THE SUBMARINE REVIEW
JULY 1998

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EDITOR'S COMMENTS

As a general rule issues of *THE SUBMARINE REVIEW* do not follow a given theme. The main reason is orientation around most appropriate themes limits the magazine's ability to address areas across the spectrum of wide interests which make up the concerns of the entire submarine community. This July edition of the *REVIEW*, however, is an exception. During the process of reviewing a number of inputs it became obvious the **challenge of the future** is being defined and that challenge can be particularized into specific **personnel** and **technology** components.

Admiral Skip Bowman has been speaking out about the traditions of the U.S. Navy's Submarine Force and the importance of those traditions, as a way of life and doing our business, to the future of the Submarine Force and its ability to exert a significant impact on U.S. security and world stability. Accordingly, it is appropriate that his address to SubPac's Birthday Ball leads off a group of pieces specifically speaking toward motivation, training and attention to quality. Those accustomed to reading the words of the Navy's Director of Nuclear Propulsion will recognize there is more here than just an excellent inspirational talk.

In that vein of remembering the past as guidance for the future, Vice Admiral J. Guy Reynolds uses the recent launching of USS O'KANE (DDG 77) to recall the courage and professional skill of one of our submarine winners of the Medal of Honor. A different approach to tradition and motivation, but with the same submariners' hallmark of dedication to craft and service, is given in Captain Ned Beach's Banquet Address to the Naval Institute's recent annual meeting. A third view of the future importance of personnel performance in submarines is given by Dr. Wetzel-Smith in her assessment of man-machine relations in the world expected by Joint Vision 2010. The point seems to be that **the submarine cultural context of knowledge, rigor, training, and tenacity will be all-important as the battlespace gets more complicated and the horizons more widely spread.**

The approach to technology by the submarine community has been cited by Dr. John Foster as key to having the equipment necessary for our dedicated and trained people to operate in the super-connected world of 2010 and beyond. His call for technologies which provide revolutionary capabilities can be recognized by

...anyone in the business of force acquisition as involving as much in determination, and intellectual integrity, as well as knowledge, skill and focus, as real combat. The stage for those coming force structure battles was outlined by both the semi-official National Defense Panel which reported out in December and the non-official, but impressively sponsored, American Sea Power Seminars held on Capitol Hill at the beginning of this year. In addition to the expert projections and assessments about the need for **technological and industrial action**, a dose of reality in the form of fiscal facts is served by the submarine resource sponsor, Rear Admiral Fages, the OpNav Director of Undersea Warfare.

Following that theme of **context for both personnel and technology emphasis**, the article by Captain Hasslinger and Lieutenant Commander Mayer describes the current context being used in the improvement of submarines, while the piece by Captain Patton gives shape to the very real problem facing us in the business of real-time, real-information communicating. **It is all a challenge.**

But let us remember the tenacity and determination with which John Holland not only brought his dream into being, but sold it to the U.S. Navy! That story is told by John Merrill in his excellent article. And let us also remember the story told by Captain Chick Bowling of the strength, skill and plain guts with which the men of SALMON saved their ship. Commander Compton-Hall also gives us an example of submarine determination, training and skill in his final depiction of a Royal Navy ace and winner of the Victoria Cross. **It is in the context of tradition.**

A little further afield perhaps, there is the tradition of Jules Verne-like imagineering to submarining, and it is in that tradition that we offer the efforts of a novelist (and member of the League), Mr. Joe Buff, to point out one way to the future well beyond the year 2010 to which we all are marching with a joint vision. Perhaps in Joe Buff's vision we can see some opportunities for the revolutionary capabilities which Dr. Foster recommended to us.

Jim Hay

FROM THE PRESIDENT

We have had, in the last two months, two very successful symposia. The classified submarine symposium at APL Johns Hopkins was once again extremely well done in May. The NSL Symposium in June was also very well received. Both had excellent speakers and topics which were most germane to the Submarine Force today. For the June Symposium, we were most fortunate to have at our banquet, Admiral Bowman who spoke of our submarine heritage, and Vice Admiral Arnie Schade, USN(Ret.) as our submarine hero.

As we go into the 21st century with its reorientation of world powers, unpredictable crises in unusual locations and the pressure of fewer resources for defense but as many or more varied needs, the Submarine Force will celebrate its 100th birthday, marking a full century of unparalleled service to its country.

That century had two phenomena especially germane to submariners. The first was World War II when two percent of the Navy personnel (members of the Submarine Force) accounted for 55 percent of the enemy's maritime losses. And, in the process they lost 20 percent of the submarines; and 3505 submariners lost their lives—a larger percentage of personnel losses than any other corps in the U.S. military.

Admiral Bowman's remarks at the Symposium reflected on our submarine heritage, of which we should all be aware and frequently review. The Admiral repeated the statement which Admiral Nimitz, CINCPAC, made at the end of the war. It is of such significance I repeat it here:

> "When I assumed command of the Pacific Fleet on 31 December 1941, our submarines were already operating against the enemy, the only units of the Fleet that could come to grips with the Japanese for months to come. It was to the Submarine Force that I looked to carry the load... it is to the everlasting honor and glory of our submarine personnel that they never failed us in our days of great peril."

The second phenomena was the Cold War, during a large part of which the world's eyes were on the war in Viet Nam. But all were cognizant of the Soviet power. Classification restrictions

have ensured that the only people who know the full range of submarine contribution to both nuclear deterrence and to national security are submariners themselves. As far as I know no one has publicly stated the extremely important role of the submarine and submariner.

Admiral Chiles discusses the emphasis we are attempting to place on the 100th birthday as we support, in partnership with the other national submarine organizations, the Submarine Force in celebration of this milestone.

Finally, as we understand the past, and celebrate and honor it and its heroes, it is mandatory that we also understand the situation today and articulate the vital importance of supporting the Submarine Force in ensuring our elected representatives and our citizens understand the purpose of, reason for, and the capabilities of our submariners and our submarines. Our mission is even be relatively more important in the future than it was in the past.

I recommend you read the Summary of the National Defense Panel in this edition and refer back to *From the President* in the April edition, which discusses the recommendations for the future contained in that report. With this as a basis, there are several articles in this edition which help to define today's problem of resources and outline some of the actions being taken by our systems designers and operators to make the personnel reductions necessary to keep the life cycle costs down. We must understand the problem and the possible solutions.

Dan Cooper

REMARKS AT THE COMSUBPAC SUBMARINE BIRTHDAY BALL

ADM F.L. (Skip) Bowman, USN
Pearl Harbor, 4 April 1998

Thank you, Admiral Ellis. Ladies and gentlemen, friends and fellow submariners...

Let me begin with a disclaimer: There is no bigger supporter of *jointness* than I am. I stand in awe of the power and the beauty of Soldiers, Sailors, Airmen, and Marines working together.

But I am also a big believer that each Service, and each community within the Services, must hone its own unique skill, must constantly strive to be the best at what it does.

Imagine a football team made up of 11 All-American quarterbacks: not much chance of winning there. To win, you need a quarterback to throw with precision to the split end who has gotten to the prearranged empty spot because of strategic blocking by interior linemen who... And on defense, you'd better not show up with 11 safeties. You need tackles and linebackers—and a punter who can *boom*! In short, you need the whole team, with all members performing their unique skills to the best of their ability.

Likewise, we in the Navy need *our* Army, Air Force, and Marine Corps—just as they need Navy Air, and Surface Warriors, and SEALs, and medical...

But tonight I'm here in my submarine finest. I come before you without shame, without guilt, to talk to and about the **world class** U.S. Submarine Force.

Because tonight we pause around the globe to celebrate the many achievements of one of our Navy's most distinguished and elite groups of Sailors. And to commemorate the heroism and sacrifice of those submariners who have gone before us.

Officially, we count submarine service birthdays from the day when USS HOLLAND (SS 1) was commissioned in 1900. But what we all think of as the submarine service really didn't come into being until World War II. It was then that we learned our trade, developing many of the strategies and tactics still in use today.

So there is not a more fitting place to celebrate this anniversary event than here in Hawaii, the home of the Pacific Submarine

Force, where the very spirit of the Submarine Force was forged in the raging fires of combat. It was from Pearl Harbor that our submarines sailed forth on their legendary war patrols—as well as from our forward bases, including Midway Island, Dutch Harbor in the Aleutians, and Brisbane and Fremantle in Australia.

The war in the Pacific began with the crushing surprise attack by the Japanese on Pearl Harbor—a devastating blow. For a considerable time it was very doubtful whether our forces could recover. The Battle Line, the backbone of the Pacific Fleet, lay for the most part at the bottom of the harbor, surrounding Ford Island with the twisted wreckage of our proud Navy. The runways of Schofield and Hickam were littered with the charred remnants of our airplanes, destroyed without even the opportunity to fight.

Those slim hopes mustered when the day was done included four critical elements of our fleet's assets which the Japanese failed to destroy: the shipyard, the carriers (which were fortuitously underway that day), the fuel supplies (which would be needed to carry the fight to the enemy), and the submarines.

The exploits of the Submarine Force in World War II are legendary and many of you know the stories. But they bear repeating because the submariners who are coming up now need to know them. They are all about our legacy—the foundation, the principles upon which we continue to operate our submarines. We need to understand our roots, because they are our greatest continuing strength and our very reason for being.

We are now almost three generations beyond that great conflict. The memory and understanding of what really went on then is beginning to fade. The events that took place are becoming clouded in the ongoing pace of life today. When I talk with our young sailors—including our young submarine officers—I find that many of them don't know about Commander *Red* Ramage's courageous 46 minutes of blazing surface engagement with an enemy convoy at night; about the exploits of BARB, HARDER, PARCHE, and the other legendary submarines and submariners that were so critical to our nation's survival. We have brought the Battle Flags with us—but can we even read these flags? Much less tell the stories?

Even those of us in my generation who grew up in the years just after World War II often fail to grasp how pivotal those events really were. We Americans have had our share of trials in the

years since that war, but we are accustomed to thinking of our nation as a perennial power, always succeeding, with some days just turning out better than others. Many do not appreciate the fact that Imperial Japan truly threatened to defeat us—*they were winning!* They had the resolve and the capability to win, and they were doing just that, having seized the advantage at Pearl Harbor.

Our Submarine Force survived that blow and immediately took the fight to the enemy. Then and there was born the principle that, to a submariner and his boat, there is no such thing as *enemy-controlled waters*. Our submarines hounded the Japanese Empire, holding their forces in check until our nation could recover from Pearl Harbor and mount the indomitable effort that turned the tide and won the War in the Pacific.

Admiral Nimitz later said:

> "When I assumed command of the Pacific Fleet on 31 December 1941, our submarines were already operating against the enemy, the **only** units of the Fleet that could come to grips with the Japanese for months to come. It was to the Submarine Force that I looked to carry the load... It is to the everlasting honor and glory of our submarine personnel that they **never failed us** in our days of great peril."

Submariners represented less than two percent of Navy personnel during World War II, but accounted for more than 55 percent of our enemies' maritime losses.

Post war records show that they sank 214 naval vessels and 1178 merchant ships —5-1/2 million tons of enemy shipping.

But the Submarine Force paid a heavy price for success against a determined enemy, bearing the brunt of our own wartime losses: 52 of our 288 submarines—that's nearly one in five—were lost, and 3505 World War II submariners remain on eternal patrol.

Many of you have heard these numbers before—maybe some of you haven't—but I'd like you to think about them for a moment and see if you don't find them as absolutely astounding as I do.

These 52 submarine crews are not very different from the crews in which many of us have served and are serving today. Every one of these 3505 men was a man very much the same as we are.

Some of you tonight are veteran submariners from that conflict. I have spoken with many of you and with your shipmates over the

years and I must tell the rest of the guests here tonight that, to a man, these heroes maintain that they were just ordinary men who did what was required when they were called upon in extraordinary times. *Ordinary men,* indeed!

Men proud to be Sailors, and even more, prouder to wear the dolphins of a qualified submariner.

Men who loved their country, their work, and their ships, and whose homes and families were never far from their thoughts, wherever they were in the world.

Men who grew bored at times underway—and lonely, too—just like we do. Men who sometimes got frustrated with the lack of showers, the lack of privacy, and the endless drilling and watch-standing and training—just like we do.

Men who understood that when the chips were down, they could count on their shipmates—just like we do.

Men who, like us, did not set out to be heroes. But not quite *ordinary men*!

They were young men. Some had slipped into the Navy at less than the legal age, eager to do their part to accomplish what needed to be done. Even the skippers were young—some younger than 30. And they were energetic. They were ambitious. They were resourceful, and they were courageous.

Many of you have read the accounts written by those who were there. If you haven't, you should. If you have, you should read them again, and then teach them. The books are those by men with the names we should know and should be teaching to our new submariners today—Beach, O'Kane, Fluckey, Street, and others—and they contain the names and the stories of many others we should know. They are our story.

A quick example: A story about Lieutenant Commander Dudley *Mush* Morton, who commanded WAHOO and was revered by his fellow submariners, then and today, for his willingness to take the fight to the enemy—a revolutionary change from the submarine tactics practiced in World War I.

At one point during the war, Morton decided to invade Wewak Harbor, an enemy anchorage he'd heard about, but that didn't appear on any Navy charts. A junior officer (who hadn't served with Morton before) suggested it might be better to reconnoiter the harbor from a safe distance out by using the periscope.

But the other JOs and the crew (who knew Mush well enough

to know they were going in, with or without charts) jury-rigged a projector from a Graflex camera and a signal light and produced a homemade chart on tissue paper...from a drawing in a high school geography book that one of the Sailors had bought while on liberty in Australia—for a quarter!

In true Hollywood fashion, they entered Wewak Harbor submerged—homemade chart on the table—and in full daylight torpedoed a Japanese destroyer, the first of several ships WAHOO would sink in her short, but illustrious, career.

Great stories like this are ones we all need to keep retelling.

They speak volumes about why our silent service is about daring, about innovation, about teamwork—and they're about **today**.

Some look at our submarine operations today and wrongly attribute many of our sound practices to the successful and meticulous culture developed in bringing nuclear propulsion to our submarines. Practices like using a *two-man rule* dealing with nuclear weapons, going over our pre-critical checks to start up our reactors, and so on.

They are *not* new behaviors developed by Admiral Rickover or any of his people, however. These are lessons learned from our World War II Submarine Force—lessons written in blood. They are lessons reinforced and correctly applied by Admiral Rickover to his operation, but they apply throughout the ship. The sanctity of the procedures we inherited and use today for our **Rig for Dive** are as fundamental as you get—and those procedures came from our World War II heroes.

Our reliance on rigid qualification and continuing training comes from our World War II legacy as well, again not just from Admiral Rickover. After reading Admiral Dick O'Kane's Clear the Bridge! I sat back and reflected on his accounts of the legendary war patrols of his boat, USS TANG. And I realized that Clear the Bridge! is one of the greatest testaments to training we have.

O'Kane disproves the wrong-headed impression some have of *the good old diesel boat days* when we didn't have to drill and train—scourges brought about by the *nuclear Navy*.

