to submerged signature, the use of Modular Isolated Deck Structures, and design simplification through component reduction as design strengths. The panel also noted the combat system open architecture approach as a strength in the program. The use of Commercial-Off-the-Shelf components in the Open System Architecture environment, along with contracted technology refresh updates should ensure that the combat system on the new submarine is the most capable combat system available.

Weaknesses. There also are weaknesses in the new submarine program. The emphasis on affordability precluded obtaining a higher performance multi-mission submarine, although, as I noted before, the desired operational performance levels will be attained with the current design. Affordability tradeoffs made early in the design resulted in performance tradeoffs which could limit the platform if radical changes occur in the threat or assigned mission. The result of these tradeoffs resulted in a design whose maximum speed, test depth, and firepower may not be as great as that exhibited, one feature at a time, in past designs, and whose signature may not be as low as the Navy can reach. The risk is that the design may not provide adequate performance margins as threats and missions evolve.

Another weakness that the panel noted was that the strategy for incorporation of future improvements is not clear. While the program noted there were plans for mission specific hull sections, preplanned product improvements, and technology insertion, the panel was unable to determine that these plans existed.

Through the review of the December solicitation papers, briefings from the shipbuilders, and discussions held with the DoD and Navy technical communities, the panel noted that the baseline design lacked certain desirable features which would probably be needed in the future and could still be incorporated into an early hull with vigorous action. These desired features could include an improved sail, a hybrid propulsor, and fiber optic towed arrays.

The Technology Program

Strengths. One strength of the submarine technology program was the availability of capable and talented people to develop and mature submarine technologies. In addition, the panel noted that extensive capital investments have been made in facilities to support developing and maturing submarine technology. Several examples include:

- Lake Pend O'Reille in Idaho which hosts large scale vehicles that can prove out hydrodynamic concerns and issues
- The Intermediate Scale Measurement System which provides unique and significant capability to evaluate signature components, and
- The Hydrodynamic/Hydroacoustic Technology Center located at the Naval Surface Warfare Center in Carderock,

Maryland which provides the modeling and simulation capability to explore hydrodynamic and hydroacoustic issues.

- The Large Cavitation Channel located in Memphis, Tennessee which can support evaluation of propulsor and hull form hydrodynamic performance.

Weaknesses. The panel noted that critics of this design fear that the next Russian submarine will be operationally superior to the new submarine. While the panel cannot determine with certainty that the Navy has been overtaken or surpassed in particular areas, it is significant to note that there have been instances in the past where the Navy has been surprised by Russian innovation and advances.

The panel noted that, historically, major technology development efforts have not had continuity and have been limited to the low risk options for the immediate submarine acquisition program. Funding for submarine technology can be classified as *spiky*—ramping up for the next specific acquisition program on the horizon and then rapidly falling off once the program has been formalized.

The panel noted that core submarine technology investments are generally too small to investigate important and/or revolutionary options in a timely manner. As a result, future modifications or new designs will be limited to evolutionary improvements over their predecessors.

We also found that the submarine requirements, acquisition, and technology communities lack both effective coordination and a common vision which would be expected to be documented in a formal long-range plan. There is no single organization with technical authority and accountability across all aspects of submarine science and technology maturation and insertion.

The panel also found that the shipyards are not continuing principal players in submarine technology planning and development until well into the design process. The panel noted that other technology-dependent communities, such as the Air Force, rely to a great extent on industry for their technical base.

Finally, we noted that only limited funding is available to utilize the vast and capable infrastructure of test assets and vehicles mentioned previously.

Technology Candidates

We performed a qualitative evaluation of the 257 December solicitation responses. Each response was reviewed by several panel members. Our evaluation of each candidate technology was based on the technology's military utility, schedule, cost, and risk with respect to the Navy's future submarine program. Technology candidates were categorized as possibly available in the near term (FY98-FY01), mid term (FY02-FY06), as well as far term (FY06+). We categorized the papers into 10 Congressional Interest areas (documented in the FY 1996 Defense Authorization Act) *[Editor's Note: See THE SUBMARINE REVIEW, April 1996, p. 13]* and 18 additional topic areas (including acoustic sensors, non-acoustic sensors, precision navigation, acoustic signal processing, and regulatory compliance to name a few). From the Congressional Interest areas, the panel concluded that there were only seven technologies available in the near term (FY98-FY01), if resources were applied at an accelerated pace. Of these seven technologies, none were deemed to have high military utility. Of the 55 near term technologies in the 18 additional topic areas, only 18 were determined to have high military utility, but the majority of these were evaluated to have moderate to high cost and risk. From the technology candidate assessment, the panel proposed a technology insertion continuum based on the panel's interpretation of the maturity of technologies in areas such as quiet launchers, fiber optic sensors, and electric drive.

Special Topics

The panel identified six special technology areas which can promote arrangement flexibility and potentially reduce the volume of the submarine, while providing enhanced performance. The panel considered these technologies as enablers for achieving revolutionary change and advancement in submarine design. In addition, the panel identified leadership and management of both the submarine and technology programs as a special topic that the Navy should consider.

The first special technology topic area was **hydrodynamics**. Hydrodynamic concepts and technologies were identified to the panel which may significantly improve submarine stealth, speed, and maneuverability. Reasonable evidence exists that several

hydrodynamic concepts have been successfully combined by others into integrated advance submarine designs to improve overall performance. These concepts are not fully understood in the U.S., nor are they being applied in the U.S. Navy. Hydrodynamic technology opportunities, coupled with newly developed research tools and large-scale testing facilities are available to conduct a vigorous hydrodynamics program to explore integrated approaches and to incorporate into submarines designs, as appropriate. The panel recommended that the Navy establish a robust hydrodynamics improvement program.

The second special topic area was **improved sail.** The panel was presented with several conceptual alternative sail designs which would provide additional volume for maintenance access, external stowage, and mission payload reconfigurability. Various geometries and materials were identified which could also provide improvements in hydrodynamic performance and reduced target strength. In addition, alternative sail geometries could provide space and surface area for embedded sensors and antennas in the long term. We recommended that potential enhancements be evaluated and an optimal alternative sail design be selected.

The third special technology topic area was **sensors.** The panel noted that fiber optic sensor technology promises increases in performance and reductions in weight, volume, and cost through applications of thin line arrays, billboard arrays, mine hunting sonars within the molded lines, and self monitoring. The panel noted that commercial-off-the-shelf electronics, open system architecture, and ease of installation make backfit of fiber optics reasonable. The panel noted that the program funding has been limited and recommended that development of advanced arrays incorporating fiber optic sensors be accelerated.

The fourth special technology topic area was **electric drive.** We found there are both internal and external electric drive concepts and technologies which may reduce radiated noise and provide more flexible machinery room space arrangements while significantly reducing ship volume and cost. Permanent magnet motor technology is available and could be developed into a submarine electric drive system in the FY02-FY06 timeframe. The panel recommended that the Navy explore the electric drive system, and, through a preplanned product improvement approach, incorporate electric drive technology into a submarine design.

The fifth special technology topic area was **mission reconfigur-**

ability and external weapons. As noted in the submarine program findings, the submarine is designed to easily accommodate mission specific modules at new construction. One possibility for these mission specific modules would allow the submarine to carry an increased number of weapons. However, the panel noted that mission reconfigurability could be achieved through the inclusion of external weapons into the existing hull. The panel recommended that the Navy pursue external weapons as an enabler to improve mission reconfigurability as submarine designs evolve.

The sixth special technology topic area was **active controls and mounts.** The technical community has a wide variety of active control and mount ideas to enhance mission capabilities and reduce cost. The panel recommended emphasis in this area.

The last special topic area was **technical leadership and management.** The panel noted that submarines are technology intensive, and therefore require a high degree of systems engineering and integration. As a result, technical leadership extending beyond the acquisition of a new design is necessary. The panel commented that this will be difficult during downsizing and in an environment that emphasizes acquisition skills. The panel noted that technical education is available and viable, but replacement, development and mentoring of technical experts appear to be random. Continual development of leading edge technology and the unique attributes of submarines mandate development and retention of talented knowledgeable technical experts. The panel recommended that the Navy emphasize technical expertise and continuity in selection of key managerial positions.

Conclusions and Recommendations

The panel determined that the new submarine, as presently designed, meets established requirements. The design provides a capable multi-mission submarine, with room and flexibility to incorporate some available and soon-to-be available technologies should they be required. We recommended that the Navy proceed with the new submarine, but commit to continuous evolution. In making this recommendation, the panel did not focus on considerations of budget, source structure, or industrial base. Instead, we relied on our finding that the design meets current requirements and has room for incorporating available and foreseeable technological advances, and there are no revolutionary advances on the

near horizon which would justify delay.

The panel noted that the commitment to continuous evolution must include the formulation and maintenance of a technology insertion plan, including the consideration of technologies identified by the panel and others, for early technology maturation investments, as well as the periodic surveillance of potentially revolutionary technologies being explored in the technology base.

Although the new submarine design is appropriate, the panel noted that there are technologies which could be available in the far term and which may warrant a redesign of future submarines. We felt there were several areas that required stable and sustained programs in research and development to evolve these far term technologies. The Navy should program sufficient resources to investigate these technology areas including: hydrodynamics, improved sail, sensors, electric drive, mission reconfigurability and external weapons, and active controls and mounts. The panel strongly believes that these technologies will allow for arrangement flexibility and serve as enablers for revolutionary submarine designs of the future.

We concluded that the submarine R&D enterprise lacks prerequisites for an assured and viable future. A continuing, stable level of R&D funding, is especially critical. A better degree of stability in the R&D lines must be instituted, if longer term technologies are to be studied and matured, or eliminated, so that 10 years from now a similar panel will not see the technologies in the same undeveloped state. The R&D funding spikes have inhibited the insertion of state-of-the-art technology in current submarines and will prevent the maturation of advanced technology for future submarines. The Navy needs (1) substantial maturation investment early enough to meet the next design, (2) a refreshment strategy for current designs, and (3) a technology base developing options for future designs.

The panel also found mission analysis and systems engineering to be narrowly focused on the new submarine. Without future-oriented analysis and engineering, and better communication with technology base management, it is unlikely that the Navy will be investing technology base funds well. The panel concluded that a formal, published, continually updated long-range plan would be an effective coordination mechanism.

The panel concluded that separation of acquisition and life cycle support can inhibit the formulation and execution of cost-

effective plans for technology maturation and insertion. In addition, we noted that some managers of the technology community seem to be so focused on early and visible transition of the work they sponsor, that they have lost the desire to support the high-risk, long-term efforts that could lead to revolutionary improvements in the performance of future submarines.

Based on our conclusions in this area, we recommended that the Navy define a single attack submarine product manager dedicated to acquisition and life-support, including the maturation and insertion of technology into existing, newly designed, and future submarines. This product manager should have clear authority and accountability of the attack submarine product throughout its lifetime, plus continuing coordination responsibility with Naval Reactors.

The panel recommends that, in addition to its acquisition responsibilities, the organization be held accountable for the performance of the future-oriented activities, including the formulation and maintenance of a long-range submarine technology plan.

Summary

The panel concluded that there are not near term technologies on the horizon which should preclude continuation with the new submarine as designed. The panel strongly encouraged the Navy to consider our recommendations regarding revolutionary technologies that should be pursued, the need for stability in R&D funding, and suggestions for improved management authority and accountability.

PANEL MEMBERS AND AFFILIATIONS

VADM Albert J. Baciocco, Jr., USN(Ret.) - Panel Chairman
- Former Director, RDT&E (OP098)
- Former Chief of Naval Research
- Former Director, Attack Submarines (OP22)

Dr. David V. Burke
- Senior Vice President, Charles Stark Draper Laboratory, Inc.

VADM Daniel L. Cooper, USN(Ret.)
- Former Director, Navy Program Planning (OP090)
- Former ACNO Undersea Warfare (OP02)
- Former COMSUBLANT

LGEN William H. Forster, USA(Ret.)
Former Military Deputy to ASA(RDA) General Manager, Army Systems, Northrop Grumman Electronic Systems Division

Mr. Charles A. Fowler
Former Chairman, Defense Science Board
Former Director of Tactical Warfare Systems, Office of the Secretary of Defense
Former Vice President, MITRE and Raytheon

Dr. Raymond Hettche
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Mr. Alfred C. Malchiodi
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Dr. Albert Narath
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President, Lockheed Martin Energy Sector

Dr. James A. Tegnelia
Former Deputy Director, Advanced Research Projects Agency
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Mr. George A. Wade
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Dr. Bruce Wald
Former Director, C3I and Military Space Technology, Naval Research Laboratory

MGEN Jasper A. Welch, USAF(Ret.)
Former Director, Air Force Systems Analysis
Former Defense Coordinator, National Security Council

RADM Robert H. Wertheim, USN(Ret.)
Former Director, Strategic Systems Programs Office
Chairman, Los Alamos National Laboratory Advisory Group ■

NAVAL SUBMARINE LEAGUE

ADDRESS TO THE SUBMARINE TECHNOLOGY SYMPOSIUM

by The Honorable J.W. Douglass
Assistant Secretary of the Navy
Research, Development and Acquisition
May 15, 1996

Thank you very much, it's good to see so many people here. *Where are we going in our Submarine Force* is a topic that is near and dear to my heart. If I had to do some sort of a chronogram of my time, in the 205 days that I've been in the Pentagon, it is probably the single biggest issue I've had to attend. I'm going to try to share with you a little bit of my views, not only where I think we're going, but just to let you know where we've been; to hopefully set some context for this symposium that you're having because we really do need everyone in this room to apply their best thinking to what our country should be doing in this critical area.

I have a much longer talk that I give when I appear before groups that are primarily interested in the defense environment in general. It's called my Paradigm Lost speech. It's built around a paper that I wrote back around 1992 when I was retiring from the Air Force and I was the number two U.S flag officer over at NATO headquarters. It was an attempt to explain how I saw the shifting paradigms for national security that were developing in the United States and in the Western democracies at the end of the Cold War. In that paper I recount an example that happened to me. In 1989 I happened to be privileged to be in Berlin for the New Year's Eve celebration of 1989 to 1990. The Russians invited me up on the Brandenburg Gate in order to have a good view of the New Year's celebrations. This was an absolutely magic period of time for Germans. If any of you have ever visited Germany, or lived there, you probably have some feel for the kind of emotion that was in the air, the emotionally charged atmosphere that was happening that Christmas and New Year's season when, after 45 years, these two parts of Germany were being reunited. There was a tremendous celebration going on in the central part of Berlin. Somewhere over a million people were crammed into that central plaza. As the clock struck midnight it was one of these really electric moments because there was very light snowfall coming down, but somehow the moon was out that

night too. It wasn't as though it was all clouded over so that there was sort of a magical air to everything. The crowd grew absolutely quiet and you could hear this big cathedral clock tolling the final moments of 1989 and we were beginning this last decade of this century. All of sudden on both sides of the wall the crowd began to sing *Duetchland my Duetchland*. It was so emotional. It wasn't like we often see in the United States where you go to the ball game and we sing the national anthem and everybody sort of half-heartedly sings it. This was a million people gripped by the emotion of the times, singing their national anthem together for the first time in 45 years. It sent goose bumps down all of our necks. The Russian General turned to me and said, "See General, it's happening again and you Americans caused it." That was the view the Russians had in 1989.

I tell this story because the Russian view of what lay ahead from that point, the beginning of this decade, was not on the mark. Germany has resumed it's place in our western alliance. They have incorporated Eastern Germany into the Western part. They've had their economic problems, but that country is off onto a course of democracy which is certainly meeting the expectations of the West in every way. Those old Russian fears were very far off the mark. I tell this story because we were off the mark in 1989, equally as far as the Russians. If you would have told me in 1989 that we would have sent troops to Somalia; started out to help with famine, turned into nation building, then it turned into *get Ahdid*, then we had to leave with our tail between our legs; I would have never believed it. If you would have told me that we would have done Desert Storm with 500 thousand American troops in the Mid-East, I would have found that hard to believe. If you would have talked about Haiti, I would have found that hard and certainly I would have found it very, very difficult to believe that we would have as many troops as we do today in a place called Bosnia. Frankly in 1989 I didn't know where Bosnia was. I had been to Yugoslavia, but I had never really focussed on what the names of the several republics were, and I didn't even know there was such a place as Bosnia. So my point is, the Russians missed the mark very widely at the beginning of the end of the Cold War, but so did we.

We are still gripping and groping our way into a future that is very, very difficult to project into. In the National Security environment though, we have finally begun to face up to the fact

that the old models and the old approaches to the way we structured our national security during the Cold War, no longer apply. Nowadays, when I am being briefed on a new weapon system, for example the arsenal ship is one that is very new in the Navy inventory, people do not come to me with an end-of-the-world scenario of what we call *The Threat*. In the Cold War, every briefing on every new system started with this gigantic estimate of how bad the other side was, and what we had to do, and how we were going to find an exact point design that would get there sooner and be better than what the other side had to do. That old threat-driven paradigm is breaking down; except in one place, and that seems to be in submarines. I'll come back to that point in a minute.

I want to remind you of a little historical perspective about his idea of the threat. If you just go back and look at our national history, from 1776 to 1816 we had three primary threats in our country. It started out with the British, who have probably been our best ally since those early years; France who is another one of our best allies; and the group that we wrote songs about that disappeared into the dust bins of history, called the Barbary Pirates. But they were a number one threat in those early years of our nation. From 1819 to 1831 we gave up on the Barbary Pirates and we focused on the Caribbean Pirates—they were our big threat. From 1835 to 1842 the threat became what was called in those days the Mosquito Fleet. This was a bunch of gun runners that were getting guns to runaway slaves and Indians. From 1846 to 1848 the threat was Mexico. From 1861 to 1865 the threat was ourselves. If you're a Yankee it was the Southerners and if you're a Southerner like me it was the Yankees. Happily that period is behind us. By 1898 the number one threat was the Spanish. If you want to learn about propaganda I would invite you to read some of the books written around the turn of the century about the Spanish, which sound very much like some of the stuff in the press today about the atrocities in Bosnia.

From 1917 to 1919 the threat was Germany and from 1941 to 1945 it was German and Japan together with the Italians sort of in there for awhile and then out. From 1950 to 1989, as we all know it was the former Soviet Union. Now the lesson that you should learn is that focussing on a single country and a single threat is a dangerous thing to do in terms of technology. Because if you go back and look at the things that allowed us to defeat the

Japanese in the Pacific in World War II, there were things developed in the '20s and '30s, principally the innovations of Naval aviation, and in those days the Japanese were not considered to be a threat. We were much more concerned about some hypothetical threat that would arise in Europe. So we find ourselves today with some very, very interesting dichotomies in looking at technology. Specifically we find ourselves in a situation where in almost every other sector of technology we are stretching and looking into the fog of the future and not focussing directly on the former Soviet Union except back to submarines again. The reason why we are doing that is because the former Soviet Union, now Russia, is the only country that produces submarine technology that can be a threat to us. So there is a kind of *well it's there, so we better focus on it*. I don't mean to in any way mitigate the fact that we may have to deal with that threat at some point in time. I'm just point out that it brings us to a focus that is so different than what is going on in all of the other sectors of our industrial base, as to stick out like a sore thumb.

Now in order for us to cope with the world where we really think Naval forces are going to be applied, in other words, future Haitis, Somalias, Desert Storms and Bosnias, we have to design a Navy and Marine Corps force structure that applies to that challenge that we are going to be seeing in the future. This is why the Navy is redefining it's doctrine in Forward from the Sea, focusing not on the deep ocean problem, but on the littorals. But here again, when you think of submarines fitting into this and you look at our attempts to focus our Submarine Force in the future as a part of a force structure which has to deal with warfare in the littorals, we are continually being drawn back to this old comparison between us and the Soviet Union in the deep ocean environment; something we have to pay attention to, something that is vastly important, but again something that is a dichotomy for us.

Now in facing this dichotomy, it seems to me that you can boil down all the travail that I've seen and had to struggle with in the 205 days that I've been over there into three main issues. The first one is, *what is it we should buy for the future for the Submarine Force*? Second issue is, *how should we buy it*? And the third one is, *who should manage it and who should pay for it*? Those are the issues that I am confronted with on an almost daily basis with various factions in the Office of the Secretary of Defense and in the Congress. Starting with what should we buy,

I think it's safe to say that the issue that we are struggling with is *how good does this thing have to be*? That seems to be the focus that we have to deal with and we have a spectrum of views on that from those who feel the New Attack Submarine is not good enough to those who feel fairly passionately that it is good enough. In fact it's probably more expensive that we can afford.

The second big issue is: *how should we buy it*? Left to it's own devices the Navy would have gone down an approach that allowed us to *single up* in one submarine builder for the future. The reason for that was affordability; not because we don't like competition and not because we don't worry about the industrial base. We did not see how we could proceed into the future with the enormous shipbuilding bow wave that we have, with this big problem of refocusing the Navy into warfare in the littorals while keeping our Marine Corps equipment up-to-date, and still be able to carry two major manufacturers in the submarine industrial base.

I would remind everyone that the submarine industrial base is unique, and separate, from all of the other sectors of our industrial base. Many sectors are carried in large degree by commercial work that can be shared. Surface ships have some commercial production that they can share the overhead with (not enough and I'm working on that, it's one of the big concentrations that I'm trying to apply my time to, but that's not the subject of the speech today). Certainly for airplanes we have a very viable commercial airplane business and then you can similarly go through the various other sectors of technology. Even tanks are supported in a large degree by research and other activities that have to do with very heavy construction equipment, farm equipment and things of that nature. But submarines are quite an entity unto themselves. It raises the issue aobut how much we can afford to invest to keep this national capability alive. There is consensus I think in almost everybody's point of view that we do need to keep it alive. The issue is how robust and how much we do spend on it.

If you listened to some factions in Congress, primarily I would say in the Senate, they believe we need competition. This is, of course, led by the Virginia delegation who would like to see Newport New brought into the equation. They have been successful in bringing that before Congress to the point where the Navy has been required to produce plans to build submarines in two shipyards.

