THE SUBMARINE REVIEW

THE SUBMARINE REVIEW IS A PUBLICATION
OF THE NAVAL SUBMARINE LEAGUE

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EDITOR'S COMMENTS

Most appropriately, leading this issue's list of current submarine-related offerings to which this publication is dedicated is the Eulogy to one of our foremost American submariner heroes, Captain George L. Street III. Captain Street won the Medal of Honor while in command of TIRANTE on her first war patrol in early 1945. At his funeral, this Eulogy was given by his Executive Officer during commissioning of TIRANTE and on that first patrol, Captain Edward L. Beach. The very warm human side of George Street, his quiet courage which led him to take his ship *into harm's way*, and the obviously high degree of professional capability which he exhibited in bringing his crew into that trial, through it and out again, are all evidenced in this tribute. All of us who knew him, and all who knew of him, can attest to Ned Beach's words and hold up George Street to future generations of submariners as a beacon and a guide. At the same time it can, and should, be noted that the excellent relationship between these two long-time friends; midshipmen in the same platoon, submariners, and shipmates, came to a glorious peak as wartime Skipper and Exec and went on for another fifty five years. The additional lesson there for us to pass on to those who come after us is that teamwork and friendship not only go together, and pay dividends beyond expectation, but form the heart of every successful submarine endeavor.

Each year the July issue of **THE SUBMARINE REVIEW** is able to provide a wealth of good information from the many inputs made available during both the SubTech Symposium in May and the Annual Symposium in June. As a matter of fact, we are never able to carry all which we wish at this time and a number of those presentations are carried over to the October issue. This year, however, the Submarine Centennial Celebration has occasioned a much larger treasure trove for us in the form of four speeches given by very senior leaders of our community. Admiral Bill Crowe, the former Chairman of the Joint Chiefs of Staff and Ambassador to Great Britain, delivered the Banquet Address at the Annual Symposium and chose *The Early Days* as his particular emphasis to

illustrate the spirit of American submarining. Admiral Jim Watkins, the former Chief of Naval Operations, spoke at the Washington area Submarine Birthday Ball in April and used as his theme the US submarine accomplishments of the Cold War era, or *The Recent Days*. In making a presentation to the Annual Symposium, Admiral Skip Bowman, the Director of Naval Nuclear Propulsion, emphasized the direction in which the Submarine Force is headed, speaking directly toward *The Future Days*. To put all of this into real terms with current, and global, application, Admiral Tom Fargo, Commander in Chief of the Pacific Fleet, gave the Annual Symposium a political-military *tour de horizon* of the Asian Pacific Theater illustrating the place of U.S. submarines in maintaining the peace over that stretch of dramatically changing territory. This set of four Four-Star perceptions, observations and interpretations are offered here as our FEATURE section and as the best summation of who we are, where we have been and where we are headed, in this, our Centennial Year.

A second section of this issue is also important in a somewhat more immediate and specific technologically oriented manner. The Submarine Technology Symposium held by The Naval Submarine League and the Applied Physics Lab of Johns Hopkins University this year focused on Submarine Mission Requirements and the technology needed to satisfy them. Vice Admiral Al Baciocco's introduction is an excellent commentary on the *push* and *pull* between those twin determinants and the difficulty which has been experienced in making those two ends of the national security equation into coherent forces. Rear Admiral Mal Fages's address is as detailed a status report of our current Submarine Force technological standing as one could wish for. An innovative way of looking at the Strike function is given by Dr. Owen Cote of MIT, in which he leaves no doubt about the necessity for the Submarine Force to take a leading role in future applications. The importance of the *Vision* presentations from that meeting which are reproduced here is that they show a derivation of the requirements part of the equation and a path for the consequent determination of the technology part.

Jim Hay

FROM THE PRESIDENT

We were exceedingly fortunate to have a very good *Centennial Symposium* this year. Having heard zero negative comments, I have to assume that my opinion is a majority, and close to a unanimous one. The zenith was, as the planners had expected it to be, the historical perspectives of the Submarine Force by our banquet speaker, Admiral Bill Crowe. [Unbeknownst to many of the audience, Admiral Crow had been in and out of bed and the hospital all week.]

The speech was especially good in that it discussed submarine history, but primarily emphasized that period with which we are only slightly familiar, the actual beginnings prior to 1940 and WWII. It was informative, thorough, interesting, and best of all, delivered with the subtle humor of a real raconteur. We were honored and greatly appreciate that Bill Crowe would dedicate the long hours necessary to research and prepare our banquet address.

Further, the preparations of all the participants and the work of all the volunteers at the desks were evident throughout. In my mind, a highlight of the scheduled presentations was that several speakers spoke in *bigger picture* terms of the geo-political nature and the increasing role of the submarine in shaping the future. Our two Commanding Officers and the Master Chiefs were their usual exuberant and enthusiastic selves. Finally, two gentlemen who were tasked, and willingly accepted the tasks, were Admiral Mike Rindskopf and Dr. Ted Rockwell, who spoke in the historical context and their experiences in that history.

The Centennial, to date, has been more successful than we had any right to expect. The energy of many people in all the various endeavors has been extraordinary. Probably 75 percent of the active duty presenters lauded the Centennial activities in their respective areas and were most complimentary of the efforts of the Centennial Committee and the League. The numbers of participants at the various balls and events around the country have exceeded expectations, helped greatly by the allocation of funds from the Centennial contributions to help defray costs to the junior personnel in particular.

For all the readers, whether you were able to attend the symposium or not, you have been provided more information in the last year in this publication and even in the press about submarines—past, present and future. One of the tenets of the NSL is to **educate the public**. We at NSL would ask you to enhance the pride you have in having supported submarines, and having observed the successes achieved, take that pride and knowledge and pass it on to the public wherever you may be. EDUCATE THE PUBLIC.

Finally, if you are living in or ever visit Washington, DC, go to the Smithsonian Museum of American History and the Navy Memorial on Pennsylvania Avenue and see the submarine exhibits. If you do not go away from those with even more pride of your small part in preserving freedom in and for our great country, I will be very, very surprised.

Dan Cooper

CAPTAIN GEORGE LEVICK STREET III, USN(RET.)

by CAPT Edward L. Beach, USN(Ret.)

What does a person say when laying to rest one of his best friends, his idolized wartime skipper, the man who, more than anyone else, epitomized the kind of naval officer we would all have liked to have been? How can one characterize that man's life, portray his virtues, delineate his achievements, measure them among a band of high class men to whom superlative accomplishment was commonplace?

My own father, also a naval officer, used to tell me that the quality of the men who made up the naval officer cadre in which he had served, and into which I was planning to enter, was the highest in the world. It could not go any higher. And now, as we look upon the life of George Street, I see even more deeply what my father meant, what he wanted me to understand. For I see George as I first knew him, a young man, a somewhat older midshipman that I, who was a petty officer in my platoon at the United States Naval Academy. Only a few years later this same somewhat older midshipman became my commanding officer in the submarine TIRANTE during World War II, and I was with him at Quelpart Island, shown on our Japanese chart as Saisho To, as he earned the Congressional Medal of Honor for valor in combat.

I see also the friend who stood godfather to my first child, the blessed little girl who today lies forever in the cemetery in Key West, not far from where many of the sailors who died when our battleship MAINE blew up in Havana Harbor, half a century earlier, also lie.

Our association goes very deep. He asked me to be godfather to his own first born, George Levick Street IV, who grew to serve as a Colonel in the United States Army, and was for a time commander of the Old Guard, the ceremonial troops who stand watch over the Tomb of the Unknown Soldier. He and his sister, Kristopher, are with us today to render this last obeisance to their father. And we must not forget Mary Martha, his wife, their mother, who could not be with us because of illness, but who also shares this moment with us in his everlasting memory. These three

persons will always carry symbolically, and bear with them in fact, the Congressional Medal of Honor that was awarded their husband and father by the President of a grateful nation for service above and beyond the call of duty.

Everyone here knows what that decoration stands for. It is the absolutely highest honor our country can bestow on one of its heroes, and it is invested with the highest possible ceremony. It was bestowed on Commander George Street by the President of the United States in the Rose Garden of the White House. As was noted at the time, as he did this, when President Harry Truman placed the starred blue ribbon, from which hung the Medal of Honor, around our Captain's neck, he told our skipper that he would rather wear that medal than be President of the United States.

But our Captain said always that the Presidential Unit Citation, awarded to TIRANTE for the same action that brought him the Medal of Honor, was more important, and meant more to him than the decoration he personally received, for it was awarded to the whole crew, who were authorized to wear it in perpetuity, and the special flag for it was flown in place of our ship's commissioning pennant from that day forward. As our Captain said, "Every man of that ship's company was there, all the way, and all of them have the right to share in the rewards too."

Knowing what both awards stand for, one can well understand that feeling. Very few people, however, will even attain the right to say it quite that way. The Presidential Unit Citation and the Congressional Medal of Honor are very special indeed. This is why our Submarine Base, on the Thames River at Groton, Connecticut, has a building bearing the name Street Hall, and why at the Portsmouth Navy Yard where she was launched, there is now a building known as The TIRANTE Tavern, honoring the most successful submarine every built at that Yard, and the entire crew that made her so.

Yet, in spite of these honors, everyone who knew George Street remembers him as one of the most unassuming, most modest man who could ever have existed anywhere. Even from the beginning, when, as Captain of the submarine, he felt it necessary to put the noses of his crew to the grindstone and keep them there until they learned the business the way he wanted them to; he never acted as

if superior to them. We were all together, doing what had to be done. That's all there was to it.

The training he put us through, and himself too, demonstrated his determination to do the job right, to make them into the most efficient submarine crew that ever existed. This was leadership of the highest order. History also shows that his crew repaid him in all the ways sailors can: We worshiped him as we did his bidding, and his crew made their submarine into the most effective war machine it was possible to be. They called TIRANTE the Cadillac of our wartime submarines, and with her they enthusiastically followed their Captain into the most immediate danger, veritably into the jaws of death and out again. He led them—he led us all—through pure example and leadership ability, and yet he made it clear that he was only one among the many who made up the crew of that boat.

Only once, in my recollection as Executive Officer (and I should be the one to know about this), did he ever have occasion to hold mast on one of his crew. One of our men, a signalman who was important to our fire control crew, had been put on report by the Commanding Officer of Portsmouth Navy Yard for failing to salute, when they met by chance on one of the Navy Yard's streets. Instead, he had made a strangely disrespectful gesture to his mouth and spat on the ground at the Captain's feet. I brought the accused sailor to mast, as was my duty, thinking the whole episode seemed to lack reality. Surely our signalman must have known better than, without reason and totally without cause, wilfully to insult the Captain of the Yard!

Gravely, George asked our man what in the world had gotten into him. When our uncomfortable sailor explained, Captain George saw his own duty clearly and announced he would make an appointment that very day to see the Captain of the Yard, a fearsome character known unofficially as *Stoneface*. He would make our apologies, tell *Stoneface* that he did not feel punishment was appropriate in this instance, and guarantee that nothing like this would ever happen again. I was there, beside the phone when he called for an appointment with *Stoneface*, and clearly recall the grin on his face when he came back to our *fitting-out* office.

Stoney had burst out laughing when told our sailor's side of the

story, and agreed to forget about the disrespect. George explained that our signalman had just walked out of the Navy Yard Medical Dispensary, where only minutes before the dentist had extracted an abscessed tooth. He had not even seen the Captain. Feeling understandingly miserable, however, with blood and saliva welling up in his mouth, at that moment he had indeed spit into the gutter, maybe a little close to the Captain's nicely shined shoes, and then again pressed the medical gauze the dentist had given him back to his lips.

The upshot of this little yarn was that then Lieutenant Commander George Street gained reputation in the eyes of the entire Navy Yard population. *Stoneface* himself became a little more popular as the story came out, and a certain signalman in our crew would have given his right arm for his skipper from that day onward. As an aside, after his wartime service this same sailor became Chief of Police of his hometown, attended a number of TIRANTE reunions, and never tired of telling how, during the war, he had a great Captain who once "saved me from a few days in the brig on bread and water."

And now we are here to commit the mortal remains of that man, that Captain, our friend, and our mentor, into the ground. As we do so, there can be only one feeling. He was a **great** naval officer. He was a very **human** naval officer. He was a very **modest** naval officer, and he was a great friend to all of us. On top of this, he attained the highest award for valor that our nation can bestow. We are proud to have served with him, through him to have so well served our country, and to share (because he always insisted upon it) in the very highest and most notable meaning of that decoration.

Goodbye, old man. We all loved you, and I know I can speak for every man who ever served with you and under you when I say this. Your were a born leader, the kind our Navy has always found when one was needed. We followed you through love, and pride, and loyalty, and all of that went both up and down. Because you inspired us, we also had the same inspiration. Under you, we learned to be bigger men, our Navy became a little better, and by consequence, our country is a little stronger.

That is what you did for us, Captain George, and, above all, that will never change.■

THE EARLY DAYS

BANQUET ADDRESS
Naval Submarine League Symposium
June 16, 2000

by ADM William J. Crowe, Jr., USN(Ret.)
Former Chairman of the Joint Chiefs of Staff
and Ambassador to Great Britain

Good evening.

It is true I dabbled in diplomatic waters for a few years. One of the pleasures was speaking to British audiences. Their ever-present sense of humor was a bonus. They don't mind kidding themselves. But they can give as well as take. I was introduced at one dinner by a speaker who compared camels and diplomats. He went on to say that camels can work for a week without drinking, whereas he had known diplomats who could drink for a week without working.

I was privileged to represent our republic in Great Britain. It capped over 50 years in government posts. I still hold the belief that public service is a high calling.

Retirement requires adjustments, as many in this audience know. There are compensations. A friend of mine insists that with the passage of time I will have increasingly vivid memories of events that never happened at all.

This evening it is most appropriate to recall our memories both real and imaginary. We are celebrating the centenary of our beloved submarine service. It's a moving event for many of us, as we honor all those personnel and their families, both past and present, who have participated in the molding of the world's leading underseas fleet. As the younger people say "tonight we should let it all hang out."

In this year-long observance, the nation will have an opportunity to reflect on the Submarine Force, it's sacrifices, and hard earned triumphs over the last century.

I am convinced that the general public will, during this one year, gain more appreciation for the capabilities and possibilities of the

submarine than in the last 100.

Earlier, Bill Smith paid our respects to the World War II submariners. I found it a gripping moment. My generation came into the boats just as the *golden age* ended. We worshiped those men who had brought the submarine into the frontline. They fashioned new and suitable strategies and tactics for the underseas forces and proved that it could harass an enemy thousands of miles from our own shores.

Their remarkable war record is well known to this audience and it certainly speaks for itself. By 1945 *dolphin-wearers* had carved out a significant and permanent role in the U.S. fleet. Above all, they gave us a warrior tradition of perseverance, courage and victory upon which all our future efforts could build.

In the post-war period submarine personnel continued the march. Some of the most dramatic technical advances in our nation's history were pioneered by the submarine community. Deep water exploration, precise navigation and ballistic missiles married to a true submersible. This is world class stuff and wrote some of the U.S. Navy's most glorious chapters.

The full Cold War role of our submarines has yet to be written, but it has been exceptional in every respect and as the symposium has made crystal clear, it is still evolving. I can add very little to the rich history that the active force is constantly compiling. They are worthy sons of their sires.

Speaking of sires, as I prepared my remarks, it kept coming back to me that we are celebrating 100 years of history. Yet most of the material I found was devoted to the last 60 years of the century. So if you will bear with me for a few moments I would like to focus on the early days of our service—the 40 years before Pearl Harbor. It is not a well-known story but it is an amazing one.

For centuries men had dreamed of probing the undersea world and some had in mind military weapons. The most well known in our country was the attack of CSS HUNLEY on USS HOUSATONIC anchored in Charleston Harbor. In the process the first rule of submarining was violated. Both ships were sunk.

During the late 1800s several European nations experimented with weaponizing a submersible with some success. The U.S. Navy, while mildly interested was stand-offish..."money was tight

and emphasis was given to building capital ships". That might sound familiar to some in this group.

In the United States two brilliant inventors, following different paths, designed military submarines—J.P. Holland and Simon Lake. The Navy in its wisdom, insisted on a series of competitions primarily devised to put off making a serious decision. Holland ultimately prevailed and in April 1900 delivered to the U.S. government its first ready-made submarine. It was given the imaginative name of USS HOLLAND and not surprisingly an accompanying number of SS-1.

She was 53 feet in length, 10 feet in diameter, displaced 63 tons. Her operating depth was 75 feet. On the surface she was powered by a 45hp gasoline engine.

Perhaps more importantly, a word should be said about the general climate. The New York Times reported that "HOLLAND may or may not play an important part in the navies of the world in the years to come." The N.Y. Times was no better then at predicting than it is today. Within the Navy the bulk of the Officer Corps took little notice. They considered the whole concept as a nuisance or at best a novelty.

Fortunately, a small group did believe that the submersible had promise. One of these individuals was of high rank and rather well known, Admiral George Dewey who was also head of the General Board. He threw his weight behind the initial HOLLAND purchase.

Incidentally, the first CO of HOLLAND was Lieutenant H.H. Caldwell who had been an aide of Dewey's. I often wondered if he was a volunteer. Caldwell's son incidentally graduated from the Naval Academy, class of 1944 and served on submarines in WWII and the Cold War. He retired a Captain and today lives in Niantic, Connecticut.

When you think about it the U.S. Navy in 1900 had just finished 50 years of unprecedented change: wood to armor, sail to steam, etc., and had just prevailed in a major war at sea—the Spanish/American War. Now came two groups of upstarts (whippersnappers) demanding recognition. They had even more radical proposals—seaborne aircraft and submersibles. It was tough

medicine for a service that was deeply rooted in Mahan and traditional surface-to-surface actions.

It's interesting to note that USS HOLLAND preceded the first naval airplane by 11 years. But the romanticism of aviation exploits and the lack of a commercial usage for submarines stifled comparative progress.

Nevertheless, the civilian inventors and later the associated builders were aggressive crusaders. They saw submersibles as a niche market and a viable maritime weapon. They carried their case to both the Administration and Congress. For its part the Navy played a subsidiary role both in the design and in generating the necessary support. I have often thought the obvious difference in the amount of visual imagery between air and undersea combat capabilities also had an effect on general recognition of submarine potential.

We should give great credit to those civilians who were the prime drivers moving the Navy in this new direction. Not only Holland and Lake, but also Mr. Frank Cable, Holland's confidant and economic advisor. I would especially include Mr. L.Y. Spear. He had spent 10 years as a naval constructor and left the Navy when a Lieutenant to join J.P. Holland's submarine building company which later became Electric Boat. He spent the next 40 years overseeing Electric Boat construction. He died in 1942.

Given the lack of submarine expertise at the higher levels and the absence of any central authority for developing a mission or support structure, it is rather astonishing how many boats were built in the first few years. They were not ships but boats, since they could be carried on ships. Ultimately, the slang term was expanded to *pig boats*. I guess that was progress of sorts.

The first six submarines were characterized as A-boats. From 1903 to the early 30s the classes were designated alphabetically as A, B, C, D, E, etc. The letters were followed by numbers for administrative purposes. Each class, of course, was designed to increase modestly in size, speed, depth, crews and equipment carried.

The fundamental challenge was to expand and refine the Navy's knowledge of submerged operations and to steadily improve the *pig boats* and associated equipment to prove they could be a viable

weapons system. The technical problems were formidable: unsafe structures, unreliable engines, inefficient storage batteries, poor communications, inadequate optics, primitive metallurgy, poor construction techniques, and on and on.

The early boats were fickle mistresses. Breakdowns and accidents were a way of life. Major casualties were always in the back of everyone's mind. Improvements didn't spring full grown onto the scene. Most solutions came after hundreds of hours of trial and error—and there were lots of errors.

Added to this were rather trying living conditions. Space was severely cramped. Gasoline and later oil fumes were constant. Berthing compartments were unventilated and normally wet. Privacy was almost non-existent and the one commode was a full-view model indelicately dubbed the throne. Admiral Lockwood commented "that sanitation arrangements at best were meager and defied description." That was a kind way of putting it. The boats were best known for their constant odors and smells. There was a great story about a skunk. It seems after one liberty-port evening, a sailor returned to the boat leading a skunk on a leash. The duty officer told him he could not bring the skunk aboard the submarine and the sailor asked "Why not, if other ships have mascots?" "It's the smell" was the officer's explanation. The sailor replied, "Oh, he'll get used to it same as I did." Then there was the canned food and Navy gasoline—coffee, black as a harlot's heart, hot as hell, and strong as a cannon.

Complicating the picture—funds were always short. There were no senior officers with direct sub experience and no overarching organization to coordinate, prioritize, and fight for the needs of the boats.

Still, the real story was people. It took time to build a corps of people who were knowledgeable and dedicated advocates. It's exciting to trace how that eventually came to pass.

Fortunately, the *pig boats* with all their faults, from the outset attracted a stream of young officers and enlisted with adventurous spirits. They were fascinated by the newness of the concept, by the technical challenges, by the ever-present dangers, by the camaraderie of small ships, and the opportunities for early responsibility.

They didn't fully understand the future potential of their boats but they were enthusiastic believers. In essence they were a special breed just as they are today.

If you peruse the list of COs and wardrooms you can see that some healthy seeds were being planted. Ensign Nimitz took command of the C-5 in 1910. This was the first of his five submarine commands. Charles Lockwood's name appears often—he ultimately commanded some eight different boats, including a captured German U-boat. These were only two out of a large number that reached flag rank and/or were later prominent in the submarine hierarchy, e.g., Nelson, Bingham, Whiting, McWhorter, Gygax, Munroe, Daubin, Fraler, English, Withers, Quigley, David Taylor, Lewis, Denfield, Whiley, Wilkes, Styer, Murray, Will, Crawford, and Low.

Occasionally an individual or an unexpected event would intervene and assist in one way or another. In 1907 President T. Roosevelt rode an A-boat in Long Island Sound for a few hours, against the advice of his Secret Service. Shortly thereafter he recommended and succeeded in getting the first submarine pay bill. It called for $1 for each dive to a limit of 15/month. It applied only to enlisted men and spawned the phrase "a dollar a dive and six months pay if you don't come up."

The most important event of the early years was World War I. It provided the kind of cold water shock the Force and the Navy needed. There was little direct participation. Twenty boats were sent to Ireland and the Azores to assist the RN in harbor defense, hardly prestigious. But Germany's U-boat exploits combined with some amazing British feats were a tonic for the whole community.

Money began to flow into the business. The O and R class boats were expedited and this fiscal spurt ultimately led to the S class which was the top of the line until the middle 1930s. In 1917 the Secretary of the Navy (after the sinking of the F-4 acknowledged the need for more sophisticated training) authorized the establishment of a submarine school in New London—thus On-The-Job Training became the follow-on practical phase rather than the sole method of indoctrination.

U.S. officers eagerly read everything published on the German and British operations. More significantly, after the Armistice,

Great Britain gave us six of the captured U-boats for study.

Above all, the war highlighted the need for central direction or a total submarine approach. Captain Thomas Hart (later Commander-in-Chief of the U.S. Asiatic Fleet in WWII) who had no previous experience in the boats had been placed in command of those units sent to Europe. He returned a dedicated advocate for submarining.

In 1918 he was given responsibility for overseeing a total submarine program. This was a watershed step. The Force was coming out of the doldrums. Soon a broader and more meaningful vision of the future began to emerge within the community led by Hart. As he advanced in rank he remained interested and involved and influential in future submarine programs.

By the 1920s operating submarine officers were becoming more and more involved in specifying ship requirements and in every aspect of construction. For example, one of the most pressing challenges was to develop reliable diesel engines to meet the demands of long patrols without mother ship support. The Force began training its own diesel experts, even sending officers overseas to become knowledgeable on foreign developments.

In 1925, government yards commenced designing and building boats. Predictably, they were more responsive to the views of the operators than the civilian yards. This, in turn, precipitated a genuine schism between Electric Boat and the Navy which lasted for almost a decade. In that period the long-running problem of the diesel engine was worked out with General Motors and Fairbanks Morse. The dream of a long range boat at last became practical.

Another fortunate intervention, in 1925 Captain E.J. King was ordered to command the Sub Base at New London. He gained considerable publicity in subsequent salvage operations. In the process he became a staunch supporter of the undersea community -which was to last all his life. In 1927 he recommended a special device be designed to be worn by qualified submariners. Hence the Dolphins we wear so proudly. Aviators—eat your heart out.

You can readily see where the strong support for the boats by the leadership in WWII came from.

One other aspect of early submarine life deserves special mention. Submarines were not a top agenda item in the press or the

public mind, except when a sinking focused all eyes on the underseas community. There were a disturbing number of these tragedies.

Such crises highlighted the risks of working below the surface and more importantly the character and resourcefulness of the men engaged.

Before 1915 there had been accidents, even deaths, but no sinkings. The age of innocence ended that year. F-4 was lost off Hawaii with all hands. By 1927 the U.S. Navy held second place in the submarine funeral cortege of navies with 146 casualties and 13 major accidents. The list of sinkings is chilling.

- F-1 rammed by F-3 off coast of California in 1915. Five men survived.
- H-3 stranded off California coast in 1916. No loss of life.
- S-5 in September 1920 off the Delaware Capes sunk in 170 feet of water. Remarkably, all hands escaped.
- S-48 on builder's trials off Bridgeport, Connecticut in 1921 sank in 70 feet of water. After half of the boat flooded. Crew escaped through a forward torpedo tube.
- S-51 was struck by the SS CITY OF ROME on 05 Jun 1926 and sank off Block Island in 132 feet of water. Only five survived.
- S-4 was struck by USCG PAULDING in 1927 off Provincetown, Cape Cod in 300 feet of water. All 40 hands were lost, although some remained alive for almost 72 hours.
- USS SQUALUS off Portsmouth, New Hampshire on 23 May 1939 in 240 feet of water. Twenty-six men lost; 33 were saved.

Every one of these incidents high drama. Time prohibits reviewing them, but I found the S-5 rescue a miraculous story of great determination and resourcefulness by the crew.

She sank when the forward torpedo room was accidentally flooded preventing a successful surfacing. In a desperate move all the main ballast tanks were blown to bring the stern out of the water. The result was a 70 degree down angle with the nose stuck in the mud; 17 feet of the stern extended out of the water. The crew was literally walking on the bulkheads; the decks had become bulkheads. There were 34 men aboard, crowded into the after

compartments. All kinds of problems were overcome but they were still trapped with no electricity other than flashlights. The CO, Lieutenant Commander *Savvy* Cooke, crawled into the tiller room with two chiefs. With a breast hand drill after 8 hours of exhausting effort they drilled a 3/4 inch hole through the pressure hull (3/4 inch). Several more holes were drilled and connected with hand saws and chisels. The effort produced a hole of 1-1/2 inches by 4 inches. It was large enough to push a stick with the captain's shirt on it out of the hole. By then the main problem was putrid air and a lack of fresh water. After a painful wait, SS ALANTHUS, Captain Johnson, was attracted by the odd sight. The ship's captain approached this small *tower of Pisa* in a row boat. Using the small opening the following conversation took place:

Johnson: "What ship is this?"