TANG's wardroom began each patrol's training before departure (just like we do), sometimes working through tactics and intentions during discussions out here on the reef at Waikiki Beach, over by the Royal Hawaiian. (The *Pink Lady*, as it was known,

was the Submarine Force's home, where the crews stayed during their short but well-deserved rest periods between war patrols.)

When TANG departed Pearl (or Midway) on patrol, the crew would drill endlessly, day and night, resting only as needed, until every man knew what to do in every contingency imagined, or lived, during previous patrols. Only when the skipper was satisfied that the crew could operate the ship expertly and like a team did he secure the drilling.

By drilling his crew, Commander O'Kane developed the ability to rapidly clear the bridge while transiting surfaced, and submerge the ship—skills TANG used to avoid becoming victim of Japanese warplanes. He tested the crew's ability to operate at great depth—and then used it to survive depth-charging by an enemy who set the charges for a shallower depth.

Training, qualification, and drilling—to develop the ability and teamwork to conduct *routine things in a routine manner*—are as essential to our survival today as they were 55 years ago. Even when you're not getting shot at, submarining holds significant inherent risk, which can only be held to an acceptable level through sound fundamentals and hard work. There are no shortcuts. That's why Admiral Jerry Ellis was so right to emphasize a return to the basics. That hard work over the last couple of years will pay off.

Ours is a heritage of teamwork, of mutual trust and mutual obligation, that keeps us safe and makes us strong—and, yes, lets us take risks when the situation calls for it and when it makes sense to do so.

We must never abandon this heritage, because to meet the challenges of the 21st century, we will need innovators, not robots.

You who are fortunate enough to call Pearl Harbor your home port have a wonderful advantage in that our heritage surrounds you. Be a part of it and share it with your people.

I went back to Lockwood Hall the other day, and I have to tell you, I still get emotional as I pass those large plaques with the names of the Navy Cross and Silver Star winners. The *Clean Sweep* doesn't get as much use as it used to, but it overflows with submarine heritage.

When I went into the Skipper's Lounge, I stood in awe again as I looked at the pictures of our heroes—the Medal of Honor winners on the one wall, and all the rest, too. I have been greatly affected

by them in the same way, ever since I was an ensign.

Just across from Lockwood is the bridge of Admiral Ramage's PARCHE—the actual bridge that passed at night within 50 feet of a Japanese warship in close, mortal combat.

And you have those 52 brass plaques on that wall—one for each of our boats who were lost—inscribed with the name of every submarine sailor who was aboard those boats.

Go there, by yourself and with your people, and remember who we are. Make this a part of our dolphin qualification. Teach the legacy and talk about it.

I know of some boats whose practice it is when the skipper pins dolphins on his sailors, to read a short passage from our history—from Theodore Roscoe's *Submarine Operations of World War II*, for example. *That's* a good practice, I think, and it creates a powerful impression on our Sailors.

Some boats do dolphin presentations and reenlistments at the PARCHE memorial or aboard BOWFIN. *That's* a good idea.

Go through BOWFIN and visit the submarine museum there. It's right near where we moor today. Look closely when you go through BOWFIN. It may strike you how much has changed—but what is really striking is how much is the same. Go look and see—and feel—what I'm talking about, and then teach our legacy and talk about it.

I said earlier that our Submarine Force is one of the Navy's most distinguished and elite groups of Sailors. Now, the dictionary defines *elite* as "the choice or distinguished part; those thought of as the best". To characterize the Submarine Force as elite would therefore seem to some an arrogant thing to say. We often try to avoid saying things like "we are thought of as the best".

But in considering that definition, I think I accept the charge of elitism. Because I do think of our Submarine Force—past and present—as the best. Our Force is elite. We should be proud of what we are and what we as a team have done. Everyone of you is a part of this great legacy. Teach it. Talk about it. Be proud of our heritage and be proud of our role today. Stand tall and let your chest swell with pride, adorned by your precious dolphins. What you're doing is vitally important.

So here's the deal: Skippers, take your wardroom on a field trip to see, to touch, to study this legacy. Use an EOOW/EWS seminar to discuss the legacy of teamwork, technical exactness, and our

elite role in the Navy. Engineers, division officers—same offer—departmental or divisional training. And yes, Skippers: Count it. Report it in your letter. Let me know what you think.

Because 30 years from now, someone will stand in a place like this and talk about the exploits of many of you here. He'll talk about when we stood eyeball to eyeball with the Soviets, saying words like Admiral Nimitz's words I told you about earlier: "It was to the Submarine Force that I looked to carry the load... It is to the everlasting honor and glory of our submarine personnel that they never failed us..." We know the irreplaceable role our submarines had in deciding the Cold War. Our submariners never failed us.

And he'll talk of the leadership, teamwork, and pride of the submariners of the early 21st century and how they ensured our nation's continued security against those who would do us harm.

You are writing that history right now.

It has been an honor to stand before you and speak to you this evening. I salute all of you veteran submariners who have gone before us, and I enjoin today's Submarine Force to go forth with great pride—and with a great responsibility to carry on. God bless our Submarine Force and God bless you all. Thank you.■

CONSPICUOUS GALLANTRY!

by VADM J. Guy Reynolds, USN(Ret.)

It was unseasonably warm with bright sun in Bath, Maine, on 28 March 1998. On that day Bath Iron Works launched its 16th Arleigh Burke class guided missile destroyer for the U.S. Navy—O'KANE (DDG 77). O'KANE is named for Rear Admiral Richard H. O'Kane, USN. Admiral O'Kane passed away in February 1994.

The naming of O'KANE recognizes the conspicuous gallantry of Commander O'Kane, the crew of USS TANG (SS 306) and those gallant submariners who took the war in the Pacific to the enemy, early, often and with devastating effect. As Commanding Officer of TANG Commander O'Kane went on five war patrols, sinking a total of 31 enemy ships, totaling more than 227,000 tons and damaging two other ships, a record unsurpassed by any submarine. On her last patrol, USS TANG sank 13 enemy ships, 11 in a single 15 minute period. On October 25, 1944, while engaged in a fierce surface battle, TANG was sunk by the circular run of her last torpedo. Commander O'Kane was one of nine who survived the tragic loss of TANG to her own weapon. After eight hours in the water, Commander O'Kane and the others were picked up by a Japanese destroyer and imprisoned on Formosa.

Transferred later to a secret prison camp near Tokyo, he was not registered as a POW and therefore was listed as *missing in action*. The fact that Commander O'Kane survived was not known until the camp's liberation two weeks after V-J Day. During his imprisonment, he and the others prisoners survived on a diet of less than 300 calories a day, eating mostly rice or barley, without fruit, vegetables or protein. O'Kane was released from captivity weighing only 88 pounds and suffering from scurvy and beriberi. He was evacuated by air to Pearl Harbor and, after a short hospitalization there, was transferred to the Naval Hospital in Portsmouth, New Hampshire.

After his recover, O'Kane commands included USS PELIAS and USS SPERRY, as well as the Submarine School in New London, Connecticut, Submarine Division THIRTY-TWO and Submarine Squadron SEVEN. On March 27, 1947, President Harry S. Truman awarded Commander O'Kane the Congressional Medal of Honor for his exemplary service on TANG. Rear

Admiral O'Kane's other military decorations include the Navy Cross with two Gold Stars, the Legion of Merit with Combat "V", the Purple Heart, the Commendation Ribbon, and the Prisoner of War Medal. The launch of O'KANE should remind us all of at least three lessons from our submarine heritage. The Submarine Force substantially contributed to the defeat of Japan; in combat a small number of highly trained dedicated individuals can have unbelievable impact in conflict on either side; and neglecting our undersea weapons inventory can have devastating consequences.

The citation for Commander O'Kane's Medal of Honor, this nation's highest award, reads,

The President of the United States takes pleasure in presenting the Medal of Honor to

Commander Richard H. O'Kane, United States Navy

for service as set forth in the following

CITATION:

"For conspicuous gallantry and intrepidity at the risk of his life above and beyond the call of duty as Commanding Officer of the USS TANG operating against two Japanese convoys on October 25 and 24, 1994, during her Fifth and last War Patrol. Boldly maneuvering on the surface into the midst of a heavily escorted convoy, Commander O'Kane stood in a fusillade of bullets and shells from all directions to launch smashing hits on three tankers, coolly swung his ship to fire at a freighter and, in a split second decision, shot out of the path of an onrushing transport, missing it by inches. Boxed in by blasting tankers, a freighter, transport and several destroyers, he blasted two of the targets with his remaining torpedoes and, with pyrotechnics bursting on all sides, cleared the area. Twenty-four hours later, he again made contact with a heavily escorted convoy steaming to support the Leyte campaign with reinforcements and supplies and with crated planes piled high on each unit. In defiance of the enemy's relentless fire, he closed the concentration of ships and in quick succession sent two torpedoes each into the first and second transports and an adjacent tanker, finding his mark with each torpedo in a series of violent

explosions at less than a thousand-yard range. With ships bearing down from all sides, he charged the enemy at high speed, exploding the tanker in a burst of flame, smashing the transport dead in the water and blasting the destroyer with a mighty roar which rocked the TANG from stem to stern. Expending his last two torpedoes into the remnants of a once powerful convoy before his own ship went down, Commander O'Kane, aided by his gallant command, achieved an illustrious record of heroism in combat, enhancing the finest traditions of the United States Naval Service." ■

FORMER CREWMEMBERS OF USS TUNNY (SSG 282)

This notice is for those former crewmembers who were serving in USS TUNNY in July 1958, and who made the emergency deployment from Pearl Harbor on 17 July 1958, in support of the worldwide alert caused by the Lebanon Crisis. Be advised that TUNNY has been awarded the SSBN Deterrent Patrol Insignia by COMSUBLANT for that first-ever deterrent missile patrol.

This award is separate and distinct from the awards made by COMSUBLANT last spring to the five Regulus Missile submarines for the 41 scheduled patrols they made, commencing in September 1959.

For a copy of the Letter of Authorization, please write to Captain Marvin S. Blair, 24 Rubi Circle, Hot Springs, N.P., AR 71909-3515. Please include details of your service in TUNNY, including dates, rank or rating, and position. He would also appreciate getting names and addresses of other shipmates.

WHAT THE NAVY MEANS TO ME

Remarks to the
U.S. Naval Institute Annual Meeting

by CAPT Ned Beach, USN(Ret.)
April 22-23, 1998

Editor's Note: Captain Beach was the honored speaker at the Naval Institute's Banquet on the occasion of its 1998 Annual Meeting. The Institute has announced that their new headquarters, in the old Naval Academy Hospital building will be named Beach Hall in honor of Ned Beach and his father.

Good evening. And after that introduction, probably the smartest thing I could do is to just put my papers down and go home. After all, I don't believe a word of it either. But, Tom, thanks a lot.

You know, I did prepare some remarks. They begin: distinguished guests, friends, and most especially my extraordinary and very good fried, Jack Shipp, sitting right here. How did they let you in Jack? Last, but not least, my wife of 54 years. She married me one week before she graduated high school. She didn't get her diploma for more than 20 years; they'd given it to a friend of hers who forgot to deliver it.

Things were different during the war. It did a lot of things to many people, but one thing it did was to bring the most happy, possible partner into my life who's been with me all these years in the form of a beautiful girl who was then a very precocious eighteen year old. There she is. Now she's my private camerawoman.

Well, you'll see where my thoughts are going in a minute. One of the traditional stories of my family concerns my mother who was a young French woman living in Haiti having recently been orphaned and had been taken in by a Norwegian family. In those days there were still a number of foreigners living in Haiti, mostly in the import/export business. And at that particular time, which was in July 1915, there was not only a revolution (they had revolutions every six months) but this was a very special revolution in which the president of the country decided he wanted to stay in office, not just take the treasury and go to Paris with it, but stay in office. So he put all his political opponents in jail and then when

he thought things were getting a little hot he had them all murdered in jail with the result that there was a real revolution. The chief of police led it, I might add. And they finally got him and they actually tore him up in the streets of Port-au-Prince, resulting in a terrific riot. Everybody was shooting everybody else, mainly they were just shooting in the air, but bullets were flying all over the place and all the foreigners and foreign families were scared to death, including the Norwegian family with whom my mother was living. So, they all got down in the cellar, which is apparently the safest place to be in that particular situation. And according to the stories that I've heard, I've got no proof of this, but some bullets actually did hit the house. Anyway, at some point my mother, I think being somewhat of a venturesome young woman, decided she would go and see what was going on—maybe things had died down a bit. So she went up to the top of the house, the third floor, and had a pair of binoculars with her and looked all around.

Why was everything quiet. In the distance was a cloud of smoke and all of a sudden appeared the bow of a big warship. Water boiling off the bow, smoke streaming out of the stacks, coming into Port-au- Prince. She ran down below and screamed, "We're saved, the American Navy has arrived." She didn't see any flags; she just knew it had to be the U.S. Navy, and indeed it was. The rest of the story which shows that little things bring more things and large things sometimes can bring personal things. The skipper of that ship, whom she hadn't yet met, became my father. So, that's one reason why he was born about 50 years before I was and I graduated from the Naval Academy 51 years after he did.

Well, my father became the ideal that I tried to live up to. I made his life kind of unpleasant at times. As a boy of four, my favorite bedtime story was not Dick and Jane, or it wasn't some of these stories that you give the kids. I would say, "Dad, tell me about the wreck of MEMPHIS". Well, MEMPHIS was a big tragedy in his life—the cruiser TENNESSEE later changed to MEMPHIS—destroyed in a tsunami, tidal wave it was then called, in Santo Domingo Harbor in 1916. So the ship was kind of a big thing for father and I made him tell me about it everyday. And I got the story down pretty good. So, that's why I finally wrote the book The Wreck of the Memphis. And I might add, my father was court martialed because he was captain of the ship. There were three Medals of Honor handed out, to his engineer and to two other

people in the engine room, one of whom died in the process. Father did not even get any credit for doing what he could. He was, of course, the last man off the ship and he was convicted of not being ready to get underway immediately. The Navy did its thing. Two years later, the Secretary of the Navy wrote a letter to my father and said, "We have investigated this a little more fully; it was not a hurricane despite what the court martial said. It was a tidal wave that could not have been predicted, and your punishment is hereby rescinded." So in effect, it was an exoneration.

Sometimes I thought that that sequence of events was what led me into thinking about Admiral Kimmel and saying the same thing ought to be done for him and I'll just leave that with you.

Well, I'm proud of my father. I'm proud as I can be. And I'm proud of the fact that somehow I think he would be proud of me.

So, this is the 124th annual meeting of the Naval Institute and it's the 125th year of its existence. And here we are, and everybody that founded it is gone and we have to wonder, at least I wonder, what is the Institute about, why are we here and what's it doing? And I think my answer is not the pragmatic, practical, useful one that you would expect from a person who spent his life dealing with the Navy and making ships go and all that. My answer's entirely an emotional one. What is the Navy? What is the unspoken basic reason for our Navy to exist? Well, one thing the Navy existed for and happened to do was it gave me life itself. Right? It also gave my brother and sister life. And these things are kind of important. Even though I don't remember how it came about, I know that it happened.