The third issue is: *who should manage it, and who is going to*

pay for it? One of the disturbing things that Congress has been doing in the last few years (and I have to say when I was a staff member on the Armed Services Committee I saw it happen a lot, and I must admit I participated in this a little bit), is that when we got into a situation where they really want to threaten a service to do something, one of the threats that they make is to write it into the law that if this, that and the other isn't done, we'll take this mission away from you and we'll give it to someone else. Sometimes in the aviation area where the three services very, very zealously guard what they do, this is an enormous threat. Sometimes it's more of just a nuisance type of thing. In our case, in the world of submarines, the threat has been made to us. If we don't do this submarine thing right, they're going to take it away from us and give it to the Office of the Secretary of Defense to manage. Most of the people in this room know that, as good as the Office of the Secretary of Defense is, and it's one of the best that we've had, and very ably run by two of my very best friends, they don't have a large capacity to manage a program like this. So that kind of a threat is somewhat idle, but it causes lots of mischief within the Pentagon. We have to compensate for that by coming up with ways to convince the Congress that the Office of the Secretary of Defense and the Navy are working together to solve the issues of how much technology we should put into the new submarine programs, and how robust those designs will be, or we'll have a problem with the Congress about where it should be managed.

Now the problems that we have within the building are not so much about where the expertise resides; the Office of the Secretary of Defense knows the expertise for managing the submarine programs is in the Navy. The problems that we have are about paying for what some people believe is an extraordinary amount of technology. For those who want to drive this weapons system to a very, very high state of capability, the issue is *where does the money come from*? Those are the principal issues that we have to deal with, are still with, are still having to deal with, and are likely to be dealing with for the next three, four, or five years. Because if we stay on the path that we're on, and we build a boat in 1998 and 2000 at Electric Boat and 1999 and 2001 at Newport News, we're likely to be debating this issue all the way up until the year 2001. This is likely to be a debate that is not going to go away and is going to continue to give us management problems.

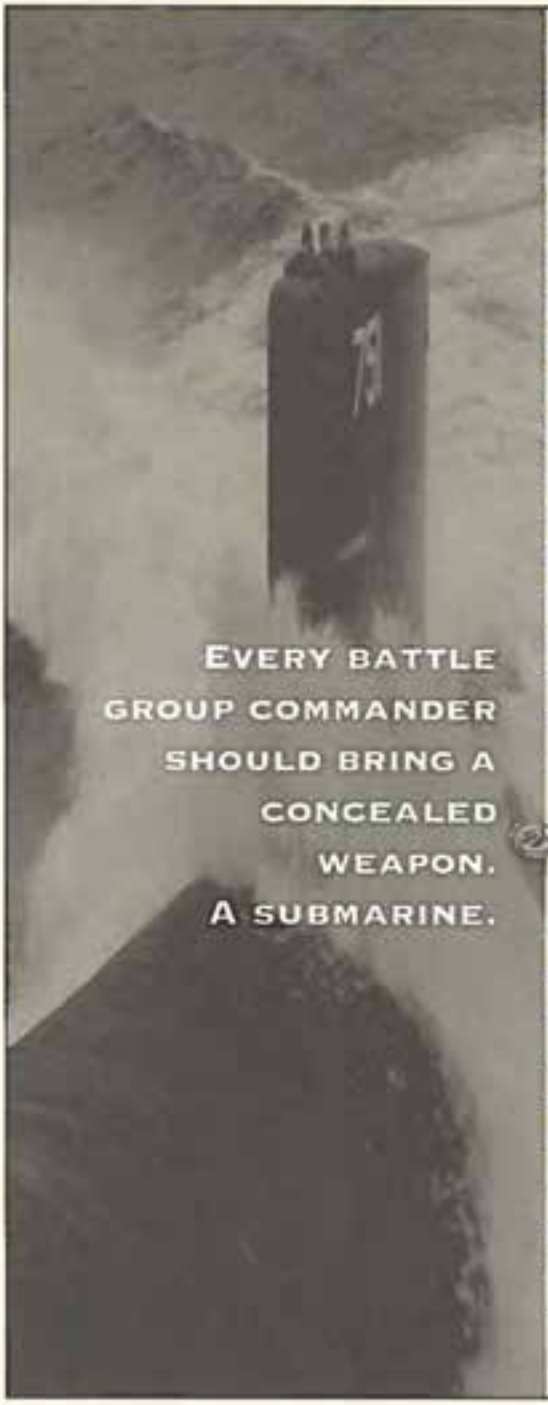
Having said that, I think that there has been some convergence in the Congress. If you look at the marks that have been produced by the Armed Services Committees and the two Houses of Congress, they are much closer together this year than they were last year, and I think that is a testimony to the emphasis that the Navy has put into working with the Congress to build consensus on the future for this program. I think a lot of it has to do with some of the excellent work that has been done by people like Vice Admiral Al Baciocco. He's been a tremendous advisor to me in helping me figure out how much technology should go into this program in the future. So there is some hope that we are converging, but we're not there yet. One of the things that you as a group can do is help us see where technology fits into the equation. How much we need, how much it is going to cost, the advantages and disadvantages, how it fits into Navy doctrine and also what management schemes make sense.

Clearly there is an enormous difference of opinion between the Senate, the House and the Navy on the final structure of the program. There are many people in the House that still have this idea that we can just build prototypes very inexpensively, get them to sea very quickly and somehow glean some information from this and make a decision by 2001 about what design we want. We in the Navy have not yet seen how to do that. I have sat down with my good friend from Electric Boat, and my good friends from Newport News and asked them how they see that unfolding. And both of them have said to me that they support the Navy program. When I go back and testify to the House, the House tells me that someone out there in those shipyards is coming to them, telling them that they can build ships such that instead of taking three or four years to build a submarine, they can build one in 18 months; and instead of taking a $1B to design it, it can be designed for a couple of hundred million. These kinds of stories and time-lines still are reverberating around in Washington in spite of all of the attempts that I have made, and others in the Navy have made, to look at this from an orderly and scholastic point of view. So any positive structure that you can help us put onto this debate will be greatly appreciated by me.

I applaud you for what you are doing here. I hope that the dialogue that is going on is good; I think we're going to be in this debate for a couple more years so you're likely to be back here again next year debating it again. But the message that I want to

leave with you is to open your minds, it is a new world. The Navy is trying to change its force structure to deal with the kinds of problems we see in the future.

We have to take into account the capabilities that the Russians have. But folks, the Cold War is over. It's over. We've got to look forward. One of the most remarkable things about the time period that we're in right now, is that we don't even have a name for where we are. What do we call this era that we're in? We call it the post Cold War era. Now think about American history and ask yourself when before did we define ourselves in terms of where we were. Even after the Civil War, we didn't call it the post Civil War era; we called it the Reconstruction era. We have a forward orientation to our national view of ourselves. We've got to do that now in my view. I think it's bad karma for us to be continually redefining ourselves by where we used to be instead of where we want to go as a nation. So our challenge as designers and manufacturers of weapon systems is to try to focus on the future, try to think of that Navy doctrine, and what those young submariners of the future need, and focus our thoughts in that way. ■



TODAY'S SUBMARINES OFFER COMMANDERS A UNIQUE COMBINATION OF STEALTH, MOBILITY AND ENDURANCE. PIONEERED BY ELECTRIC BOAT, THESE FEATURES MAKE SUBMARINES IDEAL FOR COVERT MISSIONS, SPECIAL OPERATIONS AND BATTLE GROUP SUPPORT. AND WHILE SUBMARINES ARE MORE MULTI-MISSION CAPABLE, THEY ARE NOW MORE AFFORDABLE SINCE ELECTRIC BOAT HAS RE-ENGINEERED THE INDUSTRY. AS A RESULT, AMERICA HAS A CRUCIAL STRATEGIC ASSET GEARED TO MEET FUTURE CHALLENGES. AND SO DO BATTLE GROUP COMMANDERS.

ELECTRIC BOAT CORPORATION

A VIEW FROM THE HILL

SUBMARINE TECHNOLOGY SYMPOSIUM LUNCHEON SPEECH

by Ron O'Rourke
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Library of Congress
May 16, 1996

Thank you for that introduction. It's an honor to have a chance to speak before you once again; especially at this very critical point in time for the future of the submarine technology community and the Submarine Force.

In the year since I last spoke to you, Congress has engaged in its most significant debate on submarine technology and submarine acquisitions since the Submarine Alternatives Study of 1979, if not further back than that. Today, I want to focus most of my remarks on this new debate that had developed over the past year on the Hill. Specifically, I want to talk about three things. First, I want to make some observations about this debate, and thereby hopefully put it into some perspective. Second, I would like to discuss the current situation that has evolved out of the debate—where we are now. And lastly, I would like to shift to a couple of longer-term potential issues for the submarine technology community.

I'm going to move now to the first part, which is to make some observations about the debate that began very soon after I spoke to you last year. *[Editor's Note: See* ***THE SUBMARINE REVIEW****, July 1995, p. 19.]* Submarine technology and submarine acquisition emerged as one of the top two or three most controversial weapon acquisition issues last year, along with missile defense and B-2 bomber procurement. It was one of the main reasons why the conference on the fiscal 96 Defense Authorization Bill lasted so long—almost 100 days, which was really quite an extraordinary length for a conference.

The issue of submarine technology and submarine acquisition was one that featured divisions along several different dimensions. It divided the Executive Branch from the Congress, it divided the House from the Senate and it divided one shipyard and its

supporters from the other shipyard and its supporters.

Significantly, however, for the most part, the debate was a family affair—that is for the most part, it was not a debate between supporters and opponents of submarines, but rather a debate among supporters of submarines. The debate occurred, in other words, not because the message about the continued value of submarines in the post Cold War era has not gotten through, but because it *had* gotten through. And not because the message about the continuing Russian submarine program hadn't registered, but because indeed it *had* registered, and very strongly.

The debate focussed on two primary questions. One of these was the concern about competition in submarine procurement. That was a concern that was primarily within the Senate Armed Services Committee, although the House National Security Committee was interested in it to some degree as well. This issue was very well developed by the time I spoke with you last year.

The other question was the issue of the adequacy of the New Attack Submarine design, the issue of whether it was the right boat to build. That issue was a focus within the House National Security Committee. The House Committee's concerns on this question were apparently driven by three things. One was the Committee's view of the comparative rates of improvement of U.S. vs. Soviet and Russian submarines in recent years. The second was the fact that there have been instances in the past of surprises involving the dates by which Soviet and Russian submarines have entered service. That, by the way, isn't a concern limited only to the House Committee. Senator Cohen of the Senate Armed Services Sea Power Sub-committee, also a member of the Intelligence Committee, has expressed on more than one occasion his own concerns in this area as well. The third thing that apparently drove the Committee's concern was a sense that if there were surprises in the past, there might well be surprises in the future, but unlike in the past, where we had more room to absorb a surprise, now there is very little room to absorb any further surprises that we may encounter. So the House Committee did take up that issue after I spoke with you last year.

But you will recall that last year I was concerned that this was an issue that might eventually emerge and cause difficulty for the attack submarine program. My point at the time was that from the start of the New Attack Submarine program in the early '90s through the spring of 1995, there had been no focussed review in

Congress on the program and thus no opportunity to establish a firm foundation of understanding in Congress about the history of the program and how the design for the boat had been developed. This, I said, would become a source of vulnerability to the program's smooth continuation in the future.

In a sense, that chicken came home to roost last summer, not too long after I spoke with you, when the House committee turned to the issue of the adequacy of the New Attack Submarine design and did reach a judgement that the design was inadequate in terms of both capability and affordability. Now my own view, as I expressed last year, is that it would have been better to have had this focus on the adequacy of the design of the boat earlier in the history of the program. There would have been less disruption and more potential for making adjustments if this had happened earlier. But by the same token, it was better to start focussing on the issue last year, than to wait for another year or two or three and then attempt that kind of a review, because that would have led to even greater disruption and even less potential for making adjustments.

When I first spoke to you four years ago in 1992, I discussed the need to involve Congress during the design process of the New Attack Submarine so that a repository of understanding could be built up in the Congress concerning the history of the program and how the design was developed. Four years later we are now, in a sense, finally closing the loop on the issue. The process of closing that loop has been difficult and messy because of the fact that it was delayed, but it would have been even more difficult and more messy if it had been put off further.

This leads to my next observation about the debate and how it has unfolded, which concerns the benefits that this difficult and messy process is producing and has the promise of producing. In a strictly legislative sense, the central result of the debate last year was a provision on submarine acquisition in the Defense Authorization Bill, Section 131. *[Editor's Note: See* ***THE SUBMARINE REVIEW****, April 1996, p. 7.]* Section 131 is a very long and complicated legislative provision, and in fact, soon after the bill was enacted into law, Section 131 kind of became the proverbial elephant that was encountered by the blind men. One of them grabbed the trunk and said, "Hey, this is a snake." The other grabbed the tail and said, "No, it's a rope." The third ran into a leg and said, "No, this is a tree." The fourth one walked into its

side and said, "You've got it all wrong, it's a mountain." There was a fair amount of that going on through the early weeks of this year. In a general sense, however, it can be said that Section 131 essentially merges the Senate Committee's concerns regarding competition with the House Committee's concerns regarding the adequacy of the New Attack Submarine design.

But beyond the strictly legislative result—Section 131—the debate last year on submarine technology and submarine acquisition had five other important results and I wanted to review those with you.

The first is that in a constituent sense, the debate expanded the political base of support for the submarine program by giving a second shipyard a direct stake in that program. Second, as I just mentioned, by belatedly addressing the issue of the adequacy of the New Attack Submarine design, last year's debate began the difficult but valuable process of building up the substantive base of support for the program that comes from understanding the history of the program and how the design was developed.

The third benefit that came out of the debate last year was that it highlighted the issue of the need to provide a continuing workload for maintaining not just the submarine production base, but the submarine design base as well. Secretary Douglass yesterday touched on this. The Navy's baseline submarine acquisition plan was not viewed on the Hill last year as providing a robust plan for maintaining the design base in the long run.

Fourth, and very significantly for many of you in this audience, the debate last year highlighted the issue of funding levels for submarine-related technology RDT&E work, and whether those levels are sufficiently high and, just as important, sufficiently stable. One result of this was a decision last year to increase submarine-related RDT&E funding by about one hundred million dollars.

The fifth and final benefit that came out of the debate last year, and again something that is very significant I think to many of you in the audience, is that the debate highlighted the issue of the organizational link between the submarine technology and acquisition communities and whether steps need to be taken to strengthen that link. So there were important benefits that came out of that debate last year.

I want to switch now to the second of my three topics, which is where are we now. First I would like to agree with Secretary

Douglass' observation yesterday that there are signs in this year's mark-ups of some convergence both between the Executive Branch and Congress and between the House and Senate. We've gone through perhaps a dialectic process of hypothesis and antithesis and maybe we're getting into the process now of synthesis. This process has been aided in my view by the work of the Baciocco panel, whose final report, which was submitted to the Navy and also shared with Congress in March, is helping to bridge gaps along both of these dimensional divides, between the two sides of the river and between the two sides of the Hill.

I would also like to agree with Secretary Douglass' observations yesterday that the programmatic issues that arose out of last year's debate and legislation will not be fully resolved this year. To the contrary, this is a process that may be drawn out over the next several years. Among the issues that need to be worked out, and which will not be fully worked out within the course of this one cycle, are the following seven.

The first is the question of whether there will be two, or three, or four, or five submarines that are built prior to the resumption of competitively awarded submarine construction contracts. Between Section 131 of last year's bill and the Defense Department's report to Congress from last March, all of these options have now been proposed and are, in that sense, on the table.

The second issue that remains to be worked out is whether the eventual competition that does take place should be based on price as slated in the Senate Committee's mark or on best value as stated in the House Committee's mark.

The third issue concerns the configurations of the pre-competitive submarines that are to be procured over the next few years. What new technologies will they have? How will they differ from the baseline New Attack Submarine design and how will they differ from one another?

The fourth issue concerns the approach to acquisition reform that is to be used in future submarine acquisition. The House Committee's mark this year would direct the Navy to apply the Air Force's *Lightning Bolt* acquisition reform initiatives to submarine programs. I'll have to go find out what those are. But in this connection you may recall that three years ago in my 1993 address, I said that in the new era of limited defense resources it would be increasingly important to show not just that you intend to make a new and better platform, but that you have a new and

better way of making it—and that failure to do this, to show that you have a new and better way of making it, would put the Navy at risk of looking poor by comparison to other parts of the military, particularly the aviation community. The Navy has a story to tell about how the process for building the New Attack Submarine is going to be different from the processes that were used to build prior submarines. Differences that include the design build process, a more sophisticated use of computer-based design, fuller development of modular construction techniques, open architecture and COTS for the combat system and reduction in milspecs. I don't know if this is the sort of reform that the House has in mind, but if it is, then this a message that needs to be emphasized more.

The fifth issue that needs to be worked out concerns how much funding should be added over the next several years for additional submarine-related RDT&E work. This is the question of whether we can afford an additional, speaking very roughly, one or two hundred million dollars per year on top of the amounts that are already programmed. Secretary Douglas was certainly correct yesterday in mentioning just how little room there is in the very tight defense budget for plus-ups of this kind. But Secretary Douglass also properly mentioned the need to shift paradigms. Perhaps this is one area where we might consider re-examining our paradigm.

When you add the 1.1 billion dollars in detailed design costs for the New Attack Submarine, and you add it to the other R&D for the boat, you wind up with a total plan to spend about 4.6 billion dollars to develop the New Attack Submarine. Now, that's not a small piece of change. But it's actually less than the Navy plans to spend for the development of FA-18 E/F Super-hornet. Consider that for a moment: The Navy is planning to spend more R&D money to develop a major modification to an existing aircraft design that it plans to spend on developing an entirely new submarine design.

For that matter, consider the R&D budgets for entirely new combat aircraft. The Defense Department is currently planning to spend something like 18 billion dollars to develop the F-22 and another 17 billion dollars or so to develop the Joint Strike Fighter. Those two new aircraft designs, as well as the C-17 and the V-22, will all contribute to future U.S. airpower. In contrast, only one new submarine design is currently planned to contribute to future

U.S. seapower, and the R&D funding budgeted for that one submarine design will be less than the R&D budgeted for *any* of those four new aircraft designs. I'm not saying this is wrong, but I do think it's a perspective worth considering when we look into the question of whether we can afford to put more money into the amount of work that we do in submarine RDT&E.

The sixth of the seven issues that needs to be worked out is whether or when there should be a completely new next generation submarine design; that is, a design beyond the New Attack Submarine. Much of the discussion on Section 131 has concerned the four submarines that the legislative provision calls for procuring between FY98 and FY01. Less attention has been paid to the fact that Section 131 also refers to starting procurement in FY03 of a completely new next generation submarine. The issue is whether we should continue to evolve the New Attack Submarine design as we move beyond the four boats that are to be procured in FY98-01, or whether production should shift to a completely new design in FY03, as outlined in Section 131. The funding implications of this issue alone are very significant. In it's mark this year, the House Committee has clearly stated its intention to follow through with the idea of shifting to an entirely new design rather than procuring a further evolved version of the baseline New Attack Submarine design.

The seventh and final issue concerns whether there should be any changes in the way that DoD and the Navy are to be organized to oversee submarines and undersea warfare. On this issue there have been a number of recent developments. As you know, the CNO has expressed an interest in creating a new position to give more focus to ASW. The Navy's March 26th report to Congress described a new submarine Technology Oversight Council that the Navy has established. The Baciocco panel report recommended establishing a single manager for attack submarine issues, and for establishing a stronger link between submarine technology and acquisition communities, and there was some legislative activity on one aspect of this issue last year. The House this year in its mark-up stated that it may address this issue in conference and the Senate Armed Services Committee whose report just became available within the past day, has stated in its mark-up that it would like to see DoD do something in this area so that Congress doesn't then do something for DoD.

I want to shift now to the third and final section of my

presentation, which concerns a couple of longer-term potential issues for the submarine technology community that I think are worth talking about at this point.

The first of these concerns the proliferation of submarine-related technologies around the world, especially to Third World countries. This is a strong theme in the ONI's recently updated survey on worldwide submarine challenges. An understanding of the issue of submarine technology proliferation is beginning to spread among policy makers. But as they learn of this proliferation and of the potential problems that it can cause in our own defense planning, some policy makers may begin to inquire about the desirability and feasibility of instituting a submarine technology control regime roughly analogous to the current missile technology control regime that is in place for ballistic missiles. They may ask whether such a regime for submarine technology is possible, if so, what technologies would be the most beneficial from the U.S. standpoint to try to control, and what the potential effect of such a control regime would be on our own submarine technology firms. These are all questions that might benefit from your input. This is something good to start thinking about now.

The second of my two longer-term issues concerns a topic that I have returned to repeatedly in my prior addresses—the topic of affordability; i.e., the size of the defense budget, the future submarine procurement rate, and the resulting implications this may have for the submarine technology community. When I spoke to you last year, I said that it did not appear that there would be much difference between the Republican and Democratic positions on defense spending. The budge resolution that was passed by Congress a month after I spoke to you last year, in June of last year, confirmed this. The new budget resolution being considered in Congress now is generally consistent with that same resolution that was passed last year. Which is to say there isn't really too much difference in the broad scheme of things about how much money the two parties are considering spending on defense over the next several years.

There's been a lot of attention paid to the fact that the Republican plan for the next seven years is higher than the Clinton administration top line in FY96 by about 7 billion dollars, and in FY97 the budget we are looking at now, by about 13 billion dollars. Less attention has been paid to the fact that while the Republican top line is higher than the Clinton top line in the

earlier years, it's actually several billion dollars below the Clinton administration top line in the final years of the seven year period.

Even less attention has been paid to what the Republican line looks like, taking away the comparison with the Clinton administration top line. The Republican top line last year, passed in the budget resolution, would result in a defense budget that declines in real terms by 1 or 2 percent per year. The Republican plan being considered this year does not really change that. The Republican plan does not reverse the real decline in defense spending. To the contrary, it would thus continue that decline.