Cooke: S-5 U.S. Navy."

Johnson: "Who is speaking?"

Cooke: "Lieutenant Commander Charles Cooke, commanding."

Johnson: "Where is your destination?"

(Can you believe this??)

Cooke with disgust: "Hell by compass."

Whereupon both laughed.

ALANTHUS, using hoses, managed to get pure air into the boat, and some fresh water. Also to remove some of the foul air. As other units arrived on the scene the small hole was gradually enlarged. The entire crew escaped through that small window after 51 hours of ordeal.

It's hard to overestimate the impact of these events on our history. First, every incident was an intense learning experience. A host of mechanical improvements followed every crisis.

Most obvious were the advances in submarine rescue and salvage operations. In 1915 there were no pre-planned procedures or equipment to deal with a boat on the bottom.

By 1939 when SQUALUS went down, specialized submarine rescue vessels were part of the Force. Admiral Momsen's famous lung was standard equipment on every boat. All crews were trained in escape techniques. Escape training towers had been erected at New London and Pearl Harbor. Extensive efforts were made to

develop a rescue chamber. This effort was ramrodded by a Captain McCann aided by A.I. McKee, an EDO, later to be associated with E.B. for years.

Incidentally, it is not well known, but over the inter war period seven enlisted divers were awarded Congressional Medals of Honor for their work on rescue and salvage operations. In fact a host of records for individual divers were set (depth, etc.). By 1940 the U.S. Navy led the world in deep water search and exploration. We have never relinquished that position.

Similarly, these events drew attention to the need for special bases and logistic tenders to support the operating boats.

Admiral Lockwood in his book Hell at 50 Fathoms discusses these disasters at length. One of his general comments is priceless: "Submarining, like other engineering progress, is a matter of trial and error, of learning by mistakes, mechanical as well as human. If we had waited for ultimate perfection to come from the drawing boards the fleet submarine that helped win WWII and the ballistic missile super sub that may prevent WWIII would never had dipped keel into water."

One footnote should be included. The lost CO of S-4 was Lieutenant Commander Roy Jones. Mrs. Jones, who had stood by remarkably calm throughout the ordeal, told the press that when her six year old son grows up she hoped he too would choose the Navy. Roy K. Jones, Jr. did; both the Naval Academy and submarines. Aren't submarine wives the greatest?

Just as significant, these tragedies were media events and, in a bizarre way, inspired the admiration of the public for those who man submarines as well as considerable criticism of the Navy for neglecting these problems. It also brought home the risks and the fact that special people are required to do this dangerous work. Congress reacted similarly and became more receptive to handling submarine appropriation requests (although such sympathy was short lived—just as it often is today).

Taking a step backwards and looking at the period of 1900 to 1940 as a whole, it's people that stand out.

It was not the golden age of submarining that was to come later. But although demanding, it was a necessary era. Those engaged directly didn't always have a clear vision of the submarine possibili-

ties and by 1940 many significant challenges still remained, e.g. untrustworthy torpedoes and a well thought out strategy.

Nevertheless, the flaws of those pioneers were strongly outweighed by the virtues. From the outset capable people stepped up. Men of unbelievable determination and perseverance. In retrospect it's incredible how many stayed the course—we were the beneficiaries. They were willing to take the high risks associated with this pioneering effort and no matter what the obstacles to build a viable structure for the Force. They were willing to devote their souls and talents to realizing their dreams no matter how blurred.

By 1940 there was a special command structure, an extensive logistics infrastructure. An all embracing training program, and a number of knowledgeable submariners ready to ascend to high positions. By 1940 the fleet boats, the best submarines in the world at the time, were coming out of the yards.

They gave us the one consistent thread that runs throughout the history of the community. The most priceless legacy those men left was a set of values for those who probe the depths that is still with us today. We should always pay homage to those men, e.g. Spear, Hart, Nimitz, King, Lockwood, Fyfe, Momsen, McKee, McCann, Styer, Yarnell, and many besides naval officers. It can be truly said that our subsequent achievements rested on the shoulders of giants.

Put simply, over the last century, America's submariners have risked, served, fought and on occasion died so that Americans might have a safer and freer life. In the process, they have given a full measure to the Navy, the nation, and the free world. I can think of no higher price.■

THE RECENT DAYS

ADDRESS TO THE SUBMARINE FORCE CENTENNIAL BIRTHDAY BALL

by ADM James D. Watkins, USN(Ret.)
April 1, 2000

From inventor John Holland's sale to the Navy of his submersible one century ago this month; from transition of the 64 ton HOLLAND to a line of increasingly sophisticated diesel and battery powered submersibles that would devastate the Imperial Japanese Navy in the Pacific theater of World War II; from the birth of nuclear power and its first born NAUTILUS and her descendants that would change the entire complexion of any future wars at sea; from the Trident Force which would help bring an *Evil Empire* to heel—all who have served the submarine arm of our national security forces can stand tall in the knowledge that we leave a proud centennial legacy of significant contributions to our beloved country and the freedoms we enjoy. But future submariners will be given even greater challenges as we enter the third millennium with its increased international chaos and unpredictability.

Tonight, I'd like to focus particularly on these last 50 years of submarine lore because, having lived through most of it, it's the only half of the century I know from personal involvement. However, I'm quick to admit that I can live vicariously through the awesome performance of our submarines during World War II:

- Sam Dealey in HARDER during her fifth war patrol—Congressional Medal of Honor.
- Gene Fluckey in BARB during her eleventh war patrol—Congressional Medal of Honor.
- Howard Gilmore in GROWLER during her fourth war patrol—Congressional Medal of Honor.
- Dick O'Kane in TANG during her fifth war patrol—Congressional Medal of Honor.
- George Street in TIRANTE during her first war pa-

trol—Congressional Medal of Honor.

- *Red* Ramage in PARCHE—Congressional Medal of Honor.
- Jim Cromwell in SCULPIN—Congressional Medal of Honor.

These highest decorations plus 333 Navy Crosses and countless Silver Stars won by our submariners during that noble conflict attest to the gallantry, intrepidity, selfless service, all beyond the call of duty of these *Greats of the Submarine Service*. How proud we are of the heritage they have left us.

More importantly, they were our post World War II teachers as well and laid new foundations for the next generation of submarine sailors—foundations based on powerful lessons learned from experiences in their war. What a faculty! For example, I was blessed with Dennis Wilkinson as my first skipper on VOLADOR in 1951, not long before he headed for NAUTILUS. My Division Commander at the time, another submarine Great who qualified me in submarines aboard CATFISH, was the fabulous Chick Clarey. My first staff job as Submarine Division Engineer was under Chick Clarey's relief, the indomitable Gene Fluckey. As an aside, one unforgettable lesson was left me by Dennis Wilkinson. After successfully completing one fast moving *down-the-throat* torpedo firing event, I had asked him how he knew the precise time to fire torpedoes when the torpedo track angle dials on the tactical data computer were spinning so ferociously? He answered rather matter-of-factly that he learned during the war that you fired when the pandemonium in the conning tower reached a maximum.

Now, somewhat less visible in that distinguished World War II group, but no less a *Submarine Great*, was an experienced Engineering Duty Officer by the name of Hyman G. Rickover. Enroute to the Cold War he, supported by a small cadre of talented engineers and scientists, not only envisioned the peaceful use of nuclear power, and through it the ultimate unlimited endurance submersible, but had the political and professional acuity and stamina to bring it about. In so doing, another new foundation for a revolution in the conduct of any future war at sea had been laid. Recall, not long after he commenced his work, that on 17 January 1955 the words which came from NAUTILUS, "underway on nuclear power", were shouted around the world. What a course

change for our maritime nation and the world.

Subsequent to NAUTILUS, incredible technological improvements born out of intense research and development and built into each new class of nuclear submarine were wonders to behold—the first SEAWOLF, then SKIPJACK then PERMIT, then STURGEON, then LOS ANGELES, then the new SEAWOLF, then VIRGINIA attack submarine classes and, along with them, Polaris-Poseidon-Trident ballistic missile submarine classes—all in just this last half century. With each class came a step change in capability and superiority over the Soviet submarine fleet. Also mixed in between were special prototype submarines to test various kinds of propulsion plants and noise-quiet stealthiness like TRITON, HALIBUT, TULIBEE, JACK, LIPSCOMB, and NARWHAL.

You know, when I helped put SNOOK, a Skipjack class submarine, in commission 40 years ago, I thought it was the most beautiful Cadillac of submarines ever to be built, one probably never to be significantly improved upon. How wrong I was. Only 25 years later she was declared totally obsolete. I couldn't believe it. To add to this nostalgically bad news and not long thereafter, her reactor compartment was removed from the hull and given final burial rights at the Hanford cemetery. The only saving grace for SNOOK's demise from my outdated perspective was that she was interred between PATRICK HENRY and GEORGE WASHINGTON—now that's classy and enviable company in any graveyard.

But the real story of the past 50 years of submarining is the critical role played by our nuclear submarines in winning the Cold War. You may recall that it was at the behest of the then-Chief of Naval Operations, Admiral Arleigh Burke, that a group of visionaries convened at the Woods Hole Oceanographic Institution. This group was tasked to study the fleet's vulnerability to nuclear attack submarines. In the course of their deliberations, it became clear that the nuclear submarine and the missile together would give us the ultimate strategic deterrent. Soon thereafter, the attack submarine GEORGE WASHINGTON was cut in half, modified, and our first strategic missile submarine was reality. The follow-on Polaris-Poseidon-Trident series, with their stealthy attack submarine protectors, I submit, won the Cold War. Our attack boats constantly held their *boomers* at risk. We could find the Soviet submarines, they couldn't find ours, and both sides knew it. And

that knowledge on the part of the Soviet leaders, led them to the conclusion that any nuclear exchange with the United States would be an assured loser for them. For, in the insidious and deadly competitive chess game of nuclear warfare, one does not start the game wherein checkmate of your own king is assured at the outset. And why was this the case? Because we were there, surrounding them undetected, and because of the demonstrated inherent stealth and survivability of our Strategic Reserve forces. These forces still house over half of the U.S. arsenal of nuclear delivery capability. This powerful end-game deterrent called the Strategic Reserve continues to be vested in our great ballistic missile submarines on constant patrol somewhere at sea tonight.

We have just talked about the last 50 years of stellar performance by our submariners in the Nation's defense. What about the next 50? What is the future of the U.S. Submarine Force now that the Soviet Feet has been virtually immobilized? Is there an enemy out there? I say "yes" and probably the greatest enemy of all—uncertainty.

My vision is a very simple one. Navy's requirement for deployment of capable and survivable platforms at sea will increase in proportion to the information technology explosion already engulfing us. Commercial satellite discrimination and accuracy, commercial communications and electronic intercept capability, instant fusing of public information worldwide, Internet access by the world at large—these realities, accompanied by related cyber-space mischief and warfare which it entices, all demand that our national security jewels must remain much more hidden from view than in the past. For example, take the future attack submarine missions alone. Using these stealthy submarines for strike support and time-critical targeting can only grow, but will require an evermore robust reconnaissance complex for increasingly information-hungry weapons. This complex must include inputs from all sources—space, theater, and tactical platforms. Fortunately, the Navy is still the best and most voracious user of fused all-source information to optimize its performance in the battlespace. Yet the Navy's position in space is one of high demand but low ownership. So, the Navy will need to reconfirm its ties to the all national information suppliers like, for example, the NRO (Ed. Note:

National Reconnaissance Office).

So, past is not prologue as we cross the threshold into this new world. Moreover, those that believe oceans as hiding places, for example, have become too transparent over the last 50 years due to technological investment in acoustic detection systems and the like are in the old world. In the new world we have not begun to capitalize on the potential opaqueness of the oceans whose natural protective phenomena are only just beginning to be understood. Pre-conflict stealth achieved by our greatest asset, the intellectual power of our scientific community in a free society to keep pace ahead of any adversary, will keep us secure. Hiding within the last frontier of earth's greatest natural resource will be the way of the future without any question.

The continued exploitation of this refuge will necessarily capitalize on our submarines' inherent stealth—and hence, their ability to gain access to critical areas which may be denied to less stealthy, more vulnerable platforms. The Submarine Force's unique ability to gain and sustain assured access to areas denied to others will ensure our submarines community to figure prominently in the nation's security posture in this coming century—as they have so magnificently throughout the last one. These self-sufficient platforms, on station 24 hours a day, 7 days a week, will develop dominant knowledge of the battlespace—feeding that knowledge in real time to the rest of the engaged forces.

As you know, the latest of these stealthy platforms is the new Virginia class, the newest Cadillac of submarines. My guess is that she, like SNOOK, will be buried at Hanford about 25 or 30 years after commissioning because of technological advances in the interim that are far beyond our ability as humans to comprehend today. But, rest assured her successors will be there to replace her as long as our national leaders are willing to invest now in sufficient numbers those platforms to sustain our competitive military superiority over threats from any potential enemy that decides to challenge us.

Cherished history, proud legacy, bright future—what a powerful arm of national defense! May God bless all our submarine families around the globe in this special centennial year. Thank you.■

THE FUTURE DAYS

NSL ANNUAL SYMPOSIUM REMARKS

by ADM F.L. "Skip" Bowman, USN
15 June 2000

Ladies and gentlemen, fellow members, and friends of the Naval Submarine League. I'm honored to be here with you this afternoon, and to have the opportunity to share some thoughts with you which we've been discussing within our Submarine family lately.

Thanks to the Naval Submarine League. Your efforts are crucial to the success of today's Submarine Force. In fact, the collective efforts of this wonderful organization have been very much *front and center* this year. The leadership and direction provided by the Naval Submarine League have led the way, in this, our Centennial year.

And indeed, here we are the year 2000, the Year of the Submarine.

Let me tell you, this year is special! The Centennial Celebration, the one-hundredth birthday of the Submarine Force. A lot has happened already:

- The keel-laying of our first new attack submarine, VIRGINIA, in September 1999. The ceremony included Senator Warner, Senator Robb and the Chief of Naval Operations, Admiral Jay Johnson.
- The postage stamp unveiling at historic Dealey Center, commemorating our 100th anniversary and supported by your great organization.
- The Smithsonian exhibit and its gala opening on the 11th of April. The birthday of the Submarine Force.
- The dedication of a new wing at the NAUTILUS Museum at Subase New London.
- A flurry of Submarine Balls all over the country attended by record numbers.
- U-571 and RADM *Big Al* Konetzni on CNN with Larry

King. If you watched it, then you know what a great public relations coup it was for the Submarine Force.

Perhaps the most important cause for celebration is the fact that the tide is shifting, people are recognizing the overwhelming advantage our country has in our submarine fleet and are beginning to understand what this elite force has done, is doing and will do for our country.

And that's what I'd like to talk about this afternoon.

I'll suggest to you that this groundswell of recognition and support for our Submarine Force has a lot more to it than being a well-deserved Centennial salute. In fact, I'd propose:

That people are realizing—perhaps more than ever before—that the submarine fills a critical role of irreplaceable value, and will continue to be a necessary element of our nation's military force structure.

At the risk of repeating pieces of what you've heard in this symposium or in last month's Technical Symposium at Johns Hopkins, today I want to bring together those pieces of the submarine course that has been charted into the 21st century and the technological improvements we're after.

But to tell this story, let's begin with a flashback, to ten years or so ago, when the Berlin Wall came down, and the Soviet Union flew apart. Those people I call "the misty-eyed wanderers" began voicing their fervent belief in a new era of peace and tranquility, and began demanding a "peace dividend." People with lots of ink but no responsibility.

Well, as we all know, it just hasn't come to pass quite as they'd hoped. We face some significant security challenges today, from a lot of different places, all over the world, and there's likely more to come.

But the bleatings of the misty-eyed nonetheless have taken their toll:

- All services down by about a third. Today we have a Navy of 315 ships and an attack submarine force of 56 SSNs. Until recently, we were headed toward a 50 SSN force in 2003: the result of the 1997 QDR.

- We know now that **no analytical rigor** was used to arrive at this number.
- 50 SSNs were resource driven. We got the number of submarines that resources allowed **after** we bought 12 Carriers, 12 Amphibious Ready Groups and 116 Surface Combatants.
- Beginning around 1994, the Navy has consistently validated a fleet requirement for about 72 SSNs. We have 56 today. In the Pacific, USCINCPAC, Admiral Dennis Blair, has stated in his Integrated Priority List that he needs 35 attack submarines—he has 25!
- So the Quadrennial Defense Review ignored the needs of the warfighters in the submarine area ...
- The Quadrennial Defense Review **did** hedge the bet by *footnoting* that the specified level of 50 SSNs was contingent on a reevaluation of peacetime overseas presence requirements.

But then, the 1998 Defense Science Board Summer Study rang an important bell; declaring the submarine the **"crown jewel"** of our defense arsenal and calling for more not fewer.

Then of course the more recent validation, the reevaluation asked for in the Quadrennial Defense Review, the 1999 CJCS study, confirmed that 50 SSNs are inadequate.

- The study determined that 68 SSNs are required in 2015, and by extension today.
- It went on to say 76 SSNs are required in 2025.
- The report also stated a level below 55 SSNs would leave the CINCs **insufficient capability to respond to urgent contingencies** without gapping other requirements of high national interest.

As an aside, some people **not** knowledgeable of this Study have read this to say that a range of 55-68 SSNs is OK.

Read more carefully. This is **not** the case. As the CNO has stated, it's a risk management problem. Any number below 68 represents increased risk, with 55 simply being the level at which the cumulative risk is **so great,** it is **unacceptable.**

I do not believe, nor should anyone pretend, that submarines are

a **sufficient element** of our Navy's, or our nation's, military force structure in and of themselves. But I **do** firmly believe what I said earlier, that U.S. Navy attack submarines **have served** critical roles of irreplaceable value, and **will continue** to be a **necessary, although not sufficient**, element of our nation's force structure, in numbers larger than today.

The *have served* part is becoming more and more known, and if you've heard me speak at one of our Submarine Birthday Balls, you've heard me talk a lot about our early beginnings. And how:

- We began life in 1900 with both a limited submarine and a limited vision for that submarine. Of short-range submarines, principally assigned *harbor and coastal protection* duties.
- Then in WWI, we made some forays into the open ocean, against German naval and merchant shipping during the latter months of that war, but they were generally ineffective.
- But we learned from those first, limited wartime experiences, and we learned from the German U-boat success. We recognized the tremendous potential of these new platforms and we improved them to become longer range, offensively oriented.
- We gave them new, more reliable, diesel engines, more fuel, and more payload volume. To capitalize on their inherent stealth to gain access into areas our other forces couldn't go and to take the fight to the enemy.
- Those new, long-range fleet boats began appearing in the late 1930s.
- Just in the nick of time to step up to a WWII mission that surpassed anything anyone expected, when our heroic submariners held the line in the Pacific. In fact, our submarines "were the only force to hold the line while the nation repaired its wounds" following Pearl Harbor (in FADM Nimitz's words).
- WW II was the crucible that forged our character, a culture that now is playing big as our country contemplates the uncertain 21st century. Because it was then that our submariners were presented, virtually overnight, with a **new mission** and said simply, "We can do that."

So in WW II with technology, and with a small, elite, *can do* Submarine Force, we began our reputation of stepping up to new mission requirements in response to new world situations. From that limited vision of harbor defense, to forward scout, to ASUW, to mining, to a smattering of ASW.

But of course we didn't stop when WW II ended. Our Navy and the **nation**, really, recognized that our Submarine Force gave us a unique advantage among nations of the world, a national treasure.

New missions appeared, because we knew we could count on this growing legacy of *can-do* spirit, of adaptation, of innovation, that had carried us through WWII and had enabled our WWII Submarine Force to **survive** and **prevail** against overwhelming odds.

- So, after WWII, we added the snorkel and improved on our tactical sensors. Periscopes and sonars and antennas that evolved into yet another mission: the so-called Indications and Warning mission of the Cold War.
- And then, nuclear propulsion—finally taking us from submersible surface ships to true **submarines** and providing 24 hrs/day, 7 days/week, covert **access** to places other platforms couldn't go.
- Another **radical** development of this post-WWII era, the submarine launched ballistic missiles of our SSBN force, the *boomer*.
- Our *boomers* provided the nation's only truly *survivable deterrence*, playing a key role in *coming to grips* with **that** grave threat to our national security.
- And of course, the Cold War presented us with yet another new mission, the Blind Man's Bluff ASW mission you're hearing more and more about lately, our SSNs locked-in with **their** SSBNs.
- And with each of these new missions our Cold War submariners simply said, "We can do that," just like in WW II.
- To a significant degree, more and more recognized by the public, the Cold War was won under the seas. Our attack boats could find **their** boomers and **they** couldn't find our

boomers. And they knew it.

Submarine technical superiority was the muscle in that victory but our submariners' *can-do* spirit was the heart; simply overwhelming the Soviets' simple calculus of numerical superiority.

Let's look at what submarines are doing **today** and since the end of the Cold War:

- We know in this post-Cold War era, the Submarine Force has been called upon once again to come to grips with new missions, just like those WWII and Cold War heroes.
- And the Submarine Force is again saying, "We can do this." Out of necessity once again, to respond to the nation's need, just like **they** did.
- Our guys are tasked with worldwide Intelligence/Surveillance/ Reconnaissance (ISR) missions that have doubled, over the same decade that saw our SSN numbers dwindle by almost half.

But once again, they're simply saying "We can do that." And *in this same decade*,

- *We've added* **covert** precision land attack to our kit, and more importantly, to the kit of the Theater Commander.
- *We've added* operations under direct Battle Group Command and Joint Task Force Tactical Command to our longstanding proficiency in **independent** operations.

In spite of the significant contribution that our submarines are making day in and day out around the world in every stage of conflict, in spite of the constant drumbeat for more attack submarines by our Unified CINCs, in spite of so many independent studies calling for the submarine, we still have a few naysayers.

- Bluntly stated, some are so convinced of their predispositions that they don't need any facts.
- Some complain that their questions, really not questions at all, of course, but opinionated comments **almost** in the form of a question, haven't been acknowledged yet.

Well let me answer these so called questions with a few of my own, and the associated factual answers. Ask the guy next to you:

1. How many submarine reconnaissance days, tasked out of the highest levels of our government, were not executed in CY 1999 due to competing requirements for these multi-mission

submarines and unplanned contingencies? [Pause...ask him...what'd he say?]

Answer: 365 submarine days—about 10 submarines' worth.

2. For CY 2000, how many requested submarine reconnaissance days could not even be **scheduled** due to competing requirements, and how many **scheduled** mission days have been missed due to unplanned contingencies in the first six months of 2000?

   Answer: 200 days couldn't even be scheduled (5-6 SSNs worth); another 74 days that **have** been scheduled couldn't be executed YTD (2 more SSNs worth...isn't it marvelous how all these studies and read-world metrics keep adding to the need for 68-72 submarines.

3. How much democratization, allied engagement and allied exercises in submarine days are included in the 68 SSN force level requirement for 2015 in the crucial Asian-Pacific Theater?

   Answer: None.

4. How many Arctic/under ice dual purpose missions, supporting global-warming/oceanic-feature science while maintaining a U.S. ability to operate there, are scheduled or anticipated in the out years?

   Answer: One more—this year as USS L. MENDEL RIVERS transits to her inactivation at Puget Sound ... after that, none.

5. How often is significant foreign activity obscured from submarine ISR by a) cloud cover, b) timing calculated to avoid covert SSN presence, or c) delays designed to exceed SSN dwell time.

   Answer: Never.

6. How often does significant foreign activity stop due to the presence of a covert SSN conducting ISR?

   Answer: Never.

7. How can a person who fails the above quiz pretend to speak with authority or knowledge on this multi-validated issue?

To get back to where we were, we've agreed that U.S. attack submarines **have served** critical roles of irreplaceable value and

we've proposed these nuclear boats **will continue** to be a necessary part of our Navy. What about the *will continue* part?

What about **tomorrow**? Well, we remind ourselves of this legacy of adapting to constantly changing worlds and missions because that's precisely what lies ahead.

- Futurists warn us to prepare for a very different set of national security challenges in the 21st Century than we saw throughout the last 100 years.
  - The coming challenges are likely to be a **lot** less about massing overwhelming firepower at the Fulda Gap.
  - And, more about employing stealth and agility and endurance in a number of places, without the expectation of forward friendly bases.
  - It will be about dealing efficiently, not just in full-scale wars, but in the vagaries of ever-consuming missions with labels like *peacekeeping*, *intervention*, *humanitarian aid*, and *non-combatant evacuations* (NEOs).
- And they warn us about *area denial*, the ability of some nations or rogue powers, even with limited means, to deny (at least, temporarily) access to areas of the world to many of our forces.

Stealth, endurance, agility, self-sufficiency, sounds like they're calling for an even **greater** need for submarines in the future and a lot of people are agreeing with that line of thought.

- Last November, Secretary of the Navy Richard Danzig stated his view of a future Navy force structure with **greater** reliance on the (attack) submarine. He noted the relative invulnerability of submarines to satellite detection and land-launched missiles, and other *cheap* means of denying access.
- And now this strong validation from the Unified Commanders—the CJCS Study released just three months ago.

Case presented, case made, case won.

So let's move on. From these studies, the Submarine Force is articulating four strategic objectives for nuclear powered attack submarines and their deployable vehicles, payloads and sensors, in this new century of ours. They boil down to four simple thoughts: guaranteed access, dominant knowledge, power projection and

deterrence.

Maybe we should think about these four strategic objectives as **unique, irreplaceable,** attack submarine **contributions** and really recognize the importance of the **guaranteed access** objective. Vice Admiral Art Cebrowski, President of our Naval War College, has recently defined military relevance mathematically as:

Relevance = Access x Combat Power

The first of these future strategic objectives (now called submarine contributions) then is this key one ...

Number 1 – Gain and sustain access for the **battleforce.**

Specifically, not just for the submarine itself, but for other Naval and other U.S. forces, in politically denied and/or militarily contested littoral regions, as well as the open oceans' sea-lanes. Increasingly in the future, the submarine will be uniquely suited to being the first in, sustained, and last out.

- Sanitizing the waterspace, mapping out, clearing out and keeping out mines, diesel submarines, and other threats.
- Submarines' stealth can also create uncertainty, fear and a disproportionate diversion of resources on the part of our adversary, if we will truly start operating: "covert when required, overt when desired."

Don't forget that both our WWII and Cold War heroes have already proven that for submariners, there's no such thing as *enemy controlled waters*. **Yes**, we will be there!

Number 2 – With this guaranteed access, develop and share a dominant **knowledge** of the battlespace.

- In a covert, continuous and (again when and if desired) non-provocative manner.
- Negating the bad guy's attempts at deception, by being there with him 24 hours/day and 7 days/week. Not just with periscopes and antennas but well over the horizon with deployable off-board vehicles that swim, crawl, drive or fly and deploying sensors that can see, hear, taste, and smell.
- And sharing this information, in **real time**, with our Battle Group and Joint Forces tucked safely over the next horizon, and even sharing real time with the National Command Authority back home.