But the sentimental thought is specifically foreign to a military organization in which people train to be pragmatic. However, the driving force to me has always been to recognize and act on the thing that has always been most significant to me personally. And if you look at it, that's what everybody does. You train and you practice and you do it right, but you really do what's most important to you personally. That's what you've got to do and that's what you grow up doing. And the whole purpose of the Naval Academy and the naval service is so that these things are built into you so that when you suddenly are faced with the biggest question of your life; you react the way you were trained to instead of the way you might have suddenly thought up at the last minute. This is important—it's what's basic to the Navy. But nevertheless,

it's a very sentimental, important thing that you are doing.

And what is it that we in the Navy worship most of all? Well, you can start down from the Constitution of the United States and so forth. But, taking the immediate, more practical thing—the Navy, its ships, its machinery, the Naval Academy, the Naval Institute—all these things wind up meaning the same thing. And to the sailor the most important thing in his life is his ship and his shipmates, and that ship is not a ship, it's his arms and legs extended; the periscope of a submarine or the telescope of a warship are your eyes; your heart is pumping that propeller; your arms and your legs are reaching out doing what you are supposed to be doing. I never thought of myself as being confined inside the small hull of a submarine. My mind was out there doing what was needed to be done. And I never felt confined. Quite the contrary, I was like an octopus with tentacles going all around. And I'm not saying anything that people here don't know in their own minds. This is true. This is the way you feel about it, so this is why a Navy is different from any other military organization. Of course we're military, but we're more than that. We worship the ship and we worship the sea because the sea supports the ship and in the case of the submarine, the sea surrounds the submarine and protects it too. I've had people say they hate the sea. They really don't. They know how to deal with it. They can say what they want to but really they live in it and it's part of their lives and they wouldn't want it any other way.

So, sailors love their ships, they personify them, they give them a personality, they'll say this is a great ship and that wasn't a very good one. They'll say that this ship always did everything well, this other one somehow didn't. The personality of the ship, which is a combination of the personality of the crew, nevertheless it becomes a personality and I've known cases when in order to convert a ship from something that wasn't very good they didn't just detach the captain, they took everybody off and put a whole new crew on board. And they made a new ship out of her. And that, sometimes is the only way to do it. But what you get is the synergism, the combination of the soul of everybody who lives on board that ship and is a part of it. And, essentially, that's what we're talking about tonight and that is my message to you. It's the idea, it's not the inanimate steel. To the naval officer this ship is me, it is me.

So to all of us here, one way or another, the ship in which we serve psychologically represents our bodies, our lives, and our purpose. The relationship is inescapable. And if more of us recognized it, more of us would somehow understand why we are here and in the largest sense would understand what we are doing. And it will also explain certain things, as for example, happened to me. Why I was so terribly disappointed with one of the ships I commanded. She was named after my wartime submarine that I really worshiped, it was a great ship, she was lost in the war. We built another one, named her after the first, she was a fiasco. Now what do you do as captain of a ship that was named for something for which you had every possible respect and the ship is no damned good. The engines didn't run, the torpedo tubes didn't work, the periscope was no good, the water distilling apparatus was not good. I have only once in my life had to bathe and shave and brush my teeth in half a glass of water. And I did it just to prove it could be done. And I did it aboard the Navy's newest, most modern, fantastic, no-good submarine. And that was all right. My mistake was I let it be known positively by official report. And guess what happened. The Bureau of Ships that built the ship did not catch hell, I caught hell for saying so. But it had to be said and I'm dag-gone glad I did. Because they did do some repairs. So sometimes you have to not just bite the bullet, you grab it as it goes by and you do what you have to do and you don't count the consequences. You do what you need to do, and in this case it was to write an official report saying that this shp was unfit for war service and if war were to come I would ask immediately to be relieved and given back my previous ship. Well, that was strong language, it got attention, and that's all I can really say.

So what has the Navy meant to me? It's meant adventure, it's meant travel, it's meant friendships, it's meant shipmates, it's meant speaking up when you had to, it's meant facing what you had to face. Sometimes it was the enemy, sometimes, I have to admit, it was the Air Force, but sometimes it was higher ranking officers in the U.S. Navy that just didn't see things your way and you, by god, had to show them. And you do it, if you're any good, you do it. However, you also realize that you have become an intimate part of a mechanism that transcends everything else. It's a source of service to something greater than yourself, you wind up an extension of your own personal being, and most

important I think the Navy has become to me at least, an inexpressible source of suzerainty. Suzerainty is the word I carefully figured out, suzerainty over the whole world. For one, on an individual basis the world is only what you can see and feel and touch and the Navy has given me the capability of controlling that part of the world. And you do it and you know you can, and you do it because you've got this ship, you've got this crew, and you can do anything. You can do anything, I mean this literally, you can do anything, of course that's within the framework. So on top of that of course we realize we serve the flag, we serve the President, we have sworn an allegiance. That's not what I'm talking about. I'm talking about what I can do with my ship and with my Navy when I need to. And that's the bottom line of the whole thing.

So, this is what I'm part of. The Navy gave me life, it gave me everything that I own, everything I hold dear. It gave me my wife, it gave me my mother, it gave me life itself. It's had its ups and downs, but mainly it's given me everything that I hold dear and I am grateful.

Thanks.■

DOMINANT MANEUVER: A PARTNERSHIP BETWEEN SAILORS AND TECHNOLOGY

by Sandra Wetzel-Smith

Dr. Wetzel-Smith is a Senior Research Psychologist at the Naval Command, Control and Ocean Surveillance Center, San Diego and is currently involved in analysis of Battle Group procedures. This article is a follow-on to a presentation she gave at the Submarine Technology Symposium held at Johns Hopkins Applied Physics Laboratory in May.

Dominant maneuver is an essential operational concept of Joint Vision 2010. The increased advantage in battle will be gained through "multidimensional application of information, engagement, and mobility capabilities to position and employ widely dispersed joint air, land, sea, and space forces to accomplish the assigned operational tasks...and will require forces that are adept at conducting sustained and synchronized operations from dispersed locations."

JV-2010 envisions a wide range of potential obligations—peacekeeping through warfighting—that could occur at nearly any point in the world and with highly variable notice. For the submarine community, this means maintaining tactical readiness in the traditional missions of anti-submarine warfare (ASW), anti-surface warfare (ASUW), and intelligence, surveillance, and reconnaissance (ISR) as well as executing tactical missions specific to the littorals, support of expeditionary forces on land, and clandestine strikes against critical targets ashore. These operations may be conducted independently, in combined forces, or with international coalitions and could last weeks, months or perhaps even years.

Even a casual reading of JV-2010, with its extreme emphasis on communication, coordination and precision engagement among joint forces, provokes a response from those who grew up during the Cold War and were used to a more traditional use of naval forces: *it certainly is a bold plan and very many things must work to make it succeed.*

Some of the things that must work are tactical systems that need to be invented, refined or simply bought in large supply and integrated into the combat workplace. These systems will make up

the infrastructure of communications, sensors, and weapons capability. Clearly, state-of-the-art technology is critical to the development of that infrastructure and it is unlikely that we could meet the 2010 challenge without substantial investment in those technologies.

Our sailors must work at least as well as the systems. They may be less amenable to invention or quick refinement; and are sometimes very difficult to simply buy up in large supply for the workplace. These people will make up the infrastructure of system users: tacticians, operators, analysts, communicators, decision-makers, and system integrators. They will perform operations, coordinate outcomes, resolve ambiguities, make intelligent decisions, execute with best knowledge, and then respond to evolving events.

The partnership between the sailors and the high end tactical systems will, in large part, determine how well we translate the vision in JV-2010 to the pragmatics of the battlespace. Systems will be engineered to handle much of the situational monitoring, analyzing, and even some of the higher level decision-making. Tactical programs will be designed to reduce much of the procedural tasks, memory drills, and administrative requirements that currently add to an operator's workload. Data fusion capability will help coordinate the detection, track, and classification data from multiple onboard systems or from offboard platforms. Communication systems will provide the timely exchange of critical information absolutely necessary to effect dominant maneuver.

But...systems don't run the tactical problem; people use systems to support their tactical decisions. And, for all of the expert assistance provided by these systems, people are still responsible for tactical interpretation, prioritization, and execution of their mission. If the expert algorithms embedded in the system are stymied by the range and variety of contacts, frustrated by the harsh acoustic or electromagnetic environments, or confused by non-traditional or unexpected threat signatures...then, the system operators and their tactical officers will be most intimately involved in resolving those localization and classification problems. If the offboard cueing is inaccurate or the threat assessment is incorrect, it will be up to the tactical crews to reason their way to a better understanding of the situation. If the C4I/communication process fails or is tactically inaccessible, then the crew will have to perform

their mission as an independent operation using their best judgement.

The submarine community has a legacy of excellence built on the partnership between sailors and the systems that support them. Submarines have always had the best selection of available and recruited talent; many in other communities have said perhaps more than their fair share. Submariners have always been able to retain the best and provide reward for demonstrated work ethic and accomplishments; sometimes the biggest problem was having too many good people and having to choose among them.

However, the last several years have presented a challenge to the Navy and the Submarine Force. Difficulties in meeting recruiting and first, second, and even third tour retention goals place substantial burdens on the current crews to maintain high levels of tactical readiness. It is likely that a higher proportion of both officers and enlisted personnel will embark on deployments with limited real-world experience against the non-cooperative opponents they may engage. Many with experience measured in years of service may still be challenged by executing complicated tactics in rapidly changing conditions that they have only practiced in fleet exercises. And, since JV-2010 places so much importance on shared cueing and coordinated performance, an uneven distribution of tactical proficiency across assets in the joint forces may have a much greater impact on required collective performance than in the unit level combat of the past.

It may be that these recruiting and retention problems will be resolved in some way in the near future; the projection of the quality and quantity of recruiting and retaining officers and technicians in the future is often inaccurate at best. The one thing we do know, however, is that the real competition both within the Navy and among the other services will largely be after the really smart and well-prepared recruit or officer candidate. Retaining a substantial number of these kinds of people to sustain and build the collective expertise, to refine the collaborative tactics, and to train and supervise the future Navy **will require a culture that attracts and supports the very best.**

JV-2010 stresses a highly flexible and responsive force that can effectively shape the battlespace to our advantage. Inherent in this requirement are the people who have sufficient knowledge, practice, and experience to make this happen. Nearly all of the

current commander and/or senior enlisted personnel acquired their experience through many years of apprentice, journey, and master level jobs. Task proficiency and the ability to train and supervise junior people was gained through hard work and hard gained understanding. The initial gaining of skills grew, through practice, to expertise. In certain special people, expertise transitioned to good judgement; and, in a very few, grew to wisdom. The submarine crew that could respond predictably and proficiently to almost any operational requirement had a mix of skills, expertise, judgement, and perhaps that touch of wisdom which made the critical difference in the mission outcome.

The people who will enter the Navy to take their place in our nation's defense in the year 2010 are very young now; the first tour enlisted are currently finishing 1st and 2nd grade, while the officers-to-be are somewhat older—they're getting ready to start the 6th grade. We think of them as *computer literate* and believe that the skills they are gaining and the way they interact with graphic displays will be very helpful in acquiring requisite combat proficiency. Those capabilities will undoubtedly make learning the systems easier and the mastery of the operating procedures occur faster. The question is how to get those young sailors and officers to combine their system interaction skills with a profound understanding of the problem at hand so that they become the highly flexible and effective *battlespace shapers* we read about.

In the past 25 years, the Navy has largely relied on a balance between schoolhouse instruction and at-sea training and experience to transition people from apprentice to journey level capabilities. Technical training pipelines absorbed a great deal of the initial introductory training for technical knowledge, system operation, and elements of team coordination. Following that introduction, people transferred to their fleet jobs and learned how to integrate their school-gained procedural skills into real-world operational utility. The first deployment provided not only much needed experience, but gave the first tour officer or enlisted person their first real taste of life on a submarine. Follow-on deployments, additional schools, and exposure to situations and knowledgeable people were the most commonly followed route to acquiring seasoned skills and good judgement. Almost everyone in the Navy that managed to get senior enough to be granted supervisory or command positions learned their craft that way.

The number and complexity of new systems, increased missions, and potential operating areas with the substantial emphasis on multi-platform/combined force coordination, precision engagement, and full spectrum dominance certainly could stress the people side of the partnership. Assuming the new systems not only do what they were designed to do, but are acquired and installed on all of the platforms needed for the coordination, they must be there in enough time to allow for people to learn how to use them, practice in some reasonable fashion, and have enough opportunity to acquire experience from both successes and failures. The battlespace will be stressful enough without adding newly installed equipment or upgraded computer programs to the mix.

If we are facing a highly variable set of operational requirements with the potential of limited formal preparation or real-world experience for any specific operation, then the people and the systems will have to be very good indeed. If the systems cannot support the tasks—whether command and control, communications, intelligence, sensors, or weapons—then the people will have to figure out the offsets. If the people are less experienced, then the systems will have to be designed well enough to offer significant help in achieving the tactical win.

As difficult as it is to try and imagine what the world will be like in a decade or so, it is sometimes even harder to remember what it was like to be that young sonarman, fire control technician, or officer of the deck. How it felt to be part of a tactical team for the first time. What that first deployment was like. How grateful you were that there were many aboard that seemed to know exactly what to do next so you could learn by doing in the company of an experienced crew.

We need to keep those young people in mind when we design the systems, integrate the platform tactics, and commit to operational taskings. The partnership must be real. For those of us involved in the next decade planning for JV-2010, **we need to remember that the technology we design and implement to support this bold plan will be largely of our making—but the war will be theirs to fight.■**

ADDRESS TO THE SUBMARINE TECHNOLOGY SYMPOSIUM May 14, 1998

Dr. John Foster

Dr. Foster is one of the nation's pre-eminent scientists in the field of National Security. He is a former Director of Lawrence Livermore Laboratory, and as Director of Defense Research and Development (DDR&E) was the third highest office in the Pentagon.

I think you should know that I really am excited about being able to talk to you and it's for two reasons. The first reason isn't obvious. Seven weeks ago I was skiing in Park City, Utah and was blindsided by a snowboarder. His head hit mine and it broke my jaw. After they wired my mouth shut, I received a message from Admiral Dave Jeremiah which said, "It's good to be tight jawed but you are carrying it too far." Now, the wires are off so I'm able to talk. But I suspect that some of my friends actually preferred my recent silence.

The second reason stems from my sense of the challenge we face at this symposium. This symposium follows on the publication *Joint Vision 2010* by General Shalikashvili, and the Chiefs of our armed forces. Their document, which has their unanimous consensus and is supported by Secretary of Defense Cohen, calls for the U.S. to field forces by 2010 that will dominate an adversary over the full range of missions and conflicts. Not the marginal superiority we strove for during the Cold War, but dominance as exemplified by the outcome of Desert Storm. That dominance must be the result of the unique military capabilities of our forces, because for many scenarios we can't expect to do it by sheer numbers.

This call for dominance is a call on everyone associated with our military operations. **And in particular, it is a call on the submarine community.** It is a call to identify the requirements for operational capabilities which would result from a **combination** of new or different systems, strategies and tactics that would dominate an adversary. It is also a call for the development and application of technologies which would underwrite such capabilities. To give us the best chance of success in this objective we must pursue both

these new requirements for capabilities and the technologies in parallel.