Last year I think even some Republican staffers were a little bit surprised when they saw the implications for that budget resolution for real defense spending. As a consequence, there was a view that the issue would be examined next year. Well, the opportunity for examination has arrived—it is next year—and it has not resulted in any fundamental change. We are not looking at an upslope. We're looking, in the Republican case, at a downslope. So at this point there aren't any magical solutions to the affordability problem at the level of the DoD budget that are clearly obvious at this point. It could change. But at this point, there's no strong evidence to indicate that it is a likelihood.

Similarly, when I spoke to you last year, awareness was only beginning to spread of the defense procurement bow wave that is out beyond the end of the current FYDP. A year later, the dimensions of this bow wave problem are much clearer and they are very daunting. In fact, Secretary Douglass has been very open in his testimony to the Hill this year in describing the situation, at least as it relates to the Navy. But it's an issue for all the services.

Because of this bow wave problem, the affordability issue concerning the New Attack Submarine, that I've spoken to you about in the past can now be viewed simply as part of a much larger defense procurement affordability problem. For the New Attack Submarine that's both good news and bad news. The good news is that New Attack Submarine is now not as likely to stick out as an especially unaffordable platform, because affordability will be a problem facing many defense acquisition programs. The bad news is that by the same token, the New Attack Submarine will be one of only many defense acquisition programs that will be fighting for very scarce defense procurement dollars.

One way out of this issue for the Navy and for the New Attack

Submarine in particular is the one-third/one-third issue that Secretary Douglass brought up yesterday. I understand the argument about why sea-based forces should perhaps receive a larger share of the defense budget than they have in the past, and it's a good argument. But I'm not sure that I'm quite as optimistic as some people are about whether this argument will prove persuasive to others, or how much of a difference it will wind up making in the actual division of resources.

For one thing over the past few years all of the services have honed their arguments for why they are going to be relevant in the post Cold War era. For another, on the Hill today, it isn't the Navy, but the Army that is currently more likely to be singled out as the service that is most in need of a boost in its modernization funding. There's a recognition that modernization is low across all of the services, but there's a feeling that the Army is the poorest of the poor, if you will, and that they most deserve the additional dollars that might become available. Indeed, if you ask the Army about the one-third/one-third issue, one of the first things that you might hear in response is that while the Navy and the Air Force shares of the defense budget are roughly equal and have been for a number of years, the Army's share is significantly less. I'm not saying that a redistribution of resources in favor of sea-based forces won't happen, but I don't think it's prudent to count on it in one's planning.

The Defense Department hopes to increase the amount of money available for procurement across DoD to a level of about 60 billion dollars per year by FY01. That would represent about a 50 percent increase over the amount of money for procurement that is in the administration's FY97 budget request. Even as we move up toward that 60 billion dollar goal however, the Defense Department has stated that increasing the submarine procurement rate during this period from the currently funded rate of about one boat every other year, to something more like one per year, as called for in Section 131, will pose affordability problems.

When you consider that, plus the dimensions of the post FYDP bow wave, the ability of the Navy to achieve its hoped-for procurement rate for the New Attack Submarine of two boats per year is open to question. I'm not predicting that the two boat per year rate won't be achieved, but I do think that unless the cost of future submarines can be substantially reduced from current projections, it might be more prudent to anticipate that the average

procurement rate could settle out at something less that two boats per year.

A consequence of such a lower procurement rate, of course, is that some number of years from now, we'll have fewer Seawolf-level stealthy boats than originally planned. That is going to pose a challenge for the submarine technology community. Namely, how do you compensate for having a smaller force than what you were planning on having?

Part of the solution might lie in technologies, such as improved equipment to support pierside training that can lead to an increase in the percentage of a submarine's at-sea time that is devoted to actual deployments. If you can do that, it might help the deployment multiplier for attack submarines and permit a smaller attack submarine force to do the station-keeping job of a somewhat larger one.

Another part of the solution, as mentioned by other speakers at this symposium, might lie in technologies that can improve the capabilities of the 688s that even some number of years from now will still represent a significant share of submarine force structure. I'm very happy to hear people talking about improving the 688s; I think there was a reticence to talk about the issue of modernizing the 688s for a while, perhaps out of a concern that doing so would complicate the task of getting the New Attack Submarine program into procurement.

The third solution to the challenge posed by having a smaller-than-planned attack submarine force might lie in technologies for things like off-board systems that can multiply the effectiveness of the limited amount of attack submarines that you do have. This might include things like very smart sensor packages of some kind that a submarine can leave behind, while it needs to go somewhere else, and then come back later and pick up. Or it could include things like unmanned vehicles with even more capability than what we are currently planning and developing.

In this connection, a couple of months ago the Air Force issued a new report entitled New World Vistas. I think a lot of you probably heard about this report, and some of you may have had a chance to read it. There are some fairly bold ideas in this report, including a proposal for something that the document calls *Unmanned Air Combat Vehicles* or UACVs, which are like UAVs, except that they are able to perform functions that we think about today only in connection with manned aircraft. I want to read to

you a short passage out of this report where it talks about these UACVs.

In the section entitled Future of Force, the report says,

> "There will be a mix of inhabited and uninhabited aircraft. We use the term *uninhabited* rather than *unpiloted* or *unmanned* to distinguish the aircraft enabled by the new technologies from those now in operation or planned. The *unmanned* aircraft of the present have particular advantages such as cost or endurance, but they are either cruise missiles or reconnaissance vehicles. The *uninhabited* combat aircraft (UCAV) are new, high performance aircraft that are more effective for particular missions than are their inhabited counterparts. The UCAV is enabled by information technologies, but it enables the use of aircraft and weapon technologies that cannot be used in an aircraft that contains a human. There will be missions during the next three decades that will benefit from having a human present, but for many missions the uninhabited aircraft will provide capabilities far superior to those of its inhabited cousins."[1]

Then it goes on to describe a little bit more in detail what those things might look like.

If the Air Force can anticipate a future that includes things like UACVs, then perhaps the submarine technology community can address the problem of limited numbers of attack submarines with proposals for things like uninhabited submarines, or with other equally bold proposals. The relatively small number of attack submarines in the fleet that we may have in the future, if the hoped-for procurement rate is not achieved, may well be a central challenge facing the submarine community in the years ahead. Given the lead times involved in developing bold new technological responses this to such a challenge, this is something that the submarine technology community should be thinking about today.

Just as a final remark, eleven years ago, when I was putting together a magazine article on the then-new Seawolf submarine

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[1] U.S. Air Force Scientific Advisory Board. New World Vistas: Air and Space Power for the 21st Century. Washington, 1996. (Summary volume), p. 8.

program, I came across an article in Navy Times in which an unnamed proponent of the SSN 21 was quoted as saying, "If you want to gather a crowd in Washington, just say you're designing a submarine". I liked that quote so much that I put it at the head of my article and have remembered it ever since. I think that quote has withstood the test of time quite well. The past year has witnessed the recent gathering of that crowd and the onset of a lively debate. This debate has been heated at times and the participants sometimes have appeared to be talking past one another. By all appearances, it has been a somewhat difficult and not very enjoyable process for the people that are most centrally involved in the debate. But as I mentioned earlier, it is a debate that is beginning to produce results of potentially significant benefit to the submarine community and the Navy. And if those benefits take hold and develop, then for all of the participants involved, but especially for the submarine community, it will have been well worth the effort. Thank you. ■

SETTING THE RECORD STRAIGHT

A Critical Review of Fall from Glory by Gregory I. Vistica

Reviewed by Tom Brooks and Bill Manthorpe

Gregory Vistica has written a book entitled Fall from Glory (Simon & Schuster, NYC, 1995, 448 pages, $27.50) which makes some serious accusations against the U.S. Navy, Naval Intelligence, and our senior uniformed leadership during the 1980s. The purpose of this article is to set the record straight—particularly with regard to the restructuring of U.S. Naval strategy and war plans which took place during this period.

[Editor' Note: This review was written for publication in the Spring 1996 issue of The Naval Intelligence Professional's Quarterly. It is reprinted here with their permission.]

The late 1970s and early 1980s were heady times for Naval Intelligence and for the submarine community with which we worked closely. Several sensitive sources became available which provided us, for the first time, with highly accurate insights gleaned from the highest levels of the Soviet regime. The information derived from these sources confirmed analyses of unclassified Soviet doctrinal writings that had been going on within ONI, at the Center for Naval Analysis, and at DNI-sponsored symposia for several years. It provided us with reliable second source confirmation and an indisputable understanding of Soviet naval doctrine, their development of naval strategy, their plans for weapons and tactical development, and in particular, how they would deploy and utilize their submarine force. It also provided us with valuable insights into the readiness of the Soviet Navy and how the Soviets perceived *our* Navy would fight a war. We maintained this access until, one by one, the sources were compromised by various traitors inside the U.S. government. The single best source of technical intelligence paid with his life when Aldrich Ames betrayed him, along with the host of others he betrayed.

But while it lasted, the insights gained from these sources allowed the U.S. Navy, led by Naval Intelligence, to totally reassess how the Soviets would fight a war, where their strengths and vulnerabilities were, and how their perceptions and prejudices caused them to view us. This enabled Naval Intelligence to

stimulate and participate not only in a complete rewrite of U.S. naval strategy and the war plans which governed how the U.S. would fight a war with the Soviet Union, but also to plan and conduct meaningful perception management. The unclassified exposition and documentation of these efforts became known as *The Maritime Strategy*. The classified results were totally rewritten war plans at SUBLANT and SUBPAC.

The detailed story of the sources, how we exploited them, and how the Navy utilized the resultant intelligence could be cited as a textbook example of how intelligence *should* work. It was one of the great *intelligence successes* of the Cold War!

The effort was not easy to initiate or sustain. The intelligence that we were presenting to the leadership of the Navy was not what they expected or necessarily wanted to hear. First of all, what we were telling them about the strategy and planned operations of the Soviet Navy were completely antithetical to the way U.S. and other Western admirals believed that any Navy would operate. Thus Admiral Train's observations (cited by Vistica) that Soviet naval strategy appeared to be written by Field Marshalls.

Secondly, the new intelligence would force the U.S. Navy to change their strategy and plans and effect much of their planned force structure and training. It would result in modifications to submarine design, training, peacetime exercising, and wartime deployment. Thus, initially, many found it hard to believe and were reluctant to accept the intelligence. To the great credit of the senior uniformed leadership of the Navy, and due to the open minded leadership of the Vice Chief of Naval Operations, Admiral Bill Small, and the DNI, Rear Admiral Shap Shapiro, followed by Rear Admiral John Butts, the new intelligence was not ignored but was presented, challenged, debated, and ultimately accepted as valid. Once the strategists, operators, and weapons systems developers began their work to change the direction of the U.S. Navy, the so-called *green door* was wide open to them and they were able to wargame their plans against *red teams* playing at the highest levels of classification and to base their development and procurement decisions on the best technical data available.

Gregory Vistica, currently a Newsweek reporter, alludes to these events in his book Fall from Glory. Sadly, he does not get the story straight in his rush to tar the entire Navy with the brush of ineptitude, intellectual dishonesty, and "institutional corrup-

tion", he is too busy fabricating *intelligence failures* (they usually help sell books) to pick up on what probably was the biggest story: how good intelligence, well-analyzed and well-applied by teams of Intelligence Officers and Line Officers working together enabled the U.S. Navy to devise a strategy and a set of war plans which would have helped ensure victory should we have had to fight a war with the USSR.

Bernard Baruch once observed, "Every man is entitled to his opinion. But no man is entitled to be wrong in his facts." This dictum should apply, in particular, to journalists. Vistica mixes fact with fabrication, history with self-serving and mean-spirited gossip, half truth with personal prejudice. All to provide sensationalism to a book which, handled in a more accurate and objective fashion, would have had a worthwhile story to tell.

The result of Vistica's efforts is an indictment of the U.S. Navy as an institution, and its senior uniformed leadership ("The Admirals") as little more than a self-serving cabal, bent more on preserving personal perquisites and covering up problems than protecting the nation. Naval officers are depicted as inept, "cowboys", or as drunken, lewd, sex-crazed adolescents who make a ritual of assaulting women—beginning, it would seem, at the Naval Academy.

But the central villain of the book is John Lehman. To Vistica he is the personification of evil, and anything that he did for the Navy is characterized as somehow being driven by personal ambition or self-aggrandizement. All who were associated, or even forced by circumstances to serve with him, are cast onto the same dungheap. Sadly, the list includes some of the best officers and leaders we produced during that era. Some of these officers are depicted as little more than stooges of Lehman; many suffered from the tremendous stress of serving under a Secretary of the Navy with whom they disagreed but who, nevertheless, was their lawful superior. Many of the senior uniformed leaders worked hard at modifying or changing Secretary Lehman's views. But when he gave specific direction or orders, as was often the case, they were obliged to carry them out.

And Naval Intelligence, for all its contributions, is vilified as well. Vistica properly portrays Rear Admiral Bill Cockell as one of the brightest officers in the Navy and one who possessed a unique expertise in Soviet affairs. It was Cockell, while serving as EA to CNO Tom Hayward, who was instrumental in getting the

CNO to focus on the new sources of intelligence that his DNI, Rear Admiral Shap Shapiro, was bringing him. As a result, special teams were put together to analyze the intelligence and its implications. Shap Shapiro brought Rich Haver to the Pentagon from his job as Technical Director of NFOIO to head 009J (not Team Charlie as reported by Vistica) and lead the analysis effort. In those days, ONI was known as OP-009, and 009J reported directly to the DNI. Team Charlie came later, was initially headed by Dr. Alf Andreassen, who was Technical Director for Vice Admiral Kin McKee, the Director of Naval Warfare. Team Charlie was normally populated by Line Officers and studied the implications of the intelligence which 009J produced. Seldom has the Navy had the benefit of the analytic talent of a Rich Haver and the intellectual capacity of an Alf Andreassen focused on the same problem at the same time.

The senior leadership *Board of Directors* for the effort was the Advanced Technology Panel, established by the CNO, and comprised of senior Flag Officers under the inspired leadership of VCNO Bill Small and his successors. It was the team of the VCNO and CNO Jim Watkins who successfully got the effort off the ground and encouraged what today would be called *out of the box thinking*. The ATP was supported by the ATP Working Group, led by Rear Admirals Bobby Bell and Roger Bacon, and comprised of a number of very bright commanders and captains, including Jim Hay in an executive secretary role and Captain Linton Brooks, who provided much of the intellectual energy. The Strategic Studies Group at Newport participated actively in deriving strategy and wargaming the results.

Other key players in the process were DNIs Shap Shapiro and John Butts, Vice Admiral Kin Mckee, who recognized the potential importance of this new intelligence from the very beginning, and then-Captain Bill Studeman, who was EA to the VCNO and active at the very heart of the effort. There were many others, some of whom were mentioned by Vistica, but usually with great inaccuracy.

Quite apart from the tenure of John Lehman, the 1980s were a true *golden age* of naval strategic thinking, and Naval Intelligence was at the center of that effort. The creation of the Maritime Strategy and the planning to implement that strategy with the Navy that Lehman was dictating deserve a book in themselves. Fortunately, the ATP files have been saved, organized, and

summarized for the benefit of current Flag Officers who would like to re-invigorate naval strategic planning. When their contents can be declassified and opened to historians, a truly fascinating book will result.

Not only did Vistica mis-portray the elements of the story, he also chose to vilify some of the players who were, in fact, the true heroes. He singles out Shap Shapiro for allegedly deliberately misleading Congress by painting the Soviet Navy as a threat, which the newly-expert Vistica clearly believes it never was. In his own words "Almost every senior admiral and intelligence officer knew the truth about the capabilities of the Soviet Navy and did their best to bury it." Patent nonsense written by someone with no personal knowledge, involvement, or expertise who, if he did not invent the notion out of the whole cloth, was badly misled by his sources. He claims that his work was reviewed by "several senior Naval Intelligence officers who must remain anonymous". Whoever these officers were, they clearly were not aware of the facts. If I were one of them, I would surely hope my anonymity held up!

What Naval Intelligence did discover and convince the admirals of was that, given its strategy, plans, force levels, and general readiness, the Soviet Navy was not focused on interdicting the sea lines of communication to the Central Front in Europe. It was that long-assumed threat that had led to the weakening of U.S. naval superiority, especially by those in the Carter administration who were using it as a justification to build low-end frigates and VP aircraft. Rather, the new intelligence demonstrated that the Soviet Navy was, indeed, a strategic nuclear ballistic missile threat (and a growing one at that) to the United States and a potential threat to our own strategic forces. Furthermore, it was a threat to the implementation of the Sea Strike or Sea Plan 2000 carrier-forward strategy and a growing competitor for peacetime and crisis influence in the Third World. Recall that the Soviet shipbuilding program of the time included not only the destroyer and smaller class ships which might readily be perceived as *defensive*, but also aircraft carriers (including a nuclear powered carrier), Kirov class nuclear powered guided missile heavy cruisers, new-generation submarines of every class, and an overall rate of ship construction which far outstripped ours. It was these threats that the U.S. Navy had to take into account when developing a new strategy and war plans.

While Vistica besmirched his own professional reputation by stooping to half-informed character assassination to flesh-out his book, it is sad that institutions like ONI and fine officers like Shap Shapiro, Chuck Larson, Frank Kelso, and others should be portrayed as dishonest and self-serving. Those of us who were involved in the events and have served under these men know who the true heroes were. Some day the full story will be declassified and the public will recognize that the true *Fall from Glory* lies with one who publishes damning articles about events he only dimly perceives and maligns dedicated, honorable people whose actions he could not possibly understand.

The authors were participants in the 009J, Team Charlie, and war gaming events described herein. They retired as the Director of Naval Intelligence and the Deputy Director of Naval Intelligence, respectively. ■

FLAG SELECTIONS/PROMOTIONS

One Star
John Byrd
John Davis
Tom Elliott
Jim Metzger
Paul Sullivan

Two Star
Rick Buchanan
Tom Fargo
Tony Watson

Three Star Nominations
Tom Fargo with orders to COMFIFTHFLT
Rich Meis with orders to COMSUBLANT

Four Star Nominations
Skip Bowman ordered to NR
Archie Clemens ordered to CINCPACFLT

Retirements
Admiral Bruce Demars
Vice Admiral George Emery
Rear Admiral Marc Pelaez

THE STRATEGIC SUBMARINE FORCE IN 2025
ONE MAN'S VIEW

by William L. Norris

The Nuclear Posture Review (NPR), completed in 1994 by the Department of Defense (DOD) defined the year 2003 START II strategic submarine force as 14 Trident submarines. All would be equipped with the Trident II missile and be based at both Kings Bay, Georgia and Bangor, Washington. The United States Senate has ratified START II and we now await the Russian ratification. On reading the media predictions for that action, one is left with a nagging doubt as to whether the treaty will ever be ratified. But if one reads of all the other military budget decisions being made in Russia, it would appear that Russia will have to accede to monetary limitations and eventually ratify START II.

The problem thus becomes, "What's next?" There has been continual pressure from the Arms Control aficionados to negotiate START III. This predilection to have two treaties in the ratification pipeline unfortunately stems from the START (sometimes referred to as START I) and START II origins. The DOD, again in the NPR, recommended that START II be ratified by both parties prior to negotiating the next treaty. The reason was that START II was believed to be in both the U.S. and Russian interests and the fear that the Russians might press to amend or bypass START II (prior to ratification) if a new treaty were to be negotiated.

There will also be political pressure for the President to make a bold new arms control agreement to attempt to take his place beside his predecessors. So far, he has only taken the baton they passed him and obtained ratification of their treaties (by the U.S.) and taken budgetary credit for their negotiated reductions. There is strong continuing pressure for him to get the Russians to ratify START II, as the bill for the U.S. to maintain a START I force would be in excess of $15B in the FYDP starting in 1998.

The certainty is that a new treaty will be negotiated and that the levels will be reduced. If one assumes that the next stage of reductions will be patterned somewhat after those that have gone before, then a *START III* would aim for a level of around 2000 deliverable strategic warheads. This is based on the reduction between START and START II of 6000 to 3500 (about 40

percent). Since START II also specifies a limit of 3000 to 3500, the reduction must clearly be below 2500 to be seen as meaningful by most arms control pundits. There may also be a movement to specify future limits in absolute (vice deliverable) warheads in the new era of total transparency. While this may have a nice ring to it, the intrusive verification regime necessary to count warheads vice the much more discernible delivery vehicles will probably fail, especially in the near future.

So what would be the submarine contribution to these 2000 warheads? My guess would be between 60 percent and 75 percent, up from about 50 percent today. The ballistic missile contribution in the 2003 force is just above 62 percent (1680 SLBM and 500 ICBM). The increase will come at the expense of the ICBM force, which, in my opinion will not survive. Why? Because the weapons are not considered survivable in any scenario unless launched on tactical warning, a response option that has been proposed for elimination by many arms control advocates. The President would no longer be pressured to make an immediate decision if warning systems see less than a near full scale attack. If the sub-limits were specified as ballistic missile warheads, that would probably be acceptable to the Russians as they could divide their total between land based, single headed mobile missiles and SLBMs.

The remainder of the 2000 would be attributable to bombers. While the Russians may not place much credence in the viability of their bomber capabilities, the U.S. still appears to firmly support the heavy bomber concept for both nuclear and conventional forces. For many of the same force-level-driven reasons that the START treaties were attractive, the eventual demise of the B-52 must be anticipated. It is unrealistic to believe their useful life can be stretched beyond 2025 when the newest B-52 airframe in use will be 64 years old. Therefore, a lower bomber attribution would allow that fateful decision to be made.

But what are the strategic submarine force options? With START counting rules, we can never increase our per missile loading above 5 (2003 START II force). This means that, in the future, Trident submarines could carry 120 warheads (5x24), 96 (4x24) or less, but probably not because of efficiencies of force. At 120, the force level could be between 10 boats(1200, or 60 percent of 2000) and 12 boats(1449 or 72 percent). At 96, the force could be between 12 (1152, or 58 percent) and 14 (1344, or

67 percent). I believe that the number will be closer to the upper limit of warheads because the Russians do not appear to like bombers, the lower numbers would force the U.S. to maintain a higher strategic bomber force, and the U.S. would prefer a higher number of survivable weapons on a day-to-day basis.