- Getting inside the other guy's decision loop, living with him as his invisible shadow, understanding motivations, obtaining proof of his actions, knowing what he values, sometimes letting him know that we know. Placing him on the defensive, maybe even winning the war before it starts, a familiar theme to us who have done that.

Number 3 – Project power covertly, with surprise **and** from close in.

- If objectives 1 and 2 fail to deter, to so unnerve him that he quits we can jack it up a notch.
- Fill the needed *enabler* role as an essential **complement** to other power projection forces in theater and probably as the opening salvo to suppress enemy defenses.
- Prepare the battlespace especially to **minimize risk to our other forces**, destroying anti-ship cruise missile launchers, monitoring and neutralizing Weapons of Mass Destruction sites, and severing links to overhead satellites.
- And continue to sanitize the waterspace, maintaining control of the seas.

And **Number 4** – Deter and counter Weapons of Mass Destruction (WMD).

This objective takes advantage of the access, knowledge and power projection contributions I just described.

By extending our proven strategic nuclear deterrence capability to serve as a potent offensive, asymmetric deterrent for chemical, biological and other similar activities.

- But this objective goes beyond the pure deterrence of yesterday. It includes **monitoring, targeting,** and when clear evidence is built, and with National Command Authority direction, **destroying** his capability where they are manufactured, stored and launched.
- Provides an effective means to turn the tables and **terrorize the terrorists.**

As and aside, the national debate spools up over the right kind of National Missile Defense architecture, let's not forget we have a Trident Submarine Force that's been in the business of NMD for a long time and they're still out there!

So to recap, these **unique, irreplaceable, contributions**, which

we've called strategic objectives, are

1) Access—gaining it, sustaining it, guaranteeing it.
2) Knowledge—developing and sharing it.
3) Power projection—with surprise and up close.
4) WMD—deter and counter in a **preemptive or responsive** manner.

Now, you may recall we've talked a lot of the technical need to do more to:

1) Get Connected
2) Get Payload
3) Get Modular
4) Get Electric

Let me wrap up by illustrating how I see these development thrusts, these *four Gets*, relate to the four strategic objectives.

First again—**access**, stealth in the battlefields of tomorrow. We've got to get in, survive and operate there.

- It's going to get far uglier and more demanding than today for sure.
- Stealth superiority is a must. Both acoustic and **non-acoustic** improvements will be needed.
  - Today, in our Virginia class we are adding a more sophisticated electromagnetic silencing system to improve resistance to mines. And specifying other, classified, **non-acoustic** stealth requirements for the first time.
  - Tomorrow, the *Get Electric* piece will weigh-in heavily for acoustic stealth and thus will be an essential part of assured access.
  - Because, mechanical drive is at a dead end technically.
    - At high speed, we can't squeeze any more blood out of this mechanical-drive turnip to support propulsor improvements for the next level of stealth.
    - And low to moderate speed operations in the littorals will demand continued improvements in propulsion plant machinery quieting.
- Access also involves *Getting Payload*. This time the non-

explosive kind of payload.

- Greatly expanding our off-board capabilities to extend out tactical sensor reach in depth and breadth, over the near-shore horizon. That is:
  - Covert, off-board vehicles, underwater and aerial, manned and unmanned, which can in turn deliver their own networks of sensors, in the undersea battlespace and over the horizon.
- We must invest in the more capable and versatile offsprings of:
  - Today's Advanced Swimmer Delivery System submersible.
  - Tomorrow's Long-range Mine Reconnaissance System for mine reconnaissance.
  - And the next generation of smart sensors, nanoscale or micro-electronic machines—MEMS.

Second, **Knowledge** is all about *Getting Connected* and the *Get Payload* developments I just discussed.

- In short we must leverage the *disruptive technologies* that others are developing here, and pay more attention to developments outside the defense industry.
  - Such as in telecommunications and information systems.
  - For example in microprocessors:
    - If Moore's Law continues, the one that says computational power doubles every 18 months to 2 years, that's about another 1,000-fold increase by 2020.
    - The significance to us is the ability to conduct onboard processing and assessment to develop dominant **knowledge** from a plethora of **information**. Because, we must provide timely *answers*, not just a data stream, to those who must act.
    - We need to tighten the *sense, decide, act* decision loop through this processing improvement.

Third, **Power Projection** is all about *Getting Payload* and *Getting Modular*.

- Getting payload is an obvious part of power projection.
  - It's about those deployed off-board *knowledge widgets* I mentioned earlier. They don't explode, but they can

prevent or win wars.
  - It's also about catering to the special ops guys and their gear to tag, monitor and target the enemy's offense.
- But, ultimately it's about putting ordnance on target from the submarine.
  - We need more of it and more types of it, of all shapes and sizes.
  - And we need to deploy it with **great precision**, to ensure each one counts.
- And *Getting Modular* addresses **one of the few certain things** about tomorrow in this power projection role we play. That is:
  - The absolute need for **rapid and affordable adaptability**.
    - Despite our tremendous technical prowess, our adversaries will be able to acquire many of the same new technologies driven by the demand of today's global marketplace.
    - So if technical preeminence is not guaranteed, then as in nature, survival will go to those who are most able and quickest to adapt to their practical uses. **That's** what a modular payload submarine will do for us.
  - Another dimension of payload and platform modularity is that it enables **not just a multi-mission submarine, but a re-configurable Submarine Force.** In theater if we do it right.
    - The modular mentality has a good start in the Virginia class construction and some of its design features. We must press on in this area.
- And for completeness, I'll note that *Get Electric* plays here too.
  - First in helping to achieve modularity, it is a lot easier to plug cables together then to cut and weld pipe.
  - And then, we need to make available the power output of the reactor for propulsion **or** for payload. To:
    - Recharge these off-board payloads, maybe even using the water we sail in to generate the fuel.

- Reduce, and maybe even eliminate, payload propellant to make best use of the space available.

And lastly, countering Weapons of Mass Destruction.

- This strategic objective takes advantage of the other three:
  - With close in access, having attained a knowledge of the other guy's thoughts, and being in position to act under his defensive umbrella. We can preemptively remove his capability to deploy **any** WMD.
  - Or make him damn sorry he did.

So let me stop here.

As Rear Admiral Fages said earlier today, the Submarine Force has been the poster child for disruptive technologies in the 20th century. And we are now positioning ourselves to continue this legacy, by delivering to our operators those disruptive technologies and approaches that enable:

- Disruptive ideas of **distributed re-configurable sensor networks**, delivered by the submarine or submarine surrogates, versus a **sustaining** emphasis on better stuff mounted to masts attached to the submarine.
- **Numerous covert, off-board, multi-mission, unmanned vehicles**, versus simply large covert capital ships in reduced numbers.
- **Timely, affordable and integrated hardware/software technology refresh**, versus time consuming expensive rip-outs of entire single purpose legacy systems.
- **Modularity, variety, flexibility and increased volume of payload** toward a submarine force whose capabilities can be rapidly reconfigured, versus waiting until the next ship class to come along.
- And **connectivity in real time** with many customers versus days, weeks, or months for a limited number of customers.

And to answer one of Secretary Danzig's challenges of one year ago, we listened, we acted and I see no evidence of narcissism in this vision, although we are a pretty damn good looking group!

Thank you.■

PACIFIC PERSPECTIVE

by ADM Thomas B. Fargo, USN
Commander, U.S. Pacific Fleet
NSL Annual Symposium
16 June 2000

Greetings and amenities from the Pacific Fleet. This is usually the point where, after just leaving Hawaii, you make the obligatory comment that it's great to be back in Washington—and your credibility immediately goes to hell. It's wonderful to see so many friends and shipmates. Both the folks you grew up with in the Submarine Force and the folks that raised you.

I spent the last few days at the Current Strategy Forum at the Naval War College where the topic was "Future of U.S. Naval Forces in the Pacific". The Secretary kicked it off—I was the wrap up speaker. I thought that was a pretty distinguished spot in the program until it crossed my mind—on the third day of any conference, you have to wonder what there is left to say, or even more important, left to remember. So I do appreciate the early tee time provided by Bill Smith here this morning.

So if you remember—say that we talked about the Pacific—I might claim this as a success. Actually, there is no fear that the Pacific is off your scope because Al Konetzni (Ed. Note: Rear Admiral Albert H. Konetzni, Jr., COMSUBPAC) has done a spectacular job. All you have to do is walk aboard any ship in the Pacific Submarine Force or bump into a submarine sailor from Hawaii or Bangor anywhere, and you recognize the pride he has generated in our outfit.

Winston Churchill used to say the three most difficult things to do in life are:

- Climb a wall leaning toward you
- Kiss a woman leaning away from you
- Or talk to an audience that knows more than you do.

So after listening to Skip yesterday and knowing what Al was going to say—let me correct that—that last statement is not achievable! Having seen Al's slides, I thought my most valuable

contribution might be in relating the security concerns and military imperatives both present and future in the Pacific.

As we take a look at the Pacific theater I think you will come away with the same view I hold—the same that Denny Blair (Ed. Note: Admiral Dennis C. Blair, CINCPAC) holds: **Submarines, in greater numbers than we have today, are necessary to secure our national security interests.**

In my view, we have two compelling security interests in the Pacific:

- The first is maintaining a balance of power that will preclude the rise of a government-sponsored military competitor.

There are probably a number of other ways to say this, but fundamentally it deals with managing what I would call the high-end security issue that would result from excessive armament of any number of countries that in the future will potentially have the political and fiscal resources to do so. China, Unified Korea, Japan or ultimately India—all were validated by the session we just finished in Newport.

- A second broad interest is providing the assurance that comes with U.S. presence. Assurance to Americans and allies to provide a level of peace and stability that will allow us to develop our shared interests and **contribute to collective, economic prosperity.**

I'd like to take the broader implications of Naval Engagement in this region a step further and talk about my sense of how they play directly in terms of our strategy throughout the Pacific and also the Indian Ocean and the Gulf because I believe there to be key linkages here that need to be addressed.

Let me start with the Northeast Asia and work my way South to Cross-Straight Issues and then on to Southeast Asia. I'll follow with India, Pakistan, and the Gulf.

Northeast Asia

Japan

- Many have questioned whether Japan and our alliance still remains our most important security arrangement. Answer—yes it is. It is the centerpiece and will remain so for the foreseeable future.

- The fact that despite economic problems, Japan still accounts for 60 percent of Asia's GDP needs to be remembered.
- Our presence in Japan signals more than just support for the Defense of Japan. The entire Asia-Pacific region recognizes the significance of the Seventh Fleet, and the stabilizing influence it has in the region. Even nations who are not thrilled with the idea of our long term presence in the theater, and I mean China, will acknowledge this and accept Seventh Fleet's routine visibility in the theater, right now.
- Our strategy encourages Japan to take a larger role in regional security—New Defense Guidelines facilitate this evolution. We would hope they would work with the Koreans. Joe Krol (Ed. Note: Rear Admiral Joseph J. Krol, Jr., ComSubGroup SEVEN) is working in precisely this direction.
- JMSDF is clearly ready, and there is a lot of evidence of that—nine ships plus a submarine were sent to RIMPAC. I recently heard a colleague intimate that he thought some parts of our U.S.-Japan relationship might be a little fragile. There is nothing fragile about the Navy to Navy relationship—the foundation of which is our two Submarine Forces. It is the bedrock of the alliance **and** has further potential.

Korea

We shouldn't forget, this is the place where the stakes are highest—I'm talking about potential loss of life.

- North Korea's forward-deployed army remains a formidable force and still poses a threat to the region. The recent Winter Training Cycle was the most active ever.
- Seventy percent of all combat ready units (15 Division) are positioned within 60 miles of the DMZ. Farther forward today than say five years ago. Military continues to receive priority over civilian population in allotments of scarce resources (food, medical care).
- N.K. is suspected of the development and proliferation of Weapons of Mass Destruction such as 1998 TAEPO DONG-1 launch, with a 800+ nm range that makes lots of folks nervous.

PACFLT and SEVENTHFLT support to our OPLANS gains greater fidelity each year in terms of improved interoperability with the Korean military and support ashore for General Tom Swartz, our Combined Forces Commander. And their Navy is maturing. I recently toured a Korean 209 submarine which transited 4000 miles from Chinhae to Pearl Harbor. Their progress is simply astounding.

Russia

We often skip Russia in the Northeast Asia discussion. We shouldn't.

- Russia is in the midst of determining the depth of their relationship with us. I suspect they will be cautious as they navigate difficult political and even tougher fiscal issues.
- Russia's ability to supply advanced conventional weapons to China and India is a matter of concern and has potential to influence the regional balance. "What about the Kilos to China?" is the first question I get in every regional discussion.

It is important to remember the Russian Navy has historically been a submarine Navy. There was a period in the '70s and '80s where Gorshov attempted to build a Blue Water Surface and Naval Air Capability. But it is back to their roots with their front line nuclear submarines as their essential Naval Force. (I have invited the Russian Pacific Fleet Commander to Hawaii in August and sincerely hope he can make the visit.)

Bottom line on the North East. We will need to remain engaged in this area after peace is negotiated on the Korean Peninsula. Nobody's crystal ball is particularly clear on this time line. But we watch the current talks with great interest.

There will be a debate concerning how or whether we should transform our presence in the Western Pacific. But "We can react or get out ahead of it." Submarine stability may be an advantage in this debate.

Cross Straits

China-Taiwan-Hong Kong

Obviously we maintain a very careful relationship with China. It's a major regional power: 1/5 the world's population, third largest country in terms of area and it is growing by 18 million people per year.

Not only are we concerned with the tension between China and Taiwan. So are our friends. In Hong Kong four weeks ago, I put this question to the American Chamber of Commerce: "What is the impact?" Their response was that it is a key ingredient in most investment decisions we make. I also note folks on every side in Hong Kong working hard to make the two systems work. PLA is essentially out of sight.

- China is at an economic and political crossroad. Despite the ongoing economic transformation, Chinese military modernization continues. **Budgets are up.**
- We recognize China would have a tough go at an invasion of Taiwan and should unprovoked action occur, it is unlikely that U.S. forces would stand idly by.

I see two possible futures for our relationship:

- Develop closer economic ties with a positive, mutually beneficial relationship.
- Or, in China's mind, a zero-sum game (our disadvantage is their advantage)—you hear this a great deal when talking to Asia-Pacific leadership.

We have no intention of demonizing China. In fact we will continue to pursue a policy of military-to-military engagement. Ship visits with the Chinese Navy, professional exchanges, port visits—of course appear back on track. We hope to develop a degree of transparency on both sides. Our strategy is a little like the Islamic parable where the shepherd goes to Mohammed and asks, "If I tie up my camel does it mean I lack faith in God?" Mohammed responds, "Trust in God but tie up your camel too."

Southeast Asia-Important Relationships

My first impression is of the growing acceptance of Naval Presence as a positive force within Southeast Asia. Nuclear power warships visits to Singapore and now Malaysia as a result of Archie's (Ed. Note: Retired Admiral Archie Clemins, former

CINCPACFLT) initiatives, are routine.

There are lots of other examples:

Philippines

- Visiting Forces Agreement is signed, BALIKATAN was first exercise. Port calls to Cebu, Manila and ASHEVILLE most recently to Subic are happening at a moderate pace.
- Continuing internal unrest, particularly with the Muslim extremists in the South, has captured the bulk of the defense resources and focus.

We have a measured approach. Like with a number of countries, our strategy should be to help with their valid security needs—in some cases that starts with developing a Coast Guard-like capability.

Thailand

Obviously a very positive relationship. Thais' greatly appreciate opportunity to train with U.S. forces. They very much want our submarine to play in CARAT but that is a shortfall in our SubPac resources versus tasks balance—we just can't do it. They have built a first rate shipyard that I expect us to use.

We should recognize that drugs, the huge synthetic production from Burma, are the principle threat to their security. We will gear up to help here.

Singapore

We have very close ties. Singapore has made wise investment, and have both quality forces and proficient operators. They are building a submarine force, as is Malaysia.

They are in the final stages of building a pier at Changhi, which will be able to support the dockside needs of any ship in our inventory. This will greatly enhance the level of naval support and presence in the region.

Indonesia

Remember, this is a country with more people than Russia.

It is a tremendously diverse country with a huge range of issues—a key to stability in this region. We often talk about regional concerns like piracy but a much bigger issue—and a naval

one if Indonesia comes apart—is the potential migrant problem; you can understand their neighbors' concern.

Australia

Very special partnership. We both recognize the value of our bi-lateral exercise program. TANDEM THRUST was conducted in Guam last year and next year will be in Australia. They really worry about this. Bi-lats are important because they can train against their numbers count.

Australia did the heavy lifting in East Timor. They took on the leadership role, and not without some cost. And we appreciate it.

Summary Southeast Asia

There is a perception in the region that we conduct "only transit deployments to Southeast Asia" and that we have "a pretense of a security commitment". From a U.S. Navy vantage we understand the critical importance of Southeast Asia. We are spending additional time in the area and we are attempting to spend even more time. Let me explain. USS KITTY HAWK Battlegroup just completed a two month deployment to Southeast Asia from her homeport in Yokosuka, Japan and CARAT, which stands for Cooperation Afloat Readiness and Training, was set up specifically to engage the nations of Southeast Asia. At PACFLT we are petitioning to change the operational patterns to include less time in the Gulf, more time in regions like Southeast Asia. However, the demand for Naval forces remains high.

I have broken this discussion into sub-regions for convenience but in actuality most of what happens in Asia is intertwined to a large degree (look at economic crisis). Southeast Asia is the vortex of the Asia future. The strategic ambitions of both China and India may overlap in Southeast Asia.

India and Pakistan

We are well aware of the nuclear character of India and Pakistan.

Recent India guidance has allowed resumption of selective military-to-military engagement to include high level visits and conferences.

India appears on the path of economic reform. Its economy is growing strongly (5.8 percent growth GDP). Military balance on the sub-continent now favors India, and with each year that passes, India's superior economic performance will improve its military advantage.

From a strategic standpoint it would be a mistake to forsake the balance we have always promoted in our approach to India-Pakistan or to forget the long standing relationship with the Pak Navy and their moderate views.

A real future unknown is China's relationship with India. As China's influence in Asia grows, India, which wants to be accepted as a major power, may seek to compete with China.

Gulf

I mentioned linkage. Energy is that link. The Gulf and the Middle East will increasingly look South and East to Asia-Pacific. By 2010 70 percent of Asia's energy will be imported, with 93 percent from the Gulf. Both China and Japan will be more dependent on the Gulf and sea lines through Southeast Asia.

It is most important to understand linkage from the Central to the Pacific Command:

- Two-thirds of the forces for CENTCOM are provided by PACOM
- Sub-continent have key partners with Gulf
- Muslin populations
- And economic ties are obvious.

Our lesson—naval strategy has to shed the distinction of theaters and lines in the water, in terms of our presence.

So what are the implications for the Submarine Force? Answer: lots—but let me leave you with just four.

1. We don't have nearly enough intelligence to deal with our top security interest—the balance of power in the Pacific.
   - In contrast to what we knew about the Soviet Union, our understanding of the rest of the region is minuscule. We find this out everyday.
   - Nobody is interested in waiting for intelligence. Consistent with our fast food culture, we want it now. Our efforts toward realtime reporting are in the right direc-

tion. Still not quite there yet, we need to press forward with realtime, covert, reliable comms. Where is Jay Cohen. (Ed. Note: Rear Admiral Jay M. Cohen, Chief of Naval Research.) Cohen-this is Fargo-Gertrude check, over?

2. We ought to think about the implications of future changes in the Pacific, like peace on the Korean Peninsula or the Tom Ricks article in The Washington Post which talks to the growing recognition that our military interests are shifting to Asia and the Pacific.
   - Does that mean Guam and tenders are even more important?
3. We will need a greater ASW capability than we have today.
   - Fact: HDW backlog of over 50 submarines to build in the next decade is a pretty clear signal.
   - While striving to be a first rate power each of these nations feel compelled to build a quality submarine force.
   - Today when Naval Components prepare OPLAN's most difficult problem to deal with is submarine threat.
   - PACOM submarine requirement is 35 as stated for last year's budget, and although I can't get into it here, the real world tasking to me has increased in the past two months.
   - Because of the current demand for naval forces, the only folks in the Pacific that are really doing ASW on any kind of regular basis is the Submarine Force:
     - P-3s are over committed in surveillance
     - Helos are equally tasked to the point where I'm worried we don't have airframe life to either get through to remanufacture or new platforms.
     - Neither platform had updated their processing to the degree Submarine Force has.
     - S-3s are out of the business.
     - Mike Mullen (Ed. Note: Rear Admiral Michael G. Mullen, Diector, Surface Warfare Division, OPNAV) talked at the Clambake last September and spoke of the reality of surface ship investment.
     - IUSS/Acoustic cuing is much less than I would like.

When we craft Operating Plans for any kind of regional contingency I need everything Al has in the cupboard. **This is not a mission we can outsource to any part of the joint community—it is distinctly naval.**

4. The price to enter the contested littoral will be your degree of survivability. Theater of today is one of mines, missiles, and submarines. It will be even more so in the future. They remain the enduring challenge.
   - Ballistic missiles are a great growth industry. Pick One—SR/MR/LR—they will have them all. The good news is they are not a threat to the Submarine Force.
   - Cruise missiles. We are in an era of the Mach 2.2 cruise missile that can be shot from a truck behind a sand dune. The Submarine Force is fortunate that our cross section to the cruise missile is about right.
   - Mines. They aren't going to go away. They are the cheapest possible leverage. I leave it to Mal (Ed. Note: Rear Admiral Malcolm I. Fages, Director, Submarine Warfare Division, OPNAV) and others to talk about our significant progress in this area but my guidance to you is don't let go of this. **We have to be able to operate in the contested littoral.**

In Conclusion

I'd like to add my thanks to the Naval Submarine League for their magnificent work bringing the Submarine Centennial to the American people. Skip (Ed. Note: Admiral Frank Bowman L. Bowman, Director, Naval Nuclear Propulsion Program) yesterday addressed many of the events, all of which were clear feats in their own right.

Most of us have been to a lot of Birthday Balls but nothing that compared to this year. Pearl Harbor, where I spoke, was like very place in the country—whatever the Fire Marshall would allow—1600 folks that **radiated a sense of belonging**. It is awfully good to be a part of it.■

MISSION REQUIREMENTS: THE *PULL* ON TECHNOLOGY

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

Submarine Technology Symposium
May 16, 2000

The title and theme of our symposium is Submarines: Enhancing Performance Through Technology Refresh...The Future is Now! This emphasis occurs at a time when our national security leadership is only beginning to realize that the submarine attributes of stealth, mobility, and endurance—long espoused by the leadership of the submarine community—are clearly emerging as critical enablers of needed national security capabilities for the ***not-so-distant*** future. And, fortuitously, this emphasis occurs almost simultaneously with a period when new concepts and programs are emerging on the scene—programs that vividly sharpen a heretofore somewhat-hazy vision of the Submarine Force of the future. Undoubtedly, we'll continue to be constrained by available resources, and we'll continue to be perceived as a threat to the traditional roles and missions *turf* of others. The submarine community will continue to be faced with a never-ending battle to move forward, to make inroads in the system—indeed, for acceptance...but, perhaps, the task will become somewhat easier if we can aggressively seize new opportunities and collectively move forward with vigor and determination.

The initial session of The SubTech Symposium is entitled Mission Requirements: The Pull on Technology. The objective is to sharpen views and understanding of those fleet needs for which solutions are sought in the near- to mid-term. In addition, it is possible to define a *framework of opportunity* for the further distant future—shaped by military requirements and influenced by emerging new technology and operational concepts—and tempered somewhat by reflections on a few lessons from the past.

In this context, it is appropriate to insert a few words about the process of maturing technologies, especially technologies desired for near- to mid-term application. By and large, technology programs will and do mature efficiently **only** when adequate and

sustained funding, and good people, are committed to achieving the desired goal. Technology programs that lack either adequate or sustained funding, or that lack a motivated team of good people, generally will not succeed very far beyond the *advanced viewgraph* stage—with the result that resources have, in effect, been squandered! Deep-down, these principles are well known and understood. However, too often institutional bureaucracies that manage and oversee these efforts do not require disciplined implementation of such principles, apparently—one might conclude—being satisfied simply with having an impressive number of programs ongoing. The clear message is, therefore, that in order to mature and efficiently field new technologies in the operating forces, especially in a near- or mid-term timeframe, the institutional bureaucracy must commit and be held accountable to the goal, and adequate resources, both fiscal and human, must be diligently applied.

There are examples of doing it right. The Advanced Rapid COTS Insertion (ARCI) program conducted within the submarine sonar community is a great example. This program, today producing tremendous improvements in submarine sonar performance at sea, was motivated by real-world operational experiences which suggested that our sonars were not performing up to expectations. Initiated by strongly-expressed concern, followed by strong support (and direction) from senior submarine leadership, a broad-based data gathering, analysis, and new technology (COTS) development and implementation program was rapidly put in place, overcoming all bureaucratic obstacles. In addition to sustained support and direction from the top, the increased attention paid to first-principles understanding of sonar and validations through testing with real data was a key factor in the process. The model for changing embedded bureaucratic processes to achieve important and timely results provided by the ARCI experience, in my judgement, merits broader application. In principle, the model is applicable to most submarine R&D endeavors, including truly long-term efforts, and should be seriously considered.

Now, what are some of these new opportunities—and from where are they coming? They are emerging with increasing frequency, both from within the submarine community and from outside, often unexpected, sources.

- Certainly the 1998 Defense Science Board report on *the submarine of the future* provided a fundamental new opportunity—an impetus of strong support from OSD with a clear endorsement for change.
- The ensuing DARPA Submarine Payload and Sensors Program harnessed the talents of two large industry teams. They will be reporting their results to DARPA and the Navy later this year, providing a well-conceived and scrubbed, innovative set of new systems and concepts—opportunities ready for further development. (It's worthy to note that, within these teams, there's a refreshing ground swell of innovative ideas and momentum in support of future submarine concepts and capabilities—generated by many new and different groups of people than in the past! There's notable enthusiasm for these submarine concepts in the trenches—enthusiasm that we need to maintain and nurture, and that we must spread to higher levels within the government, and to the taxpayers, as well!)
- The recently completed study of Submarine Force structure, conducted by the Unified Commanders-in-Chief and the Joint Staff, strengthened this new environment of opportunity when it clearly recognized the value of and endorsed the need for the submarine platform in tomorrow's national security environment.
- The tone and spirit of the submarine community itself, through visionary writings and clear, well-articulated messages from its leadership, are creating a renewal in awareness of the importance of submarines—thus providing the foundation for future opportunity.
  - The consistently-stated theme of commitment to payload, connectivity, modularity, all-electric and affordability sends a clear message of the vision and determination of the community and, in my view, is having a positive effect.
  - The most recent issue of Undersea Warfare, in an article by Rear Admiral Rich Terpstra entitled *Oh, How Offensive!*, captures the understanding and spirit of a submarine

community ready to take on the challenge of opportunities formerly considered the *turf* domain of others.