The achievement of dominance requires the deployment of capabilities that deter the adversary from aggression, or take him by surprise, and completely overwhelm him.

By 2010, many potential adversaries will have had the opportunity to have developed or purchased state-of-the-art equipment, so we are not likely to achieve dominant capabilities just by the pursuit of evolutionary upgrades. We will need those upgrades, but **to be dominant we must reach for some revolutionary capabilities.**

Now let's ask ourselves two questions. First, of all the capabilities that we are funding and planning to field by 2010, which ones are expected to provide dominance? Second, of the technologies we are pursuing, which ones are expected to underwrite a dominating capability? My sense is that there are not very many in either category. But I'm excited by the fact that there are some possibilities that come to mind, admittedly they are either receiving too little support or are not yet funded. But this is not surprising.

It's not surprising because in this period of reduced budgets and downsizing, major efforts are required just to upgrade a few of the present systems. And when technology developments are proposed which, if successful, would provide revolutionary capabilities, too often the finding is that funds are not available to provide the required support.

It seems to me that one reason why we have this situation is because the process by which we decide what technologies to pursue and what capabilities to provide does not yet reflect the requirements for dominance described in Joint Vision 2010. Perhaps we have not yet packaged our proposals as being responsive to the JV 2010 call for dominance. Perhaps we're not yet taking JV 2010 as a *requirement*. Perhaps we're just too involved in fighting the budget battle.

Whatever the reasons, I think that we have no choice but to give this requirement for dominance our highest priority. And we should expect that if we can objectively identify proposals which have a reasonable chance of providing *dominance*, they will be given priority support by the Secretary of Defense, the Chairman and the Chiefs. So, as I see it, the challenge to us at this sympo-

sium is to identify a few proposals for their consideration. We must accept this challenge; we must bear the burden of initiative.

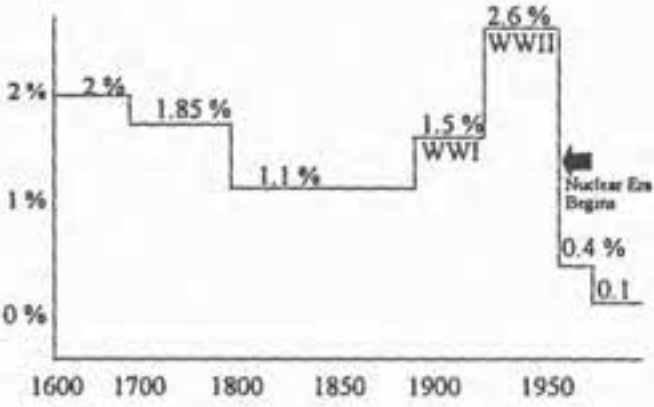
I am reminded of a submarine symposium in 1957 led by Ivan Getting called Project Nobska. It was held at the Whitney Estate at Woods Hole. The U. S. had already deployed the world's first nuclear submarine, NAUTILUS, and the issue before the conference was, should we develop a nuclear propelled submarine that would carry intermediate range missiles armed with nuclear warheads. Towards the end of the session, the debate centered on whether to use an available liquid propelled missile which raised safety concerns but which could carry the weight of a warhead with the requisite nuclear yield, or to develop a new solid propelled missile which offered additional safety but with a reduced nuclear yield.

Two things happened. One of the AEC's nuclear laboratories committed to deliver the required nuclear yield at the reduced weight. And a young man from the David Taylor Model Basin, I think it was Dennis St. John, went to the Whitney Library and returned to read the following from The Influence of Sea Power Upon History (1680-1783) by Admiral Alfred Mahan:

> "Changes in tactics have not only taken place after changes in weapons, which is necessarily the case, but the interval between such changes has been unduly long. This doubtless arises from the fact that an improvement in weapons is due to the energy of one or two men, while changes in tactics have to overcome the inertia of a conservative class; but it is a great evil. It can be remedied only by a candid recognition of each change, by careful study of the powers and limitations of the new ship or weapon, and by a consequent adaptation of the method of using it to the qualities it possesses, which constitutes its tactics.
>
> "History shows that it is vain to hope that military men generally will be at the pains to do this, but that the one who does will go into battle with a great advantage--a lesson in itself of no mean value."

In my mind, those two things provided the stimulus for initiative and consensus that launched the Polaris program. To this date, the Polaris concept, followed by the Poseidon and now the

Trident, has been a dominant element of our strategic deterrent during the Cold War.



Wartime Casualties Percentage of World Population
(Civilian and Military)

At this symposium we must create an air of expectation. We must expect that by this Friday, we will have provided to members of the Roundtable, concepts for capabilities that would dominate an enemy and technologies which if developed would underwrite dominating capabilities of our submarines in the period 2010 and beyond.

In looking to 2010 and beyond, it is useful to identify some things that will remain the same and some that will change. For example, what will remain the same is the need for the U.S. to maintain a strategic nuclear deterrent and to provide assured protection of the world's sea lanes and sea lift. Also, we will need to be able to transport most of our forces and their logistics by surface ships, at least for the larger engagements. And most of those forces and logistics must be able to pass through the littoral region to reach land. We should expect budgets to remain tight and the public have little tolerance for casualties.

What will change? We must assume that the enemy will have learned the lessons of Desert Storm. He will have deployed surveillance systems which can find our ships, systems to target them and precision weapons to attack them. He will have deployed

underwater mines, integrated sensor arrays and modern diesel submarines with high speed torpedoes. Such capabilities he will have developed or purchased, one way or another.

What we must change is our ability to deny or destroy such littoral capabilities. The U.S. has and is developing several different kinds of weapon systems to destroy those enemy capabilities so that our forces and logistics can come from the sea. **But among them, the nuclear submarine is unique.** Its uniqueness derives from its stealth, which permits its sustained presence, and its capability to perform missions such as intelligence, surveillance, blue water operations, countermine, SEAL insertion, ASW and precision shore attack. While it is a real challenge to obtain these capabilities, it is of paramount importance that we be able to do so in littoral regions without losing the submarine's stealthiness. If stealthiness is lost, we then would have to depend more on other platforms which are not stealthy and will result in even heavier casualties against a formidable opponent.

Yesterday I had an opportunity to talk with Chuck Horne, and he was kind enough to give me a copy of his article in the January issue of the Naval Institute Proceedings. He has some recommendations on how to improve our littoral capacities. Please read it. The Defense Science Board's Task Force on *Submarine of the Future* chaired by John Stenbit and being briefed at this symposium by Dave Stanford is an outstanding effort that deserves the Navy's most serious attention.

The New SSN is certainly a step in the right direction, with its simpler power plant, modular design and construction, COTS software and hardware and more stealth. However, it's clear that the supporting R&D lags the ship construction. The things we wanted in the first submarine won't be available until the fourth and at present, most of those features are not yet fully funded. Fortunately, the strategy of using a modular design approach permits less expensive upgrades.

My sense is that the challenge we are likely to face and must surmount will demand more capability and flexibility than it will be practical to retrofit into the New SSN. It is now nine years since we started to design the New SSN, so it's time to take a clean sheet of paper and begin to think through just what kind a submarine we will require to provide dominance in the littoral regions in 2015 and beyond.

I think the Navy should start now, as a matter of urgency working with DARPA, industry and the universities, to initiate the second step toward a submarine that is even more capable of joint operations in blue and brown water.

The first mission that I believe needs more attention is intelligence. Intelligence is the leading edge of our national security.

Intelligence gathered during peace time as well as hostilities can be a crucial determinant to dominance. It is fortunate that most of the time we enjoy peace and so most of the time our submarines can be on intelligence missions particularly in the littoral regions. And, in my opinion, it is the intelligence missions during peacetime that set the number of submarines required in the force. Our current plans for capabilities in 2010 will not provide submarine capabilities that are optimized for the intelligence mission. The littoral intelligence mission against a well equipped coastal defense calls for special collection capabilities which we believe could be made available. In particular, to enhance stealthiness we need to accelerate the pursuit of several approaches to the submarine's intercept antennas and remote vehicles to probe the littoral regions and its defenses. So in this example, I an challenging our investment strategy in the area of intelligence.

To be even more useful in joint operations, our future SSNs must be able to communicate with more bandwidth and much less chance of being detected, more payload space for more UUVs, more precision attack missiles, more room for more seals and marines, more space for more data processing and more room for more people to control external operations and act on the increased information. And surely it must be possible for us to design a submarine and develop the associated support and CONOPS so that more than one submarine can be on station for five that are not. In short, the new requirements of the littoral mission place new demands on the front end of the submarine. Furthermore, I doubt that in the future we will afford to build new attack submarines designed for one or two special missions. Rather, most of the time our SSNs must be configured and ready to take on most of their missions.

Clearly, to provide these increased capabilities we must find ways to operate with fewer people and less space elsewhere. We know that many more functions on our submarines can be automated to make room for the information systems operators. The

volume required for the propulsion system must be reduced, perhaps by going to electric drive, to provide increased volume for payloads.

You'll recall how we often talk about the intelligence community and all its *stovepipes*. Well, it seems to me that our submarines have inherited more than their share of historical *stovepipes*. Surely we don't need separate rooms for the radiomen, propulsion control, torpedoes, missiles, etc.

So I am challenging the navy's priority and investment strategy in responding to the challenge of littoral operations, and in particular the development of capabilities to enhance the submarine as the enabler of choice.

With the availability of precision munitions and the importance of shore bombardment, the navy and DARPA examined the possibility of a stealth arsenal ship. But we failed to achieve the consensus necessary to launch the program. Now, there seems to be more general agreement that, as Trident submarines are released from the strategic deterrent force, they could be converted so that each could hold a few hundred precision non-nuclear missiles. In my view, this is a great concept!

But as I see it, the challenge is not really in the conversion of Tridents to SSGNs. The challenge is to maintain the stealthiness of the SSGN while also providing the necessary communications for joint operations and in particular, to maintain stealthiness even during the firing of the precision missiles. I believe we must examine several options and select one which will provide the necessary stealthy capability.

During a crisis, a future adversary will have to recognize that, which such a capability, two or three SSGNs with perhaps a 1000 precision missiles are off their coast ready to attack targets at any minute. That kind of capability could be our most responsive deterrent system and for some scenarios it could be the dominant U.S. military element to deter, and if necessary to attack.

With the announcement this week that India detonated five underground nuclear explosives we are reminded of the roles that nuclear weapons have played in the last 53 years. I believe they have served us well. This chart shows the percent of the world's population that were casualties during wars from 1600 to the present. This data seems to support what many people have known all along about the value of strategic nuclear systems to deter large

conflicts.

So, what kind of strategic ballistic missile submarine should we have in the future? Our first was the Polaris, which had 16 missiles and 16 warheads, and today the Trident has 24 missiles and up to 240 warheads. The Russian SSBN is even larger. We've *been there and done that*. Those developments during the Cold War have left us with a deterrent system that, in my view, is not appropriate for this post Cold War period. We do need an SSBN deterrent capability, but we should take steps to deter others from pursuing the Cold War path.

I understand that the Navy is considering the use of the New SSN hull and inserting a plug for ballistic missiles. That approach should be considered, but I would urge the Navy to also examine a more revolutionary concept. Use this opportunity and the time, to examine a smaller submarine that could go much deeper, have even smaller signatures with superior awareness and active defense capabilities, perhaps with ballistic missiles outside and a crew of only, say 20. The deployment of such a capability might not only provide a more secure lower cost deterrent but it could be a dominant influence on the character and course of future strategic deterrent systems internationally.

I urge the navy to make a more robust investment in SSBN and SSN security technologies and focused technology investments that support design options for the ultimate cost effective successors to the Trident and its SLBMs. These are more than Navy requirements—they are Navy responsibilities in a world where international anarchy and nuclear proliferation remain facts of life.

Finally, the most important message I wanted to leave with you is the charge from JV 2010 to identify submarine capabilities which could provide us with dominance in the period 2010 and beyond. I thank the Submarine League for the opportunity to attend this symposium because from the presentations I have learned of a number of capabilities which might provide dominance, and a number of technologies which could underwrite such capabilities. But I know that in the minds of those who are present, there are even more candidates. The challenge to members of the Roundtable is to get those candidates on the table and select the ones we should pursue.

Thank you and good luck!■

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REPORT OF THE NATIONAL DEFENSE PANEL
Executive Summary

The United States enters the new millennium as the preeminent political, economic, and military power in the world. Today we are in a relatively secure interlude following an era of intense international confrontation. But we must anticipate that future adversaries will learn from the past and confront us in very different ways. Thus we must be willing to change as well or risk having forces ill-suited to protect our security 20 years in the future. Only one thing is certain: the greatest danger lies in an unwillingness or an inability to change our security posture in time to meet the challenges of the next century.

The United States needs to launch a transformation strategy now that will enable it to meet a range of security challenges in 2010 to 2020. Yet we must do this without taking undue risk in the interim. This transformation promises to be complex. We cannot know the full extent and nature of future challenges. Yet, we must make critical decisions and choices entailing significant investments of resources and energies.

The Future Operational Environment

We can safely assume that future adversaries will have learned from the Gulf War. It is likely that they will find new ways to challenge our interests, our forces and our citizens. They will seek to disable the underlying structures that enable our military operations. Forward bases and forward-deployed forces will likely be challenged and coalition partners coerced. Critical nodes that enable communications, transportation, deployment, and other means of power projection will be vulnerable.

Our domestic communities and key infrastructures may also be vulnerable. Transnational threats may increase. As recently stated by Secretary Cohen, the proliferation of nuclear, chemical, and biological weapons and their delivery means will pose a serious threat to our homeland and our forces overseas. Information systems, the vital arteries of the modern political, economic, and social infrastructures, will undoubtedly be targets as well. The increasing commercialization of space makes it feasible for state and non-state actors alike to acquire reconnaissance and surveil-

lance services.

In short, we can expect those opposed to our interests to confront us at home and abroad—possibly in both places at once—with asymmetrical responses to our traditional strengths.

Near-Term Implications

Defense choices invariably entail risk; the only question is where we take the risk. A significant share of today's Defense Department's resources is focused on the unlikely contingency that two major wars will occur at almost the same time. The Panel views this two-military-theater-of-war construct as, in reality, a force-sizing function. We are concerned that, for some, this has become a means of justifying current forces. This approach focuses significant resources on a low-probability scenario, which consumes funds that could be used to reduce risk to our long term security. The Panel believes priority must go to the future. We recognize that, in the near term, the United States cannot ignore the threats posed by Iran and Iraq in the Persian Gulf and North Korea in Northeast Asia. However, our current forces, with the support of allies, should be capable of dealing with both contingencies.

The Range of Challenges

The types of missions our military and related security structures will be required to perform in 2010-2020 remain largely unchanged but the emphasis is likely to change. Maintaining regional stability is probably foremost among them, for the best way to forestall military challenges to the United States is to foster a stable international system. This demands full interaction with regional partners and alliances through diplomatic efforts as well as the full integration of U.S. diplomatic, economic, and military activities.