This decision will also be driven by the bottom line of arms control—dollars. There will be a movement to take advantage of new arms control limits to reduce the number of strategic submarine bases to one. This means Kings Bay because it is the only base that can assemble the D-5 missile. The fact that the U.S. would be operating its strategic submarine forces in one ocean from one base on the continental shelf will play second fiddle to economics. The maximum number of submarines that can be handled is probably near 10. Thus with at least one always in overhaul away from Kings Bay, the maximum becomes 11. With 120 per submarine, that yields 1320 warheads, or 66 percent.

The second part of this sizing decision will stem from the need to begin in about 2026 to replace the oldest Trident, then 40 years old. A betting man would say that the next strategic submarine will be bigger, because that's been the norm for the last 35 plus years. But now there will be a new metric for sizing—arms control. If you build a bigger submarine with more missiles, fewer will have to be accommodated at the one remaining base. The flip side to this is you are placing more weapons in one basket, and are more vulnerable to a unit failure or future vulnerability. If you build a smaller submarine with less missiles, you need more submarines and a second base. Now the efficiencies in platforms, personnel and bases have been lost. The second economy the Submarine Force will face is to build the lowest cost fleet. Again, I believe this will mean no more than 11.

So what must the Submarine Force do to prepare for the strategic submarine requirements beyond 2025? I believe the following:

1. Be involved in the arms control process. Don't let others totally detail the future.
2. Learn the lessons of SEAWOLF. Bigger is not always better.
3. Ensure the SSBN security program is funded. If strategic submarine invulnerability is ever in doubt, the future is probably lost.

4. Start design concepts now. If the U.S. is going to build strategic submarines only every 50 years, there will be at least a 25 year hiatus between models. The CNO says that the Russians have passed us in new submarine technologies so the challenges are even greater. Be ready (no submarine has yet lasted 40 years) with a well thought out design that is sellable and can fulfill the mission.

5. Preserve SSPO. There must be a core competency in SSBN missile and weapon expertise in development and procurement available. That same 25 year hiatus above will lead the short range thinkers to look for efficiencies.

No one's vision of the future is perfect. There may well be a START IV with even lower levels. On the other hand, the Russian Bear may never turn out to be the kinder, gentler nation that leads to continued reductions and START II may be the last agreement. Whatever 2025 brings, the worst thing we can do is to wait, while so many enemies of the Submarine Force and requirement makers are pushing forward with their own agendas. ■

DOLPHIN SCHOLARSHIPS ACCEPTED BY COMBINE FEDERAL PROGRAM

The Dolphin Scholarship Foundation (DSF) is pleased to announce its inclusion on the 1996/97 Combine Federal Campaign National List. DSF has been assigned **Number 1003** for this year's campaign. With the shrinking resources available to the Foundation due to *rightsizing* of the Navy, it is critical that we expand our sources of income in order to maintain the number of scholarships and the level of support we can provide to our students. If you participate in the Combined Federal Campaign, please support Dolphin Scholarship by designating all or part of your contribution for the DSF.

ONE WOMAN'S SEARCH FOR USS TRITON (SS 201)

by CDR Dennis Murphy, USN
Submarine Warfare Division (N87)
Office of CNO

On 22 April 1996, a memorial stone was dedicated at Arlington National Cemetery to honor Lloyd McKenzie, a Torpedoman's Mate First Class on USS TRITON (SS 201), and those submariners who remain on eternal patrol. USS TRITON (SS 201) was lost on March 15, 1943, during its sixth war patrol. This event would not have gained much recent notoriety, had it not been for the circumstances surrounding it and the people remembering it—the family of Lloyd McKenzie and the veterans of World War II most notably.

This is the story of a daughter's 10 year search to learn about the father whom she barely knew, to find someone who knew her dad, and above all, to find out if he had made Chief Petty Officer before the last fatal patrol—a point disputed by her mother and aunt for 50 years.

In 1986, Mrs. Jeanine McKenzie Allen decided to have a memorial stone erected at Arlington National Cemetery to honor her father, Lloyd McKenzie. Her aunt convinced her to research whether her father had made Chief or not, before erecting a stone, so that the inscription would give him the honor with which he was never bestowed. As Mrs. Allen began her research, she found herself getting pulled deeper and deeper into the legacy and rich heritage of the Submarine Force in World War II. She poured through over 2000 pages of TRITON deck logs from War Patrols at the National Archives, tapped into the close-knit community of Submarine Veterans of World War II—including Admiral Eugene Fluckey, Congressional Medal of Honor winner and author of Thunder Below!

Her progress was slow until she attended the National World War II Submarine Veterans Convention in October 1994. There she passed out flyers with a picture of her father, in hopes that someone might remember him. She met John Deane, the Honor Commander for TRITON, Connecticut's Honor Submarine, whose wife had been formerly married to a crewmember of TRITON—coincidentally, a torpedoman like her father. Mr. Deane gave her a list of 18 TRITON crewmembers who did not get underway for

the fatal sixth war patrol and Mrs. Allen started a new phase of her journey—to find someone from this list.

She had her breakthrough when she found Mr. Willard Devling, who remembered Lloyd McKenzie quite vividly—in fact, he remembered throwing Lloyd into the Brisbane (Australia) River to celebrate his promotion to Chief Petty Officer. He told Mrs. Allen that the captain promoted him on the deck of the ship and how handsome he looked in his Chief's uniform. He also recounted the circumstances that led to his missing the fatal patrol. It seems that during the fifth war patrol, TRITON underwent 19 hours of depth charging and was stuck on the bottom of the ocean for five days. The crew worked around the clock—running out of air, food and water—to get the submarine back to the surface, and ultimately to Brisbane, Australia. The crew was so fatigued before departing for the sixth war patrol, that in order to go to sea, one had to sit down and extend both arms and legs straight out for some specified period. Those who could not do it, like Willard Devling, were left behind.

Mrs. Allen's epic journey came to an end with the dedication of the memorial stone at Arlington. She was joined by her mother, who received a telegram notifying her of TRITON's disappearance April 22, 1943—53 years to the day of the dedication and her aunt. The featured speaker of the ceremony was Captain George Whiting, USN(Ret.), Weapons Officer and shipmate of Lloyd McKenzie on TRITON, and as a member of the wardroom of USS GRENADIER (SS 210), survived 29 months as a POW, with his crew, after his ship was sunk by Japanese aerial bombardments. One of the other participants of the ceremony was Joe Mastrangelo, a member of the Submarine Veterans of World War II, whose war heroics included saving the life of a shipmate by inflating his life preserver and then treading water for four days before being rescued (he was the gunner on merchant ships before joining the Submarine Force, and his last ship was blown up—he decided it was safer under the water).

The official ceremony included the *tolling of the bells* for the 52 lost boats by the World War II Submarine Veterans and remarks by Rear Admiral Ed Giambastiani, the Director, Submarine Warfare Division (N87). The highlight of the ceremony was a presentation of a shadow box to Mrs. McKenzie by MMCM-(SS) Thomas Hefty, the senior enlisted submariner in the Washington, DC area and prospective SUBLANT Force Master Chief.

The shadow box included all of the ribbons and medals earned by Lloyd McKenzie and a set of anchors in recognition of his Chief Petty Officer status for which he was never officially recognized. The ceremony was attended by Vice Admiral Ship Bowman, Chief of Naval Personnel, and Rear Admiral Larry March, the Assistant Chief of Naval Personnel for Readiness and Community Support.

Mrs. McKenzie Allen's research of her father, the TRITON and submarines in World War II was extensive and warrants reproducing for a wider audience. Excerpts follow:

Brief History of USS TRITON

Keel laid:	5 July 1939, Portsmouth Navy Yard, Portsmouth, New Hampshire
Launched:	25 March 1940
Commissioned by:	Mrs. Ernest J. King, 15 August 1940
1st War Patrol: (11/19/41-1/3/42	Became second U.S. submarine to attack a Japanese warship.
2nd War Patrol: 1/25/42-3/18/42	Sank two Japanese cargo ships in East China Sea. Damaged two others.
3rd War Patrol: 4/13/42-6/4/42	Sank the CALCUTTA MARU, TAIEI MARU, TAIGEN MARU and the Japanese submarine I-164 in the East China Sea and a trawler and two sampans in the Sea of Japan becoming the first U.S. submarine to destroy Japanese ships by gunfire. (Note: Lloyd Mckenzie was in charge of the topside guns and Captain Whiting recounted during his remarks that Lloyd McKenzie was personally responsible for this sinking.)
4th War Patrol: 6/25/42-8/24/42	Sank the Japanese destroyer NENOHI and an escort vessel near the Aleutian Islands.
5th War Patrol: 12/16/42-1/26/43	Sank the AMAKASU MARU and the OMI MARU near Midway and Wake Island, and damaged a second tanker in the Solomon area.
6th War Patrol: 2/16/43-3/15/43	Sank the AKEBONO MARU, KIRIHA MARU and MITO MARU, one unidentified maru.

Lost on Patrol: Lost with a crew of 74 in the Caroline Basin, northwest of the Admiralty Islands on March 15, 1943. Investigations of Japanese records recovered after the war showed that a submarine was depth-charged by three Japanese destroyers in that area. "A great quantity of oil and debris came to the surface, including manufactured goods inscribed 'Made in USA'." USS TRIGGER (SS 237), in an adjoining area, heard the depth charge attack on TRITON which lasted more than an hour. TRITON was reported overdue from patrol and presumed lost on 10 April 1943.

TRITON Awarded: 5 Battle Stars for World War II service.

Messages/Letters Home from Lloyd McKenzie

September 26, 1942. "We were at Wake Island when the war began and watched it burn every night...We stayed until we lost it to the Japs...We torpedoed one of their ships on December 10th, damaging it." (Though the ship got away, it was the first attack by a U.S. submarine on Japanese forces after Pearl Harbor. Damaged, it was sunk a few days later by U.S. Marine shore fire from Wake Island.)

Spring 1942. "Elna writes that my little Gayle is walking all over the place, and she has hazel eyes now. Jeanine still remembers me...I hope she doesn't forget. I don't know when I'll see them again."

August 2, 1942. "Today is Elna's birthday, the second in a row I've missed...it's been over a year since I've seen them, and I wouldn't know my little girls—there's so much change in them—if it weren't for the snapshots Elna sends me. I carry them and look at them whenever I get a chance."

September 25, 1942—during ten days spent with his wife and children. "We've sunk the most tonnage in Japanese ships of all subs operating out of Pearl Harbor...We've sunk ten Japanese ships, including a large submarine, plus three trawlers...I'm loader of the deck gun and saw the three trawlers destroyed...we fired one torpedo, hitting the Japanese submarine near the stern, blowing part of it high into the air...We've had two Captains, and

they both have received Navy Crosses. I'll soon have three commendations."

December 3, 1942. "I'm at Pearl Harbor for only a few days. Next door to a friend of mine is a baby that I look in on every time I visit...You know how I love babies! Those babies of mine won't even know me...I surely think the world of them and my dear wife, and I miss them very much."

December 14, 1942, to his sister. "From what you've written, I realize that all of my cousins are at war, now. They hardly seem old enough. I'd like to know where they are. There is so much that I can't write. This letter will be short..." (Remainder of letter cut by Navy Censor.)

January 30, 1943. "We go out for two months and are lucky if we see daylight or feel the air in all that time. I'm fine, but I surely am homesick and tired of this war. It's a hard and dirty life, but when it's over, nothing will ever be too difficult...I'm not where you think I am, and I won't be able to write for quite a while...I hope this war's not too hard on you...don't worry about me."

(A submariner buddy who was one of the 18 men transferred from TRITON after the 5th war patrol—which had ended four days before this letter—was contacted by Mrs. Jeanine McKenzie Allen in the Spring of 1996. He recounted that TRITON had just experienced six weeks of an extremely difficult though successful 5th war patrol, during which she was badly damaged, in multiple battles and severe depth charge attacks. The crew had worked around the clock for five days and nights to repair the boat, suffering heat exhaustion and losing an average of 50 pounds each, before finally making it back to Brisbane, Australia. TRITON and crew left for the 6th war patrol, facing heaving enemy naval activity, and never returned.) ■

NAVAL OPERATIONAL ART ANALYSIS: U.S. SUBMARINE OPERATIONS AT THE BATTLE OF LEYTE GULF

by LCDR John E. Bruns, USN

[Editor's Note: The submarine engagement at the Battle of Leyte Gulf is analyzed in this article using naval operational art. The author considers the command organization, principles of war, and operational fires. The submarine operations are examined stressing the weak areas and lessons learned. The principal finding is a limited use of naval operational art, with several weakness' related to a lack of coordination and unity of command revealed by operational commanders and tactical leaders. This was written while the author attended Naval War College.]

Background

The Battle of Leyte Gulf, fought to prevent the Japanese from interfering with an amphibious landing, occurred from 17 to 26 October 1944. Codenamed Operation King II, this engagement was the largest naval battle in the history of warfare.

The war effort in the Pacific theater was proceeding at a rapid pace. Operation Forager, the reclaiming of the Mariana Islands, was a highly successful operation from 11 June to 8 August 1944. The Third Fleet's relentless air bombardment of the Philippines, in preparation for the upcoming landing, showed significant and unexpected Japanese air warfare weakness. Coupled with the rapid availability of several amphibious landing groups, both Commander-in-Chief U.S. Fleet Admiral King and CINCPAC Admiral Nimitz obtained approval to cancel the Mindinao invasion and advance the Leyte Gulf invasion by two months.

The Pacific theater was mature, with strong allied sea lines of communication. The U.S. logistics tail was stretched to the limit in support of Leyte. Submarine warfare had reduced the Japanese merchant fleet from 6,000,000 tons to approximately 3,000,000 tons, which could meet only routine peacetime requirements. Japan was unable to import the raw materials and fuel needed to keep her *war machine* running at full capacity. If Leyte was captured, the successful occupation of the Philippines would be virtually assured due to overwhelming air power and solid logistics support. Further, a springboard for assault on Japan would be

made available and the Japanese supply lines to East Indies oil would be completely cut.

The Submarine Force had solved the early growing pains of the war with respect to poor performance of all torpedoes, incompetence of some commanding officers, and a general lack of submarine radar.

When the Leyte Gulf operation went into action, the Japanese *SHO-GO* plan was not ready. Japanese leaders were desperate, given the flogging incurred in the Philippine Sea. Recuperation time was needed to ready the fleet for action, but only a quick breath was allowed.

Command and Control

Structure/relationships. Submarines were operated in two distinct chains of command.

- TF 17 under Vice Admiral Charles A. Lockwood who served as Commander Submarine Force, Pacific Fleet reporting directly to Admiral Nimitz serving as Commander-in-Chief, Pacific Fleet.
- TG 71.1 under Rear Admiral Ralph W. Christie who served as Commander Submarines, South West Pacific reporting to Admiral Nimitz (administrative) and Commander Submarines, Seventh Fleet reporting to Admiral Kinkaid (operational).

Assets. There is no doubt that all available submarines were utilized for the Battle of Leyte Gulf. TF 17 operating from Pearl Harbor, Hawaii had 26 submarines located in the waters between Japan and the northern Philippines. TG 71.1 operating from several tenders in Australia had 14 submarines located in Palawan Passage, northern Palawan, Brunei Bay, Makassar Strait, Sulu Sea, Manila, and the northwest coast of Luzon. These forces constituted what was believed to be a *watertight blockade* around Leyte. This positioning method did not best deploy available submarine assets against the known position of Japanese forces. The vast majority of the U.S. submarines should have been placed around the southern tier of Leyte to intercept the battleship fleet known to be refueling in the Singapore area, with a smaller number covering the northern approaches.

Indication and warning were the main objectives of the Submarine Force in and around Leyte. Admiral Halsey and Admiral Kincaid received a steady stream of intercepts with accurate accounts of Japanese fleet movements. The exploits of

USS DARTER and USS DACE are the most highly reported aspects of the Submarine Force accomplishments at Leyte. Assigned as a wolfpack in Palawan Passage, their orders were to intercept, report, and attack the Japanese forces. At daybreak on October 19th, while surfaced, both DACE and DARTER intercepted two Japanese torpedo boats by radar, indicating the strong likelihood of a convoy by the main body of Japanese forces. Their guard was raised to a high level. No contacts were sighted on the 20th and 21st. DACE held intermittent contact on a fast-moving group of ships early on the 22nd but was unable to maneuver into a firing position. DACE received a routine message to return to base after her allotted time on station. The DACE Commanding Officer stated he had that "funny feeling in his bones" and was granted permission to remain on station. The next night about 12 heavy men-of-war were intercepted along with escort vessels. This vital contact report gave U.S. forces 48 hours to prepare for the Japanese fleet arrival.

DACE and DARTER fought one of the most successful wolfpack attacks in submarine history on Admiral Kurita's Central Force. The daring and leadership of both submarines is legendary and show that great tacticians are just as important as great plans and orders. Delaying their torpedo attack until dawn, to allow an accurate report of the Japanese forces, DACE and DARTER sank the heavy cruisers ATAGO and MAYA and seriously damaged the TAKAO. The courage of these men is further exemplified by the physical toll on their submarines and personnel. DACE had "touched bottom" four times while evading depth charges and DARTER ran hard aground on a reef during a surfaced approach. The DARTER crew was rescued by the DACE under extremely trying circumstances.

On October 20th at 1400, Admiral Ozawa's forces moved out of the Inland Sea and into Bungo Suido in preparation for transit. This important movement should have been intercepted, position reports made, and tactically engaged by a waiting wolfpack led by USS BESUGO. Two days prior however, the wolfpack left the area, with the concurrence of Admiral Lockwood, due to little observed outbound traffic and a desire to "get some good hunting before fuel supplies ran low." This demonstrated desire for tactical effect, and failure to understand the operational purpose of their mission, reduced the warning time to the U.S. fleet of the approaching Japanese forces. The Commanding Officer also may have been misapplying his general war order: "Throughout the

year the submarines available will be used primarily to inflict attrition on naval forces and shipping and will be directed to scouting, observation, and rescue services only in cases of urgent necessity." There are many examples of strong unity of effort, but this example displays the negative effect of a lack of centralized planning and decentralized execution.

The Submarine Force achieved the objective of indication and warning despite both Admiral Christie's decision to withdraw DACE (subsequently changed) and Admiral Lockwood's removal of BESUGO (and other TF-17 submarines not discussed) immediately prior to the Battle of Leyte Gulf. Many of the U.S. submarines provided valuable contact reports to higher command. Admiral Christie did a much better job in this mission area than SUBPAC. Admiral Lockwood failed to maintain his submarines in position to intercept the enemy because "if they were to have any hunting before they ran low on supplies, they had best get going elsewhere." In conclusion, the Submarine Force leadership could have done a much more effective job by sticking with the mission.

Principles of War

The goal in analyzing these submarine operations against the index of the principles of war is to aid future leaders in making war as short as possible and, ultimately, a victory for our side. Critical analysis of the principles of war will save future leaders from repeating past leaders mistakes.

The **objective** is unquestionably the most important of all the principles of war. Best defined as the aim, scope, mission, or purpose of the war fighting effort. The strategic objective was the defeat of Japan. The operational objective was the capture and liberation of the Philippines. The tactical objective of the U.S. Submarine Force was to provide indication and warning of approaching Japanese naval forces and to maximize destruction of these ships prior to arrival at Leyte. These objectives were clearly attainable, well defined, and decisive.

The **offensive** as a principle of war means carrying the war to the enemy and to seize and maintain the initiative. Following the attack on Pearl Harbor, the Submarine Force was the only military asset available to fight the Japanese forces until the battleships, associated surface battle line, and base infrastructure could be reconstituted. As the war proceeded, our submarines became

increasingly successful at intercepting and destroying both military and merchant vessels.

The U.S. submarine war effort was aided by poor and ineffective Japanese ASW. These factors included frequently neglected shipping protection, passive anti-submarine tactics, and defective ASW weapons. Depth charge tactics showed a lack of persistence, poor mathematical solutions, and were prone to accept scant proof of sinking.

U.S. submarine *wolfpacking* was very effective against major combatant units. Although single units had many successful attacks, if surface forces conduct continual zig zag maneuvers coupled with high speed, multiple submarine assets conducting coordinated attacks are generally more productive.

The sinking of ATAGO and MAYO coupled with the heavy damage inflicted on the TAKAO by the DACE and DARTER wolfpack and the heavily damaged AOBA by USS BREAM on 23 October decisively influenced the Japanese leadership. ATAGO took 30 minutes to sink, allowing Admiral Kurita (Central Force) to shift his staff to the YAMATO. Rear Admiral Koyanagi, serving as Admiral Kurita's Chief of Staff, stated during a post war interview that the loss of the ATAGO had a devastating effect on his staff's communications capability. Half of the flagship radiomen were killed and communication was reduced at times to flashing light. Poor message handling and limited connectivity plagued Admiral Kurita's fighting ability throughout the Battle of Leyte Gulf.

Unity of Command. By the design of the chain of command, this concept was made difficult to succeed. General MacArthur serving as Supreme Commander, Allied Forces, South-West Pacific Area did not have operational control of Admiral Lockwood's TF 17 submarine forces. Rather, Admiral Christie had operational control of less than half the submarine assets allotted to Leyte via TG 71.1. The points brought out under indication and warning exemplify these shortcomings.

Both the allied submarine and surface/air forces were extremely fearful of *blue on blue* engagements. The submarines were not allowed to operate in the interior areas around the Leyte Gulf region, instead massing at the approaches and exit areas. This failure to mass effect, by coordinating submarine operations inside the Third and Seventh fleet operating areas, at the decisive point could have reduced the loss of allied lives and equipment and delivered an overwhelming blow to the Japanese fleet.

Surprise is the greatest single weapon of war, the creation of an unexpected situation for which the enemy is not prepared. Surprise is one of a submarine's strongest assets which was solidly demonstrated in Leyte Gulf. While not documented, it is highly likely that Admiral Kurita was *surprised* by the loss of four ships just prior to his *last ditch* defense of the Philippines.