- The recent article in **THE SUBMARINE REVIEW**, *The Submarine Century*, by Admiral Bill Smith cites clearly the linkage of payload to the long-term future of the submarine and makes the case for an aggressive R&D effort—starting now!

And there are additional opportunities which sometimes emerge subtly and unpredictably from unexpected quarters. Witness these:

- Very recently, the national press discussed the *real* results of the air war in Kosovo, citing the very poor return on investment in vehicles killed (and claimed killed) when compared to the very extensive and highly publicized effort expended by NATO attack aircraft—notably flying above 15,000 feet to prevent losses. Does this not further strengthen another argument for submarine strike? Or, at least, a clearer indication that one must go into harm's way to effectively take out targets, and maybe submarine strike for air defense suppression might improve the TACAIR performance while preserving their survivability? *An opportunity?* And,
- In the 8 May 2000 issue of Aviation Week & Space Technology, Admiral Hal Gehman, Commander-in-Chief of U.S. Joint Forces Command, called into the question the level of investment being made in national intelligence gathering and reconnaissance systems. Gehman's view is that it's just not working and appears to support consideration of an alternative approach—that we should try, whenever possible, to empower the tactical operator with the ability to collect his own tactical intelligence, and thus be able to sense, process, and act without a principal reliance on systems beyond his control. Sounds almost like a system concept made to order for a submarine strike payload! *Another opportunity?*

It seems, then, very likely that the Submarine Force will have

plenty of opportunities from which to choose to shape its future. Lacking a clear threat today, the initial challenge will be in the selection of which opportunities to grasp, and in choosing the right developments to enable rapid evolution of new concepts of operation and capabilities for the future—in a manner that is marketable; supportable; in a DOD context, affordable; and **inevitable!** Initially, the selection can be facilitated by a high quality output from the DARPA Payload & Sensors study. **We just cannot fail to harness and continue the momentum generated by that program!** Choice of correct developments to enable new concepts of operations and capabilities to evolve can, and probably should, be guided, over time, by a supporting program of systems and operations analyses, wargames, and a continuum of structured at sea exercises. (It's worth remembering that the evolution of our submarine Cold War operational concepts and tactics development, as well as OSD and Congressional support for submarines, was shaped by the convincing results obtained from a continuum of at-sea exercises such as PERMIT PACFLT Class Eval, Big Daddy, RANGEX, SECEXs, and many others. Adoption of a similar methodology could be helpful as we go forward.)

Given that *turf* and other cultural issues can be adequately resolved, the next—the **real** challenge—will be in execution! To assure success in incorporating new technologies and new mission capabilities into our submarines, I pose a few serious questions for your consideration. While comment is offered on a few, answers are not. Thoughtful and practical answers are left to you, the community, for further discussion and serious consideration:

- *As an institution, are we really willing to commit and to invest adequate and stable funding for important technology development and insertion enterprises?* (In my view, it's not sufficient to seek DARPA [or other] funding, but then not be committed to share funding through transition, and then sustain the program going forward. Our past track record in this area is poor!)
- *Is industry truly motivated to invest in our future? Have we really done all we can to improve their motivation in this*

regard? (Except for certain, very specialized areas, we should diligently try to involve and give substantially more latitude and control to industry for technology exploration and development—far more than today. Industry is the system engineer and the systems integrator in our enterprise; and the enterprise being envisioned will require substantial and virtually continuous systems engineering to be successful.) We'll certainly continue to need in-house capabilities, but not so much that we inhibit progress, and not so much that industry is excluded as a major player—too often the reality today!

- *Are we willing to accept, indeed demand, that our programs include reasonably prudent technical risk, and then to manage that risk?* Arguably, if one selects a program with zero risk, it may be the wrong program.
- *For truly major potential gains in capability, are we sufficiently aggressive and disciplined in fostering parallel, perhaps competing concepts and technical approaches to a reasonable point of common maturity and demonstration before down selecting and committing to the single, final solution?*
- *Are we sufficiently diligent in maintaining a systems view of the efforts within our technology development enterprise?* (However *neat* a specific technology may appear, whether HM&E, sensors, payload [including weapons], or ISR, it should be evaluated and developed in the context of the total system in which it will ultimately reside—the submarine!
- One final questions: *Are we putting enough energy into educating and motivating our Navy civilian work force to become enthusiastic evangelists for submarines?* Perhaps not as silly as it may sound. Considering the size of the S&T budget and the number of scientists and engineers working on potential submarine-relevant technologies in S&T, it's perhaps prudent to ensure they feel *members of the team* and up-to-speed on where we're going and when we want to get there. Today, many are evangelists for the process; but not necessarily for the product. We can do better here, and probably reap real benefit from a small amount of effort!

This 225th year in the history of the United States Navy—the Centennial anniversary year for our Navy's Submarine Force—is the opening year in the history book of a new century—a century which offers clear opportunity and a real potential to realize, if we do our job right, even greater growth in submarine platform capability and resulting maritime dominance than the world has seen during the past 100 years. In the context of the preceding, then, perhaps the appropriate imperative in this symposium's title could be The Beginning is Now! Indeed, how well we select, resource, and manage our research and development programs, both ongoing and new, and how well we efficiently carry them forward to timely (read: early) implementation in our force, will strongly influence the position of submarines as indispensable providers to national security capabilities in the future, and will determine whether we, the submarine community, have truly succeeded—or have failed—to capture the opportunity and potential we have before us today!■

THE SUBMARINE FORCE AND TECHNOLOGY TODAY

by RADM M. Fages, USN
Director
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OPNAV

It is particularly appropriate that in our Submarine Force's Centennial year we discuss the technological advances that will increase our capabilities as we embark on our second century of service to our Navy and our nation.

In its infancy, the submarine was envisioned as being able to deliver torpedo payloads from inside the denied area constituted by the range of a battleship's guns. That vision, of course, required the solution of important technical problems. And just like our predecessors, we have a vision for what can be done with our exceptional submarine platforms—but we also must address some very real technical challenges. The remarkable success of our Submarine Force derives not only from the courage of the men who have taken them into harm's way. The ingenuity and dedication of the shipbuilders, maintainers, scientists and technicians who have always provided our people with the most capable platforms possible to support our national objectives is also very much responsible for our legacy of success.

Today, I will discuss how we intend to provide the capabilities that we will need in 21st century combat.

Much as the earliest submarines proved remarkably capable against that era's *area denial* threat, our submarines' ability to operate in denied areas within the 21st century littoral battlespace will provide unprecedented value added in the years to come. Simply said, "**access matters.**" In addressing our vision, I will also highlight a few programs, especially regarding intelligence gathering and UUVs, to demonstrate how we are matching programmatic investments to our goals.

In addition, I will offer examples of how our investments may lay the foundations for future concepts that until recently, belonged in the realm of science fiction. And finally, I will discuss the submarine's pre-eminent role in precision strike, an especially good example of how vision and technical execution have come together

to provide our nation with an essential capability. But before I discuss the details, let me first speak to some of the recent developments in the debate about force structure.

Since I spoke to you last year, both the Attack Submarine Study and the Trident SSGN study have been completed. I like to think of these both as customer market surveys, both of which looked at submarine roles in depth, and determined what capabilities were required to meet the needs of our customers. The 1999 Attack Submarine Study is the most complete and detailed study on submarine future requirements ever conducted. This study, mandated by the 1997 Quadrennial Defense Review, indicated that the CINCs would need 68 SSNs in 2015 and 76 SSNs in 2025 to meet all *critical* national collection requirements. *Critical* refers to requirements that are **vital** to U.S. national survival. The Attack Submarine study, and the SSGN study, arrived at two profound conclusions. First, they highlighted the growing importance submarines are expected to have in collecting the vital intelligence we need to effectively prepare for and to win wars. Second, the studies illustrated the key role submarines will play in the earliest stages of future conflict. I'll discuss this latter point later in my presentation, but let me first briefly discuss the increasing prominence of submarine ISR. According to the JCS SSN study results, the vast majority of the total number of mission days available to a force of 68 SSNs would be spent conducting national level or theater ISR. Again, this is a market survey taken from the warfighting CINCs, not from the Submarine Force.

Shifting gears, let me discuss why our CINCs believe submarines will have such great relevance in the future.

Military relevance is a function of 3 crucial factors: ***Combat Power, Access, and Knowledge Superiority***. Combat power is proportional to payload, but given a certain payload capability, its employment for maximum benefit is critically dependent on access and knowledge superiority. Without the ability to get in range of your target—access—combat power is diminished, and military success can only be bought at a high price in blood and treasure. Without knowledge superiority, combat power cannot be applied in a timely and coherent fashion on key targets. In other words, using precision guided munitions with maximum effect requires sufficient

knowledge of how an enemy is organized to enable us to hit those targets that really matter.

Since access matters, and is essential to what we do, let me discuss it in some detail. Access is a function of two components: Physical access and Electronic access.

Clearly, the submarine is our military's most effective means of enabling assured access within a denied area. Virtually impervious to detection, a well operated nuclear-powered submarine is nearly invulnerable to coastal cruise missiles, tactical ballistic missiles and the biological and chemical weapons of mass destruction that are likely to pose growing problems to non-stealthy forces.

Concerns over missile flight arcs are not just a theoretical problem. During the Taiwan Straits crisis in 1996, the United States carefully maintained its two aircraft carriers with associated escorts outside the range arcs of Chinese missile. Such a policy also served the political purpose of remaining *non-provocative* while still demonstrating our interest in the issue. Only U.S. submarines, including those attached to the battlegroup, operated in international waters well within the range of Chinese missiles. It was a clear demonstration of the principle: access matters.

Assured access, even for the submarine is not free; it is a precious commodity that must be husbanded and improved. The physical access our submarines now enjoy stems from a number of factors, including the submarine's acoustic and non-acoustic stealth and the quality of our sonar equipment and mine reconnaissance equipment—all areas of sustained high profile investments by the Submarine Force. But physical access is much more. Force structure plays an important role in physical access, because having a sufficient number of submarines ensures that we can provide physical presence in the key areas of national interest. UUVs or Special Forces launched from submarines may provide the physical access to a denied area. And in the future, our access will likely increasingly depend on advanced sensors and payload. For example, leave behind sensors, submerged weapons pods that fire when signaled, or submarine launched UAVs are all realistic examples of the submarine enabling future physical access.

Let me illustrate by example how our real-world investments will improve our ability to access the battlespace. The Submarine Force is making major investments in UUVs. The Long Term

Mine Reconnaissance system, or LMRS, slated for IOC in 2003, will provide precise, autonomous and long range mapping of mines and other ocean bottom features. We intend to equip LMRS with the Precision Underwater Mapping capability that will be resident in Phase IV of ARCI. All of the knowledge of the undersea battlespace collected by our submarines and UUVs will be shared interchangeably. By 2004, we plan to leverage off of our investment in LMRS and begin work on the Multi-Mission Reconfigurable UUV, which will carry interchangeable payloads. Payloads will only be limited by our imaginations. MRUUV will provide us with a capable and flexible payload *truck*, while development of better payloads and sensors will allow us to perform ever more superior intelligence gathering. UUVs will leverage our ability to improve both our physical and electronic access.

I foresee opportunities to use UUVs in concert with our ADS (Advanced Deployable System) fields. We have demonstrated the capability to recognize acoustic transients associated with deployment of mine-like objects, using an ADS field.

A family of UUVs dormant in an ADS field could be used to investigate these potential mine plants.

Consider how UUVs and ADS could be used in concert for submarine track and trail. An ADS trip wire detection could be used to cue a UUV handoff.

If we had an ADS field in an area where mine reconnaissance were in progress, a UUV could utilize the ADS sensors as communications nodes to send back tactical data or receive new search instructions. The possibilities are endless and we need to engage a group of bright young submariners and scientists to generate potential CONOPs that old fuds like Konetzni and me don't even dream about.

Now I'd like to flesh out the concept of electronic access in some more detail by focusing on ACINT, VISINT and SIGINT. As I said earlier, our market surveys indicate that ISR is our high-demand business, so our investments in intelligence capability will directly impact our ability to provide better products to our customers.

Electronic access is more than just the ability to put a submarine sensor in an area where electronic collection is. The quantum leap

in the submarine processing capabilities—made possible largely by the people in this auditorium and your colleagues in programs like ARCI—has required us to make a paradigm shift in how we collect and process intelligence.

Providing the submarine with improved data analysis capability is an element of the shift required to achieve real-time reachback. Even if all the fruits of our *data explosion* could be delivered via our antennas, we still will fail to deliver more utility to the intelligence analysts back home if we simply swamp them with much greater amounts of unprocessed new data. Let me provide a few examples of how we are using the advanced processing and algorithms made possible by the revolution in computing power onboard the submarine to improve our ability to provide the customer with better data more quickly.

ARCI and ACINT 21 are a perfect example. Working in concert with ONI, we're moving forward with the ACINT 21 program. ACINT 21 brings significant software upgrades to the submarine to allow refinement of collected data prior to data transmission off the ship. ACINT 21 will reduce the need for ONI to re-beamform and process the data received from a submarine. Currently, acoustic data is collected on tape, triple wrapped and then sent to Suitland once the submarine reaches home after a deployment. Once at ONI, analysts reprocess the data from the tapes in order to get the nuggets of useful data. Now we are on the verge of being able to provide already-processed data--nearly instantaneously—back to the analysts. ACINT 21 is being phased in through two versions which, for lack of a better descriptive term, I'll call *lite* and *heavy*. The *lite* version will provide ARCI-equipped submarines with the ability to record display data and play it back. This capability will permit the ship and the ACINT rider, for example, to isolate the most relevant contact data. This not only benefits the ship, since other watchstanders could be trained on the relevant threat characteristics in-situ, but the data could also be transmitted to the Battle Group commander and ONI analysts to provide near real-time threat data for tactical use and analysis. Our first ships will have ACINT 21 *lite* during FY 03.

In the *heavy* version of ACINT 21, there will be increased hardware, software and storage capability that will give the ship vastly increased capability to do real-time data analysis onboard.

Our first boats will be fitted with ACINT 21 *heavy* in FY 05. Though we're not all the way there, we're certainly well along the path toward real-time reachback, by providing much better and more timely product than we do when we ship our tapes in a box to Suitland three months after the fact.

On a related note, I'd like to briefly touch on the development of a Common Operational Picture, which will be evaluated next year as part of the Advanced Undersea Warfare Concept, or AUSWC. I'm very excited about AUSWC because it leverages off of investments we are already making in the Submarine Force to provide a major step forward in our Navy-wide ability to prosecute submerged targets. For example, we are investing in the Tactical Environmental Data System, or TEDS, which will provide high-fidelity real-time environment and bottom data. Actual environment data has obvious benefits for the submarine in terms of developing search plans and weapons presets. But through the Common Operational Picture that will be tested in the AUSWC, that data will also be passed to all elements of a battlegroup so that there will be real time sharing of ground truth. AUSWC will deploy with the Carl Vinson Battlegroup next year, and I am looking forward to it being a major success.

Similar examples exist in the realms of VISINT and SIGINT. For VISINT, programmed upgrades include an improved PERIVU and Infrared capability combined with digital imaging and processing to enable 24x7 capability. By incorporating techniques to compress large files, we will enable transmission of all images of interest without overloading broadcast circuits. In parallel with the ARCI/ACINT 21 example, VISINT no longer means developing wet film in Nucleonics or the Wardroom Pantry, followed by a swift entry into a cardboard box which was slated to wait months for transit to our intelligence community.

We are making similar progress in our SIGINT superiority initiative—combining the enhanced capability of the Type 18I periscope with the *Classic Troll* exploitation suite. These improvements enable a large step forward in wideband collection capability. Just getting a 3db improvement in sensitivity with the Type 18I makes an extraordinary difference in terms of the stand off range available to the submarine. As an aside, I also think this points out

a valuable lesson for us all, namely that dramatic capability advancements don't have to mean embarking on big new expensive programs. Just developing techniques to sense and better process data have allowed us to *mine* a few extra db, with a profound increase in capability. Real time reachback is also an important element in *knowledge superiority*. I want to underline the synergy that arises from *sharing* knowledge. Much as the "common tactical picture" I discussed in the context of the AUSWC implies significantly greater operational effectiveness through the sharing of knowledge, real time reachback will significantly facilitate support our deployed forces can receive from the shore establishment and provide to senior decision makers.

I would like to highlight a second essential point on knowledge superiority. Since the earliest days of the Cold War, we as a Submarine Force have cultivated the importance of knowledge superiority—we clearly wanted to know as much as possible about the military capabilities and doctrine of our opponent while limiting his comparable knowledge. As I mentioned earlier, this proven, successful ability to conduct ISR has resulted in a sharp rise in demand for submarine ISR in the post-Cold War world security environment. Yet in the past, modest investment in ISR programs with substantial payoff have not always been made. Today, we're changing that dynamic by making a stronger investment in areas such as ACINT 21, 24x7 VISINT and SIGINT superiority initiatives and other areas that will provide, in my view, a tremendous return on investment.

Let me now spend a few moments discussing combat power, specifically in the area of Submarine Launched Precision Strike. Credible combat power must be accurately delivered to have real impact on military operations. As many of you know, we have an ultimate goal to improve our payload by a factor of ten.

Our ability to operate in denied areas in the early stages of conflict positions us to have a profound impact on the outcome. Whether destroying key portions of enemy air defenses, hitting command and control complexes or other key nodes, our ability to strike with surprise from close in early in the conflict will likely play a disproportionate role in the outcome of any military action. Let me illustrate the point by way of a few examples.

In Afghanistan, our Navy conducted its first attack against a

landlocked nation. More importantly, we chose to fire from a submarine in order to catch the Bin Laden's terrorist camps by surprise. Our adversaries had not counted on the presence of submarines, and therefore we had a significantly greater opportunity to inflict damage.

To reiterate some of Owen Cote's points: as many of you know, allied air operations against Iraq and Serbia have encountered moderately potent anti-aircraft missile defenses—but these defenses were based on older, Soviet-designed systems, against which we had developed successful tactics. However, we have yet to encounter more modern Russian missiles such as the double digit SAMs. And while our countermeasures are likely to improve, I think that any pilot would prefer flying after airborne defense systems have been hit.

The obvious solution to this problem is to employ precision strike to hit critical targets such as SA-10 batteries and command and control elements before they can engage our aircraft. And, of course, submarine launched missiles are particularly potent for a number of reasons: by firing with surprise from close in, we reduce attrition to Tomahawks; furthermore, we have sufficient range to attack the launchers from widely separated aspects with a corresponding improved opportunity for success.

Many of our most difficult targets, like missile batteries, are mobile. Unlike fixed targets, which are now far easier to attack effectively using weapons employing GPS, hitting mobile targets remains a very difficult task—as those of you who followed operations in Kosovo know. One of the conclusions of the recent MIT conference on this subject is that the reduced flight time of missiles launched from close to shore is a great enabler. Coupled with real-time intelligence, this target set can be destroyed before it is moved. Destroying enemy defenses early allows our strikers to focus on power projection without the need to devote resources to suppression. I commend Mobile Targets From Under the Sea for your reading; it is exceptionally thoughtful.

We need to make some investments to ensure that we can effectively execute *time critical* strikes. Mobile target sets will only proliferate and our relevancy will be further enhanced when we can successfully engage them. Wouldn't it be remarkable if we were

able to respond to a time critical strike order and do in-flight re-targeting from below periscope depth? This capability, as a minimum, would require a capable antenna on the missile to feed back its data, as well as some version of a floating wire-type UHF antenna with both transmit and receive capability. The bottom line is that for time critical strike to be reality we need to *see what the missile sees* and be able to guide it accordingly. We need your help to work through some of the significant hurdles that face us in this area.

I know that I've covered a lot of ground in these remarks. In closing let me highlight the key points that I believe are the most essential:

1. This has been a great year for the Submarine Force, highlighted by the broad consensus the future requirements for submarines are growing.
2. The submarine will have growing relevance in 21st century warfare; access, knowledge superiority and combat power being vital attributes delivered by our forces.
3. We need to move forward with investments to ensure that we have an effective time-critical strike capability.
4. We have shifted our investment strategy to more fully reflect the importance of submarine ISR. The goal of real-time reachback is in view. With your help, we will be there soon.

Finally, we must be mindful that the capabilities of each individual submarine must also improve dramatically into the future. We must leverage the investments being made in a host of associated fields. We must realistically be prepared to answer the bell with fewer submarines than the CINCs would like in the years ahead. We will only be able to do that by optimizing the capability of each of our ships. With your continued contributions this will become a reality, and the submarine will be recognized as the true capital ship of the 21st century. Thanks.■

ATTACKING MOBILE TARGETS FROM UNDER THE SEA

by Dr. Owen R. Cote, Jr.

Dr. Cote is the Associate Director of the MIT Security Studies Program. This speech was delivered at the Submarine Technology Symposium on May 16, 2000.

Why will the Submarine Force be pulled into making contributions to the mobile target problem that was illustrated both during the great SCUD hunt of Desert Storm, and in operations against mobile SAMs and ground vehicles during Allied Force in Kosovo?

In particular, what are the technical and geopolitical trends that are creating this demand, and which also will make submarines part of the solution?

How, as an organization, will the Navy and the Submarine Force know when it is time to begin aggressively making it so?

What arguments do you make to demonstrate the need for this kind of innovation?

My basic argument is that comparative, qualitative analysis demonstrates that traditional modes of conducting strike warfare are, to varying degrees depending on the platforms, encountering diminishing returns, while submarines face nothing but increasing returns in this mission area.

What Are the Qualitative Trends in Each Box of the Matrix?

	Expeditionary Air Wing	Global Reach, Global Power	Carrier Battle Groups	Submarines
Obtain Secure Base				
Establish and Maintain Connectivity				

Find and Identify Targets				
Penetrate Target Defenses				
Destroy Target				

The key to this analysis is this matrix, whose vertical axis comprises five operational hurdles, all of which must be cleared in a successful strike mission. The horizontal axis lists the four main modes of conducting strike warfare today, distinguished by the platform which dominates in each mode.

I want to briefly discuss in a qualitative way the trends in each box in the matrix. In doing this, I'm going to be particularly sensitive to two issues. First, in the area in question, what is the balance between opposing forces today, and is this balance symmetrical, or if not, who is on the wrong side of the asymmetry? Second, looking at the future technical trends in this area, will efforts to improve this balance encounter increasing or decreasing returns on investment?

Let's look first at the land-based, tactical Air Expeditionary Wing, the traditional source of the majority of strike assets, and focus on the trends in penetrating defenses and obtaining a secure base. In both cases, we are, or soon will be on the wrong side of an asymmetrical relationship, and will face diminishing returns in our efforts to improve this relationship.

This is already clear in the case of penetrating defenses, as demonstrated by the following two quotes.

> "The Air Force needs to find and kill non-cooperative defensive systems much more effectively than it can today." LTGEN Marvin Esmond, DCS, USAF in 10/19/99 testimony before the HASC.

> "We would have had to fight our way in with brute force because we don't have the techniques to adequately defend

ourselves against SAM-10s and 12s." GEN John Jumper, CINC USAFE during Allied Force, Aviation Week 11/1/99.

The first quote is an acknowledgment that our current techniques are designed to destroy a cooperative target, but only suppress a non-cooperative target. A cooperative target is one that seeks to complete a SAM engagement, which creates a continuous radar signal that we then locate within 100s-1000s of feet, jam to reduce its range, and fire an antiradiation missile at. If the SAM operator stays on the air in an effort to complete the engagement, the missile will hopefully destroy the engagement radar before the engagement is completed and the missile will go silly. If the SAM operator shuts down, i.e. if he is non-cooperative, both the SAM missile and the HARM go silly, and both the SAM radar and the aircraft he's shooting at survive. In the first case, the defense system is destroyed, in the second it is only suppressed.

Iraqi SAM operators during the early days of Desert Storm were by and large cooperative, meaning that early in the war their engagement radars were essentially destroyed, and after that allied air operated freely at medium altitude without need for close SAM suppression escorts. Serbian SAM operators were non-cooperative in Allied Force, meaning that every Allied strike package needed the full panoply of SAM suppression escorts, and because those escorts have become so-called high demand/low density (HD/LD) assets, this put an upper bound on the rate at which the campaign could be prosecuted.

Now this was against an air defense system that was based on the SAM-6, the first Soviet mobile, radar-guided SAM, which we first saw in action in the '73 Yom Kippur war. Gen. Jumper's reference to the SAM-10 shows that more modern mobile SAMs, which we have yet to encounter even though they were first deployed in the 1980s, will defeat current defense suppression assets. This is because their phased array engagement radar and 80-100 mile range missiles (vice 25 for the SAM-6) can complete an engagement well before being hit by a HARM, and can also probably defend itself against HARMs.

The best analogy to the situation we face here should be familiar

to this audience. Existing mobile SAMs are like modern non-nuclear submarines, they may be relatively easy to suppress, but are very hard to kill, so you can't ever do without your ASW assets, and the ratio between the cost of mounting the threat and the cost of countering it is deeply unfavorable to the ASW operator. That's today. Double digit SAMs, which are around the corner, are the fast, quiet nuke, armed with wake homers or sea skimming antiship missiles. Here, the problem is that ASW is well nigh impossible, as it was for the Soviets during the entire Cold War, and as it was finally becoming for us before we were saved by the bell by the end of the Cold War.[1]

So that's where we stand, and note that there is a doctrinal problem here as well. SAM suppression assets are HD/LD because the Air Force is focused on the air-to-air aspect of defense suppression, witness the retirement of both the F-4G Wild Weasel and EF-111 communities. And the Air Force's answer to the SAM-10 problem is likely to be to replace today's F-16 Wild Weasels with an F-22 Wild Weasel, and to develop a faster, longer-legged HARM. In other words, replace a $50 million platform with a $150 platform, and replace a $250K weapon with one that will probably approach the cost of today's $500K Tactical Tomahawk. All the while remaining satisfied with a defense suppression capability that will still not prevent a non-cooperative target from surviving and fighting another day.

Now let's look at the trends in obtaining a secure base for tactical air expeditionary wings. In the near term, we have already encountered some political constraints on obtaining access to such bases, witness as just one example Operation Desert Fox against Iraq, in which the Saudis forbade strike missions flown from their territory. More important in the longer term are likely military threats to such access.

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1 Here the speaker is referring to his recently completed monograph entitled *The Third Battle: Innovation In the U.S. Navy's Silent Cold War Struggle With Soviet Submarines*. Readers of THE SUBMARINE REVIEW will remember a brief description of this project in the July 1997 issue. A copy of the report is available by following first the "Submarine Centennial" and then the "Submarine History" links at www.navy.mil.