We must be able to project military power and conduct combat operations into areas where we may not have forward-deployed forces or forward bases. In particular, we must have the ability to put capable, agile, and highly effective shore-based land and air forces in place with a vastly decreased logistics footprint. Smaller force structures will be the norm, an evolution that must parallel the development of new operational concepts. Regular deploy-

ments to far-flung areas of the globe, from open deserts to confining urban terrain, therefore, are something we should expect. These deployments must not be viewed as a detraction from our traditional missions, but as a central element of the responsibilities of the future.

Just as deployments abroad are key to a stable international environment, an adequate defense structure at home is crucial to the safety of our citizens and well-being of our communities. One of the salient features of U.S. security in 2010-2020 will be a much larger role for homeland defense than exists today.

Effective deterrence of potential nuclear adversaries can be maintained at the reduced levels envisioned by START III and beyond. Over time, the focus of our efforts to deter nuclear attacks against the United States, its allies, and interests may change substantially from that of today. Deterrence of attack as the central focus of nuclear policy already is being supplanted by the need to manage—identify, account for, and safeguard against—the proliferation and possible use of nuclear and other weapons of mass destruction. Traditional U.S. nuclear policies may not be sufficient to deter nuclear, chemical, or biological attacks by a rogue state against U.S. allies and coalition partners.

In regard to maintaining U.S. information superiority, we will need to integrate existing and new information systems while exploiting commercial technology. We must also have effective defensive and offensive information capabilities. We will need to recognize that the U.S. lead in space will not go unchallenged. We must coordinate the civil, commercial, and national security aspects of space, as use of space is a major element of national power.

Force Capabilities

Our military is superbly equipped, led, and trained and is blessed with magnificent men and women. We must never forget that our people in uniform have been the core of our strength in the past. They, more than any hardware system, form the real defense capability of today and tomorrow. Under no circumstances should we reduce the quality or training of our people. The technology revolution and advanced weapons we seek to embrace will be for naught if we take our military and civilian work force for granted.

It is clear, however, that in the 2010-2020 time frame our

military forces will need capabilities very different from those they currently possess. We are on the cusp of a military revolution stimulated by rapid advances in information and information-related technologies. This implies a growing potential to detect, identify, and track far greater numbers of targets over a larger area for a longer time than ever before, and to provide this information much more quickly and effectively than heretofore possible. Those who can exploit these opportunities—and thereby dissipate the *fog of war*—stand to gain significant advantages.

Current force structures and information architectures extrapolated to the future may not suffice to meet successfully the conditions of future battle. Automation and systems architectures capable of disseminating information to widely dispersed and dissimilar units and integrating their actions will be key. We will need greater mobility, precision, speed, stealth, and strike ranges while we sharply reduce our logistics footprint. All operations will be increasingly joint, combined, and interagency. Furthermore, the reserve components will need to be fully integrated with active forces.

Legacy systems procured today will be at risk in 2010-2020. We must carefully scrutinize their utility for future conflicts as well as for peacetime military operations. Joint Vision 2010 and the visions of the services contain many of the capabilities we need in the future. However, the procurement budgets of the services are focused primarily on current systems and do not adequately support the central thrust of their visions. In light of these factors, the Panel questions the procurement plans for Army equipment, Navy ships, and tactical aircraft of all services.

Reserve and Guard units must be prepared and resourced for use in a variety of ongoing worldwide operations. They will play an increasing role in a variety of these by relieving active units and reducing the operational and personnel tempos of frequent and lengthy deployments.

While the other services have successfully integrated their active and reserve forces, the Army has suffered from a destructive disunity among its components, specifically between the active Army and the National Guard. This rift serves neither the Army nor the country well. The Panel strongly believes the rift must be healed and makes a series of recommendations toward that end.

A fully integrated total force requires a common culture to

engender unity of thought and action. Shared operational and training experiences, common educational opportunities, and frequent exchange of leaders among active and reserve components, the different services, coalition partners, and national and international agencies will serve to deepen mutual respect and reinforce a common ethic.

Transformation Strategy

Transforming the armed forces into a very different kind of military from that which exists today, while supporting U.S. near-term efforts, presents a significant challenge. Beyond Defense, we must also transform the manner in which we conduct foreign affairs, foster regional stability, and enable projection of military power.

It is important to begin the transformation process now, since decisions made in the short term will influence the shape of the military over the long term. The Defense Department should accord the highest priority to executing a transformation strategy. Taking the wrong transformation course (or failing to transform) opens the nation to both strategic and technological surprise.

Transformation will take dedication and commitment—and a willingness to put talented people, money, resources, and structure behind a process designed to foster change. Greater emphasis should be placed on experimenting with a variety of military systems, operational concepts, and force structures. The goal is to identify the means to meet the emerging challenges, exploit the opportunities, and terminate those approaches that do not succeed. It will take wisdom to walk the delicate line that avoids premature decisions and unintended *lock-in* with equipment purchases, operational concepts, and related systems whose effectiveness may quickly erode in a rapidly changing environment.

At the core of this effort should be a much greater emphasis on jointness, building upon the legacy of Goldwater-Nichols. However, competition among the services can assist in determining how best to exploit new capabilities or solve emerging challenges. It takes a considerable amount of time, a decade or two, to play out an effective transformation. Indeed, even those military systems that are placed on a *fast track* for development and fielding often take 10 years or more to reach forces in the field. Time also is

required to determine how best to employ new military systems, and to make the appropriate adjustments in the force structure.

We must look beyond the challenges for defense and assess the relevance of the National Security Act of 1947 for the next millennium. This framework served us well during the Cold War, but we must objectively reexamine our national security structure if we intend to remain a world leader. Interagency processes, both international and domestic, must be reviewed and refined to provide the National Command Authority and the American people with an effective, integrated, and proactive organization.

We must also look closely at our alliances to ensure they are adjusting to the changing environment. As we work hard to establish mutual trust and commitment with our allies, we must be willing to sacrifice for common goals. Alliances have been and will continue to be a two-way street.

Our intelligence structure faces immensely more complicated tasks than during the Cold War. Asymmetric threats pose particular difficulties. Information technologies are a two-edged sword of both tremendous opportunities and vulnerabilities. The various facets of the intelligence community must merge their efforts and information, handle highly complicated technical challenges, ensure all parts of the intelligence gathering apparatus are robust, and work to ensure their products are easily accessible and meet the needs of the warfighter.

The Panel has identified areas in the Unified Command Plan where seams might hinder the effectiveness of our forces. We recommend that an Americas Command be created to address the challenges of homeland defense as well as those of the Western Hemisphere. A Joint Forces Command would be the force provider to the geographic CINCs, address standardization among the various Unified commands, oversee joint training and experimentation, and coordinate and integrate among the networked service battle labs. A Logistics Command, would merge necessary support functions that are now divided among various agencies. Space Command would expand to absorb the domain of information.

Infrastructure

Fundamental reform of the Defense Department's support

infrastructure is key to an effective transformation strategy for the years 2010-2020. Today, the Department of Defense is burdened by a far-flung support infrastructure that is ponderous, bureaucratic, and unaffordable. Unless its costs are cut sharply, the Department will be unable to invest adequately for the future. The Panel supports the initiatives put forward by the recent Defense Reform Initiative. However, the Panel believes even more can and should be done.

Meaningful reform of the support infrastructure is not possible unless the Department establishes a more effective and business-like approach to resource management. To that end, the Panel recommends that the Department continue its efforts to reform the acquisition process as well as to rethink the Planning, Programming, and Budgeting System (PPBS) to make it less burdensome and more receptive to innovation and change.

Accurate cost information is also a prerequisite for cost-effective resource management decisions. Without good cost data, Defense managers have difficulty identifying inefficient practices and unwittingly make suboptimal resource allocation decisions. In addition, the Department must work with Congress to relax *color of money* restrictions.

The Defense Reform Initiative recommends competing 150,000 positions across Defense. We endorse this plan, but recommend expanding it to the 600,000 military and civilian personnel who perform commercially oriented support tasks.

Industrial Base

In coming decades, the United States can only preserve its current technological advantage through time-based competition. The Department of Defense needs to provide industry with incentives to innovate so that we may maintain a qualitative technology and systems edge so that the United States will continue to be preeminent in military technology. Rather than being reactive, we should make our military acquisition process proactive. The Department must work with Congress to devise new rules and procedures that encourage technology development, rather than large production quantities, in order to recover cost and profit. This may create unit cost *sticker shock* unless we shorten the development cycle to lower development costs. But reduced

production quantities will reduce total program cost, the real measure of the cost to the nation.

A close examination must be made of industrial mobilization programs. Much of the existing requirements and structures are predicated upon maintaining or overseeing an industrial and manpower mobilization base for a Cold War era contingency. This approach and associated overhead is clearly inappropriate to the relatively short wars we expect in the future. Further, this mobilization approach is clearly inappropriate, given the short technological life-cycles we experience today and certainly will experience in 2010-2020.

Installations

The Panel strongly endorses the infrastructure recommendations within the Defense Reform Initiative, which stated that there is sufficient surplus capacity for two additional BRAC rounds. Indeed, we believe there may be even more excess capacity that could be identified, should a review be done from a joint-base perspective. Therefore, the Panel strongly recommends that two BRAC rounds be conducted earlier than the current 2001-2005 Department proposal. The object is to transform the base structure from an impediment to a cost-effective enabler of readiness and modernization.

The services should also reconsider the traditional concept of the military base. Rather than using on-base housing, commissaries, and other support services, military personnel would receive additional compensation. This shift would allow the services to reduce their on-base infrastructure, while increasing the benefit received.

The Cost

The issue of how to fund this transformation in this fiscally constrained environment is no small challenge. The Panel estimates an annual budget wedge of $5-10 billion will be needed to support a true transformation. This money would fund initiatives in intelligence, space, urban warfare, joint experimentation, and information operations. In the absence of additional defense funding, the transformation could best be funded by infrastructure

and acquisition reform. If these reforms are not forthcoming, it will be necessary to reduce Operations Tempo (OPTEMPO), cancel acquisition programs, or reduce force structure and end strength. There will be no easy answers, and difficult choices must be made.

Conclusion

In the increasingly complex world that we foresee, the Department of Defense and its armed services cannot preserve U.S. interests alone. Defense is but one element of a broader national security structure. If we are to be successful in meeting the challenges of the future, the entire U.S. national security apparatus must adapt and become more integrated, coherent, and proactive.

Implementing the transformation described in this Report promises to be complex and will require careful balance to preserve our current security interests. It is our belief, however, that if we refuse to change in a timely manner we could be fundamentally unprepared for the future, and put at risk the safety of future generations of Americans. We have the time and the opportunity to adjust. But we cannot equivocate. We must begin now.■

AMERICAN SEA POWER IN THE 21st CENTURY

by CDR Nathaniel French Caldwell, Jr., USN (Ret.)

CDR Nathaniel French Caldwell, Jr., USN(Ret.) served on USS BIRMINGHAM (SSN 695) and USS BATON ROUGE (SSN 689)—both Los Angeles-class boats that were decommissioned long before the end of service life—and USS WILL ROGERS (SSBN 659(B)), another casualty of early decommissioning. He is now a senior manager at Arthur Andersen LLP.

Five years ago while working for Secretary of the Navy John Dalton I proposed that the Department of the Navy should bring together its many constituencies in a series of seminars to debate the future of American sea power. As the Secretary's congressional special projects officer, I was very aware of the confusing signals that various parts of the Department of the Navy, industry, and the many naval and defense associations were sending to Capitol Hill. It was very clear then, and remains so now, that strategy and naval policy are out of sync.

I did receive approval to work with one of the naval associations on this project, but the initiative fell flat due mainly to a lack of urgency and a sense that the roles and missions of the Navy-Marine Corps Team had been resolved with the publication of *...From the Sea*. At the time, very few people shared my sense of urgency about the future direction of naval forces and the funding to secure that future.

After an early retirement from the Navy in 1994, I continued to promote the idea of a project on American sea power. Finally, last summer, long after having given up on seriously pursuing the project I mentioned it casually to Ms. Cindy Brown, President of the American Shipbuilding Association. Ms. Brown's response was: "Let's make it happen."

Joining Forces

Ms. Brown's association represents the *big six* private naval shipyards—Newport News Shipbuilding, Electric Boat, Ingalls, Bath Iron Works, Avondale, and National Steel and Shipbuilding. Earlier this year, with funding from the American Shipbuilding Association, enthusiastic support from Ms. Brown, and lots of hard work from her and her staff, I brought together a coalition of

defense associations--the Naval Submarine League, the U.S. Naval Institute, the National Defense Industrial Association, the Navy League of the United States, the Surface Navy Association, and the Association of Naval Aviation. This coalition was joined by over four dozen congressional co-sponsors and representatives from the Secretary of the Navy, the Joint Staff, the Chief of Naval Operations, and the Commandant of the Marine Corps to present a series of three seminars called *American Sea Power in the 21st Century.* To maximize the participation of congressional staff, the seminars--one each in January, February, and March--took place in the U.S. Capitol Building. The first seminar chaired by Senator John Warner focused on sea power and the role of the United States in the post-Soviet threat era. The second seminar chaired by Congressman Ike Skelton laid out the naval requirements for the United States if it is to be a 21st Century sea power. The third seminar chaired by Senator Thad Cochran described the challenges of maintaining a shipbuilding rate to support the 21st century fleet. So overall the series addressed the following three questions:

- What is sea power in the 21st Century?
- What kind of Navy is needed to maintain the role of the United Sates as a sea power in the 21st Century?
- What naval policy is required to meet the requirements of that 21st Century fleet?

Project Findings

Summarized below are my personal findings from this project. They are drawn heavily from the comments, observations, and papers of the participants--the panelists, the audience, the working groups, and others associated with this project--and especially from the remarks of Senator John Warner, Dr. Robbin Laird, Mr. Ron O'Rourke, Dr. Scott Truver, Dr. Paul Kaminski, and Admiral Frank Kelso. However, they are not in any way *official* findings of the project, and, unfortunately, the question of how to pay for the ever-shrinking 21st century fleet remains.

The nature of global leadership is changing in that no *one size fits all* security system is satisfactory for all regions of U.S. interest. The security environment continues to respond to the collapse of the Soviet Union, and also to the twin revolutions of

democracy and economic development around the world. However, despite the emergence of a sweeping American-European-Asian zone of security, large pockets of turbulence and violence in the Mid-East, the Mediterranean, Southern and Central Asia, the Korean Peninsula, and Central America threaten international security and stability.

Regional instabilities demand regional solutions. However, when some solutions fail there is often a need for an international and global crisis-response. The United States is the only global power, in that only the United States has the capacity to maintain credible security arrangements in all regions. Therefore as a supra-regional power, the new leadership role of the United States is to facilitate networking between regional security arrangements in a way that allows the rapid development of inter-regional coalitions—a *networked* security strategy.

Over the last decade, the nature and utility of sea power have changed fundamentally from a sea-control force to a force enabling the projection of U.S. power and influence. Sea Power in the 21st century is fundamentally different from its historical antecedents in that it is the capacity to project power from the sea to effect outcomes on shore, rather than control of the seas, that will be the measure of global military capabilities of the United States in the next century.

Sea-based forces are not subject to the same diplomatic restrictions as are land-based forces and hence the Navy and Marine Corps become the central enabling force for not only military action, but also for the credible projection of diplomatic efforts, as pointed out by U.N. Secretary General Koffi Annan recently after his efforts toward resolution of the Iraq crisis. Sea-based forces are central for enabling a networked security strategy.