Simplicity. The keynote is simple planning, easy to understand instructions, and time to prepare the organization for battle. Moving up the battle time line, while a solid decision, did have some negative effects. DARTER and DACE received their orders for the Battle of Leyte Gulf on 1 October, although they were periodically in port during the weeks prior. The DACE Commanding Officer stated in his patrol report that he first learned of the invasion by a radio news broadcast on 20 October. It is difficult to expect our tactical operators to think operationally when they have little information of the battle around their ships.

Security provides the means to give freedom of action, denial of information to the enemy, and deny enemy interference with our own forces. "It prevents surprise by the enemy; it is essential to the surprise of the enemy." Operational commanders poorly positioned their submarine assets in relation to expected tasks. Admiral Nimitz completed final positioning arrangements with Admiral Halsey on the morning of 15 October. The error was pulling some submarine assets off station early before Admiral Ozawa sailed.

Following the Battle of Leyte Gulf, poor communication between Admiral Halsey's aircraft intercepts of the retreating Japanese forces, and submarine staff officers who failed to press for this valuable intelligence, reduced the ability of U.S. submarines to surprise the enemy and inflict heavy damage. To achieve surprise requires proper force location and timely intelligence data, both of which could have been conducted more effectively.

Operational Fires

Operational fires are attacks in the enemy's depth aimed at influencing the outcome of a major campaign. One final look at the ATAGO sinking is warranted. A wounded ship frequently proves more burdensome than a destroyed ship. Admiral Kurita's Chief of Staff stated "...my remaining communications personnel were divided between two destroyers, one of which had to accompany the TAKAO back to Brunei." A wounded ship

requires the enemy to expend effort both in transport back to friendly waters but also to protect the vessel in transit.

The destruction of Admiral Kurita's staff integrity and the resulting psychological effects prior to the decisive battle was the primary influence of the ATAGO attack. Accounts differ on how Admiral Kurita and staff achieved the transfer, some references stating they had to "swim for it" and others stating that lifeboats were utilized. Regardless, this was a rude beginning to their SHO-GO plan execution. This effect is an excellent example of how tactical action can influence the operational level of war.

Lessons Learned

The following lessons learned are intended to apply the strengths and weaknesses at the Battle of Leyte Gulf into summations that can be applied to our current operational art philosophy.

- Submarine operations must be closely coordinated with surface and air forces by intensive joint training. We must focus our submarine assets into the joint arena stressing the seamless integration with air and surface forces.
- IFF systems must be significantly improved to better support integrating complex ASW missions in the battle groups area of operation.
- Poor ASW tactics can have devastating effects. The U.S. must maintain our submarine technological advantage over likely opponents.
- Take advantage of your opponent at every possible opportunity. Bold and aggressive offensive tactics will pay big dividends. Always take the initiative and maintain a high tempo of operations.
- Operational commanders must not let their subordinates' tactical *desire for glory* result in a missed strategic or operational advantage. Stay focused and maintain concentration on the mission. Try to see through the *fog of war*.
- Operational commanders must keep their subordinate commands appraised of the developing situation to enable them to support his operational mission. Adequate planning and training time should be allotted if available.
- The sinking of enemy vessels may not be as important as mission kill, as evidenced by the ATAGO attack.
- Our leaders today must be constantly reminded of the force multiplication effect that submarines bring to the battle during a wide range of missions.

- A faulty command structure inhibits the proper application of operational art.

Summary

To fight smarter with fewer resources, we must become masters of operational art. Since few future leaders can learn from practice, we must study and teach the detailed review of past military engagements.

The best proponent on this subject is Rear Admiral C.R. Brown, this quotation written in 1949:

> "Some say war is an art, not a science. But to say this is to sacrifice truth for a maxim. There is both an art and a science of war. Were there no science of war, war would tend to become a lost art for want of a continuing body of knowledge to keep it alive. Art and science are not incompatible. They are both found in all forms of human endeavor. The arts of the musician, the sculptor, and the painter all are erected on the firm foundations of their particular sciences. Science consists of knowing; art of doing. Science is knowledge; art is knowledge translated into action. Indeed science is more than knowledge. It is classified knowledge. It is useful knowledge. But science is only an instrument. It can never be master. Art is the master.

After the war General Tojo stated that one of the three main reasons Japan lost the war was the destruction of merchant shipping by U.S. submarines. Japan's defense of Leyte Gulf was a last ditch effort, an all or nothing gamble. However, the war was already lost by Japan's inability to sustain itself logistically.

The ability of U.S. submarines at the Battle of Leyte Gulf to seize the initiative, convert tactical actions into operational advantage, and aid in the destruction of Japan's navy was a result of the limited use of operational art. Overall, the results of the battle could have been more decisive had early knowledge been gained, and engagement joined, of Admiral Ozawa's decoy Northern Force by SUBPAC submarines. This missed opportunity may be attributable to Admiral Lockwood's decision to pull TF 17 submarines off assigned patrol areas.

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SUBMARINES FOR THE BRAZILIAN NAVY

by CAPT Paulo R.B. Miró, Brazilian Navy

Brazil, a developing country whose global strategy is strictly defensive, in accordance with its Constitution, has a very peculiar geopolitical *status*. Brazil's geographic size stands out in comparison with any other American country, including the United States of America, if one does not consider Alaska. Its economy, while rapidly recovering, has the great advantage of being propelled by a large variety of natural resources, including strategic ones. Combined with an expressive work force, it represents a huge legacy, still in the process of being exploited to its full extent by the Brazilian people.

Brazil occupies a highly strategic position in relation to the South Atlantic Ocean and Africa, and the corresponding sea lanes as we could observe during both World Wars, the Cold War period and more recently in the Falklands conflict.

The Brazilian Constitution states that National Security, expressed through the foundations of sovereignty and territorial integrity, is the unique responsibility of the Armed Forces.

Naval Strategy

One of the Brazilian Navy's tasks is to provide close and stand-off defense of our territory, including not only vital coastal areas, but also the protection of our Merchant Fleet in vital shipping lanes, especially those converging in the South Atlantic Ocean.

The more a nation trusts its military power, the more attractive becomes the diplomatic solution for its opponent. On the other hand, the lack of this military power will lead to a strategic vacuum that someone could ultimately occupy.

If we add to these concerns the need for protection of the long Brazilian coastline, including those vital coastal areas where the Brazilian seabed provides the strategic resources from oil and gas to a vast variety of sea life, and the future's need for food, we see that such maritime interests demand a *first class* Navy and Coast Guard, not affordable nowadays with a developing country's national budget.

Therefore, due to Brazil's current economic, social and technological constraints, it is totally impossible to acquire all the requisite naval forces to defend the nation against any potential

aggressor coming from the sea.

Navy surface forces are vulnerable to satellite surveillance, but that new technology is not yet available to Latin American countries. In addition, operating surface naval forces for relatively long deployments is also extremely expensive.

Consequently, the prevailing strategy is to provide the Navy the proper means for defense, with enough offensive capacity to impose on a potential enemy considerable and meaningful costs for military aggression. This is the avenue taken instead of acquiring the required naval power to defeat any opponent. This option also prevents conflict, through the dissuasion of offensive or military pressure, thus promoting peaceful and long term solutions for disputes.

Based upon this strategic concept, the Brazilian Navy has opted for having a relatively small force, modernly designed, with quality prevailing over quantity, in order to ensure a response of high risk to any military aggression carried out by any potential enemy.

Submarine Considerations

Going a little farther into this naval strategy, which aims to optimize the desired effect through the use of scarce but effective means, the submarine was found to be, within the scope of the naval warfare, the weapon of excellence for the weakest contender. This was historically proven in both World Wars, in the case of Germany against Great Britain and the former Soviet Union against the United States in the beginning of the so-called Cold War.

Thanks to their concealment capability, submarines provoke uncertainty, compelling the opponent to employ a vast amount of naval means to face a single submarine threat. Yet, the chances of *blind* detection are minor. It becomes obvious that on a cost/benefit ratio comparison, the submarine is extremely advantageous for it is able to deny the dominion and the use of the sea to a highly superior enemy. Therefore this underwater weapon is tailored to impose on the adversary a very high risk, thus strongly contributing to prevention of possible conflicts.

The use of conventional submarines only, however, restricts the tactical advantage of the submarine to a very stationery local scenario. One must take into consideration the area to be covered by a submarine in the open ocean, the capability of approaching

the detected surface target in order to reach a desirable weapon envelope for firing, and also to maintain undetectability considering the modern high resolution compressed pulse surface and airborne radars. These factors demand a large submarine fleet for maximum patrol coverage. The dependence of a *diesel boat* on oxygen, not only to run its engines submerged, but also to renew the atmosphere onboard, together with the need to raise other masts for surface surveillance and communication presents quite a serious tactical constraint.

New technologies provide high performance batteries and new propulsion plants, as well as new communication resources that diminish the tactical exposure to surface sensors. The nuclear submarine, due to its strategic mobility and freedom from the surface, depends only on the endurance of its crew.

Brazil and Submarines

In fact, the Brazilian Submarine Fleet started with Italian boats designed in La Spezia and has existed for almost a century. The Fleet entered the post World War-II era operating ex-U.S. fleet type boats, evolved to snorkelling U.S. Guppies and built three especially designed British Oberons (one is currently decommmissioned) and finally entered the German Type-209 production in the Arsenal de Marinha do Rio de Janeiro.

Current Concerns

As Brazil has an enormous oceanic area to be covered in the South Atlantic Ocean, it takes too long to deploy a conventional submarine departing from one or two submarine bases, thus diminishing the reaction time for an engagement or other specific task in a so called *focal* area, normally encompassing the so called *patrol area*.

In the aftermath of the Cold War, a new lesson has been learned by the strategists. The Warsaw Pact used to provide a well defined threat, easing the task of NATO. Nowadays one can see the continuation of the construction of large and powerful nuclear attack submarines in developed countries as well as arms sales in the developing ones independent of a precise *threat*.

Nations build and operate sophisticated naval means, designed to face an unexpected enemy, creating the concept of a *Quick Deployment Navy*. The pacifist disarming theory is no longer valid, for a nation has to invest during peaceful years for decades

to be able to face unexpected conflicts. These occurred recently in the Malvinas/Falklands War, where *dissuasion* from the British naval nuclear power was not enough to avoid war, as well as in Granada, Kuwait, between Peru and Ecuador, and Canada and Spain.

These new concepts also apply to Brazil, and it will continously require strong naval power to back-up its economy and political growth within its unique geopolitical scenario.

Brazilian SSN Plans

The Brazilian Navy always knew that it would never be strong enough without possessing a real deterrent weapon such as the nuclear powered attack submarine. That is why, realizing very clearly that the construction of such a powerful and strategic weapon could never rely on foreign technology transfer or even on the weapon's international market sale, the Brazilian Navy started very early, in 1978, to develop its indigenous nuclear plant for submarine propulsion. It also served as a fantastic and unique example to the Brazilian scientific community of how to manage sensitive and sophisticated technology in a very proficient and autonomous manner.

The Navy has very recently come to realize that, despite the top priority of a future nuclear submarine fleet, the Brazilian economy was demanding severe budget constraints, including defense. Consequently the Navy would be unable to maintain the same pace on the project as before.

It must be considered also that the Brazilian Navy has a historical tradition of surface warfare, with many other tasks assigned. Brazilian Navy surface warships and auxiliaries conduct amphibious operations, aircraft carrier operations, minelaying and mine sweeping, logistic support at sea, coastal patrol and search and rescue (those normally assigned to a Coast Guard) besides all the activities of the Marines. All of which require not only funds for operation, but also for modernization, overhauls, shipbuilding and so on.

Although the project had already spent $700 million in successful development over the past 15 years, it cannot be considered a large amount of funds. Considering the results obtained, in comparison to other civilian projects, it would certainly require around $1 billion in addition for the rest of the development and the construction of the first submarine. The

initial estimates for the second and third submarines would be equal, considering the large investment required for the specific support and maintenance facilities, such as bases, shipyards, submarine tenders (eventually) and also personnel training. That is a huge amount of money if one considers the extremely severe budgetary shortage imposed on the Navy this year, which is currently allowed only $ 200 million for modernization programs. The Navy had five times as much available for investment 15 years ago.

Considering that the prospective view of the Brazilian economy is bound to be favorable, once government expenditures get balanced, expectations are that the defense budget will gradually provide suficient funding for investment, thus ensuring the country the naval defense means it deserves.

Current Programming

Back to submarining, the solution the Brazilian Navy found to overcome this temporary constraint is the intelligent and proficient use of this transition period for the accomplishment of the following intermediate goals:

- Continue building the rest of the Type-209 boats, limited to five submarines, and upgrading the last one, in terms of propulsion plants and other features. Taking advantage of the operational feedback the Brazilian builders are getting from the first two submarines, the S. TUPI and TAMOIO, as the S. TIMBIRA has only been recently launched. The contract for the last Type-209 is already signed and construction is already underway for completion in 2002;
- Continue the development of the new conventional submarine project, entirely designed by the Brazilian naval builders, large enough to provide the naval expertise and the experience required for the nuclear project. The estimates in costs for the first submarine are presently around $300 million. The number of units would still have to be thoroughly discussed vis-a-vis budget availabilities in the near future;
- Continue the development of the nuclear propulsion plant, upgrading the size of the current project, through the domain of new technologies that permit the construction of a smaller hull in diameter, like the French nuclear boats, which provides better shaft power/speed ratios, as well as

more discreet, quiet and deep operations; an intermediate step will obviously include a prototype plant ashore;

- Upgrade the firing system of the S. Tupi class (Type-209) through the acquisition of a new class of *smart* torpedoes. The current studies include the Mk 48 torpedoes (U.S. designed), the German SUT, a French torpedo, the Swedish Type 2000 (not operational yet) and the latest version of the Tigerfish (Mod 2). Some technical points to be carefully considered are the reliability, interoperability (interface) with the current firing system, storage and handling on board (Type-209 class is very limited in space) and of course other maintenance and logistic issues including shore facilities.

The advent of the nuclear submarine in our Fleet will bring to discussion several other points concerning new technologies and personnel requirements.

Colatteral Requirements

Submarines are very different from surface ships for they are not supposed to keep continuous communication while submerged. The standard use of masts and antennas, mainly in HF or SATCOM, are only available when operating at periscope depth, to ensure full tactical discretion. That demands the capability of having land based antennas able to transmit in VLF or ELF, in order to penetrate the ocean to a certain depth, allowing the submarine relative depth freedom for transit, patrol, attack or evasion. These installations are extremely costly and require a careful and detailed study of the region to be covered within the operational theater.

Another technology to be available is the inertial navigation for submarines, which requires very specific requisites different from those available in commercial airplanes and military aircraft. Taking into consideration that the nuclear submarine remains submerged for days or months, normally next to the enemy environment, most of the times it will not be possible to get any fix to update the inertial system. As well as the nuclear power plant and missile technology, these are systems that have to be indigenously developed, for the commercial versions available for sale do not match operational requirements.

Even a basic need as air purification on board a nuclear submarine requires sophisticated systems, which must be capable

of providing enough oxygen for various demands and at various operational depths. These systems must also provide continuing monitoring of the internal ambient in relation to the several existing polluters such as CO, CO_2, freon gases (refrigeration and air conditioning plants) and other hazardous elements.

Not only new technologies will be required to operate this new weapon, but also a full reevaluation of the recruitment process, training requirements and psychological and medical follow-up that will certainly change the professional profile of this new submariner who will have to face new professional challenges. The experience already lived in developed navies over several decades operating nuclear boats will be vital, including the aspects related to differential payment in relation to personnel on board surface ships. This aspect has been one of very special concern in the Brazilian Submarine Fleet, due to the loss rate from the *silent service* during the past ten years. This is not an exclusive problem of the Brazilian Navy, but also happened in other navies, including the Royal Navy, specially after the Falklands/Malvinas War, when the Oberons (the only British conventional submarines at that time) had to deploy for longer transits and patrol periods in the South Atlantic. ■

WHAT'S IN A NUMBER?

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

During the period 1971-1972, while I was serving as Commander Submarine Division 41, I became very interested in a number. It dealt with Mk 37 torpedo effectiveness. At the time, the Mk 37 was the submarine ASW torpedo, the Mk 48 still being only in its operational test and evaluation phase. NOL White Oak published a quarterly document that laid out the probability of kill (P_k) for the Mk 37. Interestingly enough it was 0.37, and consequently easy to remember. What it conveyed was that, all other things being equal, the average submarine would need to fire three Mk 37s to be reasonably sure of a kill against an enemy submarine during an engagement. Presumably the P_k number was also used to help generate the total number of torpedoes that would have been needed in wartime in an all-out conflict with the USSR. The Mk 37 P_k number thus had two levels of significance for ASW operations, the first at the tactical level, and the second at the strategic (logistic) level.

A thorough reading of the NOL publication indicated that all Mk 37 submarine torpedo firings were used in arriving at the P_k number. Every torpedo firing that produced a torpedo firing report was an input into the NOL number. That seemed reasonable at first glance. However, on reflection I began to have second thoughts. Were all submarine torpedo firings equally valid in arriving at a P_k that would be a guide for wartime operations? The answer, of course, is a resounding "No". When an SS or SSN completed overhaul and commenced refresher training, it turned to torpedo firing as soon as crew proficiency permitted, since that was the primary reason for its existence. However, early torpedo firing exercises, like all other exercises and drills, were rarely conducted at an advanced level. Submarine crews coming out of overhaul (or commissioning), like surface ship and aircraft crews, have to learn to walk before they can run. I dare say that most early torpedo firing exercises started with simple problems, with the target movement constrained, and the firing submarine having a fairly good idea of opening range, target speed, and direction of approach. *Hits* in these early exercises were gratifying to the fire control party and the torpedomen, but have little to do with the accurate estimate of a wartime P_k. As

time progressed, exercises increased in complexity and uncertainty, until toward the end of the firing submarine would have very little information about possible targets.

I am not suggesting that submarine commanding officers tried to *load the dice* to make their division and squadron commanders think they were tactical hot shots. On the contrary, tactical training in something as complicated as a bearings only sonar approach is a gradual progression and a building up of many skills. At some point, of course, initial refresher training is over and the individual submarine reaches a state of reasonable proficiency in torpedo firing. Logically, wartime P_k determination for any weapon system should start to be measured at the end of refresher training, rather than from the beginning of refresher training.

What then was the *real* P_k for the submarine-fired Mk 37 torpedo? It certainly wasn't 0.37, since some of the firings that contributed to that number were more nearly tests of torpedo tube operation and guidance wire payout performance than of sensor operation and fire control party ability to solve for target motion. Was it 0.25, or perhaps even as low as 0.20? If the latter, then it would have taken five Mk 37s per enemy submarine engagement rather than the three allocated earlier. That would be a 66 percent increase in total weapons required, a not insignificant difference. The correct answer is that nobody knew, because some of the data input into the NOL calculations was irrelevant.

The point of the discussion is that operational submariners need to look very carefully at numbers, in particular at the derivation of submarine weapon systems P_k, to ensure that they reflect the level of performance that can be expected from trained crews operating under conditions of uncertainty. We of course must provide the trained crews. Wartime and our enemies will provide the uncertainty, whether we like it or not. We should not fool ourselves by accepting calculated weapon systems P_k numbers blindly. We need to examine carefully what goes into P_k numbers calculations, and to insure that we are not getting *garbage out*. What is in a number is significant, both at the tactical and strategic levels. ■

POST WWII TORPEDOES—1945 TO 1950
Mk 27 Mod 4 and Mk 34-1

by Thomas J. Pelick

Homing Torpedoes in WWII

The U.S. Navy entered World War II with few torpedoes and no acoustic homing torpedoes. When the war ended in 1945, the Navy torpedo inventory contained several torpedoes including passive acoustic homing torpedoes, Mk 24, Mk 27, and Mk 28. The capture of the German G7e torpedo demonstrated the feasibility of electric propulsion for fleet torpedoes. The quieter electric propelled torpedoes became the platform for the acoustic homing systems. The original thermal propulsion systems using oxidizers (air, enriched air, oxygen, or hydrogen peroxide) and a fuel (alcohol or kerosene) had too much internal noise for acoustic systems to be effective in these torpedoes. The aircraft launched Mk 24 torpedo, called FIDO, was the first U.S. acoustic homing torpedo (see **SUBMARINE REVIEW**, January 1996). It had an electric propulsion and steering system. The passive homing system from FIDO was modified and put into the Mk 27 torpedo which was designed to be launched from submarines.

The Mk 27 Mod 0 torpedo was affectionately known as *cutie*. It began service as an anti-escort torpedo in late 1944 and about 100 torpedoes were fired during WWII with an efficiency of about 33 percent. A single homing torpedo could take the place of a salvo of non-homing torpedoes, thereby increasing the effectiveness of a submarine load of torpedoes. The Mk 27 was a quiet running torpedo with an electric propulsion system. It was designed as a swim out torpedo, thereby reducing the alertment noise from the alternative compressed air torpedo ejection system. It was a smaller torpedo than most submarine launched torpedoes. It had a diameter of 19 inches, 90 inch length, a weight of 720 pounds and a warhead of 95# HBX-1. It had a speed of 12 knots and a range of about 5 kiloyards. About 1000 torpedoes were eventually built by Western Electric. Because of the small warhead, this torpedo like its sister, the Mk 24, provided for mission kill versus platform kill.

The Mk 28 torpedo entered WWII at the close of the war. This was a submarine launched passive homing torpedo with a larger warhead (585#HB.) than the Mk 27. It was also larger than the Mk 27 torpedo with a diameter of 21 inches, length of 246

inches, and a speed of about 20 knots. It had a range capability of about 4 kiloyards. Although about 1700 torpedoes were built by Westinghouse, very few saw service during WWII because of its late entry into the war. This torpedo was later replaced by the Mk 37 torpedo.

The success of these passive homing torpedoes depended on fire control accuracy. Some submariners thought that they could just point in the general direction and shoot and the torpedo would find its way to the target. These torpedoes had endurance and range but the acoustic homing range was shorter depending on the target's noise and the environment. Proper placement of these homing torpedoes relative to the target was critical to success.