There are two trends here. First, most countries do not make the $billion investment required to harden their bases, as we did in Europe, Japan, and Saudi Arabia during the Cold War. Thus, the ramps filled wingtip to wingtip with tactical aircraft parked out in the open, and the acres of tent cities that are both ubiquitous in current land-based tactical air operations overseas. No better target is imaginable for submunition-dispensing, GPS-guided, cruise and ballistic missiles. These are soft, fixed, very high value targets that exist in very small numbers and are not particularly time urgent and can be geolocated precisely well in advance of a conflict. Now this threat lies a little further down the road, but it is clearly coming, and it will result in tremendous asymmetries in favor of the opponent if we continue with our current emphasis on this mode of strike warfare.

The trends in these two boxes, defense suppression and secure base access, demonstrate the demand side of the technology pull I talked about at the beginning. We will need to pursue alternative modes of conducting strike warfare because the dominant traditional mode is well into a spiral of diminishing returns on investment.

Now let's look briefly at the submarine in these two boxes on the matrix. Briefly, because the trends are so clearly running in the opposite direction. Standoff precision weapons like Tomahawk operate with impunity against even the most modern air defenses, and future trends will continue to favor such weapons; witness the efforts now being mounted on our side to counter fast, low cross section antiship missiles. Likewise with obtaining a secure base. The base is the submarine, and to threaten that base you need an ASW capability against a fast, quiet nuke. Who has such a capability today, and what would be necessary to develop one? In the interest of time, and with this audience, I'm not even going to bother answering the question.

The story with intercontinental bombers and carrier battle groups is also simple to summarize. They will face the same trends in penetrating defenses that tactical aircraft will, but they will face fewer obstacles in obtaining a secure base. On the other hand, in neither case are the long-term trends regarding base access and security as favorable as they are with submarines. So bombers and

carriers occupy an intermediate position between land-based Tacair and submarines.

What about the other boxes on the matrix, keeping our focus on expeditionary land-based TACAIR and submarines? How about the trends in destroying the target? Here, there used to be an enormous advantage for TACAIR, in that real precision weapons generally required man-in-the-loop guidance, either with a laser illuminator or a line-of-sight data link to a weapon with a terminal seeker. But GPS has already begun changing that because it is even cheaper and yet gives an all weather capability. Thus, before too long, almost all weapons will be so guided, and indeed the Air Force has already decided post Kosovo to add such a capability to its Paveway series laser-guided bomb kits. By taking the man out of the loop of the weapon guidance process, you take away the need to put air crews within line-of-sight of the target in order to achieve precision in attacks against that target.

How about the trends in finding and identifying the target? Again, there is little or no basis any longer to distinguish between alternate strike platforms. Against fixed targets, the answer is a GPS-guided weapon using traditional intelligence sources for target info. Against mobile targets, the answer is that no strike platform today is effective at finding and identifying mobile targets ashore, especially non-cooperative ones. Here, creating the ability to find and identify such targets will put us on the wrong side of an asymmetric relationship. It will require the development and deployment of sophisticated and expensive offboard networks consisting of multispectral sensors, able to operate within line-of-sight of their targets, and linked together by jam resistant, LPI data links.

This is a truly formidable challenge, but it is not one that is unique to any particular strike platform. All strike platforms will exploit such networks, should they be developed, using reliable connectivity, and here again, there is no longer much basis to distinguish submarines from other strike platforms in this area. For example, compare submarines and land-based TACAIR—the latter has EHF, SHF, and UHF Satcom, while the former is largely limited to line-of-sight UHF voice and simple data modems. (Remember here that I said land-based TACAIR. Fortunately naval

aviation does not have the allergy to dedicated, high capacity, digital data links that the Air Force seems to have.)

But what about continuous connectivity? Here I would make two points. In the near term, as Admiral Fages quoted Admiral Murphy in the most recent issue of Undersea Warfare, "Submarines are now better than surface ships at strike. They had better launch reliability during Kosovo." And here's the key point: "They also seemed better able to react to the targeting." So the fastest way to put a weapon on a time urgent target in Allied Force was with a sub-launched TLAM, which tells you something about the continuous connectivity that was available to SSNs like USS MIAMI. In the longer term, perhaps in a more challenging ASW environment, there is obviously demand for continuous submarine connectivity to UHF satcom and Link 16 using a wet antenna; demand that it is encouraging to see both APL and Lincoln Lab working hard to meet today.

So where do we stand? Do you remember Ross Perot during the '92 election debate about NAFTA? He used to talk about the giant sucking sound of American jobs that would be pulled south of the border with Mexico. Well I think we're all going to begin hearing a similar sound pulling on the technology for striking mobile targets from under the sea the first time we face an air defense system based on the SAM-10, or the first time somebody lands a submunition dispensing TBM on a ramp full of F-16s.

Now I recommended in Mobile Targets From Under the Sea (an MIT Security Studies report available at http://web.mit.edu/ssp) that the Submarine Force anticipate this demand by looking first at the defense suppression mission against modern, mobile SAMs. SAM engagement radars are both a finite and very high value part of the mobile target set, particularly because their destruction enables the full exploitation of the one main advantage left for combat aircraft, the essentially infinite size of their magazines when they can ignore air defense systems. Thus, there is a wonderful potential division of labor here between submarines and both long range bombers and carrier battle groups, whose bases of operations will remain more secure than land-based tacair for some period of time, but which today face the same constraints in penetrating

modern air defenses.

Leaving that particular recommendation aside, I want to close by talking more generally about submarine sensors and payloads, and particularly about why the Submarine Force needs to be aggressive in moving down both these avenues as part of the pursuit of a significant mobile target from under the sea capability.

Start first with the sensor part. We all dearly hope that long endurance UAVs and satellite systems like Discoverer II will solve the problem of finding and identifying non-cooperative mobile targets with their SAR/MTI radars. But remember three things: two obvious and one not so obvious. Obviously, these platforms will need to operate and survive within line-of-sight of their targets, and many sensor phenomologies are not available on an air or space-based platform. Less obviously, is it wise to rely completely on such national or joint systems? Here is a quote from Admiral Harold Gehman, the current CINC JointForces Command:

"We are experimenting with processes that call into question the very strategy of the U.S. military in ISR, which currently is putting enormous amounts of money into reach back capability or more satellites. It ain't working. The intelligence is not getting down to the guys who need it. It may be that tactical-level guys need to get tactical intelligence themselves. This would drive an entire new investment strategy by the U.S. military." Aviation Week 5/8/00

One way for the Submarine Force to respond to this challenge in the mobile target area is to experiment with the great potential latent in the marriage between unattended ground sensors, covert RF communication networks, SOCOM, and submarines.

Now on to the payload part. I'll frame this discussion with a question. Is a large payload submarine an opportunity or an imperative? In other words, can the submarine force afford to assume that it will not bear a primary weapon launching role 20 years from now in precision strike from the sea?

Annual Cost Per Forward Delayed 21 Inch Diameter Weapon

	Lifetime (years)	Acquisition Cost ($ millions)	Lifetime O&S ($ millions)	Presence Factor	#21 inch Weapons	Annual Cost Per Forward Weapon ($ millions)
DD-21	35	550	525	.2	100	1.5
SSGN Conversion (non treaty compliant)	22	500	880	.5	154	.8

Annual Cost Per Forward Weapon on 20 Years?

DD-21	-	-	-	-	50	3.0
SSGN Conversion	-	-	-	-	308	.4

My second and last graphic is an attempt to show why I think it cannot. It compares the cost of forward deploying 21" diameter standoff precision weapons on submarine and surface platforms, both of which were designed from the start as dedicated strike platforms. The first comparison is today, and it shows that even when a DD-21 devotes almost all of its magazine to strike weapons, it is less cost-effective than a Trident SSGN that uses only half its magazine volume. The second comparison is tomorrow, and it shows what happens if DD-21 needs to start defending itself more vigorously, and if Trident SSGNs fully exploit their payload volume.

Now the only purpose of this slide is to demonstrate a simple quantitative trend in precision strike operations from the sea, which is that surface ships will face more formidable defenses than submarines in the close in battle early in a future conflict. This

fact, combined with the cheapness and long life of Admiral Bowman's fuel, and the fact that submarine crews are relatively small, making for very low operating costs, and, therefore, low life cycle costs as well, produces what for me was a stunning result when I first saw it.

Now this is a very small piece of primitive quantitative analysis in what has been a qualitative discussion. I will close by arguing that both the Submarine Force and the Navy will need much more rigorous, quantitative analyses of the trends and comparisons I have discussed here, both to decide what path to take in the future, and to convince others of the viability of that path once it is chosen.■

IN MEMORIAM

Mr. Arthur R. Cecelski
CAPT Enders P. Huey, USN(Ret.)
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SUBMARINE VISION

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This presentation was made at the Submarine Technology Symposium 2000. Rear Admiral Young was the Chairman of the session titled Submarine Joint Strategic Concepts for the 21st Century and his remarks opening that session are included in his subsequent Submarine Vision.

It is appropriate to begin this subject of *Concepts* and *Vision* by conveying some of the background that led to convergence of ideas and concepts and, most importantly, to the teamwork and innovation that is ongoing today.

Many of these efforts began about two years ago when the Defense Science Board Task Force on the Submarine of the Future clearly articulated the importance of submarines to our national defense. They recommended the Navy focus on the Payloads and Sensors capability portion of our submarines as opposed to putting more effort into the propulsion plant. And finally, and I think most importantly, they recommended we team with DARPA to tap the ability of industry to innovate.

The second backdrop for this morning's session deals with the efforts of the Future Studies Group (FSG). About two years ago, Vice Admiral Giambastiani chartered the Submarine Future Studies Group to work on future concepts and goals beyond the FYDP. The Future Studies Group has continued that work under the leadership of Vice Admiral Giambastiani, Rear Admiral Konetzni, Rear Admiral Fages, and Admiral Bowman.

The third backdrop occurred a year ago at this symposium when Dr. Paris Genalis and Ron O'Rourke challenged us, the Submarine Force, to articulate our far-term vision in terms of bringing compelling capability to the fleet. To continue that theme about eight months ago, the Director of DARPA, Dr. Frank Fernandez, also requested the Navy further articulate a general vector for where the Submarine Force is going in the future. All of these

influences precipitated the FSG-lead efforts this past fall to develop the Submarine Joint Strategic Concepts, which have subsequently been endorsed by the Submarine Force leadership.

The fourth backdrop that I would like to mention is teamwork or partnering. The FSG has lead the efforts that incorporated some very important work by the Navy organization and industry. The first element of the teamwork and partnering that I'm talking about is the Naval Maritime Concept for the 21st century. A year ago, we were honored to have Vice Admiral Tom Fargo, then Deputy Chief of Naval Operations for Plans, Policy, and Operations speak to this symposium. Since that time, the Navy has better focused its concepts of the future. It has operationalized them and, through wargames and engagements with the CINCs, I believe the Submarine Force's strategic concepts that we have developed are well within the context of this evolving Navy concept. That is one aspect of the partnering and teaming that I am talking about.

The second aspect is the teamwork or partnering with industry. Since its inception the Submarine FSG has engaged with industry for ideas and innovation during development of the strategic concepts. The FSG was directly engaged with the DARPA/Navy Payloads and Sensors Program industry teams. The nature of the teamwork was such that it would be impossible today to separately talk about the industry efforts and the government efforts. These efforts were synergistically combined in producing a Submarine Force future that is only possible when combining the best resources of all involved. Because the DARPA/Navy Payloads and Sensors Program work is ongoing and competitive in nature, it is not possible to share any of their proprietary information at this time. However, we will give the vector that we, the Submarine Force and the industry teams, are on. The FSG has developed in parallel with this industry effort, the Submarine Force Vision. We are not giving rudder orders to the industry teams but we are working with them to take advantage of the prevailing current.

The events and efforts that I have just described are the underpinning of this work, which is still in progress. The future that we are setting our path towards will be characterized by innovative revolutionary capabilities that submarines will provide, and innovation in the business approach to delivering those capabilities.

I believe it is an exciting time in the Navy and certainly an exciting time in the research and development and acquisition communities to help craft new submarine capabilities.

The Submarine Force has defined its path to the future with the goal being four concepts:

- Gain and Sustain Battleforce Access
- Develop and Share Knowledge
- Project Power with Surprise from Close-in
- Deter and Counter Weapons of Mass Destruction

First of all, it is important to understand that submarines have access. Most believe that there will be access challenges in the future. Many realize that there are access challenges today. And submarines can get into the area of interest as we've just discussed—whether it is militarily or politically denied—and set the stage—prepare the battlespace—for follow on forces. And we can sustain our presence there and be part of the team to protect our forces.

Once there, we can collect the information necessary to develop and share knowledge, our second concept, a critical enabler for all of our military operations and crucial to our nation's peacetime efforts.

Should the situation develop, we can project power: missiles, special forces, offensive information warfare, bringing our unique ability to get close to shore and attack with surprise.

And finally, as many of you know, the most challenging and insidious threat to us and our allies is the use of Weapons of Mass Destruction. With the submarine's inherent access capability, and through specialized applications of developing knowledge and projecting power, submarines can be a key contributor to solving this growing threat.

Three very relevant studies provide the underpinning and are integrated as a part of the future vision for the Submarine Force.

- The Defense Science Board report set the stage for the DARPA/Navy Payloads and Sensors Program. It stated the following:

a. SSNs are the *Crown Jewels* in America's arsenal
b. America needs more, not fewer SSNs
c. A Flexible Payload Interface is needed.

- The JCS SSN Study stated:
  a. 68 SSNs will be needed in 2015
  b. 76 SSNs in 2025
  c. 18 Virginia class will be needed by 2015

  And projected ISR to be 72 percent of peacetime tasking
- Naval Maritime Concept
  a. Forward Presence with a Landward Focus
  b. Knowledge Superiority through Network Centric Operations
  c. Effects-base vice Attrition-based Operations

The FSG was chartered in 1998 by N87, then Vice Admiral Giambastiani, and our charter was to develop future concepts with the emphasis on revolutionary capability. It was designed to provide needed focus to industry, DARPA, ONR, and government laboratories to enable them to invest in the technologies that will provide military capability from under the sea—needed in the 21st century.

The strength in the FSG lies in its smallness and its closeness to Submarine Force leadership and the ability to communicate these thoughts and ideas. There have been three significant efforts that the FSG has undertaken.

One are the concept statements, the first two of these concepts statements are focused on ISR and Payloads.

Second, an effort to engage junior officers and get their innovative ideas on where the Submarine Force should be in the future. These JO innovation efforts are important as they bring tremendous ideas for both the near term and far term. John Schuster will talk later about the importance of this effort and how our vision of the future will challenge the innovation, dedication, and proficiency of our sailors in new and exciting ways.

And finally, our third effort in the FSG has been the Submarine Force Vision—formulation of the Submarine Joint Strategic Concepts for which the remainder of the brief is focused on.

The goal of the Submarine Force's efforts is to map out an

investment strategy to position us as a relevant element of the joint force for an uncertain future. The future we looked at is considered to be the 2020 timeframe, which is very much consistent with many of the Navy and Joint Staff's long term plans. However, to develop our investment strategy for the long term we first need to define what capabilities we will need for the 2020 timeframe.

To define those capabilities, we must understand what submarines will do in the 2020 timeframe, and to do that, we must have a strategic vision for future submarine operations. That is where the Submarine Joint Strategic Concepts come into play—they set the framework for the future of which all of our efforts are based. The ultimate goal of this *process* is to define the technology roadmap that will provide the Submarine Force with the capabilities they will need in 2020.

The way we approached this was with an alternative future world study, which is a credible methodology. We established a study team consisting of senior submariners with significant operational experience, non-submariners who would provide us with a broad view of naval operations, as well as other independent reviewers. We used a top-down, capabilities based approach. The alternative worlds are broad in context and we adopted the National Defense Panel Worlds to circumscribe the vector of the uncertain future. In this process we found that the common challenges of the alternative worlds we will probably face in the 2020 timeframe have five basic characteristics:

- There will be a proliferation of weapons of mass destruction.
- Access challenges will exist
- Quiet, long endurance coastal submarines will be our adversaries primary opponent
- Competition for information advantage in cyberspace will proliferate, and
- Littoral operations will predominate the area in which we will operate.

This effort gave us four alternative worlds.

- Shaped Stability (optimistic)
- Extrapolation of Today (challenging)
- Competition for Leadership (more challenging)

- Chronic Crisis (new challenges)

We started by defining a set of candidate submarine tasks that were examined across these future worlds. We defined these candidate submarine tasks based on history from evolving strategy and a review of forward looking assessments of defense needs. It's important to note that the submarine tasks were formulated by the efforts of experienced submariners and other military officers having significant current and past knowledge of submarine and naval operations.

Using the four alternative future worlds, we built three matrices, all with respect to the alternative worlds. The first matrix examined common world characteristics such as economic, transnational challenges, WMD proliferation, ethnic rivalries, U.S. influence, and what level of challenge they presented to the U.S. The second matrix examined the importance of the elements of national strategy, the elements of engagement, homeland defense, counter asymmetric threats, and regional conflicts. And the third matrix examined the importance of the elements of the naval maritime concept which supports our military strategy, such as forward presence, knowledge superiority, battlespace knowledge, and battlespace attack, control, and sustainment.

Based on the information from each of the matrices, we evaluated the relative importance of candidate submarine tasks in each world, both in a naval and a national context. We then determined the relative importance of each of the candidate tasks using an evaluation across the worlds, which provided us with a representative set of tasks that account for future uncertainty. It's important to realize here that the alternative future worlds analysis was conducted within a national and joint context and we assessed submarine contributions to both the joint and naval operations.

We then took the evaluation one step farther—we reviewed our *list* of the highest priority submarine tasks for the future and identified the common operational themes, these common operational themes are the Submarine Joint Strategic Concepts.

As I mentioned earlier, these concepts set our vision for the future. The Submarine Joint Strategic Concepts are:

- Gain and Sustain Battleforce Access for Joint and Naval Battleforces

- Develop and Share Knowledge Netted with Joint and Naval Forces
- Project Power with Surprise from Close-in, complementing fires from other forces, and
- Deter and Counter Weapons of Mass Destruction as an element of Join Forces.

Vice Admiral Cebrowski in November 1999 articulated in *Naval Institute Proceedings* the need to rebalance the Navy-after-Next, to assure adequate forces for access, as well as power projection. He stated that access and power projection defined relevance for future operations. I contend that, within the context of our strategic concepts, that access, knowledge, and power projection define relevance for the Submarine Force of the future. The submarine's ability to gain access enables it to gain and share knowledge, gain access for the battleforce, project power, and impact the efforts against WMD as a unique and complementary element of our joint and navel forces. Finally, these concepts apply accross the spectrum of operations, not just during conflict.

Gain and Sustain Battleforce Access. Submarines leverage their enduring attributes (stealth, endurance, agility, and firepower) to gain access and develop the conditions that will enable access for follow-on forces. In peacetime and the transition to conflict, as the first arriving military asset, submarines can provide non-provocative presence in what might be termed *politically denied areas*, or if necessary the submarine can be overt and while it's there it can gain and gather information characterizing a theater of operations. Submarines capitalize on proximity and covertness and will be ready to neutralize threats to U.S. and allied forces.

Finally, as combat is engaged, submarines operating in collaboration with other forces will be key elements of battleforce protection, aggressively seeking out adversary challenges, sending required warnings, and eliminating threats. Throughout the spectrum of operations, submariners will employ the expanded reach of offboard systems and vehicles as a force multiplier, further sustaining battleforce access.

The second strategic concept of Develop and Share Knowledge stresses that knowledge is the underpinning for battlespace aware-

ness. Joint and naval forces harnessing revolutionary capability for information collection and processing will achieve an unprecedented visualization of the future battlespace, which will enable collaborative and simultaneous efforts to solve the most complex of battlespace problems. Through the vastly expanded reach afforded by new onboard and distributed sensors and offboard vehicles, submarines and their adjunct systems will collect, synthesize, use, and share information and knowledge of the battlespace. Submarines will be a node in the larger network to enable the battleforce to develop dominant knowledge, but will also leverage their unique position and collection capability to obtain tactically useful information.

Attaining dominant knowledge necessitates the sustained clandestine collection of information leading to a complete awareness of adversary decisions and operations. The results will be an unprecedented ability to conceptualize and predict adversary actions and responses, potentially deterring conflict escalation. This ability also enables the battleforce to confuse and disrupt the adversary's strategies leading to optimum U.S. and coalition force employment.

The third concept is Project Power with Surprise from Close-in. Submarines complement power project forces—attack with complete surprise, from close to land, and with relative invulnerability. During peacetime and the transition to conflict, submarines will execute deterrence through assured devastating response as we have for so many years.

Submarines will leverage their unique operating profiles, stealth, and endurance that enable early and sustained access to threaten and/or provide critical firepower. Surprise and the ability to attack from close-in, providing rapid attack are a force multiplier and increase uncertainty in the mind of the potential adversary.

With dramatically improved payload capabilities, including information attack, submarines will provide the Joint Force Commander with a wide range of power projection options. During combat, submarines will operate in areas not otherwise accessible to other members of the Joint Force and they will augment these forces by providing survivable, prompt, precision striking power. Embarked Special Operating Forces fielded with an array of equipment will conduct clandestine direct action ashore against

targets that demand their specialized capabilities and absolute surprise.

The fourth strategic concept is Deter and Counter Weapons of Mass Destruction. This is a fundamentally different approach to deal with the WMD threat. As I mentioned before, the proliferation and potential use of weapons of mass destruction is considered to be the greatest threat to U.S. security in the future. Deter and counter weapons of mass destruction enhances the security of our allies, and reduces the threat of the asymmetric employment of WMD against U.S. and Allied forces. In the face of proliferation and non-state employment of WMD submarines, as a component of Joint Forces, will offer a clandestine solution to gathering information and executing attacks necessary to counter the threat of WMD use. Deter first with credible and assured threat of devastating response should WMD be employed against the U.S. or its allies.

Submarines can be a key player in developing the knowledge of adversary efforts to develop and use WMD. This allows the U.S. to counter through exposure and sanctions against the offenders, as well as disruption to compromise their WMD capabilities, or attack to eliminate the capabilities fielded or in development.

That sets the context for the future, as defined by the Submarine Joint Strategic Concepts. During that process we defined representative submarine tasks. We started with approximately 50 candidate submarine tasks for the alternative futures analysis. After assessing those tasks in the analysis it resulted in 25 representative submarine tasks for 2020. This was not a prescriptive list, but a representative list.

The next step was to operationalize the list, so we got the warfighters involved and got their input on this list of submarine tasks for 2020. As part of our Strategic Concepts Working Groups, the TYCOMS reviewed the analysis—looked at the tasks in an operational context. The result is a list of 23 submarine tasks for 2020.

HIGH PRIORITY TASKS FOR 2020

- Clandestine ISRT
- SOF Operations
- Mine Reconnaissance
- Underwater Mapping
- Littoral ASUW
- Theater ASW
- Attack Against Hard or Deeply Buried Targets
- Rapid Attack Against Time Critical Targets
- Strategic Deterrence
- Forward Presence
- Information Operations
- Forward Engagement
- Suppression of Enemy Coastal Defenses
- Theater Nuclear Deterrence
- Tactical Reconnaissance and Targeting
- Combat Situational Awareness
- Attack against Nodal targets (with high volume, if required)
- Interdiction Operations
- Theater Network Reconstitution
- Covert Neutralization of Mines
- Theater Ballistic Missile Defense
- Arctic Operations
- Extended Mobility Operations

Submarines as a Component of Joint Forces

This list represents the highest priority submarine tasks for 2020. This builds upon the existing capabilities of today's Submarine Force, and they represent the tasks in which submarines can provide a compelling contribution to joint and naval forces across the spectrum of operations and within the context of the Joint Strategic Concepts. Significant warfighter involvement was used in the development of this list.

The question that we next dealt with is why do submarines need to do those tasks? In other words, what is the compelling reason for submarines to have the capabilities to execute these tasks?

First of all—unalerted presence—we exploit surprise; for example,

- it allows SOF employment for maximum effect;
- we also defeat the adversaries' denial and deception tactics; adversaries know when satellite coverage is not available—submarines can defeat this today and they can defeat this in the future. An example is the India-Pakistan nuclear testing—they were aware of satellite timing and

coverage and we were unable to get the information. Submarines could get information like that.

First in and last out—stealth enables access and staying power. Not only do submarines have access, but they can enable access for the battleforce and help sustain access. Submarine collection contributes to determining adversary operating patterns and intent and creates uncertainty in the mind of an adversary.

And certainly dwell combined with vast sensor reach will give us the capability to stay on station 24 hours a day, 7 days a week, independent of the weather.

Close-in, On-scene Operations—being close enables us to be responsive and to maneuver the deployed sensor net, what we call expeditionary sensors.

- It also enables quick response or pre-emptive fires with surprise, producing maximum effect. An example is the strike against Bin Laden. That particular strike was a combined surface ship and submarine attack in Afghanistan. Surface ship movements were observed and may have given away the operation. A couple of SSNs could have probably accomplished that same mission with surprise, but with probably different results. Can you imagine what would have happened if we had a submarine with greater volume of firepower such as the SSGN and be able to do that with surprise.
- The ability to be close in provides the opportunity to collect information that is not available using other sources.

With these attributes, submarines provide the Joint Force commander with options.

The next step in our Path to the Future is to define the desired 2020 capabilities. A TYCOM Working Group conducted a representative set of end-to-end assessments of the submarine tasks, which resulted in a long list of desired capabilities to accomplish those tasks. I cannot possibly go into that list in detail since it is an exhaustive list.

However, reviewing this list of capabilities and their associated tasks, you can roll them up and identify three overarching *capability themes*. First, extended reach through offboard vehicles and

distributed sensors. Second, being fully netted to national and theater command networks is absolutely crucial and this is something that the type commander working group insisted is a prerequisite to operations in the future. And third, greater adaptability through modularity.

Now that we have the strategic vision embodied in the Submarine Force strategic concepts, we have an idea on how submarines will execute the vision—submarine tasks for 2020—and we know the desired capabilities to execute those tasks. So what's left?

Next we need to look hard at what technologies we will need to execute this vision and define our investment plan to prepare for the future. We have just recently reorganized the submarine technology management system to take advantage of this particular construct and we'll do the technology development as the strategic concept working groups turn over their deliberations to these groups.

TAKEAWAYS

- The Submarine Force is an essential element within the Navy's vision for an uncertain world
- Submarine Joint Strategic Concepts provide focus and are compelling
  - ⇨ Support Joint and Navy concepts and strategy
- Expanded capabilities critical to the future vision identified
  - ⇨ Extended reach, fully netted, and adaptable

Access ... Knowledge ... Power Projection

➡ Relevance

So what are the takeaways? The message I want to leave with you from this part of the presentation is that the Submarine Force has a vision, we believe the vision is compelling, and we have identified the capabilities needed for our future vision, and now we need to turn this vision into action, which will require a team effort from both the government, as well as industry, as well as other agencies outside of the Navy.■

Computer image courtesy Electric Boat Corporation

Victory on Land Begins Under the Sea

The role of SSNs has changed, reflecting the challenges of the post-Cold War world. So, we are aggressively incorporating new technologies into the *VIRGINIA* Class. Optimized for the littoral, near-shore environment, these submarines will be the ***first in*** and ***last out*** to prepare the battlespace, launch land attack missiles, deploy Special Forces and more.