As an enabling force, the number of naval ships is determined by the number of places that *you want to be*. U.S. interests overseas range from security interests to economic interests to diplomatic interests. The effect of naval forces on the protection and promotion of economic and diplomatic interests are difficult to access absent a crisis. However, the Iraq crisis and the Taiwan Straits crisis both show the inter-connection of security, diplomatic, and economic interests, and the presence of naval forces made the difference with regard to providing a credible, effective crisis-response in areas of tremendous U.S. economic and

security importance.

The tangible benefits of maintaining U.S. naval forces in a region absent a crisis include the development of combined procedures for working with regional forces, both sea-and land-based and improved access to regional facilities, which improves crisis response time. In the event of a crisis that threatens U.S. interests, the presence of U.S. naval forces improves not only the response time of other U.S. forces, but also the coalescing of regional forces and international response to the crisis.

Based at sea and thereby not encroaching on the sovereignty of potential partners and allies, only naval forces have the peacetime diplomatic acceptance that allows the United States to project its power and influence in regions around the world.

The numbers of naval ships affect not just the size of the fleet, but the overall capabilities of the fleet. New technology is driving the Navy toward the concept of *network-centric* warfare. In this context, network-centric refers to the electronic connectivity of the fleet, enabling ships and even forces ashore to share surveillance, detection, fire control and even weapons resources. This new enhanced connectivity of systems is leading to new concepts of naval power projection such as Operational Maneuver From the Sea which focuses on operations of dispersed forces in non-contiguous littoral battlespace.

The capabilities of a *netted* task force will in turn depend on the numbers of ships available for that task force. For in broad terms, the numbers of ships will dictate the numbers of aircraft, unmanned vehicles, weapons, sensors, combat systems, and even Marine Expeditionary Units available to the Task Force Commander.

The reduced size of the fleet is already impacting U.S. ability to project power and influence. While the connectivity of *network-centric* warfare improves the quality of the fleet, the numbers of available ships remain the major factor in providing regional presence and hence the ability to project U.S. leadership in support of international peace and regional stability. For example, to maintain two aircraft carriers in the Persian Gulf region requires leaving the Mediterranean and the Western Pacific with no carriers. This reduces U.S. influence in those two areas at a time of increased tensions in the Eastern Mediterranean and economic insecurity in the Far East.

The reduced size of the fleet will continue to reduce readi-

ness. With 12 total aircraft carriers in the fleet, the two deployed in the Gulf confirm a 6 to 1 ratio for maintaining these ships in the Gulf region. This ratio correlates to previous studies by the Congressional Research Service, that show that the fleet size must support forces anywhere from 4 to 8 times the size of the task forces that are to be projected, with the ratio increasing with an increase in the transit time from the homeport. While temporary surges of naval forces in a crisis may decrease the ratios in the short term, for long term projection of forces, the ratios hold true.

Recognizing these deployment ratios, the Quadrennial Defense Review, and the Bottom-Up Review before that, called for a fleet of 346 ships. With the force structure today already at that level, officials in the Pentagon are projecting that the fleet will be down to 306 ships by the end of the current FYDP. Although the future fleet will still contain 12 aircraft carriers, other types of ships will be drastically reduced in number with a corresponding decline in the ability to project forces ashore.

Contingencies that call upon expeditionary military forces, especially the U.S. Navy and Marine Corps, have grown since the collapse of the Soviet Empire. This increase can in part be attributed to the fact that former Soviet clients are now no longer stable without Moscow's leadership. Such a situation might then be considered a blip that would resolve itself as various regions adjusted to the new strategic situation. However, the growing global economy has the added effect of increasing the relevance of regional security to the United States' own national security.

Furthermore, economic interests are not confined to friendly democracies. China in particular is experiencing tremendous economic growth and, with the economic insecurity of its neighbors, shows every sign of actually increasing its influence in Asia. With an economic might that now surpasses Japan, China is a direct competitor to the United States in the Far East and potentially in Central Asia as that region develops into a major oil producing region.

The point is that this is an era where there is no direct global competition to U.S. power and influence; there are a number of regional competitors – and these regional competitors are no longer controlled or restrained by an opposing superpower. Therefore, increased challenges to U.S. economic and security interests are occurring and will continue to occur. A 306 ship fleet will be

stretched thin indeed.

Already, increased steaming days and flying hours are taking their toll on ships, aircraft, and equipment. Personnel who have so far been spared a lengthening of deployments beyond the established policy of six months, can expect deployment lengths to increase with a decrease in the size of the fleet. And with new enlistments at only 91 percent of requirements, sea-shore rotations will certainly be affected.

Without an increase in the naval shipbuilding rate to ten to twelve ships per year, the United States will cease to be a sea power, and hence will cease to be a global power. The math is very simple. Assume a reasonable lifetime for current ships. Most ship lifetimes are in the range of 25 to 45 years, so 35 years is a reasonable number, though empirically 30 might be more appropriate. With an average lifetime of 35 years, and a desired fleet size of 346 ships, then 10 ships per year would seem to be a reasonable building rate.

If the figure is 300 ships, then divided by a 35 year service life, a long term building rate of about 8.6 ships per year is required. If there are some years when the rate falls below 8.6, there is a need to have other years where the rate is higher, so that it averages out to maintain a fleet of 300 ships in the long run.

However, for several years now the naval shipbuilding rate has fallen short of the average. The rate began to fall below the required figure in FY 1994, and it is programmed to remain below that figure through FY 2003. That is a 10 year period of falling short of the mark. During this 10 year period, a steady state replacement program would have procured a total of 86 ships. Instead, the Navy will procure a total of 57 ships during this period. So by the end of the current Future Years Defense Plan, the Navy will have fallen 29 ships behind the steady-state replacement rate. Compounding the problem, longer term procurement plans maintain the building rate below the required average of 8.6 ships per year, leading to a further shortfall 12 years beyond the FYDP of an additional 11 to 12 ships. By 2015, the fleet will be over 40 ships behind what would have been procured under a steady-state procurement policy.

Since the Navy has been falling behind for the past four years, an increase soon to a building rate of 10 to 12 ships per year would be reasonable to minimize the length and breadth of the trough in

fleet size. However, the longer the decision to increase building is put off, the higher the initial building rate will need to be. The danger to the U.S. Navy is that at some point the expense of restarting naval shipbuilding will exceed the political will to do so. At that point—and it is not so far away—the United States will cease to be a sea power. And we will most likely recognize that point not by the size of what will be our small but highly capable U.S. Navy, but by a regional opponent's growing and highly capable navy.■

REUNIONS

USS DIABLO (SS 479) November 4, 1998, St. Marys, GA. Contact: Ed Shields, P.O. Box 524, Minneola, FL 34755

USS IREX (SS 482) September 3-7, 1998, Albuquerque, NM. Contact: Wally Krupenevich, 81 Apple Hill, Newington, CT 06111, (860) 665-8084, e-mail: WFKrup@aol.com

USS PETO (SS 265) November 4, 1998, St. Marys, GA. Contact: Scott Protho, 8701 S. Kolb Rd., Tucson, AZ 85706-9607.

USS SAM RAYBURN (SSBN 635) 28-30 August, 1998, Groton, CT. Contact: Larry Oiler, 12 Meehan Lane, North Berwick, ME 03906, (207) 676-5864, e-mail: loiler@ime.net.

SUBMARINE PROGRAMS: A RESOURCE SPONSOR'S PERSPECTIVE

RADM Malcolm I. Fages, USN
Director of Submarine Warfare Division
Office of the Chief of Naval Operations

This article is adapted from RADM Fages' presentation to the 1998 Annual Symposium in June.

Thank you, Admiral Smith for that kind introduction. Before I begin with a programmatic tour, let me share some views from the waterfront, coming as I do from Commander, Submarine Group Two. Our ships and crews are performing magnificently. We have enjoyed great operational successes during both battlegroup and independent operations. We are adapting reasonably well to the austere funding climate. Screening rates for XO and CO are improving. Promotion rates are very solid. Our crews seem to accept the challenges at sea with enthusiasm and I sense a revitalization of sense of mission and purpose in the Force. But all is not roses. Funding of the shore establishment has been cut dramatically and that is often perceived as a reduction of entitlement in quality of life areas. The impact of the change in retirement annuity to 40 percent at the 20 year point is taking its toll. My greatest concern and focus as Group Commander revolved about quality of the workplace issues. The inport grind, with long hours and three/four section duty for officer and enlisted alike is a real dissatisfier.

Several personnel trends exacerbate this problem in the near term. Junior officer accessions have not kept pace with fleet requirements. This will mean smaller wardrooms and longer JO tour lengths over the near term. Junior officer retention is several percentage points below the steady state sustainment rate of about 38 percent that we shoot for to ensure an adequate inventory of department heads at the seven years of commissioned service point. Accessions are becoming more challenging in our current vibrant economy. Not surprisingly, retention is equally challenging. Current retention rates will not provide sufficient future inventory at the 10 to 20 year point to man our billets at sea and ashore.

The Navy is not standing still in the face of these challenges. In the short term, the officer detailers are carefully managing junior

officer detailing to mitigate wardroom shortages. Plans are underway to increase officer accession bonuses and enlistment bonuses, officer continuation pay and reenlistment bonuses and Special Duty Assignment Pay for nuclear operators and supervisors. Nuclear recruiting is the Recruiting Command's number one priority which will be addressed with more nuclear recruiters and a revised recruiter incentive system. Finally, careful attention is being paid to attrition, from a recruit's enlistment to his arrival aboard his first submarine. We must reduce attrition rates.

These initiatives are important and will play a key role in maintaining a healthy personnel picture. But we must also carefully evaluate how we do business at sea and, especially, in port to reduce burdensome practices which reduce quality of life/workplace. I know I speak for the Type Commanders as well when I tell you that we are all very sensitive to this issue and committed to its solution. Let me now shift to a programmatic discussion.

At 65 SSNs today, we are entering the final gate of the steep downsizing slope—after inactivating nine more SSNs in 1999, we will gently glide to 50 by 2003 as required by the 1997 Quadrennial Defense Review (QDR). Four NSSNs are programmed in '98, '99, '01 and '02, to be built in a teaming arrangement between Electric Boat and Newport News. The Navy's POM-00 shipbuilding plan is currently under review by the Office of the Secretary of Defense, so I am not at liberty to discuss it in this forum. One point concerning SSN Force Structure should come across to you all, loud and clear; a build rate of two to three NSSNs per year in FY-07 and beyond is necessary to maintain a 50 SSN Force. Absent fundamental changes in the manner in which we fund the SCN accounts, you decide for yourself whether we will be able to sustain that build profile.

So what does all this mean? Will we drop below 50 SSNs in 2014 as the rate of 688 decommissionings overtakes the NSSN build rate? This is a fiscal decision which Congress and the American people must address as we enter the 21st century. However, as stewards of our nation's security, we need to educate the country on the need for submarines. It is our job to ensure this country realizes why submarines are so important. The Naval Submarine League, on a national and a local level, has an important role to play as we take this message to the American people.

In March of this year, the Chairman of the Joint Chiefs of Staff

commenced an attack submarine study. A follow up study directed by the QDR, its goal is to determine the number of SSNs required for peacetime forward presence, national tasking and warfighting in the 2015-2025 time frame. In considering the future security environment, the study will carefully consider the importance of stealth in littoral regions and whether submarines will be required to assume new roles because of the vulnerability of other platforms. Among other things, the study will take into account previous Force level studies, the Defense Science Board's study on the Submarine of the Future, and national requirements. Finally, affordability, in the context of the total DoD budget, will be a major consideration. The Joint Staff (J8) will lead the study, with participation by the Offices of the Under Secretary of Defense for Acquisition and Technology (A&T), Under Secretary of Defense for Policy, and the Under Secretary of Defense for Program Appraisal and Evaluation (PA&E). The Defense Intelligence Agency, and the Navy, including my staff at N87 will also assist in the study. The results of the study will be briefed to the Secretary of Defense in September of this year.

The fleets have also been studying the SSN question, and in particular, how we will match commitments and inventory in a 50 SSN Force. The punch line, of course, is that with a 50 SSN Force we are asset limited. Recently we have seen the beginning of the pressure on our deployable assets as we have been forced to reduce our presence in specific mission areas. For example, EUCOM presence has been reduced from four to about 3 SSNs in theater. Independent Atlantic ASW deployments have been reduced by nine percent compared to 1996. Virtually all independent Pacific ASW deployments ended in 1991. Some national level Intelligence, Surveillance and Reconnaissance coverage has been gapped, with additional and more frequent gaps projected as the downsizing continues. With CNO's mandated constraints on PERSTEMPO, OPTEMPO, and Turn Around Ration, by 2003, each theater commander, with the exception perhaps of CENTCOM, will experience the loss of approximately one to one and a half SSNs in deployed presence when compared to today's level of effort. Additionally, since there will be fewer submarines deployed and fewer in the interdeployment cycle, there will likely be more flow of forces between theaters to compensate for contingencies that require additional presence, demanding an unprecedented level of flexibility on the part of Fleet Commanders and Unified CINCs.

Let me describe another study that is on the horizon. Senate Armed Services Committee language in the FY99 Defense Authorization Bill directs the Secretary of Defense to review the conversion of Trident SSBNs for non-strategic use, pending ratification of the START II Treaty by Russia. As you may know, we have considered this concept for several years, and there are no insurmountable technical hurdles. Obviously, there are fiscal challenges which would have to be overcome if the DoD and the navy decide to go forward with this concept. Given these studies and the fiscal environment, what can we expect in the future?

Let me start by looking at the past. In FY89, the Navy's Total Obligation Authority (TOA) was $112B. Submarine programs consumed 18 percent of that pie or approximately $20B. At that time, we had more than 150 capital ships in the Submarine Force and nearly 70,000 military personnel. Today, the Navy's TOA has been reduced to slightly more than $71B; our TOA has been reduced to just over $7.5B, 14 percent of the Navy's TOA. And finally, the Navy's projected FY05 TOA will likely decrease to $68B with our share accounting for approximately 13 percent of the total.

The QDR was to lay the groundwork for enhancing investment, DoD wide, by stabilizing operations and support (O&S) accounts. In theory, this would allow an increase in investment in modernization and weapons procurement from a current level of $45B to $60B per year. Stabilizing the O&S accounts depleted virtually all of N87's traditional large *bill-paying* assets, including infrastructure, personnel end strength and Force structure.

With these assets depleted, in the face of the Balanced Budget agreement, there will be **only one place to turn to pay future bills**: modernization accounts. This is not an *N87 only* problem. This is a Department of Defense wide challenge. Our challenge will be to modernize the Fleet in an era of geometric technological change, but in the face of stringent fiscal constraints. How do we balance operations and modernization while budget dollars are shrinking in real terms? None of the options are appetizing.

One common method is to extend research, development and acquisition timelines —keeping programs alive by throwing seed money at them in the hope that we can free up funds in the future, as technology matures and investment dollars are made available. I have minimal flexibility to use this method. Primarily, this approach delays getting combat capability to the Fleet. Secondly,

we are too close to *breaking* many programs. Further cuts of the *salami slice* variety will make many programs unexecutable.