There were many homing torpedoes being developed with the Mk 24 FIDO acoustic system, but most of them did not get into significant production. Some of these torpedoes were designated as the Mk 21, Mk 29, Mk 30, Mk 31, and Mk 33. Active homing was attempted in the Mk 22 but only in the horizontal plane during terminal homing. The Navy decided to stop work on these projects and incorporate the best features into other torpedoes. Work continued on modifications to the existing torpedoes.

Non-Homing Torpedoes in WWII

The non-homing torpedoes in the Navy's inventory at the end of WWII were the aircraft launched Mk 13, the surface ship launched Mk 15, and the submarine launched Mk 14, Mk 16, Mk 18, and Mk 23 torpedoes. The Mk 28, patterned after the German G7e torpedo, had an electric propulsion system with a speed of 29 knots and a range of 4 kiloyards. Although it was electric, the control system used compressed air which made it somewhat noisy for acoustic homing systems. Several non-homing torpedoes were still in development, such as the Mk 16, Mk 17, Mk 19, Mk 20, Mk 23, Mk 25, Mk 26 and the Mk 29. Of these non-homing torpedoes, only the Mk 16 and Mk 23 entered production. The Mk 16 produced at Newport, Rhode Island and Forest Park, Illinois, had a length of 246 inches, weight of 2 tons, 746#HBX warhead, a speed of 46 knots, and a range of 11 kiloyards. This torpedo had a late entry into WWII. Most of these torpedoes were produced after WWII. The Mk 23, a *high speed only* version of the Mk 24, was produced (9600 units) at Newport, Rhode Island during WWII, but was not used to any extent because of its short firing range requirements. Since the fuel consumption goes up on

a cubic rate with speed, this torpedo had to be fired close to the target, thereby endangering the launching submarine.

Post War Homing Torpedoes

After WWII, the Navy maintained research facilities on torpedoes. Newport, Rhode Island continued testing thermal propulsion systems for torpedoes and the newly formed Ordnance Research Laboratory (ORL) at Pennsylvania State College continued research on acoustic homing torpedoes. ORL was initially staffed by many former Harvard Underwater Sound Lab (HUSL) scientists and engineers that moved to ORL after HUSL closed in 1945. ORL (now Applied Research Laboratory (ARL)) is one of four Navy sponsored university laboratories. The other laboratories are Johns Hopkins, Applied Research Lab (formerly Defense Research Lab) University of Texas, and Applied Physics Lab, University of Washington.

During the years following WWII, many innovations in torpedo development took place. The Navy was determined to maintain its technical edge. In 1946, underwater fired rockets were designed and tested at ORL Penn State with the assistance of a German scientist, Georg Knausenburger. This was the forerunner to the Polaris missile system. The scientists and engineers at ORL demonstrated successful optical wake homing torpedoes in 1947 and successful acoustic wake homing torpedoes in 1952. Work also continued on improving the passive homing systems and developing active homing systems using echo ranging techniques.

The Mk 21 torpedo was a passive acoustic version of the aircraft launched Mk 13 torpedo developed by HUSL and Bell Labs. Although it had a steam propulsion system, newer acoustic isolation techniques made it possible for this torpedo to operate with a passive acoustic system. This torpedo launched from aircraft was an anti-surface ship torpedo. The Mod 0 version did not make it into production. Later, ORL developed the torpedo Mk 21 Mod 2 which was intended for use with a guided missile system. It was given a set of wings and a rocket motor and designated as the Petrel guided missile system with a range of 10 miles. Only a few hundred of these were produced.

The Mk 32 Mod 2 torpedo became the first fleet torpedo to use an active homing system. The active homing concept conceived in 1942 at HUSL was developed at ORL by the transplanted HUSL engineers. About 3300 of these torpedoes were produced

to be used against submarines from either aircraft or surface ship platforms.

General Electric incorporated a combination active-passive homing system into the Mk 35 torpedo which was to be a universal torpedo capable of being launched from any platform. However, only 400 Mk 35 torpedoes were built. The Mk 35 torpedo, in service from 1949 to 1960, was replaced by the Mk 37 torpedo which was produced in quantities greater than 3000 units.

Mk 27 Mod 4 and the Mk 34-1

Near the end of the '40s, the conflict between North Korea and South Korea was beginning to involve the U.S. The Navy was concerned that the Russians, with a large number of captured German Type XXI U-Boats at Vladivostok, may possibly enter the war on the side of the North Koreans. The Type XXI U-Boat was faster than its predecessors from WWII and could outrun a MK 27 running at 12 knots. A dependable submarine launched acoustic homing torpedo was needed. The Mk 27 torpedo was a submarine launched version of the Mk 24 (FIDO) torpedo developed at Harvard during World War II. Similar updates were needed for the aircraft launched Mk 24 torpedo. ORL was tasked by the Navy in 1948 to develop new versions of the sub launched Mk 27 and the aircraft launched Mk 24 torpedoes with significant improvements to the vacuum tube homing system, warhead, endurance, own ship safety, and torpedo electronics.

Paul Ebaugh, ORL, was the Project Engineer who had responsibility to develop the Mk 27 Mod 4 torpedo and the Mk 34-1 torpedo. There were many component changes to modify tolerances on power supplies and related homing system functions. New concepts were added to the homing system to increase the detection and tracking capability. New type gyros were used to insure torpedo dynamic stability. Larger warheads were used with improved exploders. Anti-circling safety systems were included to protect the launch ship from its own torpedo. Paul Ebaugh, Ed Ulrich, and their associates were able to complete the crash project within one year. The Navy produced 2000 Mk 27 Mod 4 torpedoes and 4050 Mk 34-1 torpedoes at the Forest Park, Illinois facility. The first 400 Mk 27 Mod 4 torpedoes were tested at the Key West, Florida test site.

The transducers were located on the sides near the nose to make room for the exploder contact mechanism. There were four

sensing elements in each transducer. later designs moved the transducers to the nose as in the first Mk 24 torpedoes. Actual homing range is dependent on acoustic propagation conditions and target characteristics, such as aspect, speed, and noise. Table 1 shows the comparison of the features of the Mk 27 Mod 0 torpedo and the Mk 27 Mod 4 torpedo. Significant improvements were increases in homing range, speed, warhead size, and component tolerances.

Table 1. Mk 27 Mod 0 and Mk 27 Mod 4 Torpedoes

Characteristics	Mk 27 Mod 0	Mk 27 Mod 4
Length	90 inches	126 inches
Weight	720 lbs.	1175 lbs.
Diameter	19 inches, 21 inches guide rails	19 inches, 21 inch guide rails
Propulsion	Electric	Electric
Homing	Passive	Improved Passive
Warhead	95 # HB.	128 # HB.
Speed	12 knots	16 knots
Range	5 kyd (12 minutes)	6.2 kyd (12 minutes)

The Mk 34-1 torpedo was a new torpedo based on the successful Mk 24 torpedo. The improved characteristics are shown in Table 2. Technology improvements and component tolerance improvements to the Mk 27 Mod 4 were also incorporated into the Mk 34-1. Significant improvements were increases in the speed, homing range, and warhead size.

Design work was also done at ORL for the fire control systems of the Mk 27 Mod 4 torpedoes as well as the Mk 34-1 torpedoes. ORL also designed the aircraft launcher for the Mk 34-1 torpedoes.

The first wire guidance used with torpedoes was in the Mk 27 Mod 4 torpedo. This new torpedo designation was called the Mk 39 Mod 1 torpedo. It carried a trailing wire for mid-course guidance through the fire control system. The Mk 27 Mod 4 and

Mk 30 Mod 1 torpedoes remained in the fleet from 1948 to 1960 being replaced by the Mk 37 torpedo. The Mk 34-1 torpedo remained in the fleet until 1958, being replaced by the Mk 43. The Mk 39 Mod 1 was removed from the fleet when wire guidance was added to the Mk 37 Mod 1 torpedoes in the late 1950s. The Mk 37 torpedo development will be discussed in a future **SUBMARINE REVIEW.**

Table 2. Mk 24 and the Mk 34-1 Torpedoes

Characteristics	Mk 24 Torpedo	Mk 34-1 Torpedo
Length	86 inches	125 inches
Weight	680 lbs.	1150 lbs.
Diameter	19 inches	19 inches (21 inch guide rails
Propulsion	Electric	Electric
Homing	Passive Circle Search	Passive Circle Search
Warhead	92 # HBS	116 # HBS
Speed	12 knots	Search—11 knots Homing—17 knots
Range	4 kyd (12 minutes)	12 kyd @ 11 knots (30 minutes) 3.6 kyd @ 17 knots (7 minutes)

The author wishes to thank all those who provided comments relative to the writing of this article. History is easy to reconstruct, tough to verify. There is still much documentation and varied opinions on the chronological development of torpedoes. Parochial interests sometimes illuminates or shadows actual events. This author has made a serious attempt to weigh the multitude of information as to authenticity and to present that data in a readable format.

■

THE WORLD WAR II WOLF PACK— ATTACK HELICOPTER CONNECTION

by MAJ Stephan A. Ingalls, Aviation, USA

[Editor's Note: The similarity between combat by submarines and helicopters—across a 50 year period—was recently explored at the Army Command and Staff College with interesting results.]

> The study of history is a form of vicarious experience, of learning from the experience of others. "It provides us with the opportunity to profit by the stumbles and tumbles of our forerunners," wrote the British military theorist and historian, Sir Basil Liddell Hart.
>
> from John E. Jessup, Jr. and Terry W. Coakley's
> A Guide to the Study and Use of Military History

In Thunder Below! Rear Admiral Gene Fluckey describes a wolf pack engagement involving his BARB, PICUDA, and QUEENFISH against a Japanese convoy, designated Mo-Ta 30 (Moji to Takao) (Figure 1). At 1724 hours on January 8, 1944, after a long end-around to place herself between the convoy and China's coast, BARB fired three torpedoes and began an engagement which lasted nearly five hours.[1] Fluckey's description of the battle highlights the tactical communication between the three submarines and how they rotated individual engagements to assure continuous pressure, while permitting the boat which had just fired to reposition for successive shots.

Interestingly, U.S. Army Field Manual 1-112, Tactics, Techniques, and Procedures for the Attack Helicopter Battalion, describes a similar tactic: the continuous employment technique (Figure 2). The continuous attack is intended to "exert constant pressure on the enemy force" and ensures "that at least one company [of three in an attack helicopter battalion] will be in the battle."[2]

Apart from the obvious differences in terrain and logistics support required for the attack helicopter battalion, each of these forces utilize a third dimension for maneuver, engaging a target constrained to two dimensions. Enroute, each is required to fine-tune intelligence regarding target location through reconnaissance, before maneuvering elements toward firing positions (a term used by both forces) from which an attack is commenced with the

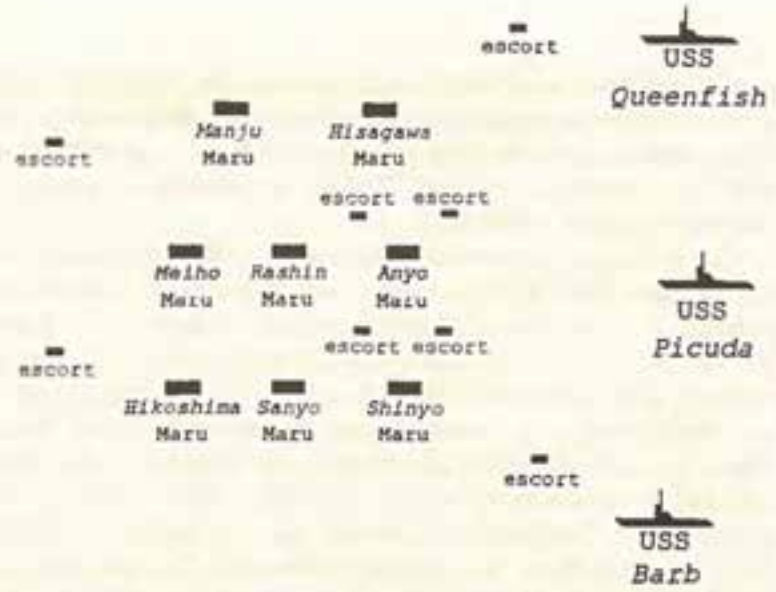

Fig. 1. Force disposition of Mo-Ta 30 and three submarine wolf pack on 8 January 1945. The convoy's composition was taken from Rear Admiral Gene Fluckey's book, Thunder Below and presents vessels assigned to columns within Mo-Ta 30, but does not clearly delineate location within the formation.[3] Fluckey does not describe escort positioning. The placement in this figure represents doctrinal locations at that time.[4]

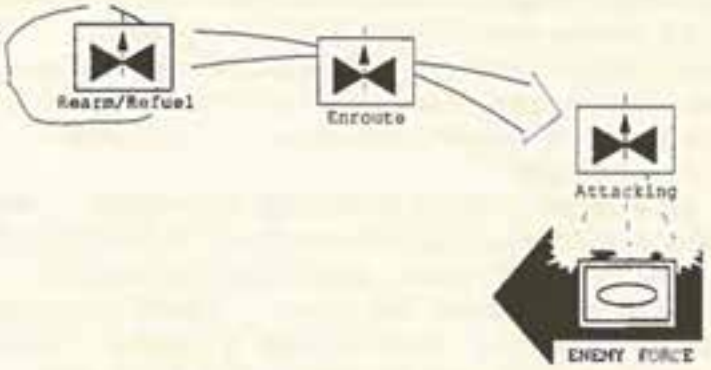

Fig. 2. Three attack helicopter companies of an attack helicopter battalion attacking using the continuous attack method. One of three companies is engaging the target while a second is enroute. A third is rearming and refueling. From FM 1-112, Tactics, Techniques, and Procedures of the Attack Helicopter Battalion. Washington: Department of the Army, 1991, pp. 3-13.

primary weapon, an onboard missile system. The attack helicopter force, owing to its limited fuel endurance, will often handover an engagement to another attack helicopter element, a practice Clay Blair, Jr. describes in Silent Victory as sometimes conducted between American wolf packs.

This similarity was recently explored in a US Army Command and General Staff College thesis, which sought to answer the question: *Is there a parallel in the tactical employment of World War II wolf packs and modern attack helicopters?* The study proposed a set of four battlefield mechanics (force, action, target, and counterforce) as a comparative framework. Each force, submarine wolf packs and attack helicopter battalions, were then explored in detail using these mechanics before making the comparison. The study's conclusions are too lengthy to outline here, but while there are certainly differences between the two experiences (owing to their unique battlefield environments), there appears a definite parallel in *what* these two forces are tasked to do and *how* they do it.[5]

Of course, submarines don't fight that way anymore. It is true that the author drew conclusions regarding the similarity of a 50 year old submarine force to modern attack helicopters. However, with that point of comparison, further work was intended to explore the submarine's evolution since World War II to determine if that development, in concert with an evaluation of future conflict, might describe the route attack helicopter forces should take in their own evolution into the next century. In other words, what can Army Aviation learn from the Navy? After all, why reinvent the wheel?

An admitted weakness in drawing the comparison was the author's lack of naval experience: none vs. 14 years as an Army Aviation officer. Therefore, a submariner was solicited to serve on the thesis committee, Dr. James J. Tritten and submarine officers assigned to Naval Doctrine Command periodically reviewed the work, and the author made a one week cruise onboard USS AUGUSTA (SSN 710) to gain some first-hand submarine experience. During this naval *liaison*, contacts began asking: "What can the Silent Service learn from the Army attack aviation experience?"

Recognizing how presumptuous it is for someone in the Army to offer the Navy insight, particularly one with so limited experience with submarines, it is best to confine the response to

something the author knows a little about: the similarity of World War II wolf packs to modern attack helicopters. Phrasing the Navy's question a different way: "Within the framework of a tactical engagement, what does the helicopter force do better than their submarine counterparts?" The answer is twofold: helicopters *maneuver* more freely and offer the commander greater tactical *flexibility*.

What Attack Helicopters Do Better

Maneuver. Among four definitions Joint Publication 1-02 offers for maneuver are "a movement to place ships or aircraft in a position of advantage over the enemy".[6] For the World War II wolf pack, as well as for the modern attack helicopter battalion, that positional advantage is offered in an optimal torpedo/anti-tank missile firing positions with respect to the enemy formation.

In their respective World War II histories, Clay Blair, Jr. (Silent Victory), Gene Fluckey (Thunder Below!), and Dick O'Kane (Clear the Bridge!) offer examples of the endurance race involved with a submarine, hence wolf pack, closing on the target. The attack helicopter, in contrast, spends an order of magnitude less time in the approach than her submarine counterpart due to the speed advantage of the force over target.

The wolf pack moves in the same fluid medium as her prey, while the helicopter does not. Numerous technical histories show that World War II submarines were only a few knots faster than *slow* convoys, and were often unable to *overhaul* faster formations. Any advantage enjoyed on the surface was lost when forced to submerge.

Helicopters, on the other hand, although operating in the ground environment, are unconstrained by it. While flying at nap-of-the-earth altitudes and slower airspeeds in the vicinity of the target, helicopters will also employ higher speed low-level and contour terrain flight techniques further from the threat. Table 1 compares both forces to their corresponding target rates of movement. AH-64A velocities are maximum speeds, and would not reflect airspeeds used in the target's vicinity. However, the table does highlight the order of magnitude associated with these forces' speed advantage, a characteristic inextricably tied to *maneuver*.

Table 1

FORCE TO TARGET SPEED COMPARISONS

	AH-64A	Soviet March Rates
Max Velocity @ Max Weight	287	
Max Velocity @ Low Weight	363	
Day (on road)		30
Night (on road)		20
Cross country		15

	Type VIIC U-Boat	Gato class Submarine	Atlantic Fast Convoy	Atlantic Slow Convoy
Surfaced	33	39	18.5	14
Submerged	14	17		

(All speeds in kilometers/hour)

Source: US Army, TM 55-1520-238-10, Operator's Manual for Army AH-64A Helicopter (thru Change 28). Washington, DC: Department of the Army, 1993, Chapter 6; US Army, FM 100-2-1, The Soviet Army: Operations and Tactics. Washington, DC: Department of the Army, 1984, 5-2; David Westwood, The Type VII U-Boat. Annapolis, Maryland: Naval Institute Press, 1984, 12; Norman Friedman, U.S. Submarines through 1945. Annapolis, Maryland: Naval Institute Press, 1995, p. 311; and Stephen Roskill, The War at Sea, 1939-1945, 3 vols. London: H.M. Stationery Office, 1954, p. 345.

This does not suggest, however, that wolf packs were incapable of maneuver; the *end-around maneuver*[7] employed successfully by Pacific theater wolf packs is an important example to this issue. Operational maneuver may alleviate this speed disadvantage, but the technological advances of 50 years still find the submarine and her prey traveling at speeds on the same order of magnitude.

Tactical Flexibility. With the possible exception of airborne envelopment, helicopter forces offer the ground commander the fastest maneuver capability on any modern battlefield: the speed advantage. Those weight-restricted aircraft, however, are

constrained by the ordnance and fuel they can lift. Fortunately, sophisticated refuel and rearm systems are in place which often move with the helicopter force to increase its range and tactical endurance in terms of both fuel and ammunition.

In comparison, World War II Gato class submarines had a surface endurance of 11,000 nautical miles at ten knots, and the modern submarine force is restricted only by crew provisions. True, but the helicopter's advantage is *tactical*, rather than operational or strategic flexibility. In effect, helicopter forces can *change their minds* every two hours (roughly the fuel endurance for a combat-loaded AH-64).

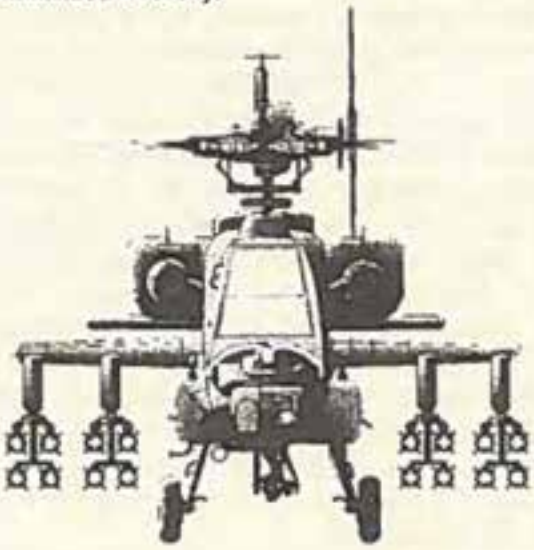

Fig. 3. AH-64 Apache configured with 16 Hellfire missiles.

Within an attack helicopter company, organized with eight AH-64 helicopters, the commander might mix weapons loads, depending on the type target expected in the vicinity of an engagement area. One element may carry 16 Hellfire anti-tank missiles (Figure 3), while another might swap the inboard Hellfire launchers for 2.75 inch rocket pods. Still others might carry an external fuel tank to extend their range. Regardless of the weapons mix a unit launches with, in about two hours, they have an opportunity to change their mind. Admittedly, choices are not that easy to make, but the modularity of modern attack helicopter weapon systems allows commanders this tactical flexibility.

Fifteen hundred miles from Midway is a terrible time to determine the crew should have loaded Mark 14 (compressed air propulsion, 45 knots, maximum 4,572 meters) instead of Mark 18 (electric propulsion, 29 knots, 3,658 meters) torpedoes.[8]

What Does It All Mean?

It is no revelation that the post Cold War world is more confusing, dangerous, and busy for folks wearing uniforms. Professional military journals offer nearly as many insights about that confusion, danger, and OPTEMPO as there are readers. A general point of agreement, however, is that conflict will confine itself to regional (vice global) boundaries. Naval prognosticators see this trend as a shift from blue to brown-water maritime engagements, with *littoral* the naval buzzword of the '90s.

Commander Frank C. Borik recently published a thought piece in Proceedings entitled *Sub Tzu and the Art of Submarine Warfare*. In that article, he describes the fictitious ascendancy of a low technology force to successfully wage a guerrilla war at sea against the United States. Whether in agreement or disagreement with Borik, readers should have recognized the stronger regional (read "littoral") flavor of the article, and mirrored in the Navy's own strategic vision, *Forward...From the Sea*. Interestingly, Figure 1 of that article presents a regional map with "fatal terrain" ovals covering portions of the South China Sea and the Formosa Strait, a region the American Submarine Force has some wartime experience, and success, in.