We are teamed to build the *VIRGINIA* Class. And we're proud to serve the Navy as it charts a new course ***Forward from Under the Sea.***

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CAPABILITY VISION

by John Schuster
OPNAV N875

As a product of, and complement to, the Submarine Vision, we can now outline where we are going with capabilities and technologies and how we are proceeding to take this vision to reality.

First of all, we can say what's revolutionary about this, and hopefully, it will be apparent that we are proposing to do things quite differently than we do today. We see five major areas of technology that are important in this revolution. The first one, and one of the most important, is this whole idea of getting offboard. We're talking about sensors in the water, on the bottom, on the sea, on the surface, on the land, but away from the submarine. And why do we do this? Because it gives us an order of magnitude more coverage in the Intelligence, Surveillance, Reconnaissance, and Targeting (ISRT) arena. It allows us to use sensors that are quite different from today. Today we talk about SIGINT and visual sensors, but for the future we also talk about acoustics, vibration sensors, and perhaps chemical and biological sensors for WMD. The idea of this sensor network is that it's covert—it defeats enemy efforts of denial and deception against our satellites and against today's other assets that they can see and avoid. Importantly we think in the future that it fits into targeting. The whole idea is that this sensor network can be used not only to provide information about what's going on, but to provide localization information for follow-on targeting either from ourselves or follow-on forces.

The next revolution is offboard vehicles—the way we buy extended reach with the sensors is to put them on vehicles that swim, that fly, and that walk on the ground to get them off and away from the submarine. Doing this covertly with a wide range of payloads enhances the stealth of the submarine. Submarines do not have to operate close to shore and at periscope depth in order to make these things possible. And when we need a man in the loop for high priority missions such as when you need a guy on the ground, we have the Advanced SEAL Delivery System and our

SOF forces.

To make all this work, we need dramatic improvements in processing back on the submarine. The submarine needs to be able to monitor the networks we put in, it needs to react to the information that comes from them, it needs to move the sensors around when necessary to cover the right areas, and it needs to do this in near real-time. Lots of times today we don't see the results of ISR for months afterwards. In this vision we will have to react in seconds, and minutes, and provide the information back to follow-on forces. Not all the processing will be done onboard, but enough processing to send the relevant nuggets back to the follow-on forces. All of these things are also available to the follow-on forces when they arrive, particulary the ground sensor network.

The fourth area is connectivity; it has been said that submarines don't have a connectivity problem—they have a stealth problem. The issue is how do we get high data rate connectivity while maintaining stealth for a long period of time. Concepts such as high bandwidth fiber optic with a remote surface buoy that can communicate at high data rates back to the joint forces or back to CONUS are potential solutions to this problem. In addition to communicating with other forces we have to communicate with the sensor network. The combination of advanced microcomputer technology, wide bandwidth, low power, hard-to-detect RF communications systems, and then perhaps connecting fiber optic networks under the sea provide another solution to this.

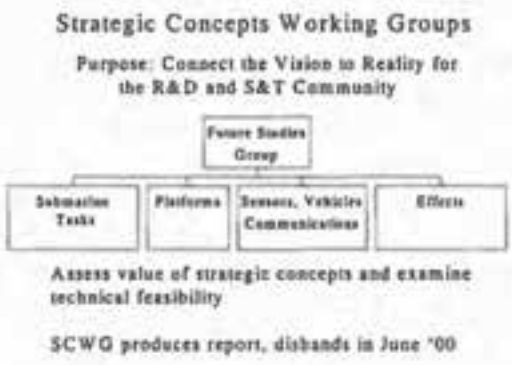
And the final area is payload—we need more volume, we need more flexibility in that payload ... we're not going to send everything out of a 21 inch tube. Miniaturization is going to help expand the capacity of the payload that we buy—a big piece of this is adaptability. The submarine itself is going to be adaptable with payloads installed in a matter of hours or days using the modularity concept. Of more significance, the whole force will be extremely adaptable at the theater level to do the missions that we are tasked to do. And the weapons we carry can be a much wider variety than we talk about today: potentially to neutralize mines, not just to detect them but be able to counter them, to attack swarms of small surface craft with small weapons, and to take out coastal defenses. All of these things we talk about are challenges and are clearly

revolutionary capabilities and technologies. However, what impressed us when we looked at this list is that all of these things build on the strengths that we already have in the Submarine Force or that our American commercial technology is already developing. Small, powerful computers, miniaturization, electronics, communications ... all these things are heading in that direction, which we think is the right direction to go.

We also need a corresponding revolution in the way we use our human resources onboard. The strategic concepts by their nature are demanding: increasing levels of effort onboard the submarine, controlling all these offboard vehicles, monitoring and placing all these sensors, and significantly increased data throughput back into the hull. We need to do that without arbitrarily increasing the number of people we carry onboard and, more importantly, not overloading the people we already have. Some of this is technological; computers and automation are going to help. More importantly, we really have to take to heart the kinds of things that Secretary Danzig is saying and aggressively remove barriers to improve quality of work. It's not a nice to have, but it is essential to meet the missions in the future. And what we are going to lever on here are the traditions of the Submarine Force: the technical proficiency of our people, their ability to innovate, and their personal initiative are going to be critical in the future.

Now that we have articulated a vision, the question is how are we going to take this long-range vision and mold it back into budget submits, to acquisition plans, etc. And we are starting to do just that ... the Future Studies Group stood up four strategic concepts working groups. In the figure on the following page are the areas the working groups reviewed: the first group comprised of fleet representatives looked at submarine tasks and capabilities; a second group looked at the submarine platform; a third group looked at the offboard concept—sensors vehicles, and communications; and a last working group assessed submarine effects (weapons). We are conducting these reviews over a short term in parallel with the DARPA-Navy Payloads and Sensors Program. The Payload and Sensors Program efforts are at a time when most of what they work

on is proprietary so we're trying to set the umbrella in place now to be able to pickup what's coming out of those efforts.



These groups are small groups and we've staffed them with members of industry, government, and the fleet. The fleet involvement here has been critically important to what we are doing. These groups have been validating what we have done to date with the strategic concepts and submarine tasks and going forward to validate the technological feasibility of the concepts. Our intent is not to setup a new process; our intent is for these groups to disband this summer, and turn over the results to our existing Submarine Technology process. Supporting this, we have recently realigned the entire SUBTECH process to match the strategic concepts, and we have also directed that the DARPA-Navy consortia become part of that SUBTECH planning process. Our intention is to meld together the things that are going on within the processes we have today.

I will discuss each of these four groups quickly and talk about what they have been doing. In the first group, submarine tasks, we had heavy involvement from the fleets—both SUBLANT and SUBPAC. They reviewed, in detail, the strategic concepts and the submarine task list. They validated these, modified them slightly, and produced an extensive list of desired capabilities for 2020 that the fleet has identified as needed for the future to execute the strategic concepts and submarine tasks. A critical element identified by the TYCOMS is adaptability—that concept of adaptability

through modularity is very important.

This adaptability concept that we talk about is enabled by modularity on the submarine. The platform group has looked at this and there are two areas that they focused on. One, is what we're calling payload modules. It must be emphasized that this is just an example and has not been through an extensive design effort. The idea is that fairly large payloads can be of different types and are rapidly deployable. The idea is that these things can be installed and removed from a submarine while forward deployed, to completely reconfigure a submarine's payload. The modules are extremely flexible in their interface with the ocean and they may be interchangeable with other forces such as surface ships.

In addition, the group identified platform modularity as an important piece of the future. The idea here is that the submarine itself would be made up of modules. When major changes to one of these modules was required, instead of laying the ship up in a major overhaul for years, one could go in and cut out a section of the boat and replace it perhaps in a matter of months. Again, we think this is a key for where we may go in the future and concepts like making an all electric ship are going to be an important enabler to be able to do this.

So what do you get out of all this if you have modular submarines? No longer does every submarine have to be able to do every mission all the time, but we have the capability to change out individual modules as part of an overall strategy for how we outfit the Force to meet the missions at that particular time.

The group looking at offboard sensors is looking notionally at whether or not these concepts we talk about are really feasible. For example, in terms of offboard sensors, they've looked at whether in 15 or 20 years we can take something the size of a cell phone, add a sensor capability, a communications capability, and a lifetime duration on the order of months. Basically there are technologies that we think will be able to do that. They then looked at an ongoing UAV program. They looked at a DARPA LOCAS vehicle—about $30,000 or $40,000 to build one of these that with its current design could deploy about 50 of these types of sensors.

And while the vehicle duration is relatively short, the duration of the sensors is very long and aligns with the concepts that we're talking about.

Next is communications—this group looked at the feasibility of a submarine to carry and lay small fiber optic cables to establish links back to the joint forces. Buoys to talk to the land based sensors, underwater connectivity to these links, and RF links in the air—and concluded that these are feasible with the types of technology that is coming out today.

Overall, we concluded that near-term technologies are supportive of our long-term visions.

The weapons or effects group is looking at how submarine carried weapons can play in joint fires. A key driver for submarine fires is what we call non-provocative dwell. The idea is that we can bring in weapons to augment, not supplant, but to augment our joint forces that the enemy doesn't see and therefore doesn't react to. Submarines can fire from close in and with great surprise. This group has conducted some first order analysis through wargaming and what we are seeing is that we have the potential to blunt the enemy early as they start to conduct operations and that could effectively shorten the war. And so we think we could contribute to joint fires with this capability.

This group is also looking at weapons to defend against swarms of small craft, possible weapons to neutralize mines and do it covertly, and they are also beginning to look at what we could do to counter weapons of mass destruction. My first takeaway is that offboard vehicles and sensors are the key and at the heart of what we're talking about in these strategic concepts to extend the reach of the submarines.

Connectivity is critical—it's not just important but it is absolutely required... both connectivity back to the joint forces as well as to our networks.

And finally, modularity is really crucial in the platform in order to provide the adaptability we need across the Force, and we believe that this is doable.

We see no show stoppers from the work that is going on today and we think this is achievable considering the direction of current technology.

Today, and over the last few years, we have developed the SUBTECH process. I think we are all very proud of that process and how its working and particularly its interaction with the R&D and the S&T communities. But it has been primarily focused on the POM today.

Our vision for the future has been set by the Future Studies Group and endorsed by Submarine Force leadership for the 2020 timeframe.

Our challenge is how do we tie those two things together. What we are looking at and what we are already achieving success in is coupling across from the POM to the vision for 2020. In the Future Naval Capabilities process we have been successful in getting funding for UUVs. We're also getting funding from the ASN chief technology officer for the Navy to provide demos for technologies like CAVES, which we think is going to be critical for where we are going. The buoyant cable antenna with DARPA, the DARPA-Navy payloads and sensors program are all critical to where we're going. As I mentioned before we have realigned the SUBTECH process. It now encompasses and is reflective of the joint strategic concepts. DARPA, ONR, and the consortia are going to be members of that team going forward. We have made commitments now to industry that DARPA is going to continue beyond the current level of contract in the payloads and sensors program and that the Navy has committed to industry to take proposals and to fund demonstrations of their concepts beyond the end of this work in the fall.

So the bottom line is we're excited about this but we're serious about this, and this is where we're really going.■

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Richard Malins	CAPT Chester Malins, USN
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Justin Miles	MT1(SS) Alan Miles, USN(Ret.)
April Mohr	LT Dennis Mohr, USN
Lena Muir	MTC(SS) Darryl Muir, USN
Erin Orren	MMCM(SS/SW) Dale Orren, USN
Sara Orzalli	CAPT John Orzalli, USN
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REMARKS AT OLD TIMERS LUNCHEON

by VADM B.M. Kauderer, USN(Ret.)
San Diego Maritime Museum
14 April 2000

Thank you, Captain Schwanz, for inviting me to speak at this very special Old Timers Luncheon. I assume that implied in that invitation is the pre-condition that the speaker must be one. Not too subtle, but OK, I'm here.

We are gathered to commemorate the 100th anniversary of a Submarine Force that has been, and remains, so much a part of our lives. Since receiving the invitation, I have given considerable thought to what I might say to Old Timers and not-so-Old-Timer friends on this occasion.

I must note that when I was a junior officer, even up through my command days, the annual Old Timers Luncheon was looked upon as entering a time warp, a step back through the glorious history of our force to an era of war at sea that would remain unique in maritime history, never to be repeated. It was an opportunity to honor our much revered heroes who had played such an important role in the World War II victory at sea.

It was not unusual to look about the dining room and be able to count a number of Silver Stars, Navy Crosses, and an occasional Congressional Medal of Honor. It was a thrill just to be with them, for the memory of that conflict was still relatively fresh in our minds, sustained by books and movies. We marveled, more accurately, shuddered, at the thought of conducting a torpedo attack, on the surface, deck gun blazing away, surrounded by the enemy, at ranges that hardly allowed the torpedo minimum range counter to enable the warhead detonator..or, threading your way through a minefield to gain access to an anchorage or an inner harbor to conduct an attack, and then, having stirred up a hornet's nest, get out of there, back through the minefield, in one piece...or, lying to on the surface within a stone's throw of a hostile beach while inserting or recovering special agents by rubber raft, or surfacing off the enemy's coast to conduct a deck gun attack on a

passing train...living helplessly through a relentless depth charge attack, praying that Manitowoc had built a strong boat...or, more basically, trying to fight a war with torpedoes that bounced off a target's hull, after risking your life to get close enough to be sure of a hit. And so forth. One story more daring than the other.

Two percent of the Navy sank 55 percent of all enemy shipping. The cost was high. We all know the statistics—52 boats lost; with 374 officers and over 3100 enlisted men. More decorations for valor awarded per man than any other Navy branch. I quote: "We shall never forget that it was our submarines that held the line against the enemy while our fleets replaced losses and repaired wounds", said Fleet Admiral Chester Nimitz. He went on to say "It is to the everlasting honor and glory of our submarine personnel that they never failed us in our days of great peril".

Many of those heroes are still with us today but a new generation of Old Timers is emerging to sustain and carry forward our traditions and noble heritage. The significant role played by submarines and submariners during the Cold War with the Soviet Union is finally, in part, a matter of public record. Whether you like it or not, Blind Man's Bluff has broken through the veil of secrecy to reveal in part to the American people the great return on investment our nation has realized in its post war Submarine Force. A collection of anecdotes, legends, and snippets of conversations, pieced together, here and there, over seven years of investigation, formed the basis for the book. No one condones the apparent violation of lifetime security oaths, but now the public has a glimpse of how submarines contributed to our resounding defeat of the Soviets and the subsequent end of the Cold War.

From the very early and dangerous diesel boat special operations—snorkeling every night to provide enough battery to go back in for the next day's ops; to the regulus missile deterrent patrols in the Northwest Pacific (now that was a trip); to the first of the Polaris A-1 missile patrols in the North Atlantic; or the courageous beginnings of under ice operations and the entry of SSNs into the special ops world—it is a story that had to be told. And based on sales of the book, both hard cover and paperback, the people loved it. And now they know part of the story. There will be more revealed as current declassification efforts go forward. And it's

about time, I say.

Much of what will be disclosed from 30 to 40 year old operations will not be news to the Russians. They were certainly aware of our ability to trail both their SSNs and their SSBNs. They knew that we were conducting intelligence, surveillance, and reconnaissance operations in and about their waters. They knew that at any moment in time we had a pretty accurate picture of their deployments. What they didn't know was that based on the success of those intelligence operations, we had gained a priceless knowledge of the capabilities of their ships and their weapons. It was not until the Walkers delivered the crypto material that the Soviets then understood how vulnerable they were. That is, how great was our acoustic advantage.

It was then that they made the national commitment to build the research and industrial infrastructure to develop and construct quiet submarines. That massive investment contributed to the bankrupting of a system that could not compete with our democracy, our economy, or our technology. The house of cards collapsed, much to the credit of our Submarine Force.

Despite our successes then, the Force is now fighting for survival. From a Cold War high of 100 SSNs and 41 SSBNs, we have been mandated to force levels of 50 SSNs and 14 Trident SSBNs. Here is the dichotomy: several recent high level studies have validated the operational requirement for submarines independently specified by the theater CINCS, that is, a need for a minimum of 68 SSNs now, and a minimum of 76 SSNs early in the next decade.

The submarine building program, currently authorized at one Virginia class SSN per year, will not sustain even a force of 50. If you build one submarine per year, with a 30 year ship life, it is not rocket science to understand that the force level will eventually fall to 30. The current force is composed primarily of our very capable Improved Los Angeles class and two Seawolf class SSNs.

It brings a tear to my eye to talk of SEAWOLF, the world's most potent SSN, everything you ever wanted in a submarine but were afraid to ask—fast, quiet, deep-diving, and heavily armed with eight 30 inch diameter torpedo tubes and a stowage capacity of 50

weapons, in any combination of torpedoes, cruise missiles or mines. The new larger diameter tubes—remember from high school geometry, volume equals PixR²xL—have the potential to launch longer range, more powerful weapons, or a variety of long endurance, unmanned undersea vehicles.

The price tag for each of the first two ships hovered around the two billion dollar mark; however, I believe the production learning curve would have rapidly drawn the cost down to an affordable level based on credible pricing experience with both the Los Angeles and the Ohio classes. As an aside, compared with the 100 million dollar price tag for each of the coming F-22 fighter aircraft, the Seawolf class is a bargain. But the fiscal pressures in an era of defense downsizing were too great. Hence, the Virginia class emerged, an affordable SSN for the post Cold War needs.

Virginia will provide advanced acoustic technology, that is, stealth equal to the quiet levels of Seawolf, and enhancements for multi-mission littoral and regional operations. In addition to open ocean anti-submarine and anti-surface ship missions, Virginia will be capable of offensive and defensive mining operations, mine reconnaissance, special operations forces insertion and extraction, battle group support, intelligence, surveillance and reconnaissance, and land attack with cruise missiles. Her modular design will facilitate customized changes in configuration during construction. Virginia will be a great addition to the Force, but not in sufficient numbers to stem the hemorrhaging.

As a related matter, I think you should know that our SSNs represent the Navy's only ASW capable force. In the Fleet, there is a sense of immortality as if a threat does not exist, despite the recent delivery of the most advanced Russian Kilo class SS to China, and rumors of negotiations to purchase Akula class SSNs. The acquisition of top of the line German and Swedish air independent propulsion submarines, the poor man's answer to nuclear power, by a variety of nations not necessarily friendly to us, should be a cause of concern. Some day, some young submarine CO with visions of earning the Order of the Red Star, First Class, or the Revolutionary Crescent for Valor, is going to get lucky with his Russian wake homing torpedo—they come as part of the Kilo delivery package—and we are going to have a disastrous awaken-

ing. But that's another story.

Is there any good news? First, the quality and enthusiasm of our young, dedicated submariners remains superb. It is a special thrill to talk with them as they walk you through their boats. They are, however, working at high personnel tempos to satisfy operational demands, which have not diminished and, in fact, have increased, even as the force level withers away. Example, six SSNs are now home ported here in San Diego versus 22 when I was the Group commander. We risk running them and their ships into the ground. The Force Commanders are sensitive to this and are watching carefully, and reluctantly will accept only the highest priority missions.

In submarine technology, the future is bright. One of our most successful programs uses low cost, commercial-off-the-shelf electronic components for acoustic signal processors. The beauty of the concept is that the sonar systems can be upgraded on an annual basis, unlike the previous mil-spec equipments for which years were required to develop and deliver expensive field changes or major modifications.

We finally have a passive acoustic ranging system. On BARB, I had the SSN prototype of PUFFS. It worked. We never missed in a torpedo exercise because we always had the range cold. But I could not convince the experts in Washington of its value. So we lost thirty years of development time until the concept was suddenly rediscovered.

The next generation periscope is in reality a very sophisticated TV camera. The periscope well is a thing of the past, for the camera requires only a fiber optic cable penetration for video and one for power. Thus, the control room can be located anywhere in the ship, giving great flexibility to the ship designers. Mechanical components are smaller, lighter, and quiet.

The electric drive submarine will not require a massive reduction gear and propulsion shaft. Cable penetrations will deliver power to external electric motors. Again, flexibility in engineering space layout is maximized.

We can communicate with the Joint Task Force Commander either direct or by satellite at data rates most adequate for our

needs. No longer can our detractors say, "Submarines are OK, but you can't talk to them". Even e-mail has come to our submarines.

In weapons, today's Tomahawk land attack cruise missile is a far cry from the relatively simple weapon that rolled out of GD Kearny Mesa over twenty years ago. Navigation by GPS and in-flight targeting capability assure extreme accuracy with a variety of payloads.

We finally have a true long range mobile mine, and some very capable submarine launched unmanned undersea vehicles. Very soon we will have a very advanced submarine launched and controlled unmanned air, yes, air, vehicle.

Nuclear power plant technology has also moved forward so that the SSNs under construction will never have to refuel. The cores will last for the life of the ship, eliminating the very expensive, both in dollars and in off-line time, refueling shipyard overhauls.

Finally, there is a movement toward converting the four Ohio class Trident SSBNs to SSGNs. Predeployed, stealthy, and survivable in a hostile environment, the 150 or so cruise missiles would represent a significant threat to any aggressor. There are some arms control issues to be resolved, but the concept has great support.

So, there you have it. A salute of honor to our real Old-Timers. A welcome to the new Old-Timers, the Cold War heroes. And a brief look at the future. All of us, old and young, can be proud of our Force and of our association with it. Happy 100th birthday!■

DISRUPTIVE TECHNOLOGY IN UNDERSEA WARFARE FOR THE 21ST CENTURY

Part Two

by CDR M.E. Martin, USN

Commander Martin is an Engineering Duty Officer currently attached to the Strategic Systems Program Office. She wrote this paper while a student at The Naval War College and was awarded The Naval Submarine League Prize for her research and writing on a submarine topic. Part One appeared in the April 2000 issue of ***THE SUBMARINE REVIEW.***

Part II: Preserving the Option for Revolutionary Innovation in the Submarine Force

Further Impetus for Getting Out of Our *Boxes*: Three keys to success in modern warfare are technology, maneuver and information dominance. Today, major technological advances are spawned primarily in the commercial sector, not the defense sector, and they are proliferating on a worldwide basis at an astounding rate.[1] The U. S. holds no monopoly on state-of-the-art technology. Economic factors may serve to keep U.S. military forces more technologically advanced, on an overall basis, than those of rogue states and potential future adversaries but, given time, they, too, are sure to make advances in C4ISR, precision weapons and integrated defense systems. On an individual basis, some of their systems are likely to be very capable. **Differences between our technological capabilities and theirs may become more of a case of quantity and availability rather than one of quality.**

With much of our force structure coming due for modernization and replacement, the need to make difficult choices in prioritizing between modernizing and equipping the force is likely to be with us for some time. One-for-one replacement of today's major plat-

[1]Dr. Jacques S. Gansler, Into the 21st Century A Strategy for Affordability, January 20, 1999, pg. 3.

forms with new, even more complex, platforms will require massive increases in available funding to step up build rates or become a process extending over many years resulting in additional decreases in force structure. With funding likely to remain a significant constraint, it is prudent to investigate, and pursue, promising alternative strategies to field modern systems capable of offsetting, at least in part, the adverse impacts on our flexibility and readiness, of temporary (or permanent) decreases in force structure and manning.

Economics may play a role in making UUVs and automated networked systems attractive as a means for modernizing our capabilities and effectively multiplying our force structure. They are likely be less expensive to design and build than new manned platforms or even integrating major new systems into many existing platforms. Thus they can provide the means for rapidly fielding new systems in greater numbers than would otherwise be possible. UUVs can be important tools in reducing acquisition timelines and costs of innovative new designs for submarines and submarine systems, as well as an alternative platform for researching, developing and fielding new technologies. Modularization and interchangeability in vehicle design and payload packages will facilitate greater effectiveness and efficiency in deployment. It will no longer be necessary, for instance, to deploy or reposition fully-armed, fully-manned warships to accomplish sonar surveillance or mapping tasks. One will be able to dispatch the sonar alone, and often one configured specifically for the task and operating environment rather than a generalized multifunction system. Breaking free of the notion that all of our payload systems and warfighting potential must be confined within the bulkheads of manned platforms and shifting to a *swarm* architecture may result in some positive cyclic trends as well as a better equipped more capable force.[2]

The Way Ahead: Commercial and research interest in UUVs and

[2] See Part I of this paper for a discussion of *swarm* architectures and their potential benefits.

automated undersea systems have provided reliable, capable, systems and vehicles of varying scale and complexity and can be expected to continue to do so. A number of programs and projects developing sensors, communications systems and other technologies for undersea and sea-based applications such as the Joint Mine Countermeasures Advanced Technology Demonstration (ATD) and the Acoustic Communications ATD will produce products applicable to UUVs and undersea networks.[3]

Many of the same technologies and very similar components to those required for these systems are also in the process of being developed and applied in various industrial robotics programs, for space and planetary exploration systems, for airborne robotic vehicles (UAVs and UCAVs) and for land based robotic vehicles (UGVs). These could all potentially facilitate development of tactical UUV systems. However, we should not expect these efforts to present us with an optimized off-the-shelf tactically ready UUV. Their programs don't have this as an objective and most don't have access to either the information or resources that would be required to develop a system of major tactical import.

For these technologies to reach an appropriate level of maturity to significantly influence design development of a VIRGINIA class follow-on or USMC Ship-To-Objective-Maneuver architectures and doctrine, a serious, well-guided UUV program should be initiated sooner rather than later. Many of the resources (technology, funding and technical and administrative expertise) for such a program already exists. However these are spread very broadly over too wide a variety of programs, some having no direct focus on UUVs, to be considered a viable program. For these to result in one or more integrated products, they should be brought together under a fully engaged and empowered, knowledgeable management structure, capable of supplying proper focus and direction.

[3] Information on the Joint Mine Countermeasures ATD can be found on their Internet homepage (ONR) and information on the Acoustic Communications ATD can be obtained from NUWC and/or the Advanced Systems Technology Office (ASTO)

Disruptive, Revolutionary Innovation vs. Incremental, Evolutionary Innovation: Distinct differences should be expected between pursuing a route toward innovation through gradual and sustained improvement of technologies and systems currently found in U.S. submarines and one that involves a discontinuous leap to new, disruptive technologies. True revolutionary or disruptive innovation is neither common nor easy. It is risky and unpredictable. The availability of technologies that make this type of innovation possible and the potential for establishing new interrelationships between them that result in this type of innovation are difficult to recognize. This type of innovation rarely stems from a single root. Its usual source is the integration of components based on proven technologies in a novel packaging or product architecture such that they now offer a set of attributes never before possible, or enable a radically different (disruptive) change in approach. Success occurs when the technologies that make such innovation possible and requirements coincide such that the right technology-based product becomes available at the right time. The match-up is not always smooth and rarely predictable at the outset.