Another traditional solution for funding shortfalls is to reduce the acquisition profile for modernization. This may become necessary. Not every boat will get every new piece of equipment. Finally, vertical cuts may become the order of the day. We are considering a number of such deletions in POM-00.

We are taking a lead angle on this issue. We are refining our portfolio of submarine capabilities with a view to synchronizing program implementation. We are analyzing our investments, from Science and Technology, through Research and Development, to Acquisition, to ensure our ships will receive an *end-to-end capability*, in a cost efficient manner, with a reasonable *time market*. We are also looking hard at our infrastructure costs, to rationalize our maintenance, personnel, training, and organizational plans with our anticipated 2003 Force structure.

In the face of these challenges, we have still been able to bring new combat capabilities to the fleet. The most visible example of this enhanced combat capability is the Seawolf class. Commissioned last July, USS SEAWOLF continues to perform superbly in trials and testing. Last month, she successfully completed Weapons System Accuracy Testing. Later this summer, she heads to the North Atlantic, before commencing Post Shakedown Availability in August. In August PCU CONNECTICUT will get underway for ALPHA trials. The final ship of the class, SSN 23 is over 40 percent complete. In April, Secretary Dalton announced that SSN 23 would be named USS JIMMY CARTER.

Since the Los Angeles and Trident class submarines will comprise the bulk of the Force well into the next century, we must find new technologies that can be backfit into these platforms, as well as forward fit into NSSN. Perhaps the most successful example of this strategy is the next submarine sonar system, AN/BQQ-10, also known as Acoustic Rapid COTS Insertion, or ARCI.

ARCI represents one of the Navy's finest efforts in **quickly** and **affordably** getting new technology to sea. Designed to improve our submarine's acoustic superiority, this system made it to sea just two years after design work began—on time and within budget. ARCI development costs were one-tenth (1/10) the cost of BSY-2 and shipset cost was less than one-thirtieth (1/30) the price of BSY-2. Leveraging commercial computer advances enabled us to

increase signal and processing power in ARCI by an order of magnitude over the BSY-2 system. ARCI is a fully funded program. Ultimately, we will have a submarine sonar system common to the entire Fleet.

ARCI will reach the Fleet through a phase implementation plan, capitalizing on the build-test-build concept that brought *black box* upgrades to the Fleet in recent years. ARCI Phase One is complete and has been installed on two ships, USS AUGUSTA and USS LOUISVILLE. ARCI's flexible design allows the incorporation of periodic improvements through Advanced Processor Builds, or APBs. APBs provide software and hardware grades to ensure processing and detection algorithm improvements quickly make it to the Fleet. The first APB went from the drawing board to the Fleet in only 18 months!

ARCI completed at sea testing on USS AUGUSTA this May with outstanding results, including a multi-fold improvement in towed array broadband detection and tracking ranges and a significant improvement in exploiting unique submarine transients.

Let me now shift to a discussion of Weapons systems. Tactical Tomahawk (TACTOM) is on the horizon. TACTOM will provide us with so many performance upgrades that I think of it as essentially a new missile. The missile will have a two-way, satellite data link to enable inflight re-targeting and battle damage assessment reporting. A ring laser gyro will reduce spin-up time from 45 to 5 minutes, providing operational commanders with a more responsive strike weapon. Missile reliability is improved with an anti-jam GPS capability.

But as the old adage goes, "you can't get something for nothing". Prior to Tactical Tomahawk, the Navy's plan to improve Tomahawk capability had been through incremental upgrade, with the Tomahawk Baseline Improvement Program (TBIP). Block IV upgrades were due to the Fleet in FY-01. Tactical Tomahawk will arrive about two years later than the Block IV was anticipated. TACTOM will be capable of vertical launch only, and only from periscope depth. This limitation stems from an airframe redesign undertaken to lower cost.

For the last few years, the Navy has been investigation the marinization of the Army's tactical ballistic missile. This came to ben known as NTACMS. This new missile would have been capable of launch from surface ships and submarine vertical launch tubes. These efforts were terminated following a Navy Analysis of

Alternatives (AoA) that identified the Land Attack Standard Missile (LASM) as the most cost effective, near-term, Navy alternative for improved, responsive strike capability. LASM will be deployed only on surface combatants. NTACMS missile development efforts will be terminated by FY99. However, termination is being conducted in a manner which will allow renewed NTACMS development as a LASM follow-on if appropriate. Now let me shift to a discussion of mine warfare.

Our Unmanned Undersea Vehicles programs continue to make excellent progress. In just four years from initial concept development, the Near Term Mine Reconnaissance System Vehicle completed its first phase of at-sea testing in Dabob Bay, Washington last month. At-sea testing will occur on a Pacific Fleet SSN either later this year or in early 1999. Our Unmanned Undersea Vehicle program will mature and eventually produce six to twelve Long Term Mine Reconnaissance System (LMRS) vehicles. LMRS will provide significant capability enhancements over the NMRS. LMRS will be an untethered, autonomous vehicle with improved sensors and endurance. Still on schedule to achieve IOC in FY03, we have consistently protected this program from budget cuts.

The Submarine Force will retain its offensive mining capability with the Improved Submarine Launched Mobile Mine (ISLMM). Successfully tested last year on USS INDIANAPOLIS, ISLMM will bring significant combat capability to theater commanders. It will provide greater flexibility to minefield planners than did SLMM, due to its 150 percent range increase, dual warheads, greater accuracy and the ability to perform a waypoint turn.

In closing, I have tried to outline the challenges we face in administering Submarine Force programs, and the successes we have had in designing, building and fielding systems which have dramatically improved the stealth, combat capability and affordability of our ships. I must tell you that POM-00 was a very difficult submission. Needless to say, we are doing everything possible to maximize the efficiency of our programs and to ensure that every dollar invested will deliver capability where and when we need it.

I look forward to working with the Naval Submarine League as we deal with these issues of great importance to our Navy and our country. Thank you for this opportunity to speak to you today.■

THE NAVAL SUBMARINE LEAGUE

Statement of Financial Position
As of March 31, 1998

ASSETS

Current Assets	$426,200
Fixed Assets	209,445
Total Assets	**$635,645**

LIABILITIES & NET ASSETS

Current Liabilities	$118,149
Long Term Liabilities	96,292
Total Liabilities	$214,441
Net Assets	**$421,204**
Total Liabilities and Net Assets	**$635,645**

Statement of Activities
For the Year Ended March 31, 1998

REVENUES

Contributions & Dues	$144,166
Symposiums	224,641
Investment Gains	46,012
Interest & Dividends	34,007
Review Advertising	15,750
Other	10,147
Total Revenues	**$474,723**

EXPENDITURES

Program Services:	
Awards, Grants, Support	$ 76,340
Symposiums	176,632
Review Publishing	63,647
Total Program Services	$316,619
Supporting Services:	
Office Operations	163,813
Total Expenditures	$480,432
Decrease in Net Assets	($ 5,709)
Net Assets, April 1, 1997	$426,913
Net Assets, March 31, 1998	$421,204

THE SUBMARINE FORCE: SMART FROM THE START

by CAPT Karl Hasslinger, USN and
LCDR Ed Mayer, USN

Editor's Note: As the U.S. Navy has come to grips with the reality of greatly reduced defense budgets, it has become obvious that the total cost of a ship over its entire life is of more importance than its cost of acquisition. A major portion of life-cycle cost is the expense involved in manning each ship. Naturally, reductions in crew size can result in very significant savings when calculated over a ship's thirty year service life with a full crew embarked. The Navy's Surface Force recently has been experimenting with reduced manning of USS YORKTOWN (CG 48) in what they term the Smart Ship project. The nominal complement of that class is about 385, and over the past year or so they have made some good progress in cutting down their manning numbers. All of the attention given to that project, and to crew size reduction in general, has however prompted questions from those outside the submarine community about manning and cost reduction efforts in the Submarine Force. The following article by two submariners on active duty in the Pentagon is in answer to those specific questions.

The end of the Cold War sparked a reevaluation of U.S. defense needs which ultimately triggered budget cuts and a major downsizing. Over the past several years, the Submarine Force has undergone budget cuts at a rate higher than most other warfare areas. The attack Submarine Force is being reduced from a Cold War high of almost 100 SSNs to a force of at most 50 SSNs by the year 2003. Like others, the Submarine Force is renewing its efforts to accomplish its mission with increased efficiency. However, even at the height of the Cold War, with larger ship construction and operational budgets, the Submarine Force strove for efficiency, continuously searching for improvements in the way it designed, built, operated and maintained its ships. As a result of those efforts, today's nuclear powered submarines provide the United States with a cost effective undersea warfare capability that is second to none. While they represent nearly 30 percent of the Navy's combatant ships, submarines are manned by only 9 percent of the Navy's people and use about 12 percent of the Navy's budget. Throughout its history the Subma-

rine Force built a tradition of innovation, carefully adapting emerging technologies to maximize its undersea warfare capability. Building on that tradition, ongoing efforts to streamline manning, minimize the cost of ship design and modernization and decrease life-cycle costs, promise to keep the Submarine Force stealthy, combat capable and affordable into the next century.

Manning Efficiencies

Submarine crews, by necessity, have always been small. However, even as hull size increased to accommodate greater combat capability, the crews did not grow proportionally. World War II fleet boats displaced about 1500 tons and were manned by approximately 80 men. Today, a 688 class SSN displaces 6900 tons and is manned by 141 men; a 360 percent increase in displacement but only a 70 percent increase in manpower requirements. Submarine displacement and crew size peaked with the commissioning of the first Trident submarine, USS OHIO. Large by comparison to other classes, the 18,750 ton Ohio class submarine goes to sea combat ready with a crew of only 143. Part of this manning efficiency comes from submariners performing *double duty*. Almost everyone onboard a submarine is a watchstander; there are no special damage control personnel, no master-at-arms force, barbers, postal clerks or the like. Submariners have always performed these functions as collateral duties.

Today, even as the complexity of our submarines and their missions increases, the concept of minimal manning is supported by exponential advances in the commercial information technology sector. In addition to the automation of some specific skills, major improvements are being made in the ability of personnel to access, process and move the large amounts of information they need to do their jobs. Local Area Networks or LANs, have been installed in about 50 percent of our commissioned submarines and have been designed into the newer Seawolf and NSSN classes. These systems link the ship's fixed computer systems with portable lap-top type computers which are in wide use throughout the ship. This use of LANs has helped minimize watchstation manning requirements and reduce the crew's administrative burden, in addition to providing excellent training and logistics resources.

As the Submarine Force welcomes the recently commissioned USS SEAWOLF, first of a new class of attack submarine, it

continues its tradition of manning efficiency. Although SEAWOLF displaces more than a Los Angeles class submarine, it has fewer watchstations. Similarly, SEAWOLF's successor, the New Attack Submarine (NSSN), is being designed with further watchstation reductions. The application of technology and automation throughout the NSSN will enable a reduction of 15 additional watchstations over SEAWOLF. Some examples of NSSN reductions include:

USS SEAWOLF (SSN 21) New Attack Submarine

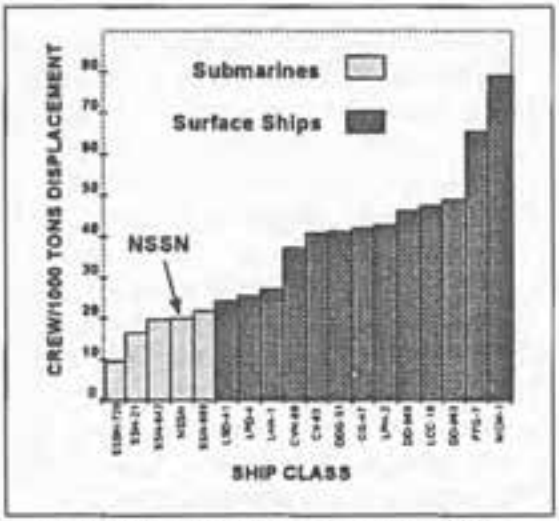
NSSN Fly-By-Wire Ship Control Station Requires 40 Percent Fewer Watchstations Than Previous Submarine Classes

- **Ship Control Station:** The NSSN digital *fly-by-wire* advanced ship control station will be operated by a Pilot, Copilot and a Relief Pilot. These three watchstanders replace the traditional Diving Officer, Chief of the Watch, Helmsman, Planesman and Messenger used on previous submarine classes.
- **Navigation-Quartermaster Watch Station:** The increased use of automation such as electronic charts, allows combining the Navigation Electronics Technician and the Quartermaster of the Watch into a single Navigation Watch.
- **Throttleman-Reactor Operator Watchstation:** Increased use of technology and automation allows the Reactor Operator to perform the duties of the Throttleman as well as

his traditional duties.

- **Auxiliaryman Aft Watchstation**: The relative simplicity and innovative automation of the NSSN engineroom will allow engineroom personnel to monitor installed auxiliary equipment, eliminating the Auxiliaryman Aft watchstation.
- **Torpedo Room Watch**: Automated systems and tours by other watchstanders allow the elimination of the Torpedo Room watchstander.

In general, submarines have had, and are maintaining, a history of manning efficiency. They traditionally have lower manning per thousand tons of displacement than other combatant types. Although this comparison does not measure a ship's contribution to the national military strategy, it does exemplify the submarine's low manpower requirements. Continued reductions in required watchstanders for new submarine designs demonstrates a commitment to operational affordability by applying technology and automation when it makes sense, when it does not compromise combat capability and when it is consistent with the Force's high standards of safety and reliability.



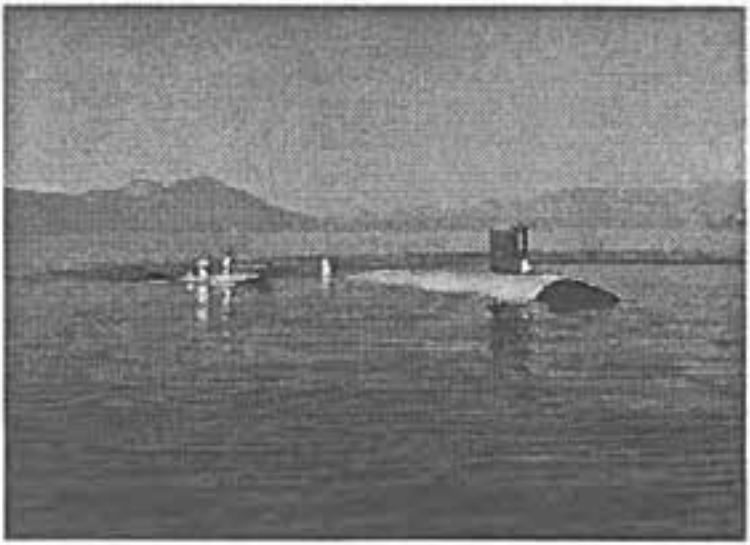
Navy Ship Manning Comparison in Crew per 1000 Tons of Displacement

Modeling And Simulation: Rapid Prototyping with Large Scale Vehicles

From the conception of USS NAUTILUS, the Navy designed and built eighteen classes of nuclear powered submarines. In some cases, these were single ship classes serving as both fleet combatants and as test platforms for various technologies. In today's fiscal environment however, the cost associated with the design and construction of a modern submarine, as well as a 16 year acquisition cycle, renders the full scale prototyping of submarines fiscally untenable. Accordingly, the Submarine Force has aggressively pursued various methods of modeling and simulation as an alternative to full scale prototyping.