Commander Paul Murdock and Lieutenant Commander James E. Wright have individually published thoughts in Proceedings on the submarine design required for this type of warfighting. Murdock returned to 1944 in describing the aggressive nature these new boats should adopt, and uses the German's World War II Type XVIII (Walter) U-boat in describing peroxide-based propulsion systems he thinks are appropriate to these missions.

Wright looks to the Netherlands and Australia for "modular submarine shipbuilding" he feels is suited for the littorals. He goes on to describe the multi-mission requirements for such a vehicle and the ultimate need for versatility in weapon systems. History might suggest the 20 knot speed he advocates for the vessel insufficient in the anti-shipping mission; the World War II Gato class had a maximum surface speed of 21 knots with

associated difficulties in *maneuver* described by Blair, Fluckey, O'Kane, and Theodore Roscoe, among others.

These thoughts combine to suggest future submarine warfare may take on many of the same characteristics it had in the 1940s. The trend toward regional contingencies and warfare in the littorals, combined with forward presence advocated by the Navy's strategic vision, imply a move away from operational or strategic focus to the tactical. Tactical maneuver and flexibility; whether garnered through increased submarine speeds, proposed NSSN modular weapons mixes, or integration of existing Los Angeles and Seawolf class boats with national intelligence assets to improve reaction time and weapon selection; are characteristics that point the contemporary attack submarine toward, rather than away from, its World War II roots.

The previous section offered two advantages modern attack helicopters enjoy over World War II wolf packs. The thesis comparing these two forces discovered a number of issues where wolf packs and attack helicopter battalions were decidedly similar: tactical communication, selection of firing positions, and their offensive orientation, to name a few. Whether the Navy needs to improve the tactical maneuver and flexibility of its Submarine Force is an issue for the Navy, not this author, to determine. However, the apparent trend toward what once was (the World War II submarine force), and the similarity of that force to modern attack helicopters, suggests the prudent military professional take a look.

Those so inclined can suggest a hundred reasons why such a similarity is invalid, and are invited to do so. This author, however, finds great excitement in the grander "vicarious experience" Hart describes in the opening to this discussion, which both the helicopter *and* submarine history offers.

Despite the confusion, danger, and OPTEMPO America's victory in the Cold War helped produce, the Department of Defense is tasked to continue *doing more with less*. The thesis comparing these two experiences was written with hopes the submarine's evolution might prevent the helicopter force from making similar mistakes. The "stumbles and tumbles of our forerunners" are avoidable.

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TAKING ADVANTAGE OF THE COMMERCIAL REVOLUTION IN SIGNAL PROCESSING TECHNOLOGY

by RADM John J. Donegan, Jr., USN(Ret.)

Digital computing systems have been installed in U.S. Navy ships since the late 1960s. From inception, those computers were viewed as examples of the leading edge of digital technology. They were designed to meet rugged Mil-spec requirements and built on dedicated production lines often in parallel with the best of commercial technology. Mil-spec production offered computers with superior availability and reliability that were able to function effectively in conditions that would have been too adverse for their commercial counterparts. This process produced excellent computing machines for over two decades and allowed Navy combat systems to achieve performance capabilities that were not otherwise attainable.

By the early '90s the microprocessor was over twenty years old and the desktop workstation had been in service over a decade. The introduction of the personal computer and its use in a large variety of harsh environmental conditions had pushed the envelope for reliability of commercial products to the point that Mil-spec machines were no longer able to maintain their advantages in performance and reliability. Furthermore, the Navy recognized that the long development cycle required for unique mil-spec products was constraining their ability to rapidly update technology and performance. In order to provide the most capable and affordable processing technology for the Fleet, the Navy needed to adapt its acquisition approach to take advantage of the explosion in commercial technology.

The Navy began this experiment with the introduction of commercial computers housed in rugged racks for the command and control functions in ships. The premise behind these Tactical Computers (the TAC Series) was that they could be competitively procured and re-procured in batch lots from commercial vendors on a schedule to match technology advancement. This strategy was intended to reap the significant cost reductions being experienced in the computing industry. The Navy could then provide these products to their combat system integrators for incorporation into complex weapon systems. These computers would still be custom machines in the sense that the performance required by the

government did not have identical commercial counterparts, however, they would use the same technology, components, and assembly process as the vendor's commercial products.

Critical to this approach was the ability to procure the next generation TAC computer which could replace its predecessor in a shipboard rack. This required new technology software designs which would allow affordable and reliable transition of applications software to the next generation. In addition, communications between computing assets needed to support new and older generation technologies functioning together. Early efforts to achieve these objectives were impressive and through a maturing of software called the Common Operating Environment (COE) this technique launched a revolution in technology advancement, performance improvements, and cost reductions to the Navy's command and control functions onboard our ships. The Navy's TAC program is continuing this approach to executing upgrade cycles for both hardware and software throughout the Navy.

The introduction of Commercial-Off-The-Shelf (COTS) hardware and COE software in shipboard computing has reduced significantly the time required for performance improvements and the cost of upgrades. This has allowed the Navy's command and control systems to maintain parity with the best available commercial systems. Critical to this goal was to separate the acquisition of the computing asset from the Mil-spec provider and place it squarely into the commercial domain. This evolution was not without controversy. The business interests of Mil-spec providers had to be re-focused from the manufacture of Mil-spec computers to the integration of COTS systems. It was difficult for some to accept the fact that the commercial computer industry had displaced the DoD establishment as the definer of the leading edge of hardware and software design, performance, and production. Additionally, many viewed the move to COTS as a reduction in the capabilities of the military systems just to save money. Time and a demonstrated capability to meet mission critical requirements was needed to build confidence and security within the Navy community to allow the role reversal to occur. Now the global marketplace has firmly established itself as the definer of leading edge technology for these computing systems.

Single chip processing power continues to explode with home PCs operating above the 100 MIPS performance point. Complex distributed processing architectures continuing to mature in ways

that other combat system functional areas are now following the model established by the introduction of TAC machines. These include the *real time* processing functions such as fire control and signal processing. A particularly good parallel to the TAC program is emerging in the anti-submarine warfare area. The Multipurpose Processor (MPP) is moving sonar signal processing down the TAC pathway. The MPP was developed under the Small Business Innovation Research (SBIR) program by Digital System Resources, Inc. (DSR) and sponsored jointly by the New Attack Submarine Program (PMO 401) and the Submarine Combat Systems Program (PMS 425). Very much like the TAC, the MPP represents commercial design and construction built to a military performance requirement and housed in a rugged rack. The MPP is designed to address the real time processing requirements of signal and data processing. Once again, critical to the goal of maintaining parity with the revolution in commercial processing technology was the need for a transportable software solution. To address this requirement a software layer called "MPP middleware" was developed which isolates the applications software from the processing hardware. By using this technique the Navy can protect its investments in complex software and competitively reprocure its signal processing assets to gain the cost reductions and performance enhancements being seen in the TAC program and throughout the industry.

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Rear Admiral Donegan was recently appointed to the National Research Council of the National Academy of Sciences.

COPING WITH OPEN SYSTEM/COTS SUPPORTABILITY

by CDR Thomas J. Belke, USNR and
CAPT Robert H. English, USN(Ret.)

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To avoid wholesale system obsolescence, more systems are incorporating large amounts of commercial-off-the-shelf (COTS) products within an open system architecture (OSA) framework. Recent experience with OSA and COTS solutions to military system requirements highlights the need for caution in adapting commercial technology to defense systems (as well as recognition that some COTS products may be unsuitable for some military environments). The introduction of OSA and COTS products into DoD systems represents an enormous challenge that encompasses virtually all elements of design and life cycle management.

Changes in a Complex Culture

Use of COTS and OSA is being increasingly mandated for new and legacy defense systems. Both OSA and COTS products have advantages and disadvantages, however, that must be considered when carrying out that mandate. The advantages include faster system development, reduced design costs, reduced reliance on original equipment manufacturers (OEMs), use of the latest technology, a wider product choice, easier upgrade pathways, and system flexibility.

The disadvantages, mostly resulting from the use of COTS products, can include system upgrade downtime, incompatible formats, lack of control over suppliers, possible lack of design documentation, a short product life, the need to comply with evolving open system interface standards, and the need for ongoing product management.

Accommodating OSA. OSA for combat systems is based on a SECNAV mandate and driven by the need to achieve cost, schedule, and risk reduction coupled with flexibility and performance improvements. To accommodate OSA, traditional acquisition and engineering approaches will require modification. Program managers will be faced with evolving standards that will be updated frequently based on the findings of prototype demon-

strations and testing. Like COTS, OSA represents a program-wide problem and challenge. OSA components must be selected with great care, as they will have an impact on testing, integrated logistics support, configuration management, modeling, and integration/interface.

Ongoing Standards Analysis. The standards for the fundamental building blocks for all combat systems—operating systems, communication networks, backplanes, application program interfaces, databases, and programming languages—will need to be analyzed frequently. Approaches and methodologies include monitoring, reviewing, and upgrading of OSA standards; trade-off analysis of OSA components; and systems engineering of COTS components.

Comprehensive Systems Engineering. Comprehensive system engineering will be required to achieve the maximum benefits of open system acquisition. The system or components to be developed, modified, or upgraded should be designed from the start using open system and COTS building blocks. System performance requirements often must be decomposed and altered to fit into open system and COTS products available in the commercial market.

The traditional requirements analysis and allocation engineering processes are applicable to open system interface standards. The detailed specification process is not. In a system applying open standards, detailed specifications are directed toward compliant non-developmental item (NDI)[1] open system products. Therefore, in conducting technical assessments, the emphasis should be on interface compatibility, not solely on the form, function, and fit of the components.

Market Analysis and Upgrades. As an open system is developed, functional obsolescence and upgrades of system components become central issues. Information derived from market analysis becomes an economic driver for reviewing and possibly revising requirements. If requirement modifications to fit new OSA/COTS building blocks are possible, the rewards in cost and schedule may far outweigh any difficulties.

OSA: The Right Framework for COTS. COTS and OSA issues overlap in many areas. Use of OSA originated with

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[1] NDI is a broader category of products which includes COTS.

commercial computer systems to allow new technologies to be inserted into a system yet to leave ample room for future growth. Open systems are composed of COTS components that work together or work interchangeably because of a compatible interface. The focus of OSA is not to optimize or integrate the system or to make the system seamless throughout all its parts. Rather, the aim is to have standard interfaces that allow the equipment and its components to work together.

COTS Uses and Its New Challenges. DoD guidance to include non-military specification (non-MIL SPEC) items with MIL SPEC items in defense systems using military logistics support presents a problem more complex than that faced by most commercial organizations. COTS equipment is now being combined with legacy military systems that are integral to combat systems operation but are not easily upgradable due to outdated technology or unreasonable cost. The challenge is to ensure that the integration of old and new technology is achieved. To maximize the benefits presented by COTS, some cultural changes will have to be accepted within the DoD acquisition system For example:

- The prime contractor will be more of a system integrator than a system designer, and will be concerned more with interfacing COTS products as they exist than with designing their functions.
- Commercial vendors will not be willing to change their products, processes, or practices for small purchases. The former government method of product specification—"Build me this product and build it this way"—will be replaced with the query: "Is a product with this capability available?"
- Requirements for post-development engineering support will be greatly expanded. The entire life cycle of COTS products will be shorter than the development cycle of the typical new DoD system. This shorter life cycle will require system engineering and product supportability upgrades throughout the system life.[2]

Thorns in the COTS/OSA Bed of Roses

Much has been written about how commercial market forces

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[2] *COTS Supportability*, Joanne Spiller, NSWC Crane, NGCR User's Conference, September 19-21, 1995, pp. 7-9.

have resulted in an ongoing revolution in DoD acquisition policies. Analysts generally agree that the significant use of COTS products in new systems provides opportunities such as:

- Increased performance-to-cost ratio
- Access to the latest technology
- Accelerated development
- Reduced development costs

However, the COTS/OSA bed of roses has its thorns. The use of COTS and OSA presents inherent risks and a new set of problems, including the dangers associated with unauthorized, ad hoc changes.

Inherent OSA/COTS Risks. Rapid configuration changes resulting from advancing technology mean a looser approach toward standardization and new challenges in supportability for the 21st century. Open system and COTS environment risks arise from ambiguities that exist within commercial standards. These ambiguities result in vendors' offering incompatible versions of the same standards in their products. Also, support and obsolescence of COTS parts become major concerns because of the commercial marketplace's *here today, gone tomorrow* philosophy.

A New Set of Problems. The problems inherent in open systems and commercial electronics products demand new ground rules.

Loral Federal Systems[3] cautioned users about some of the negative aspects of open systems/COTS products as follows:

- Do not expect the products to be exactly what you want.
- Upgrades will be frequent and unsynchronized across products.
- Support of obsolescent versions may be expensive, if even possible.
- Products may conflict with each other.
- Vendors do not advertise what is wrong with their products.
- Conformance to a standard does not guarantee interoperability.
- Customized features are costly and may not be supported.
- Riding the leading edge of technology is expensive.

Danger of Ad Hoc Changes. The officially sanctioned introduc-

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[3] *COTS Issues & Approaches*, Pat Watson, Loral Federal Systems, NGCR User's Conference, September 21, 1995, p. 5.

tion of COTS products can be further complicated by ad hoc, unauthorized changes. Crew members, for example, may introduce systems aboard ship. A recent check aboard a combatant surface ship disclosed three unauthorized tactical software systems and at least two unauthorized digital hardware products operating. These products, which were purchased directly from a retail electronics vendor, included a video teleconferencing capability.

Such ad hoc, unauthorized introduction of system components causes serious problems with configuration management, integrated logistics support, reliability, safety, and other logistics features. Therefore, program managers must maintain their position as the arbiters and final authorities on processor integration into digital systems at sea. Proliferation of unauthorized computers or peripherals must be carefully monitored and controlled.

Caution Amid Innovation

Caution is appropriate amid the ongoing innovation associated with OSA and COTS products. Requirements for joint connectivity, increased processing power, higher fiber-optic data transport rates, and future upgrade cost considerations mean new DoD systems require solutions incorporating COTS products within OSA designs. Each successful COTS adaptation brings with it a new challenge in supportability. Proven life cycle approaches may not be adequate to meet these challenges.

New Supportability Considerations. The challenge of OSA/-COTS supportability must be met with ongoing innovation. In a COTS environment, even the same types of workstations are not guaranteed to have the same memory chips. Since not all chips are compatible, supportability of these workstations over their life cycle presents special form, function, and fit problems for the defense logistics system.

Capability with Limited Supportability. In the rush to achieve joint interoperability, between 1993 and 1995 approximately 90 ships in five carrier battlegroups were equipped with COTS shipboard fiber-optic local area networks (LANs) without a comprehensive supportability approach in place. New systems may provide an immediate upgrade in capability and communications connectivity, but the absence of a prime contractor, lack of a contractor test bed, and poor configuration management can be

long-term disadvantages.

Increased Operational Risk. Operational risk is another problem associated with the rapid infusion of COTS capability without proper supportability. For example, in 1994 USS GEORGE WASHINGTON experienced a shipboard LAN failure that placed about 80 workstations out of commission for a major portion of an overseas deployment. The problem was finally identified as attributable to improper system configuration and not to the design of the system, highlighting the increased operational risk of not having predefined standard configurations prototyped in a contractor test bed.

Configuration Management, Not Control. Configuration *control* is difficult in a legacy MIL SPEC system, and it will be even more so in a similar-size OSA/COTS-based system. What is required and what has been demonstrated as effective in other systems that are large users of COTS products is true configuration management. With real configuration management, change is accepted as progress and is *managed*, not controlled. The OSA/COTS environment does not require all systems to be exactly the same. Differences in systems and applications can be accommodated as long as strong configuration management is in place. However, managing change in this fast-paced high-technology environment requires approaches to configuration management that give project managers and the users confidence in system reliability and performance.

The Keys to Success

Flexibility and a willingness to adapt are the keys to operating successfully in the complex OSA and COTS environment. To control life cycle costs, more and more new and legacy C^3I electronics systems are made up of COTS products operating in an open systems environment. The challenge is to merge the functional and planned obsolescence focuses of commercial manufacturers with existing military product and logistic approaches. With the right balance of flexibility and comprehensive planning, innovative management, and due caution, our defense systems can ride the wave of new technology and remain supportable. ■

THE FIRST SUBMARINE CENTURY

by ETCM(SS) Matt Beckman, USN

For the Submarine Birthday Ball in Orlando, Florida

Present day subs are sleek and stealthy
They can perform a myriad of *tricks*
But in 1900 things were different
April 11th we launched HOLLAND No. 6

It was a small vessel of 53 feet
And had a very narrow beam
In a short time improvements were made
And diesel propulsion replaced the steam

In the first war there were three distinct classes
They were First Line, Second Line and Fleet
With the stories told about these submarines
It's clear that serving on them was no treat

It became so clear during World War II
The value of the submarine came to light
With the crippling of the Pacific Fleet
The submariners had to carry the fight

The accomplishments of those submarines
Fill many a book it's true
But we must always remember those still on patrol
The crews we lost totaled fifty-two

There was Daley on HARDER
Dick O'Kane commanded TANG
Mush Morton escaped Wewak Harbor
After his torpedoes delivered their bang

Submarines returning from war patrols
Surely became the toast of the town
But there is one who made the supreme sacrifice
From the bridge, Gilmore said "Take her down!'

We can not image their fear
When depth charges dropped like rain
But think about the celebrations that occurred
Like when Fluckey's crew blew up a train!

Then came the end of the diesel boat era
The advent of the Nuclear Age
It seems we have jumped a light year
When we merely turned a page

The new era brought us many a first
Speed and endurance records seemed to snap
We accomplished what seemed unthinkable
Who ever dreamed of reaching the Polar Ice Cap?

We still have ties to our heritage
With modernization it becomes a slight reach
Circumnavigating the world under water
Accomplished by TRITON's crew and Ned Beach

Wherever technology takes us from here
Whether larger, faster or more quiet yet
We are here because of those before us
And this we should never forget

In our 96 years of advancements
Inception, the snorkel, and nuclear fuel
One saying has remained true through the ages
And that is "FROM THE DEPTHS WE RULE!"

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RECOGNITION

by CDR Wayne T. Hildebrand, USN(Ret.)

POMFRET (SS 391) was returning to San Diego from an extended deployment to the western Pacific. We were in our dress whites as we headed toward the channel into Pearl for a brief stop on our way home. Rear Admiral John H. Maurer, USN, who was COMSUBPAC, met us early in the channel and boarded us from his barge. The Admiral usually met returning submarines in this manner. A trip through the boat, underway, gave him an opportunity to meet with the crew members at their stations. The Admiral would remain nothing more than an abstract being otherwise. This way the troops had a chance to see that he could be looked at as a real person, another submarine sailor; and, more importantly, he had a chance to recognize the work and get a feel for the pulse of the men that performed so well for ship and for the service.

ET3 David was manning the radar console as a member of the nav team when the Admiral climbed into the conning tower. During a break between radar ranges and bearing readings Petty Officer Davis took his head out of the rubber hood to look into the face of COMSUBPAC himself, who had been observing the nav team for a few moments. The Admiral looked Petty Officer Davis over closely, observed the sparkling whites, the ET3 crow on his sleeve and the silver dolphins on Davis' breast. The Admiral asked how old Petty Officer Davis was. "Nineteen, sir", was the reply. "Well", COMSUBPAC stated, "nineteen, hmmm. I see you've made petty officer already, and you are already qualified in submarines. You're doing pretty well for yourself, son." Petty Officer Davis, startled to be the subject of the Admiral's interest, did what any red blooded American sailor would do under the circumstances. He noted the bright gold shoulder marks of the flag officer, the heavyweight gold braid on the bill of the Admiral's cap, his gold dolphins and his combat patrol pin, and the several rows of umpteen ribbons above his left shirt pocket. And he said to the Admiral, "You're doing all right yourself, sir." ■

"Don't look back, somebody might be gaining on you."

Satchel Paige

NSSN C³IS:

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HUGHES SAIC LOCKHEED MARTIN

THE SUBMARINE FROG CAPER

by CAPT R.C. Gillette, USN(Ret.)

In the early '60s, the Navy added a doctor to the complement of nuclear submarines. To implement the assignment of the doctors, the Submarine Medical Research Unit, at the Sub Base, New London, was assigned the responsibility for the training and indoctrination of young doctors in the nuances of onboard submarine medicine.

As Flotilla Commander, I had certain operational and administrative responsibilities for the off-crew and commissioning crew training. I felt that the assignment of a doctor to a submarine, while desirable, would not fully employ the talents of the medical officers. The crews were always given thorough medical exams before each patrol. Statistics indicated that the probability of emergency medical attention was rather remote. Experience to date indicated that the young doctors, being very active, would become involved in non-medical evolutions, such as radar, sonar and other aspects of submarine operations to keep them from becoming bored.

As a result of the above, the suggestion was made to the CO of the Submarine Medical Research Unit, that each doctor be assigned a submarine related medical research project. The only requirement was that the Flotilla Commander review the outline of the proposed research project. The Commander of the Submarine Medical Research Unit was enthusiastic and the program was off and running.

Before long, it became apparent that the majority of the proposed research projects were based on the psychiatrist's assumption that the close confines of a submarine over the long periods of the patrols, combined with the continual stress brought on by the inherent dangers of submarine operations, guaranteed that some of the crew members would crack under the mental strain. To counter this assumption, it was pointed out that all crew members were volunteers, received extra pay, were highly respected by their peers and served in a very prestigious organization within the Navy. As a result, such projects were replaced by some more creative ones which addressed other types of submarine medical problems.