The initial presentation of disruptive technologies often appears in a relatively simple product form with limited capabilities initially appropriate for less advanced, low-performance applications that might appeal only to niche or emerging markets. For the mainstream, they initially do not represent performance improvement or meet the criteria established for providing incremental improvement and sustained leadership. They look like steps downward or backward and don't match well with current concepts of useful technology or where major users feel they want to go.[4] The appreciation of their implications and the requirements that define their importance all tend to evolve over time and often turn out very

[4] Clayton M. Christensen, The Innovator's Dilemma When New Technologies Cause Great Firms to Fail, (Boston, MA: Harvard Business School Press, 1997) pg. 1997 and pg. 15.

differently from initial anticipations.[5] Many of the Navy's most revolutionary innovations were initially proposed as simply a new or better way to perform well established Navy tasks or missions.[6] They were proposed as technology based innovations but not as disruptive innovations. Perception of the profound discontinuous or disruptive nature of the changes such innovations would produce in military capability and the conduct of military operations or their strategic and political implications came only later.[7] Initiating and successfully managing this type of innovation requires a rare insight and/or level of experience that is hard to quantify or transfer. Significant up-front investments in attention and major adjustments or modifications to management structures and techniques may be required to support such an effort.

Organizational and Personnel Aspects: Revolutionary innovations do not look or behave like evolutionary incremental innovations and they usually can not be successfully managed using the same processes that apply to incremental innovations. Research on naval innovation in the post World War II environment, when fiscal constraints, downsizing and modernization were conflicting drives much like today, shows that successful revolutionary innovation efforts in this environment shared a number of key characteristics. A list of these characteristics, identified in the 1960s, have much in common with the results of studies conducted in the commercial

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[5] Clayton M. Christensen, The Innovator's Dilemma When New Technologies Cause Great Firms to Fail, (Boston, MA: Harvard Business School Press, 1997) pg. xvi.

[6] Vincent Davis, The Politics of Innovation Patterns in Navy Cases, (Denver CO.: The Social Science Foundation and Graduate School of International Studies Monograph Series in World Affairs, University of Denver, 1967), pg 28-29, and pg. 56-57.

[7] This is also true in the commercial sector. See Clayton M. Christensen, The Innovator's Dilemma When New Technologies Cause Great Firms to Fail, (Boston, MA: Harvard Business School Press, 1997) pg. 158.

sector more than twenty years later. [8] Both highlight the importance of dedicated knowledgeable individuals who care more deeply about the advancement of their organization and its mission than their own personal gain. They also show clearly that in order for innovation and innovators to succeed in achieving their full potential the organization must respond at some point by making some critical concessions supporting further progress and integration of the proposed innovative technologies or concepts. Admiral Hyman Rickover and the Naval Reactors organization he created are an obvious (perhaps overly obvious) example of many of the characteristics these studies cite as common in cases of successful revolutionary innovation. The relevant point, however, is that if someone had not emerged and done at least some of what he did, we might not have nuclear propulsion available to us today.

The recurring characteristics of major revolutionary innovation in these studies are:[9]

1. A *champion* who believes in the new idea and will keep pushing for it regardless of roadblocks or adverse career implications. The champion usually emerges from the middle ranks rather than from the top or bottom of the organization. They have typically been in the organization long enough to develop a broad perception of its values and requirements but not long enough to become either cynical or mired in routine and higher level obligations. The champion is rarely the originator of the idea or innovation but usually possesses significant technical knowledge pertinent to the innovation. These people are not just sales representatives

[8] Andrall E. Pearson, Tough-Minded Ways to Get Innovative, found in Seeing Differently Insights on Innovation, edited by John Seely Brown, (Boston MA.: Harvard Business Review Books, 1997) pg. 183 and Vincent Davis, The Politics of Innovation Patterns in Navy Cases, (Denver CO.: The Social Science Foundation and Graduate School of International Studies Monograph Series in World Affairs, University of Denver, 1967) pg. 51-58.

[9] This list represents a synthesis of ideas expressed in the writings of Vincent Davis and Andrall E. Pearson. (See footnote 8.)

or schedule managers; they are committed believers, leaders and co-developers.

2. A *sponsor*, high in the organization, to marshal key resources such as people, money and time and direct them toward the effort. The champion can usually build what Davis terms a *horizontal political alliance* from among his peers to initiate an innovative effort and sustain it for a brief period. However, the broader *vertical alliance* building and management of higher level politics necessary for long term success are critically dependent on the involvement of the senior sponsor.
3. A mix of creative, technical minds to initiate ideas and propose concepts and **experienced operators** to select the most promising ideas, keep things practical and smooth out the path toward implementation. The value of such relationships initially emerges as the champion interacts with peers to establish a horizontal political alliance of support for their innovation and continues to grow in importance throughout the development of the innovation and the infrastructure that supports its implementation. In today's acquisition oriented environment such a group might come together in association with the more or less formalized process of establishing concept working groups and integrated product teams. Such alliances and their effort, however, can not survive forever on air, sketchpads and view-graphs. It must move on to something of substance or good people will lose heart.
4. A process that moves ideas through the system quickly in order for them to receive required endorsements, access to resources and attention from key decision makers in a timely fashion. The lack of a clearly identified and sustained means of initiating such processes to support innovation within the Navy and other large organizations reinforces the criticality of champions and sponsors. It is their ingenuity and dedication that results in the establishment and customization of an adhoc process for successful innovation efforts on a case by case basis.

The survival of a revolutionary innovation is often dependent upon the success and strength of its champions and sponsors in finding shortcuts around organizational and bureaucratic roadblocks or alternatively, at an appropriate time, establishing a stand alone organization for its continued development and support. **Organizational structures and processes that exist in large organizations, within the Navy, and elsewhere, to facilitate getting work done and keeping well-established programs on course can be obstacles to revolutionary innovation.** *(Emphasis added by Editor.)* Elaborate approval systems and excessive layering can stifle and kill good ideas before they ever have a chance to reach the attention of senior managers. Resource allocation processes can grind promising innovations to a halt by diverting key personnel and other resources to *higher priority* programs or by insisting on full application of various measures of effectiveness before the innovation or its potential applications are mature enough to stand rigorous scrutiny. The type of environment such technologies require is difficult to create and maintain outside of a small, dedicated organization that can roll with the punches, recognize unexpected breakthroughs, and adapt to changes. [10]

There are valid reasons for considering a new organization, independent from the mainstream, to manage revolutionary innovations or disruptive technologies. They generally require a great deal of flexibility, lots of management attention and a greater tolerance toward initial shortfalls or developmental failures as well as a different approach toward setting performance requirements, especially at the outset, that may not be valued or appreciated by a *mainstream* organization's existing customers. Both the product technology and the requirements for it will emerge simultaneously. Program managers must collect, interpret and propagate information about both the emerging product technology and its potential applications. Well-established, successful organizations involved in evolutionary innovation often can not readily afford to divert key

[10] Clayton M. Christensen, The Innovator's Dilemma When New Technologies Cause Great Firms to Fail, (Boston, MA: Harvard Business School Press, 1997) pg. 201.

talent or adapt to applying radically different sets of rules and management techniques to revolutionary innovation while at the same time pursuing more traditional routes on projects aimed at incremental improvement of established products.[11]

Dedicated, total ownership can play an important role in the successful integration of concurrently emerging technologies into a successful product that might not see the light of day if the component technologies remained under other forms of management. Naval Reactors (SEA 08) and the Strategic Systems Program (DIRSSP) are examples where the Navy and the submarine community did exactly this. The National Reconnaissance Office (NRO) for space based surveillance is another example where this approach proved successful in the DoD environment. It may be appropriate for Navy and USMC leadership to initiate activities, in the near future, to determine an appropriate organizational environment for the development and implementation of robotics-based, off-board system technologies for naval expeditionary warfare, how its activities should be regulated and how its progress should be measured.

A Program Office tasked with developing an integrated undersea warfare architecture incorporating UUVs and various networks of deployable automated systems will need to be properly structured and staffed to address a broad range of technical and operational issues, some of which will differ significantly from those normally seen in more traditional systems acquisition offices. Rather than following traditional formats for either implementation or justification of a new acquisition program, managers will need first to identify what critical information is most necessary to determine potential customers and the applications they may be most interested in. Strategies of this type, requiring managers to identify the assumptions upon which their plans or aspirations are based, are

[11] Clayton M. Christensen, The Innovator's Dilemma When New Technologies Cause Great Firms to Fail, (Boston, MA: Harvard Business School Press, 1997) pg. 199-202 and 207-210.

termed *discovery-driven planning*.[12] Careful initial research may reveal a sequence in which such information may be required in order to create key guiding parameters or resolve important uncertainties before expensive commitments of time and/or funding that may be difficult to reverse are made.

In dealing with the emergence of disruptive technologies, unlike the development of a follow-on variant of an existing system or capability, we often literally do not know initially what we are going to end up building or what we are going to do with it.[13] Despite the mythology that develops over time in program offices, most major revolutionary innovation efforts involve significant amounts of re-analysis, re-assessment, re-planning and re-adjustment. The final product is often very different from the initial sketches or view-graphs. It is probably inappropriate and perhaps even counter-productive in cases that show indications of potential for disruptive innovation to attempt to develop far-ranging detailed master plans or funding profiles at the initiation of a development effort. Many factors are going to change as things go along in the beginning and it will be necessary to make frequent choices and trades on technical issues, potential applications, operational and engineering requirements. The master plan holding such an effort together is going to have to be one that evolves over time through the efforts of those involved in the initiative with appropriate overarching guidance and focus. An open, flexible approach is required with soft boundary constraints but near constant attention and a substantial number of tripwires signaling requirements for re-scopeing and re-assessing.

Nearly all of our acquisition management training and tools for assessing and managing innovation are geared toward the context of *sustaining* and incremental innovation in which customer needs

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[12] Clayton M. Christensen, The Innovator's Dilemma When New Technologies Cause Great Firms to Fail, (Boston, MA: Harvard Business School Press, 1997) pg. 160-161.

[13] Clayton M. Christensen, The Innovator's Dilemma When New Technologies Cause Great Firms to Fail, (Boston, MA: Harvard Business School Press, 1997) pg. 158.

are easily understandable and predictable. Applying these *up-front* or prematurely in cases of potentially disruptive innovation can be misleading. With such innovations, it is not their potential performance regarding established tasks or missions that we really should be interested in. What makes them important and entitles them to priority is their potential to effect **discontinuous** change. An analysis of alternatives or the various cost and effectiveness comparisons that usually form the justification for implementing an acquisition program may be mostly pointless exercises in the case of innovations where nothing akin has ever previously exited and for which the applications and requirements are unclear. Mission Need Statements and Operational Requirements will not exist, since nothing like the capability these technological innovations represent has ever existed before. Likewise, there may be no readily identifiable organization to which responsibility for generating these can be assigned. Technical performance requirements or engineering specifications for systems embodying these technologies will not be entirely available either, although some may exist that are applicable to individual components or to some of the interfaces that will be required between new and established systems to serve as a guide in building a basic understanding of issues to be addressed. An initial period of intensive experimentation with the technologies, potential applications and various potential customers, possibly requiring several iterations, is often a key strategy element in efforts of this type.

Establishing Technical Requirements and Design Parameters: Autonomous UUVs are neither manned vessels nor full-scale submarines. They will not replace submarines nor operate in the same fashion as submarines in the same environments that submarines will operate in. Because they **resemble** submarines and will operate in **similar** environments to submarines employing some systems **similar** to submarine systems, much of the technologies, tools and data-bases applicable to submarine design will be applicable to the design and development of tactical autonomous UUVs. However, there will be **differences** between design of these vehicles and design of a full-scale manned submarine that we

must be aware of. Some new tools and technologies will also be needed.

As is the case in submarine design, a set of mission dependent systems engineering performance requirements that tactical UUVs must be capable of meeting will need to be specified. These will most likely include parameters similar to those required for submarines; speed, depth, range, lethality, survivability, flexibility and affordability. However, parameter values selected, here, must be appropriate to a tactical UUV. These will not be the same as those appropriate for a full-scale manned submarine. Performance requirements will need to be established for the tactical UUV's onboard control system. Functions to be performed remotely by human controllers must be determined and performance requirements set for shipboard systems that will facilitate their execution of these functions. Performance requirements must also be specified for those critical systems providing interfaces between the UUV and human controllers.

Many of the technologies being discussed and developed with the objective of reducing manning, maintenance and logistics requirements for full scale ships and submarines have obvious applications and implications for the development of better, more affordable UUVs needing less maintenance and logistics support. These include development of control technologies and embedded sensors for marine applications, modularization of components, standardization of components and interfaces, new hull materials, lubricants and preservation techniques. New component materials, precision manufacturing techniques, open systems architectures, condition-based maintenance, extensive automation with continuous monitoring and greater access to expert maintenance and repair advice should decrease the frequency and duration of major upkeep and refit periods and make it possible to keep ships and submarines on-line and at sea. They should do the same for tactical UUVs and deployable undersea systems. Being unmanned provides the additional advantage that a tactical UUV will have no significant ties to a homeport or other requirements to keep it from remaining pre-positioned or deployed to remote forward areas for extended periods. Large tactical UUVs can be expected to have to make at most a very few long open ocean transits over the course of their

life cycles. This has important implications for a number of design performance factors especially with respect to propulsion and navigation systems.

Whenever technically feasible and economically practical, components and technologies common to ship or submarine design, commercial undersea systems, or manned undersea systems such as the Advanced Seal Delivery System (ASDS) should be considered for use in tactical UUV systems. Modularization in component and systems design should make it possible to readily reconfigure UUVs to meet mission requirements making the most out of scarce payload space. Even so, it may be desirable to look at the cost trades in grouping similar mission requirements to facilitate developing a family of simpler low cost tactical UUVs rather than a single vehicle capable of satisfying all range, depth, speed and payload requirements.

Experimenting with Applications & Testing the Validity of Premises: An initial approach leading to the development of networked undersea systems and autonomous or semi-autonomous vehicles may be expected to entail the development of various models employing these technologies for use in various expeditionary warfare simulations and wargames. Systems and components developed for commercial, academic or military research might be employed in demonstrations, exercises and experiments allowing both system performance and operator reactions and comments to be documented. More extensive demonstrations and investigations involving various combinations of currently existing technologies and simulations of potential future systems such as those commonly seen in various Advanced Concept Technology Demonstrations may also help in developing understanding of the interplay between potential undersea battlespace capabilities and broader littoral requirements.

Initial experimental efforts should be supplemented and followed by detailed concept development and serious mission analysis. This should include a careful and open analysis of our present capability to execute expeditionary warfare operations in the littorals and potential for performance improvements. It should also bring into

play projections of the world geopolitical situation, potential future threats and their access to advanced and asymmetric technologies. The objective of this effort should be an update of roles and missions and doctrine to bring them into alignment with projected warfare requirements and identify and prioritize requirements for new undersea capabilities. This should not be a closed or isolated Submarine Force or submarine community effort. Rather, it should draw on the full spectrum of resources and experience available to both the Navy and Marine Corps. Clear articulation of a well-educated and informed fleet's priorities, sound engineering assessments and thoroughly executed and documented mission analysis are required to create a common future vision of undersea battlespace objectives and a wisely balanced technology investment program. Performance requirements derived through these processes should constitute a key part of legitimate and well supported systems engineering efforts coordinated across the broad undersea community to develop and mature needed technologies for future installation in submarines and off-board adjunct systems. A broad framework for networking the processes of such an effort was outlined by the Submarine Technology Assessment Panel.[14]

Revolutionary Innovation in Today's Fiscally Constrained Environment: The Defense Acquisition System is currently under enormous pressure to cope with residual effects of regimented observance of obsolete standards and practices and accommodate to post-Cold War drawdowns. The net results of the many stresses inherent to pursuing reorganization and reform initiatives aimed at streamlining acquisition processes and eliminating practices that add unjustifiable costs are manifested in increasingly dysfunctional internal dynamics within the system as a whole and within individual program offices. The politics of this world drive the vast majority of acquisition program managers to avoid drawing attention to their programs by staying well within established boundaries and guidelines of normal practices and timelines

[14] Submarine Technology Assessment Panel, Final Report, (March 1996) pg. 18.

promulgated as standardized model paths for acquisition programs. Properly supported and executed standard acquisition programs ensure a steady flow of evolutionary modernization and incremental improvements in systems and capabilities. The atmosphere right now is one that is very supportive of such sustaining innovation.[15]

In the past, standard programs were supplemented by a number of non-standardized, less regimented *special projects* run at least partially outside the standard regulations of the acquisition system resulting from time to time in significant revolutionary leaps by pursuing the development and integration of disruptive technologies. Today, this is not the case. Institutionalization of written and unwritten policies favoring an evolutionary, incremental approach toward modernization, sustaining powerful current organizations and contractual relationships, and precluding revolutionary innovation and discontinuous change in our key warfighting systems is inherently dangerous and out of sync with the stated objectives of Defense leadership. **Without at least some discontinuous change in our means to wage war, there can be no near-term *revolution in military affairs* but only a slow, steady evolution of new approaches, which, lacking sustained coordination and carefully defined interfaces may fall short of anticipation.** *(Emphasis added by Editor.)* At the same time, the widespread commercial availability of potent modern technologies with potential military applications raises the specter that the next great disruptive-technology-driven leap in military capability may originate outside the United States. If such were to be the case, the prospect exists that the *revolutionary* military capabilities stemming from it might circumvent or nullify our efforts at evolutionary innovation. By emphasizing evolution and incremental improvement so strongly we may be pursuing a path that offers short-term savings and stability but leads to bankruptcy in the long run.

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[15]Clayton M. Christensen, The Innovator's Dilemma When New Technologies Cause Great Firms to Fail, (Boston, MA: Harvard Business School Press, 1997) pg. 7-14.

Summary Remarks: The potential near-term development of both mission specific and multi-mission capable unmanned vehicles offers an attractive alternative for achieving substantially increased submarine payload capacity and introducing new undersea capabilities faster and with less expense, avoiding the need for design or modification efforts involving major manned warfare platforms. They also offer a unique promise to expand our potential to conduct littoral operations in ways it has not been possible to consider with only major manned warships.

Determining whether a manned platform or robotic vehicle is employed should depend on the functions it is expected to perform and the overall warfighting environment. In designing a force architecture in which both options will be available, the overall mix of manned and automated systems comprising the warfighting *system of systems* should be optimized from both a performance and cost perspective. There are many potential benefits in shifting our emphasis for the future away from larger more complex platforms and toward a distributed, networked *system of systems* or *swarm*, where appropriate systems are automated and moved off-board to UUVs. A more aware, more capable submarine is of greater value to its commander and crew and also to the expeditionary force commander and his forces. Its payload of weapons, sensors and communications systems will be increased and distributed to provide wider, sustained coverage and will be capable of being easily adjusted or reconfigured to meet the requirements of its environment and employment in support of the expeditionary force.■

PERSPECTIVES OF AMERICAN BALLISTIC MISSILE SUBMARINES DEVELOPMENT

by Dr. George Sviatov

Dr. Sviatov is a retired Captain, 1st Rank, in the Russian Navy.

For the seeable future the United States will continue to need a reliable and flexible nuclear deterrent survivable against the most aggressive attack and highly confident, constitutional command and control. The U.S. Defense Department believes these goals can be achieved at lower force levels and is poised to begin mutual early deactivations, now that the Russian Duma has ratified the START II treaty, and to negotiate further strategic nuclear reductions in a START III context.

Until START II enters into force, the United States will maintain 18 Ohio class ballistic missile nuclear submarines, each carrying 24 Submarine Launched Ballistic Missiles (SLBMs).

The nation's SSBN force is a key component of the overall nuclear deterrent posture. It convinces any adversary's leadership that seeking a nuclear advantage, or even parity, would be futile.

The final 18th Ohio class SSBN was commissioned in 1997. The first eight submarines carry the Trident I (C-4) missile; the final ten are equipped with the Trident II (D-5) missile. The FY 1999-2000 budgets provided for continued procurement of D-5 missiles to support the conversion of four SSBNs from C-4 to D-5 missile systems. The retrofits will be accomplished during regularly scheduled submarine maintenance periods, beginning in FY 2000.

Under current plans, as START II enters into force, four submarines will be removed from strategic service, leaving 14 SSBNs armed with D-5s. These UGM-96 missiles (weight 130,000 pounds; length 44 feet; diameter 83 inches), capable of carrying eight nuclear warheads with a range of more than 4000 nautical miles, will be consistent with START II limits. No new SSBNs or SLBMs are under development.

The FY 2000 budget also supports Navy planning for a life extension to the D-5 SLBM to match missile life to the recently extended Trident submarine service life of 42 years.

U.S. SLBMs at sea are maintained on continuous alert, but are not targeted at any specific country. The missiles could, however, be returned to their targeting on short notice. The United States maintains two full crews for each SSBN, with about two-thirds of operational SSBNs routinely at sea.

There is a question: what are perspectives of U.S. SSBN development in the next decade? The answer is: the United States will have on 14 Ohio class submarines 336 Trident II (D-5) SLBMs with 2,688 strategic independently targetable nuclear warheads. But what about four other Ohio class submarines and what about modernization of the 14 basic strategic subs?

In December 1997 the congressionally chartered National Defense Panel presented a report Transforming Defense: National Security in the 21st Century in which it suggested that the Navy should look closely at converting one or more of the four Trident SSBNs coming out of strategic service to alternative missions.

The United States Navy has long experience in converting some SSBNs into special forces transport submarines (SAM HOUSTON, JOHN MARSHALL, KAMEHAMEHA, JAMES K. POLK) to carry and land up to 65 troops, such as SEALs. It also has experience in using some SSNs in that role and as land attack Tomahawk cruise missile carriers, with future possibilities to use the Seawolf and Virginia class newest attack submarines in the same role. At the 16th Naval Submarine League Annual Symposium and Business Meeting in June 1998, Electric Boat displayed a model and characteristics of its Trident (SSGN) Conversion Project for four Trident SSBNs which are candidates for early retirement as nuclear strategic systems.

A converted submarine would provide sustained precision land attack strike capability in support of Navy/Marine Corps expeditionary forces engaged in hostile actions with an enemy ashore. It can be a survivable stealth platform that supports, delivers, and retrieves covert special warfare forces well into the 21st century.

As an existing, proven stealth submarine, the Trident SSGN would be capable of launching up to 132 land attack missiles from her 22 missile tubes (two of the tubes would be modified as lockout-lockin chambers for special operations personnel). In

addition, some of her 25 torpedo tube-launched weapons can also be anti-land cruise missiles. As presented in this project, each Trident tube can hold six conventional anti-land cruise missiles in Vertical Launch System (VLS) canisters. She would be able to also clandestinely deploy up to 102 Special Operations Forces with their organic swimmer delivery systems.

At a cost of $1.4 billion for the conversion of the four Trident (SSBN) submarines, including refueling, it is a very affordable answer to the Navy's need to move toward small-signature ships capable of providing long range, precision fire power. The SSGN requires no supporting escort or logistic train, can remain on station for long periods during crises, and can be withdrawn without anyone having had knowledge of its presence. Sometimes the U.S. leadership could use her as a deterrent even without her deployment into an area.

Such are pros for conversion of four Ohio class submarines to SSGNs. What are cons?

Number One: The United States has a lot of cruise missile launchers in its existing Armed Forces: 93 B-1, 21 B-2, and 76 B-52 bombers, each equipped to carry up to 20 cruise missiles. The majority of the U.S. Navy's cruisers, destroyers, and attack submarines can carry and launch more than 5,000 anti-land cruise missiles, including more than 1000 from submarines. In addition, there are huge anti-land Navy and Air Force conventional missiles and bomb strike capabilities of the United States and its allies.

Number Two: As always, some alternatives exist to the Ohio class SSGN. One of them is an improved Seawolf class (submerged displacement some 9,500 tons) with eight 533 mm torpedo tubes and 50 inside the pressure-hull weapons and 16 outside the pressure-hull VLS which would allow the loading of up to 66 cruise missiles. Another one is an improved Arleigh Burke class (Flight IIA) destroyer with up to 96 VLS for cruise missiles.

It seems that another direction of future U.S. SSBNs development is more organic and perspective. Generally speaking, it is relevant not only to SLBMs but also to ICBMs. That direction is about the use of strategic ballistic missiles not only with nuclear but also with very accurate and effective conventional warheads for

providing not only nuclear but also conventional strategic deterrence and war waging capabilities.

Existing U.S. Ohio class SSBNs, by virtue of their missiles' range and patrol posture, can deter and destroy a potential aggressor in every region of the world and they are highly survivable. They are also extremely flexible, capable of rapidly retargeting their missiles using secure and reliable communication links.

But in comparison with a strategic bomber and an aircraft carrier's tactical air capability, they have one very significant deficiency: they could not be used for deterring and waging a major conventional war. In this respect one can raise a question: why does not the U.S. Navy use the design philosophy of the Air Force's strategic bombers' or it own tactical aircraft as regards the Ohio class strategic submarines/ that is, in addition to nuclear Trident missiles, why not develop and, if necessary, deploy conventional versions of these missiles?

The underwater Ohio class battleship has a huge strategic weapons payload (up to 1,500 tons) which is many times more than on a strategic bomber and comparable with that of an aircraft carrier. With one conventional super powerful warhead with a deep penetrator or eight conventional independently targetable warheads, the Trident D-5 conventional strategic missile could be a very efficient conventional strategic deterrent and war waging instrument. Using such conventional super long range missiles, SSBNs can effectively participate in deterring and destroying any potential major aggressor in any point of the globe instantaneously. And such missiles could be used not only against land but also against sea-stationary and -moving targets.

Several years ago, the distinguished American statesman and scholar, Paul H. Nitze, in a big *Washington Post* article, strongly recommended for the United States a concept of strategic conventional deterrence in addition to strategic nuclear deterrence.

Another strategic mission could be conceived for such an underwater battleship. She can be used in an ABM or anti-satellite role and also for launching satellites.

The United States Navy has also considered a Trident D-5 missile in a configuration for carrying a conventional high explosive warhead. This concept has been suggested by the Navy's Strategic

Systems Project Office as a means of striking time sensitive, heavily defended, high value targets.

One very important question arises relating to this idea. Should it be implemented as arming an Ohio class submarine with only conventional D-5 Trident missiles or all such submarines could get both nuclear and conventional capabilities? Both options are available, but it seems that the latter option with mixed nuclear and conventional strategic payload is more productive. For a potential, especially regional, aggressor strategic instantaneous conventional deterrence might be much more convincing than a nuclear capability.

It is very important that arming Ohio class submarines with conventional D-5 Tridents does not require much modification and changing of their operational and organizational procedures. The main job would be to create two models of conventional D-5s: one with a super powerful warhead, and for example, with eight smaller MIRVed warheads. It would be a very cost effective program.

In a recent very sensible USNIP's article Trident Can Fire More Than Nukes, Captain James H. Patton, Jr. strongly argued for arming SSBNs not only with nuclear but with conventional warheads with the same D-5 boosters.

With such SSBN conventional deterrence and warfighting capabilities, the President of the United States will not necessarily ask "where are my aircraft carriers?" His underwater battleships will be always on patrol and able to strike conventionally at any targets in the globe instantaneously.

Of course, this idea also has its cons. One can say that U.S. strategic bombing B-1s and especially B-2s have such capabilities. That's correct. But not so instantaneously, with not such big payload and with some vulnerability from a sophisticated enemy's anti-aircraft defense.

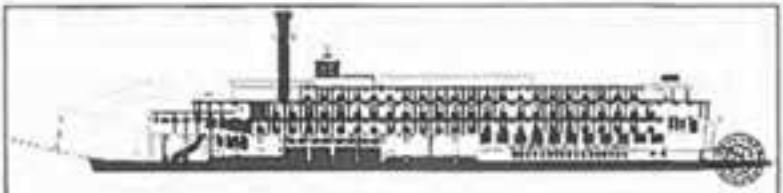
One more pro. It seems that by providing SSBNs with not only war preventing but also conventional war waging capabilities their crews will get some kind of additional sense of usefulness in real contemporary military conflicts, and that will be a supplemental booster in their professional careers.

And one last pro. The Soviets in the 1970s created their SLBM

R-27K (a version of SS-N-6) with nuclear and conventional warheads for Project 667A (Yankee I) SSBN, which was able to strike not only land but also moving sea targets with terminal homing, using the submarine's fire control system, and space satellites for target acquisition. They tested that system on a specially built Project 605 diesel submarine and planned to implement it on some Project 667A SSBNs.

Until recently the Russians were building in Severodvinsk their new Project 885 YURY DOLGORUKY SSBN. It was possible that she would have had not only nuclear but also conventional RSM-52U (SS-NX-28) SLBMs. But in August 1998 Commander in Chief of the Russian Navy, Fleet Admiral Vladimir Kutoedov, announced that the SLBM's development had been canceled and a new smaller SLBM will be developed for YURY DOLGORUKY on the base of the solid fueled ICBM Topol-M. As a result, the new Russian SSBN delivery date was shifted from 2004 to 2010. But a possibility of arming that new Russian SSBN with not only nuclear but also conventional strategic warheads remains.

In conclusion, it seems that the above mentioned proposals of the U.S. Navy's Strategic Systems Project Office is absolutely correct. In the beginning of the next century the U.S. can create such a missile without any difficulties and on one of the four SSBNs which will be converted from C-4 to D-5 SLBMs such a nuclear/conventional missile complex could be installed.■



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MORE ON SUBMARINE LANS

by LCDR Edmund E. Kaufhold, USNR

I read with some interest Lieutenant Buchanan's essay in the January 2000 issue of **THE SUBMARINE REVIEW** Submarine Information Technology: It Begins With the Backbone in which he discusses the IT revolution and the introduction of Local Area Network capabilities in various attack submarine classes, especially the Virginia class SSN.

While I have no direct knowledge on this score, by this late date Virginia certainly ought to have a fairly detailed network architecture on the drawing boards. If not, however, a model that is somewhat simpler and perhaps more secure than Lieutenant Buchanan's is certainly feasible, as long as we pay heed to some fundamental network security principles.

Instead of four networks, three are suggested:

- A purely unclassified, general-purpose local area network (LAN) to host ship's administration, management, and general purpose processing (FITREP and Evals, Planning Maintenance System, etc.). Users of this LAN are the entire crew. This system is equivalent to Lieutenant Buchanan's Quality LAN.
- A Secret (and below) LAN hosting general operations, planning, much propulsion plant information (usually caveated as Restricted Data or NNPI), information on the status of weapons, and any classified PMS (if they are required on Virginia). If the classification level of this LAN is kept to the Secret level and below, the bulk of the crew could also utilize this LAN, since all personnel are subjected to an ENTNAC upon entry into active duty. This investigation is virtually identical to the NAC, which is used to grant access to Secret and Confidential classified information. Moreover, once the boat is underway, generally the entire crew is privy to a great deal of classified information as a matter of course. Future connection to the SIPRNet (Secret Internet Protocol Routed Network) is also somewhat simpli-

fied.

- A Top Secret SCI LAN, hosting sensitive compartment information (SCI), TS collateral intelligence, and special access program mission planning information. Users of this LAN would require standard SSBIs, fully adjudicated for SCI access. Since physical access to networks or their components operating at this level is tantamount to granting access to the data itself, these systems are always confined to exclusion areas such as radio and ESM, or tactical sensitive compartmented information facilities (SCIFs), generally established on submarines only when underway, again, usually in radio and ESM. Depending upon the final implementation of several of the network component lock-out scenarios described in Lieutenant Buchanan's paper, however, a very reasonable risk assessment could be made to argue for additional network drops or installations in the CO and XO staterooms, sonar, and the wardroom, obviously dependent upon final Virginia class configurations.

Lieutenant Buchanan is right on target when arguing that networks (and their often long support tails) be treated like any other ship system. Likewise, his conceptual Knowledge Acquisition and Analysis Center (KAAC) has great merit. However, the notion that LAN operations and the cadre of personnel who support it be housed in the Weapons Department "...since [it supports] the largest weapons system (the ship)" is either illogical or tongue in cheek. By this measure, *everyone* works for the Weaps. I'm guessing the rest of the wardroom won't go for it, but it was a decent try.

No, this team belongs in operations because that is what connectivity is all about—supporting operations and facilitating communications. And not nearly all of our operations are weapons related. Moreover, there is a rating that already does this work: that amalgam of ET and RM, Information Technology (IT).

Also, co-locating classified and unclassified systems or PCs in immediate proximity to each other (as Lieutenant Buchanan suggests) is a salient reason that classified information continues its steady migration over to the Internet. Users get confused enough

about which system they are on in the luxury of an open office, on the surface. Submarine network users engaged in operations, or pushed by fatigue will inevitably make errors like everyone else, and type the wrong information on the wrong system (fortunately, on a submarine, your contamination problem is definitely localized!). The aggravation and loss of information and resources during the system sanitization is extensive.

Finally, laptops should be cable-locked down, or they will walk away. The only advantage a laptop brings to a submarine is its compactness, not its portability. No classified information should be put on laptops for just this reason. And physically lock down or disable those floppy or tape drives, to arrest the inevitable virus problem before it ever breaks out.■

U.S PACIFIC SUBMARINES IN WORLD WAR II

William *Bud* Gruner, World War II submariner and skipper of USS SKATE (SS 305), has authored a small, 19 page, unbound pamphlet containing the best encapsulation of historical facts and data surrounding the greatest untold story of World War II.

Some topics included are: WWII history in the Pacific Theater, U.S. submarine warfare directives, WWII submarines (fleet/S class boats), torpedo problems, Japanese ship losses to U.S. submarines, number of patrols, and personnel losses.

This pamphlet is available through the San Francisco Chapter of U.S. Submarine Veterans of WWII. A $2 donation covers printing, collating, folding, stapling, and postage. Make checks payable to U.S. Sub Vets WWII-SF Chapter. Send requests to Everett *Bud* Burchell, Past Pres., SF Chapter, U.S. Submarine Veterans of WWII, 701 Second Street, Gilroy, CA 95020-4904.

MULTI-LEVEL SECURITY NETWORKS ON SUBMARINES

by Steve Kurak

Mr. Kurak is a retired naval officer with 25 years of submarine communications experience. He is presently working as part of the Virginia class ECS design development team.*

The January 2000 **SUBMARINE REVIEW** included an article which discussed a proposed Information Technology (IT) architecture for the Virginia class submarine. *(See Submarine Information Technology by LT T.R. Buchanan, p. 81, January 2000 issue.)* While the need for a robust IT environment on USS VIRGINIA (SSN 774) submarines is unquestionable, the proposed implementation of separate networks, each carrying a different classification of information and providing limited physical access points, would only perpetuate our present *stovepipe* communications infrastructure. Instead, what is needed on VIRGINIA, as well as on existing submarines, is a single Multi-Level Security (MLS) network that fully supports the Information for the 21st Century (IT-21) vision. The war fighter must be able to access the needed information, in the desired format, from any location on the ship, in real-time.

IT-21 is a fleet initiated C4ISR war fighting philosophy intended to transform military operations by developing a globally interoperable Navy network architecture which provides for the rapid transfer of tactical and tactical support data between all echelons of command. IT-21 is based on two main functional pillars:

- A robust network architecture based on TCP/IP-based, client-server environment with multi-level security, emphasizing open industry standards and extensive use of commercial-off-the-shelf (COTS) networking equipment.
- Radio frequency (RF) communications channels that support high-speed ashore/afloat transfer of voice, video, and data information. The minimum data transfer rates required to

* See page 136.

achieve an IT-21 enabling capability is currently assessed as 128 kilobits-per-second (kbps).

Although both functions are equally important to achieving IT-21 functionality, this article addresses implementing a submarine-wide MLS network.

The VIRGINIA IT network architecture, and the Exterior Communications Subsystem (ECS) are designed to fully support the IT-21 concept. An IT architecture, similar to that which is being deployed on VIRGINIA is being developed by the Navy for backfit installation on other classes of submarines. There are also communications upgrades in development that will provide all submarines with IT-21 enabling capabilities.

Submarines in commission today have the Navy Tactical Command Support System (NTCSS) network. This fiber optic network, which can be operated at up to the Secret-High* level provides mainly logistical support for the submarine. There are two near-term initiatives that provide submarines with IT-21 network functionality. The first connects Radio to the Combat Control system with a small, classified Local Area Network (LAN) consisting of a Windows NT Server and four laptop computers. The second initiative connects this tactical network with the existing NTCSS for greater network functionality. These improvements are being back fitted on to submarines concurrent with communications upgrades that allow the submarines to transfer data at higher speeds. The back fit network installation plan includes a separate unclassified LAN. The unclassified network will provide a means of providing sailor e-mail and other quality of life applications. The back fit plan does not, at present, provide a means of transferring higher than Secret data across the classified network.

The network architecture for VIRGINIA takes great steps towards, but falls short of, achieving the IT-21 vision of full MLS functionality. On VIRGINIA, a single Asynchronous Transfer Mode (ATM) OC-3 (155mbps) Secret-High system LAN will provide network access for tactical and non-tactical subsystems, and for individual users.

*A System High network is a network in which all users are cleared for access to information equal to the highest level of data processed by the network, and all users have a *need to know* for at least some of the data residing on the network. In the case of VIRGINIA, this means that all NPES network users are cleared for Secret and have *need to know*.

The VIRGINIA ECS will provide the RF gateway between the ship's network and the Global Information Grid for all data and voice communications. All properly cleared users of the submarine LAN will potentially have access to Secret and below information at any terminal authorized for such access. However, Top Secret (TS) and Sensitive Compartmented Information (SCI) will require additional encryption in order to deliver that data to appropriate end users over the Secret LAN. Only certain workstations will be authorized to process TS/SCI data.

In order to transfer TS/SCI data across the network, VIRGINIA plans to use In-Line Network Encryptors (INE) to provide the additional required security. Products available today include the Network Encryption System (NES), KG-75 (FASTLANE), and KG-175 (TACLANE). These INEs will be collocated with the workstation that will process the information. It is anticipated that by the time VIRGINIA is ready to go to sea, the functional equivalents of these INEs may be reduced in size to the point where they can reside inside each individual workstation chassis. This would greatly simplify transfer of both classified and unclassified data over the network between individual workstations, thus improving security.

In a fully implemented MLS network, all classifications of information, from unclassified to TS/SCI would share the same network backbone. Although data of varying classifications might be stored on separate servers, authorized users would be able to access desired information from any network terminal. Such a configuration is achievable today by employing a Defense in Depth architecture for the entire ship's Information Technology Environment. It is important to note that this MLS strategy will only work

if the architecture is applied to the entire enterprise, in this case the entire submarine. An explanation of Network Defense in Depth follows.

> "Defense in depth is provided by employing multiple security mechanisms at various locations (both physical and logical) in an information system. These mechanisms are applied in both a complimentary and redundant manner to satisfy the information system's security requirements. No single mechanism is relied upon to provide complete information security. To compromise the security of a DON information system, an adversary must defeat the security mechanisms, layer-by-layer. Defense in depth is extremely beneficial because most modern DON information systems are composed of Commercial Off-the-Shelf (COTS) Operating Systems (OS) and applications, and these are regularly discovered to have subtle security flaws. With proper defense in depth, the risk is minimized that a single security flaw in an OS or application will leave an information system vulnerable."[1]

The foundation of this defense is the use of Trusted Operating Systems. Trusted Operating Systems control what specific information users can access and other functions that users can perform on the system. Trusted Operating Systems provide safeguards against internal and external threats. Enterprises can fine-tune security protections to their own specific requirements. Multiple workstations and servers can be configured together in a distributed system whereby users can share files, send mail, remotely login and print--all at multiple levels. Trusted Operating Systems use labeling of information according to classification, and Discretionary and Mandatory Access Controls (DAC/MAC) to control user access to network data. Information residing on the network is labeled according to classification and other parameters set by the network administrator. DAC/MAC create sophisticated profiles of each user. User access to information on the network, as well as use of network peripherals, such as printers and disk drives, is controlled by a comparison of information labels to the authorizations provided by user profiles. Other features in Trusted

Operating Systems include the ability to ensure that no one user can override system protective features.

In addition to Trusted Operating Systems, Trusted Servers and other hardware also enforce access limitations and provide a means of creating enclaves of sensitive data. Positive identification of users can be enhanced through the employment of login passwords and/or biometric means of verifying identity. Fingerprint readers, for example, have become so inexpensive that some PC vendors include them as standard features. The Navy's SMART CARD initiative includes Public Key Infrastructure (PKI) features that in addition to verifying a person's identity when they log on to a network, also provide non-repudiation by assigning a unique *digital signature*™ to any message generated by a user, ensuring that no one can deny having originated a message.

Administrative procedures and user training must also be part of the overall strategy to further ensure that security is maintained. Although individual platforms have unique Standard Operating Procedures for maintaining network security on system high networks, there is little Navy guidance that stipulates requirements or guidelines for designing or implementing an MLS network. Force standards are required that outline the necessary hardware, software, and administrative procedures to be used in implementing a submarine MLS network. Developing such a standard would greatly reduce the certification and accreditation challenges that currently exist.

A force-level strategy for training and retaining, billeted *sysadmin* personnel is essential to keep the submarine's mission critical networks operating at peak efficiency and security. The Submarine Force, up to this point, has experienced great difficulty in identifying either the billets or the training methodology to ensure proper network administration and maintenance. Network sysadmin responsibilities have been assigned as collateral duties, vice identifying a dedicated billet for network administrators and support personnel. Training courses established at the Fleet Training Centers for IT training have only recently identified submarine ratings as eligible attendees. Moreover, although submarine training pipelines for FTs and ETs, now include IT training, they are not yet producing the numbers of qualified IT professionals that the Submarine Force needs serving at sea.

In addition to assigning personnel to submarines, specifically

assigned as network support personnel, one solution to alleviate the lack of IT trained personnel would be to provide all submarine ratings with basic computer and networking training as part of their initial training pipeline. Similar to the basic electrical & electronics training that most submarine ratings receive today, this training would provide a foundation that would be reinforced by fleet experience and could be built upon in subsequent pipeline training. Another method of easing acute training deficiencies specific required skills is to *buy* seats in specific short (one or two day) classes taught at most community colleges. This method, which is currently used for training of federal employees, is an attractive, cost effective option to sending personnel off the ship for long periods of training at Submarine School or Fleet Training Centers. These techniques can be augmented through use of commercially available interactive courseware products that a sailor can use while on the ship.

COTS technology exists and is available that can be used to construct a Defense in Depth environment that will support an MLS network that provides the required access to the appropriate user, commensurate with security clearance and *need-to-know*, without jeopardizing security. The controlled environment of a submarine and the nature of submarine operations make this platform the natural choice for implementing an MLS network. However, a platform level architecture based on a Defense in Depth strategy, including Force Guidelines, and adequate personnel assignment and training are essential to successfully implementing this aspect of the IT-21 vision.■

ENDNOTE

1. DON Chief Information Officer Information Technology Standards Guidance Version 98-1.1 dated 15 June 1998.

LOW SPEED MANEUVERABILITY—A MUST

by CAPT James H. Patton, Jr., USN(Ret.)

Catching up on some reading, I was interested in what Commander Daniel Farson had to say in his On SSN Design in the July 1999 **SUBMARINE REVIEW**. His views were *right on* as regards future submarines needing to have *both* low speed (to include zero or even minus values) maneuverability and large payloads. With due respect to the expressed views of Dick Boyle in his Attack Submarine Design (April 1999 **SUBMARINE REVIEW**), submarines don't have to be small to maneuver at low speed.

Long, long ago in a distant galaxy, a 637 class submarine had need to closely investigate (and photograph) some near-bottom objects. To make a long story short, the ship spent three weeks in 600 feet of water some 10 or so feet off the bottom searching about *one square mile*. The technique employed was to have the Secondary Propulsion Motor (SPM) running at 000° relative (having been rigged out and locked shallower as required), while backing down on the main engines. Fortunately, stealth was not an issue in this case. At about 30 turns, the speed was zero, while at something a little greater or less, slight forward or astern motion occurred. However, there was always *wash* across the stern planes and rudder, so a very fine degree of control was achieved over both pitch and yaw.

The CTFM under-ice sonar served well as a detection device, but since the first 25 percent of any range scale is blanked out, one of the topside profilers had to be relocated to the bow dome to provide contact from the last 50 yards into the final desired six to eight feet. It was not particularly fun or easy, and the ship's trim had to be watched carefully, but with a little practice, the ship was controllable. Fore and aft transverse thrusters ala NR-1 would have been very welcome.

I've been fortunate enough to be asked to serve as a government advisor for the ongoing DARPA Submarine Platform and Sensors Program and it is likely that in a decade or so the process will probably result in a VIRGINIA variant which has an order of magnitude greater payload, but is not that much bigger, has a

repertoire of adjuvant vehicles, and which will be capable of *quiet* near-bottom operations at +/- zero knot speeds.■

THE SUBMARINE REVIEW

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

Articles for this publication will be accepted on any subject closely related to submarine matters. Their length should be a maximum of about 2500 words. The League prepares **REVIEW** copy for publication using Word Perfect. If possible to do so, accompaning a submission with a 3.5" diskette is of significant assistance in that process. Editing of articles for clarity may be necessary, since important ideas should be readily understood by the readers of the **REVIEW**.

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

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

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

MORE ABOUT HITLER'S U-BOATS

by Norman Polmar

I am pleased that Captain Enos has changed or mitigated most of his views related to my comments on his review of Hitler's U-Boats (April 2000 **THE SUBMARINE REVIEW**, in response to my commentary in the October 1999 issue). Still, Captain Enos states that according to Clay Blair, author of Hitler's U-Boats, "contrary to Polmar's assertions—Allied shipbuilding was replacing losses faster than they were occurring and had been doing so since November 1942."

According to official documents, my late friend Clay Blair and Captain Enos are not correct. I would cite Captain S.W. Roskill, RN, official historian of British naval operations in the war. In Volume II of his The War at Sea, Roskill wrote (emphasis added):

> Although our loss of ships **in convoy** had never, since the beginning of the war, fallen below our gains of merchant shipping from new construction and other sources, **our total losses** had so far [May 1943] exceeded our gains. It was ... to be precise in July 1943—that the rising curve of Allied merchant ship construction overtook and crossed the more slowly rising curve of sinkings.

Whereas Blair and Enos limited their counting to ships in convoy sunk by Bu-boats, the overall Allied shipping losses were much more significant. For example, in the cited month of March 1943 U-boats sank 72 ships in convoys worldwide (not just North Atlantic), a more significant number than Captain Enos' "39 ships [sunk] in four eastbound convoys." Another five ships in convoys were sunk by other causes, mostly air attacks, and U-boats sank 23 merchant ships sailing independently with another two lost to other causes—a total of 102 Allied merchant ships sunk in March 1943.

Thus, Allied merchant construction had to produce 102 merchant ships just to *keep even* (with some adjustment for increased tonnage of newer ships). But equally important, in the spring of 1943 Britain was hardly surviving as a nation and as a base for the war against Germany. Rationing for British civilians was severe; the

merchant ships also were feeding hundreds of thousands of U.S. and Canadian troops being assembled for the invasion of Western Europe (at one point planned for 1943); tanks, trucks, munitions, and the millions of tons of other material needed for such an invasion also was being brought in by ship, as were most of the bombs and fuel needed by the U.S. bombers and fighters already operating over the continent.

Any discussion of the effectiveness of Hitler's U-boats must take a broader look at the Battle of the Atlantic. As Winston Churchill declared, "The only thing that ever really frightened me during the war was the U-boat peril... I was even more anxious about this battle than I had been about the glorious air fight called the Battle of Britain."■

REUNIONS

USS BANG (SS 385) 16-19 October 2000 in Atlantic City, NJ. Contact: Phil Beals, 2127 Oahu Drive, Holiday, FL 34691-3625; phone (727) 934-9665 e-mail: pebeals384@juno.com

USS SKATE (SSN 578) 18 October 2000 in Atlantic City, NJ. Contact: Bob Law, 469 Severnside Dr., Severna Park, MD 21146; phone (410) 987-2164, fax (410) 987-3948; e-mail ahoybob@aol.com.

NAVAL SUBMARINE LEAGUE
STATEMENT OF FINANCIAL POSITION
March 31, 2000

Assets

Current Assets	
Cash	$112,815
Cash Equivalents	83,705
Investments (Market)	432,759
Prepaid Expenses	9,992
Accounts Receivable	5,324
Total Current Assets	**644,595**
Fixed Assets	
Furniture and Computer Equipment	38,227
Office Condominium	251,021
Sub Total	289,248
Less Depreciation	(100,222)
Total Fixed Assets	189,026
Total Assets	**$833,621**

Liabilities

Current Liabilities	
Accounts Payable	2,278
Deferred Income	61,935
Deferred Membership Dues	40,861
Rental Deposit	675
Total Current Liabilities	105,749
Long Term Liabilities	
Deferred Membership Dues	101,150
Total Liabilities	**206,899**

Net Assets

Unrestricted	
Undesignated	279,665
Board Designated for Equipment	21,150
Temporarily Restricted (Centennial)	325,907
Total Net Assets	626,722
Total Net Assets and Liabilities	**$833,621**

NAVAL SUBMARINE LEAGUE

STATEMENT OF ACTIVITIES
FOR THE YEAR ENDING MARCH 31, 2000

Revenues	Restricted	Unrestricted	Total
Contributions		$147,153	$ 147,153
Dues		26,289	26,289
Annual Symp.		59,463	59,463
SubTech Symp.		160,569	160,569
Sub Centennial	$1,657,579		1,657,579
Bank Interest		917	917
Investments		30,452	30,452
Advertisements		16,200	16,200
Rent		8,100	8,100
Back Issues		194	194
Realized Gain on Investments		4,645	4,645
Unrealized Market Gains on Investments		31,725	31,725
Other		905	905
Total Revenues	**1,657,579**	**486,612**	**2,144,191**
Expenditures			
Awards and Grants		67,693	67,693
Publishing		68,153	68,153
Promotion		27,569	27,569
Annual Symp.		63,675	63,675
SubTech Symp.		131,769	131,769
Sub Centennial	1,785,089		1,785,089
Chapter Support		19,486	19,486
Special Event		10,000	10,000
Total Program	1,785,089	388,345	2,173,434
Supporting Services	1,785,089	561,981	2,347,070
Total Expenditures	**1,785,089**	**561,981**	**2,347,070**
(Decrease in Assets)	(127,510)	(75,369)	(202,879)
Assets Start of Year	463,417	366,184	829,601
Assets End of Year	**$ 335,907**	**$190,815**	**$626,722**

E-MAIL ADDRESSES

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

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LETTER

NEW ELIGIBILITY FOR COMBAT PATROL INSIGNIA?

April 11, 2000

Along with my membership application I'd like to make an inquiry of the League's membership at large.

I recently transferred to the Kings Bay Naval Submarine Base and while visiting the St. Marys Submarine Museum I noticed posted inside the lobby a flyer discussing the approval to wear the SSBN Deterrent Patrol Insignia for personnel who served on the SSG and SSGN (Regulus I and II) submarines during the 1950s. The SSBN Deterrent Patrol Insignia was instituted as a result of the FBM submarines in the early 1960s. However, it took almost 40 years for someone to recognize that the insignia requirements were met by the contributions of these Regulus platforms and crews.

With this as a background, here is the body of my question. I was attached to USS LOUISVILLE (SSN 724) during the Persian Gulf War. We left San Diego two days after Christmas 1990 and arrived in the northern Red Sea in time to launch the first of eight Tomahawk cruise missiles into Iraq on January 19, 1991. Once expended, we transited to Guam to reload and return to the theater of operations. However, the war ended before we could inflict more damage on Iraq. (USS PITTSBURGH launched missiles from the Med.) For our efforts, the boat received a NUC and the CO was awarded a Legion of Merit and Bronze Star (which I understand is a combat decoration). The public announcement highlighted the fact that this mission (or patrol) was the first time since WWII that a submarine had expended ordnance in combat. To many of us serving with her at the time we wondered whether or not we'd be awarded the Submarine Combat Patrol Insignia for our efforts. However, nothing ever came of it, as we were told that it only applied to submarines in WWII. With background on the Regulus boats and the approaching 10th anniversary of our patrol, my curiosity was peaked in reading exactly what the award criteria is for the Submarine Combat Patrol Insignia. MILPERSMAN 1200010 states:

"Authorization for the Submarine Combat Patrol Insignia is given to members regularly assigned to submarine duty on or after 7 December 1941, who completed one or more wartime combat patrols designated as successful because:

- the submarine sank or assisted in sinking at least one enemy vessel, or;
- **the submarine accomplished a combat mission of comparable importance**

The insignia represents completion of one successful patrol."

It states further that "the determination of whether a patrol is successful is made by the type or task force commander under whose command the submarine operated."

I don't recall if we were still under COMSUBPAC or had transferred to USCENTCOM jurisdiction. Giving the CO and XO the benefit of doubt, maybe the request to wear the insignia was forwarded and then denied by the type or task force commander. If this was the case, by what rational was it denied? If it wasn't submitted for consideration, what are the available avenues for seeking recognition?

In conclusion, I don't want to find out in 20 or 30 years that a submarine I was attached to is receiving recognition for an accomplishment of this nature. The case can be made as well for those submarines that have launched Tomahawk missiles in the Persian Gulf and Med since 1991. Wouldn't their deployments qualify them too? Since WWII the rules of engagement and the definition of war and combat have changed. With today's submarines expanded strike and offensive capabilities, this affords a continued opportunity to recognize submarine crews with this insignia. This recognition in no way takes away from the contributions and sacrifices of our submarine brothers in WWII. I'm inclined to believe in the further perpetuation of the submarine's role in supporting and defending the interests of the United States.

I hope that someone from this membership body can give an explanation and/or direction to my questions.

Very Respectfully,
Kenny L. Jacobson
USS MAINE (SSBN 741)

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Date _____

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I was introduced to the Naval Submarine League by _____

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