One project which was particularly creative, involved the use of frogs. The young doctor sponsoring this project had deter-

mined that the esophagus of the frog was in many ways similar to that of the human being. He pointed out that the closed environment of the submarine had resulted in exposing the crew to many minor internal and pulmonary infections which involved the esophagus. He proposed to establish small families of frogs in various compartments and compare their well being during the course of the patrol, while closely monitoring the condition of the air and environment of the particular compartment to see if there was any correlation. The experiment met with great enthusiasm by the crew as the individual frogs were named and their activities closely observed by the occupants of the particular compartment.

I would like to report that the research project resulted in scientific findings of great value to the Submarine Force related to the care and feeding of submariners. Unfortunately, no such research findings resulted. However, the crew proclaimed that the frog experiment was a great success, if not from a medical point of view, but certainly as a morale booster during an uneventful patrol. The crew, in closely observing their particular stable of frogs, determined that there were those frogs who seemed to be able to move faster and jump further than others. Shortly, challenges were offered to other compartment's stables of frogs for jumping and racing contests. Bets were made and the Frog Olympics took off running and jumping.

Whether or not any profound conclusions resulted from the frog caper is not known, nor was the validity of the original assumption that the frog's esophagus was similar to that of the submariner's firmly established. However, as far as the crew was concerned, the frog caper was a great jumping success. ■

FROM A HOP, SKIP, TO A JUMP AHEAD!

by Noreen Wagers

Never has the phrase, "you've come a long way, baby" been as appropriate than when applied to the advancement of submarines.

The first submarine, the American TURTLE, was built by David Bushnell in 1776. It was a one man operation, constructed of wood, and housed gunpowder to harass enemy ships. Compared to today's modern, steel, super-structures it seems as though it came from the Stone Age.

In the early 1900s great improvements were made in the design, propulsion, and safety features of submarines. For example, three very distinctive submarines have had the honor of being called USS NARWHAL.

The first *Lady NARWHAL*, SS 17, was also known as D-1. She was built at Fore River Shipbuilding and commissioned on 23 November 1909. She derived her power from a gasoline engine whose fumes were a constant hazard to the crew and the threat of an explosion was very real.

During WWI her mission was to train crews and participate in experimental work. She continued her service until being decommissioned on 8 February 1922.

The second *Lady NARWHAL*, SS 167, joined the fleet in 1930 with her sister sub NAUTILUS. She was 371 feet long, displaced 2800 tons, and was considered a real bargain at just over $6M.

Her power source was diesel/electric with four engines to propel the generators, drive the motors, and turn the propeller shaft. On the surface the diesel engines were engaged; submerged the motors were powered by her large storage batteries. She had a surface speed of 17 knots, housed six torpedo tubes plus four on deck, and two deck guns. The crew was 88 men.

During WWII NARWHAL had a colorful history. She delivered supplies to cut-off troops, evacuated refugees and downed aviators, transported agents and prisoners, gathered weather data, planted mines, participated in shore bombardments, and photographic reconnaissance. In all, she completed 15 war patrols and sank six enemy ships. She faced her last battle on 23 April 1945 at the Philadelphia Navy Yard where she was decommissioned and sold as scrap.

In the early '40s new technology was finding its way aboard

submarines to include periscopes for viewing and firing, new and improved torpedoes, and active sonar. Even with these advancements, more than 3000 men and 52 submarines were lost during WWII.

The last proud *Lady NARWHAL* is the SSN 671. She is quite remarkable to her predecessors. She was built by General Dynamics Corporation and commissioned on 12 July 1969. She is an attack submarine with one nuclear reactor and two steam turbines. She can proudly displace over 4000 tons surfaced and over 5000 tons submerged. Her measurements are 315-38-27, feet that is! She is the ocean home to 141 officers and men.

Within her hull many of the conveniences from home can be found. She possesses a modern galley of which any cook would be proud. It sports a microwave, ovens, large mixing bowls, refrigerator, and a walk-in freezer. The crew is often treated to scrumptious desserts by her chefs. Milk, soft drink, and ice cream machines are the norm. Televisions, VCRs, and stereo systems entertain the crew while they relax in her exclusive *Mermaid Lounge*.

The NARWHAL's credits are numerous commendation medals and awards. She alone holds the record for submerging pierside in the Cooper River during the relentless force of Hurricane Hugo.

Yes indeed, submarines have come a long way—from attacking enemy vessels with gunpowder to housing missiles capable of being launched at targets over 6000 miles away. Today's modern, nuclear propulsion submarines are safe, effective, and powerful machines capable of extended underwater patrols. Man is no longer severely limited by the demands of the machine, the machine is now limited by the needs of man! ■

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NUCLEAR SUCCESS

Reprinted from the May 6-12, 1996 issue of Defense News.

Defense News, in the April 1-7 issue, published three articles by Robert Holzer, each of which discussed some aspect of the history and present status of the Naval Nuclear Power Program. The articles appeared to strive to present, in a balanced fashion, the diverse views of various people who have had some relationship, either briefly or over a longer period of time, with that office and its director.

Naval Reactors is the one outfit, certainly in the Navy, probably in the Defense Department, maybe in the entire government, that has reached and maintained a pinnacle of success only desired by other organizations.

There have been some others that reached for and even achieved such success for a relatively brief period; but as is frequently the American way, they were then scaled back, and asked to continue the same level of accomplishment with unreasonable funding levels and reduced resources.

In this case, Nuclear Reactors is an organization with wide-ranging accountability over the highly technical and potentially dangerous field of nuclear power. To appreciate how that responsibility can be diluted we need only observe other nuclear programs. The obvious and frequent comparison has been with the old Soviet Union. I would suggest that those interested also glance at our own Department of Energy and the sad state of any attempt at modernizing and supporting the U.S commercial nuclear enterprise.

There are several facts that are germane to any understanding of Nuclear Reactors today:

The Navy's nuclear power capabilities include aircraft carriers, the nation's most recognized means of rapidly projecting power. Today, 8 of 12 carriers are nuclear powered; in five years, 10 of 12 will be nuclear powered.

The Navy's contribution to the nation's strategic deterrent force, Trident strategic missiles, is the most survivable and cost effective leg of the strategic triad, according to the General Accounting Office's 1993 review.

The Navy's nuclear powered attack submarines are typically the first U.S. forces to arrive on scene and the last to depart. Frequently, they arrive and depart with nothing else happening, and nobody aware of the fact.

Naval Reactors, in designing the new SSN engineering plant, has achieved the Seawolf level quieting in 25 percent less space, reversing a long standing trend. Additionally, the plant will require 30 percent fewer construction hours than the Seawolf and 20 percent fewer than the Improved Los Angeles class.

A major accomplishment is that the reactor core is now a *life-of-the-ship* core (30 plus years), thus precluding expensive refueling overhauls.

In March, the director of Naval Nuclear Propulsion testified before the House Appropriations energy and water development subcommittee. In the prepared statement, he carefully defined those factors that had enabled the project to be successvul, over the almost 50 years since it was first established.

> "Foremost...a clear, focused mission defined in Executive Order 12344...responsibility for nuclear propulsion plants from their inception to their disposal, i.e., design, construction, operation, operator-training, maintenance and disposal of the reactor plants, plus reactor safety, radiological control and related environmental and health matters.
>
> "People come to the program and stay, knowing that we have a long-term commitment as an organization and as individuals, [which] causes a high sense of responsibility.
>
> "Nuclear Reactors is responsible for 20 percent more reactors than the entire U.S commercial nuclear power generating industry (130 vs. 109) and almost the same number as the next three largest commercial nuclear power generating nations in the world combined (France, Japan and the United Kingdom)."

I sincerely hope any discussion of major modifications to the structure and operations of the naval nuclear propulsion program will be short-lived. If there must be such a debate, I hope that it will rise above individual perceptions or sensitivities and focus on principles and goals as well as the history of success and, finally, what is best for the country.

Possibly the best quote in the three articles was that of my friend, retired Rear Admiral Jerry Holland, who stated "Reform-

ing the propulsion office would be a serious mistake. You must very carefully manage individuals and organizations that are not in line with the standard hierarchy.

Daniel L. Cooper
Retired, Vice Admiral

SUBVETS OF WWII & DOLPHIN SCHOLARSHIP FUND

As we attend various meetings of our NSL, we hear about the Dolphin Scholarship Fund and what an excellent job they are doing for the children of submariners and those of other units of the Submarine Force.

The United States Submarine Veterans of World War II have had a large scholarship program for over 30 odd years and it is still some of the mortar which holds us together.

As we grow older and our number of candidates for scholarships began to decrease over the years we looked around for a very suitable organization to take over our project.

The Dolphin Scholarship program was the most natural repository for our project. They worked with our scholarship director very closely and we educated our membership as to what the Dolphin Scholarship was all about.

Our general membership voted full strength to turn over our program, including our finances, to the Dolphin Scholarship Director for continued operation.

It has been over three years that this turnover has been completed and the Dolphin Scholarship Director and his staff have done a masterful job of putting our program into the computer world and running the program very smoothly.

Our decision to join with the Dolphin Fund enriched their fund by a six figure amount. In the year 2000, or perhaps before, they will take over complete control of our funds and will include a scholarship or scholarships granted by the U.S. Submarine Veterans of World War II to dependents of the members of the Submarine Force.

Our name and organization will reign forever, as long as there is a submarine scholarship program. We could ask for nothing more. We salute the Dolphin Scholarship Program and wish them long life and continued success.

Keep a zero bubble.

Joe McGrievy
7525 University Avenue
La Mesa, CA 91941-4801

SUBMARINE LIFEGUARD LEAGUE MEMORIAL

I am Chairman of the United States Submarine Veterans, Inc. Memorial Committee that is developing a Lifeguard League memorial in tribute to U.S. submarines that have rescued American aviators during war and peace.

The memorial is in the spirit of our creed to perpetuate the memory of our shipmates so that their dedication, deeds and sacrifices be a constant source of motivation toward greater accomplishments. The memorial design depicts a submarine rescuing downed aviators, diamond etched on a black granite stone, 60 inches high and 96 inches wide. Flanking this scene will be the Aviators Wings on one side and Submarine Dolphins on the other, with each submarine and the number of aviators rescued listed below. The lower center panel will include the history and mission of the Submarine Lifeguard League.

Documentation for submarine rescues of aviators during World War II is readily available, however we are lacking reliable information of such rescues for the periods prior and subsequent to the Second World War. We are in need of any information concerning submarine rescues of aviators during these periods. It is our goal to list the name of each submarine participating in rescuing downed aviators and the number of airmen rescued.

Any information that Naval Submarine League members can provide concerning submarine rescues of aviators will be greatly appreciated.

Sincerely yours,
Thomas E. Gilbert, Jr.
5141 East Lake Road
Milton, FL 32583-7111
(904) 623-1727

FIDO CLARIFICATION

I would like to thank all those who responded to my article on FIDO, Mk 24 torpedo, which was published in the January issue of **THE SUBMARINE REVIEW**. Many have contacted me in appreciation of the article and several have offered to pool our resources, such as Dr. Fred Milford, also a torpedo contributor in the April **REVIEW** issue.

Dr. Milford was correct in his letter (April issue) stating that others beside the Harvard Underwater Sound Lab (HUSL) were involved with the development of the Mk 24 torpedo. However, the major thrust of this torpedo was the homing system which was developed by HUSL with funding from Admiral Louis McKeehan of Mine Warfare in 1942. Torpedo shells and other standard parts were obtained from other sources, such as GE, and other facilities, such as Bell Labs, were included to produce the torpedo. The first 50 Mk 24 torpedoes were produced and tested by HUSL according to a HUSL engineer's documents. As the initial development progressed, Bell Labs came on board to implement and produce these torpedoes. Bell Labs made changes in the transducer type and location and some other production changes. HUSL was also developing active homing systems in addition to the development of passive homing concepts and prototypes. There was a cooperative effort by many scientists and engineers during that time, however, the initial funding was given to HUSL to develop the *MINE*.

Mr. Polmar in his letter (April issue) repeats one of my original comments that the term FIDO was used to confuse German Intelligence. That was only one of the factors. Another factor as indicated in my article was to maintain the work at HUSL instead of a torpedo facility. This program was sponsored by the Mine Warfare office, which was another factor in calling the Mk 24 a mine. Mr. Polmar was correct in stating that the Mk 24 "dove to a pre-determined depth" prior to beginning a passive circle search. I had intentionally eliminated several minute details, such as "the dive to a pre-determined depth" from my original article for brevity in publication. I thought that the concept of passive circle search would be sufficient for a description. I do have a copy of the schematics and operational documentation of the Mk 24 torpedo, if anyone is interested in technical and scientific details.

Tom Pelick

BUILDINGS HONOR SUBMARINERS

Dear Admiral Rindskopf,

I have enjoyed your articles on *Buildings Honor Submariners* and offer these as possible addenda.

I think that the FBM Training building at the Charleston Naval Base was named after Admiral Richard Stanislaus Edwards. He was born on 18 February 1885 and graduated with the USNA Class of 1907. I am pretty sure he was the Commanding Officer of the Submarine Base, New London in 1939 or 1940 when my mother and I spent a couple of days with them.

RADM Edwards was Commander Submarines, Atlantic Fleet on 7 December 1941 when he was called to be Admiral King's Deputy Chief of Staff before the year was out. He spent the war in Washington and became Deputy COMINCH—Deputy CNO to Admiral King. (Fleet Admiral King - A Naval Record by King and Whitehall refers.)

There is an Eadie Hall (Bachelor Enlisted Quarters) at the Naval Education and Training Center, Newport, RI. A placque inside reads:

> Dedicated to the memory of Thomas Eadie of Newport, RI
> Chief Gunner's Mate USN
> Awarded the Congressional Medal of Honor 18 December 1927. During diving operations to rescue survivors of USS S-4 which had been sunk off Provincetown, Massachusetts, Chief Eadie risked his life under the most adverse conditions to free a hopelessly fouled diver. After more than two hours of extremely dangerous labor, he succeeded and brought him to the surface.

I don't know if Chief Eadie was attached to the Submarine Force or not, but I don't mind claiming him.

Thanks for your articles.

Sincerely,
Robert B. Connelly

Editor's Note: At the Annual Symposium on June 5, Rear Admiral Jerry Ellis, COMSUBPAC, noted that the refurbished Submarine Sanctuary in Japan is to be named Fluckey Hall.

THE SWORD OF DAMOCLES

by Vice Admiral Sir Hugh Mackenzie, Royal Navy
Published in the United Kingdom in 1995
by the Royal Navy Submarine Museum
HMS DOLPHIN, Gosport, Hampshire, UK
ISBN 0-952-66960-9

Reviewed by CAPT W.J. Ruhe, USN(Ret.)

This autobiographical account of Rufus Mackenzie's life is aptly pictured as being as tenuous as the Syracusan courtier's sitting at a state dinner with a razor sharp sword suspended by a single thread above his head. Thus, his life as a submariner in war and later as a surface ship CO, tells of incident after incident when that single thread might easily have been severed and his distinguished career brought to an untimely end.

Moreover, this is a fine account of the British way of submarining in their European theater of operations—giving American readers the opportunity to appreciate the differences with U.S. submarine operations in the Pacific war against the Japanese.

Although Admiral Mackenzie claims to have reconstructed this life story strictly from his "fading" memory of long past events, his good recall of moments when the sword of Damocles hanging over his head could have been cut loose, and the names of literally everyone he dealt with are so exact, that one recognizes that his bad memory was helped by a great amount of research into his past.

How lucky he proved to be time, and time again, alive in one fashion or another, is established in his first chapter entitled The Lucky Thirteen. In this chapter he tells of his third war patrol as CO of the British submarine THRASHER, operating in the Mediterranean in 1942. The patrol started on 13 February from Alexandria Harbor and was Mackenzie's first *close* thing. On 16 February off Suda Bay, Crete he sank an *important* ship, well protected with five escorts and air cover. The subsequent counter attack sets the stage for the rest of his autobiography. Rufus recorded that: "A dull muffled explosion shook the submarine severely, to be followed by the rat-tat-tat of machine gun bullets hitting the water around my *attack* periscope. It seemed obvious that one of the escorting aircraft had sighted and attacked us."

Then after THRASHER was taken to 270 feet and the hunting escorts had dropped 33 depth charges, they appeared to have lost contact and THRASHER stole quietly away. But much later, when on the surface at night, a rhythmic banging in the superstructure due to a slow roll in the swells, revealed that a 3 foot long unexploded bomb was rolling around under the deck gun's muzzle, while a second unexploded bomb was also discovered inside the gun casing near the breech of the gun. Two men, Lieutenant P.S.W. Roberts and Petty Officer T.W. Gould volunteered to dump the bombs overboard. They had a particularly tough time clearing the bomb inside the gun casing and dumping it over the bow. For this act Roberts and Gould were both awarded the Victoria Cross (the equivalent of the Congressional Medal of Honor). So, at least the highest authorities were convinced that Admiral Mackenzie was indeed lucky to remain alive after this patrol.

For the next 85 pages of this book, Rufus Mackenzie tells about his life up to The Lucky Thirteen. He tells of being accepted as a Naval Cadet at the Royal Naval College, Dartmouth, after an interview by a board established by the Admiralty. The final exams four years later were such a threat, he felt, to the thread holding a sword over his head, that he includes them in an appendix to his book. One of the math questions in this exam can illustrate Mackinzie's concern about his naval career ending at that point: "Find the moment of inertia of a uniform sphere about a diameter in terms of its mass and radius."

But flunking an exam was of little threat to Mackenzie's future compared to what happened to him once he was in submarines. In March 1941 he took temporary command of the H 28 and proceeded to collide with a steamer, bending the H 28's bow and wrecking her torpedo tubes. From this collision, he merely got an admonition "not to do it again". Then he took command of HMS THRASHER and after the unexploded bombs incident, he had a British Sunderland flying boat mistakenly strafe THRASHER while she was on the surface "on a dark night" and then drop two bombs near her as she was diving. Luckily the bombs were off target. On Mackenzie's next war patrol he attacked a two ship convoy escorted by a small torpedo boat. In a periscope approach, just prior to firing torpedoes, however, on a last look before firing, he discovered the escort within a few feet of his scope. Mackenzie noted: "(the torpedo boat) had fortuitously passed over the fore casing which was deep enough not to be hit,

and we were lucky not to have the periscope standards knocked off".

A few more war patrols were successful with the sinking of valuable ships, as for example: "The two ships sunk were heavily laden with supplies for Rommel's armies, soon to launch a devastating drive towards Egypt."

Then at the end of July, a British Swordfish torpedo/bomber "swooped in low from our port bow, dropping its load of depth charges" as it passed over the surfaced THRASHER. Below, Mackenzie was just stepping into the control room "when there was a most violent and shattering explosion and I (Mackenzie) was thrown about twenty feet through the air, landing with a crash on the deck at the after end of the control room". The submarine main batteries were ripped apart and a fierce fire was started in the battery well. Luckily THRASHER got back to port. By 6 October, THRASHER was sufficiently repaired to go "off on her thirteenth patrol" (ten since February). It was the last patrol of Rufus as CO of this submarine.

After a slight breathing spell, Sir Hugh was made CO of the newly built and commissioned HMS TANTALUS "a commission that lasted more than two years which took her halfway around the world and back". The first TANTALUS war patrols were conducted in the Straits of Malacca off Southeast Asia, "with a scarcity of targets worthy of attack by torpedo". But several small coasters were sunk with gunfire and special operations were conducted along the Malayan coast. "The landing or picking up of agents was featured in every patrol." Rufus then admits to being "saddened by our failure to retrieve anyone in each of the picking up operations conducted". And it was his failure to pick up 23 British and Canadian Commandos from the island of Meripas in November of 1944 that came back to haunt him only two years ago when the media tried to ruin his reputation for not having retrieved the raiding party that had been landed there earlier to sink the some 60 ships in Singapore Harbor—only 40 miles away. Recently retrieved information about this clandestine operation told of the 23 men being slaughtered by the Japanese when they returned prematurely to the island after having sunk only three ships. And Rufus was being blamed for not picking the men up at the time he was ordered to do so. Rufus was, however, able to put this scurrilous accusation to bed by citing his orders which were to pick up the men as early as 7 November and no later than 8 December. Although he had landed two members of

this operation to search the island for the commandos, they found no sign of the men because the Japanese had assassinated all members of the raiding party before the 7 November pickup date.

But before this sad event occurred, Mackenzie and a signalman had TANTALUS inadvertently dive under them due to insufficiency of buoyancy on surfacing. Rufus relates getting the upper hatch shut, then climbing up the periscope standards, when he and the signalman clung for dear life—their heads going under water for "about the limit" of submerged endurance before they broke the surface "and we could breathe again". The main ballast tanks of TANTALUS had been blown just in time.

That was about it for Rufus's submarine war. After the war Rufus transferred to the surface Navy to increase his chances for professional advancement. Once again he almost had his head chopped off by the suspended sword over his head. In 1954, the destroyer CHEVRON which he commanded collided with the aircraft carrier CENTAUR. The damage to CHEVRON was quite serious whereas "CENTAUR appeared to be undamaged". Fortunately Mackenzie received only a written admonishment from Admiral Earl Mountbatten. Rufus notes that: "the collision had to be considered an obvious blotting of my copy book".

All of these incidents which could have ended Sir Hugh's career prematurely but didn't, are seemingly the prelude to the final chapters which tell of Sir Hugh's role in bringing the British Polaris System into being. "It was the most strenuous five years of my whole career, but also in the end the most satisfying." Interestingly, he worked closely with Admiral Pete Galantin of the U.S. Navy on the Polaris program. Both have authored books of their lives, Admiral Galantin with his Submarine Admiral and Vice Admiral Mackenzie with his Sword of Damocles. Both were eminent submariners in World War II, and had similar adventures, (except that Rufus never had to work with Admiral Rickover in his Polaris project whereas Pete Galantin had to work intimately with *the kindly old gentleman* while bringing the Polaris system to fruition).

As a result, although The Sword of Damocles is a good read in itself, it is even more rewarding if followed with a further reading of Pete Galantin's book. By doing this, one can best recognize the similarities and differences between submarining in the two navies while appreciating how these two distinguished men got to the top of their naval profession—despite the many difficulties encountered. ■

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 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.

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- Invitation to Annual Meeting
- Forum for Exchange of thought on submarine matters

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