In one of its most successful modeling efforts, the Navy's Acoustic Research Detachment in Bayview, Idaho uses that state's largest natural body of water, Lake Pend Oreille, as a test environment for large scale models. Hundreds of miles from the nearest ocean, this 43 mile long lake combines deep depth, low ambient noise, large unobstructed operating areas and still waters to provide an environment conducive to the development of advanced sensors and submarine stealth improvements.

Starting in 1967, a quarter scale model of the Sturgeon class nuclear attack submarine was introduced to test acoustic silencing capabilities. The success of that effort led to the development and construction of a specialized, quarter scale, Large Scale Vehicle (LSV) designed to support propulsor development for the super-stealthy Seawolf class. It took approximately four years of LSV testing to evaluate Seawolf's propulsor design at a cost of about $158 million, which includes the acquisition cost of the LSV. Had the same testing been performed on an actual ship, the estimated cost in time and money would have been about eight years and $863 million. Overall, the Acoustic Research Detachment's large scale modeling capability has saved the Navy approximately $1 billion in development costs. From the Fleet Commander's perspective, the savings achieved are actually higher, since submarines not assigned to test and evaluation roles are available to perform forward presence and combat missions.



150 Ton Large Scale Vehicle (LSV) Saved the Navy Over $1 Billion in Research and Development Costs

While the LSV is currently being used to develop the propulsor for the NSSN, the Naval Sea Systems Command (NAVSEA) is designing an improved Large Scale Vehicle, LSV-2. Larger than the original LSV, its scale factors will provide designers with even greater prototyping capability since it will have the volume to accommodate a wider variety of test components. The LSV based "Rapid Prototyping" of submarine control surfaces and propulsors, as well as evaluating internal components, acoustic signatures and wakes will allow the Submarine Force to continually improve stealth and combat capability in a more affordable manner.

Maintenance Efficiencies and Operational Availability

As the Cold War competition increased in the early 1960s, U.S. leaders placed more emphasis on nuclear powered submarines when they recognized that submarine stealth, speed and firepower were required to counter the Soviet threat. Unfortunately, the mounting cost of submarine maintenance began to jeopardize the Navy's ability to maintain a force structure adequate to meet expanding operational commitments. While existing maintenance practices were effective in ensuring safe and reliable submarine operations, they were far from efficient. Accordingly, submarines

spent more than 25 percent of their life cycle time in major depot availabilities. Several factors contributed to this undesirable situation:

- Early reactor core designs had relatively short lives, necessitating major refueling overhauls after only 43 months of reactor plant operation.
- A standard baseline overhaul work package did not exist.
- Technical guidance available to shipyard planners was inadequate and promoted the thought that submarine maintenance was intended to restore all ship's systems to a *like new* condition rather than meeting specific operational specifications.
- Maintenance at the depot, intermediate and ship levels was not integrated.

In response to the protracted duration and high cost of submarine overhauls, in March 1967 NAVSEA began to develop an array of innovative programs to cope with the complex business of overhauling nuclear submarines. The first order of business was to instill greater order, uniformity and control in shipyard availabilities to reduce the cost and length of submarine overhauls. This was done by developing complete and integrated Ship Overhaul Work Packages for all non-nuclear work. The packages included all detailed plans, procedures and long lead time materials required to overhaul a nuclear submarine. Costs were reduced by improved work planning that reduced escalating work packages.

In the 1970s, NAVSEA developed a formal life cycle Class Maintenance Plan (CMP) for all SSNs. The CMP identified all the preventive maintenance to be done throughout a submarine's life, specified its periodicity and assigned its accomplishment to the appropriate maintenance activity. Ship alteration packages and corrective maintenance could be added to the CMP-required preventive maintenance, to produce a consolidated work package for any given submarine availability. The CMP was initially based on conservative engineering judgment rather than detailed historical data. To refine the plan, procedures were developed to collect material condition data on submarine components disassembled for preventive maintenance during the operating cycle. NAVSEA successfully used CMP implementation to:

- Create a comprehensive maintenance program.
- Develop a process to formulate detailed availability work packages.
- Use the rigorous analysis of material condition databases to update both maintenance programs and baseline availability work packages.

The next step in improving submarine maintenance efficiency was to capitalize on these new systems while preserving submarine safety and reliability.

Following four years of detailed data collection, engineering analysis and component maintenance extensions, the Chief of Naval Operations approved the first Submarine Engineered Operating Cycle (SEOC) for Permit and Sturgeon class SSNs. The operating cycle (the time between shipyard overhauls), increased from 43 to 70 months. NAVSEA's system was now paying dividends. Submarine time in shipyard overhauls dropped to 22 percent representing an increase of 18 months of operating time over a submarine's life cycle. These operating cycle extensions have continued, the most recent being implemented in 1995 for Los Angeles class SSNs that now have a 120 month operating cycle. Using the SEOC process, NAVSEA nearly *tripled* the original SSN operating cycle, reducing submarine time in shipyard overhauls to an impressive 11percent.

While these maintenance improvements evolved, Naval Reactors (NAVSEA 08) worked continuously to increase the life of reactor cores. Their efforts were so successful that New Attack Submarine class ships will be built with reactor cores that will power these ships throughout their lives. Not only is the cost of refueling NSSNs avoided, but naval architects also have greater design flexibility since the ship design does not need to be optimized for refueling operations. These improvements in maintenance and reactor core life have significantly improved attack submarine operational availability.

Ballistic Missile Submarines (SSBN)

Although previous classes of SSBNs duplicated the SSN's maintenance successes, the Ohio class Incremental Overhaul represents a new breakthrough in maintenance efficiency. The Ohio's revolutionary life cycle maintenance strategy accomplishes

overhauls progressively during refit periods between patrols, thus reducing required shipyard availabilities. Additionally, the ship's design played an equally important role in improving maintenance efficiency. Specifically, ample equipment accessibility inside the ship, equipment quick-disconnect and fit-up provisions, well-planned removal and installation pathways all facilitate internal maintenance operations. Further, large diameter logistics hatches which are removed during in-port maintenance periods, provide ease of equipment movement into and out of the ship. On ship classes without these logistics hatches, time consuming hull cuts may be required to remove major components.

The Ohio CMP has been improved using the same material feedback system found in the SSN program. In 1993 the Ohio CMP was revised to reflect periodicity extensions of 518 maintenance items and the deletion of 170 overhaul requirements. Between 1986 and 1995, the number of depot level maintenance items underwent a staggering reduction from 350 to 11! Accordingly, because of the small number of remaining depot maintenance items, Ohio class ships have significant flexibility in scheduling shipyard availabilities, now known as Extended Refit Periods (ERP). ERPs are performed at the 14 year point in the OHIO class life cycle to accomplish shipyard level maintenance that cannot be performed during the normal 35 day refit periods between each 70 day patrol. The results of the CMP strategy are remarkable. Ohio class submarines have reached **92.2 percent** operational availability.

Nuclear submarine maintenance is an unprecedented success story that continues to evolve. The successes of the submarine maintenance system have been incorporated into the NSSN design. In addition to reductions in depot maintenance time and a reduced maintenance burden, significant financial savings have been achieved as well. To date, a total of $3.9 billion in shipyard level material and labor costs have been avoided because of the SEOC. This translates to $20.1 billion in savings over the anticipated life cycle of the entire Los Angeles class. Ohio class ships have seen proportional savings with $275 million in maintenance and modernization costs avoided to date translating to $2.9 billion in savings over the life cycle of the entire Ohio class. These savings do not include the effective increase in fleet size resulting from the increase in operational availability. The men and women of NAVSEA, their supporting agencies and submariners in the fleet

have made nuclear submarine maintenance a streamlined, cost effective program without adversely affecting safety, reliability or material readiness.

Nuclear Submarine Maintenance is a Streamlined, Cost Effective Process

Summary

President Truman once noted that "The United States is pre-eminent among nations in the development of industrial and scientific techniques ... our imponderable resources in knowledge are constantly growing and are inexhaustible." By designing and building the world's first nuclear powered submarine, and by developing the innumerable technologies necessary to build SEAWOLF and design the NSSN, the Submarine Force has confirmed President Truman's assertion. It continues to be a leader in adapting emerging industrial and scientific techniques to improve submarine stealth and combat capability while improving efficiency and maintaining affordability. Despite contradictory claims that submarines are expensive platforms with high acquisition costs, a careful life cycle analysis reveals that submarines are among the most cost effective platforms in the Navy. Moreover, a submarine's inherent stealth provides force protection without necessitating the construction, manning, operation and maintenance of escort vessels, missile systems or aircraft.

As proud as the Submarine Force is of its record of innovation and efficiency, there is still work to be done. Research continues across a broad spectrum of technologies necessary to improve open system architectures and methods to reconfigure a submarine's internal spaces to accommodate advances we have not yet envisioned. New operational concepts are also being developed which leverage these improvements and also maximize the effectiveness of existing platforms. Submariners are carefully watching the efforts of other Navy, military and private sector groups for innovations which may lend themselves to improved undersea warfare capabilities.

As its first centenary approaches, we find a Submarine Force composed of minimally manned, efficiently designed and modernized ships with reduced life cycle costs. By any measure, it is a *Smart Force* that is well positioned to provide the United States with a stealthy, combat capable and affordable undersea warfare capability well into the 21st century.■

SUBMARINE MEMORIALS

Please note that USS SILVERSIDES (SS 236) was inadvertently omitted from the list of submarine memorials on page 114 in the April **SUBMARINE REVIEW**. She is located in Muskegon, Michigan.

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Corporate Headquarters
North Stonington, Connecticut

ADVANCE NOTICE

SYMPOSIUM

Submarine Warfare and Tactical Development

A Look - Past, Present and Future

Submarine Development Group TWO
and
Submarine Development Squadron TWELVE

1949-1999

Following the Submarine Force's success in World War II, Submarine Development Group TWO was established in May 1949 to develop tactics for new submarine missions.

Fifty years later, following the Submarine Force's successful contributions in the Cold War, Submarine Development Squadron TWELVE continues tactical development for new submarine missions.

On the occasion of the 50th anniversary of CSDG-2/CSDS-12, an unclassified symposium will be held to review 50 years of submarine warfare and tactical development and explore current and future missions.

LOCATION: U.S. Naval Submarine Base
New London, CT
WHEN: 21-22 May 1999
CHAIRMAN: ADM Bruce DeMars, USN(Ret.)

THE SUBMARINE CONNECTIVITY ISSUE
What to Do?

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

Background

It should come as no surprise to anyone in the submarine community that our *old way* of communicating is simply no longer acceptable. Although it is unlikely that an SSN will ever be able to match the communications capabilities of platforms which will always have many large (and dry) antennas a hundred feet or more above the air-water interface, improvements are required in both communications accessibility and transmit/receive throughput. At the recent Submarine Technology Symposium, however, this subject did not attract the attention one would have expected—other than the two frequently voiced and broadly-based observations that "...we must communicate better" and "...we mustn't compromise our 'core competency' of Stealth". Indeed, a pessimist could draw the conclusion that although all admit its existence, operators view better connectivity as a technical problem and technicians view it as an operational problem.

Discussion

Rear Admiral Tom Elliot, the recently reported Deputy Director, Submarine Warfare Division (N87B) was a notable exception to the above general statements. In his Keynote Address for the second day of the proceedings, he drew heavily on his work, under CINCPACFLT Admiral Archie Clemens, on *Information Technology for the 21st Century* or IT21. It would appear, fortunately, that both *legacy* and emergent technologies and techniques are coming together that offer dramatic improvements without violating any laws of physics. An example of their work was related wherein the data rate on an existing onboard communications system was increased by orders of magnitude through nothing more complex than replacing the installed modem. Prerequisites to properly employing and exploiting these technologies and techniques, however, include the defining of some terms and the controlling of some expectations. What is it the submarine needs to do and when and from where does it need to do it?

Connectivity Data Rates

First, we cannot forget that data rate is to data as power is to work. One of Rear Admiral Jerry Holland's memorable one-liners is that "...time is a dimension of any process", and it is not just bandwidth but the time-bandwidth *product* that determines how much communications *capacity* exists—an observation that is probably trivial to everyone in the Navy except submariners, since others tend to assume that the *t* in the time-bandwidth relationship is 24 hours/day of constant, active, bi-directional traffic. Even under present battle group operational scenarios, SSNs don't have to be told all that much, and have even less to say. What is important is that the SSN be quickly available for on-demand communications, and that its equipment suite be capable of sending and receiving the information required. The real reason for better data rates to support transferring relatively limited time-bandwidth products is to constrain the total time spent doing it.

Another issue of importance to submariners (and really, everyone) is that there are too many subjective and vastly different terminologies as to just what is a *high* or *low* data rate. As has been done with both the RF (radio frequency) and acoustic spectrums, quantitative values are needed in lieu of the now largely qualitative descriptors. Certainly, that rate at which ELF (extremely low frequency) is received—in the order of 5 to 10 baud—represents a *stake in the sand* for ELDR (extremely low data rate) communications. Similarly, an order of magnitude around typical VLF (very low frequency) data rates might define VLDR, and so on. If the nomenclature continued on in sync with classic frequency bands, then the end of the descriptive road would happen with EHDR (extremely high data rate) equating to anything more than 3000 megabaud—maybe not high enough to describe transfer by some exotic radar or photonic means, but certainly more than adequate to encompass most other probabilities for several decades, particularly for submarines. Therefore, at least for the purpose of this article, the following are defined:

Connectivity Band	Baud Rate
Extremely Low Data Rate (ELDR)	<30
Very Low Data Rate (VLDR)	30-300
Low Data Rate (LDR)	300-3000
Medium Data Rate (MDR)	3K-30K

High Data Rate (HDR)	30K-300K
Very High Data Rate (VHDR)	300K-3000K
Ultra High Data Rate (UHDR)	3M-30M
Super High Data Rate (SHDR)	30M-300M
Extremely High Data Rate (EHDR)	300M-3000M

This logic would show most current on-line home computers operating on the Internet at about the MDR level, not a bad point of reference (in fact, all that telephone companies are required to assure of a *standard* line is 9600 baud—right in the middle of the MDR band).

The Connectivity Envelope

Connectivity is the principal submarine issue—for the sake of discussion, let it be defined as the ability, *on demand* and while submerged, to establish a bilateral link with some other entity or thing (i.e., some component within a *network* or *system of systems*). In fact, submarine-associated terms that might ultimately attain some degree of accepted meaning are *connectivity depth* (as opposed to periscope depth or even communications depth), or even better, *connectivity envelope*, analogous to current operating envelopes. Similar to operating envelopes, connectivity envelopes would be speed and depth dependent, but would also vary as a function of frequency, data rate and perhaps even sea state. In the vertical dimension, the envelope would be defined as a function of the *range* of non-broached keel depths from which communications can be conducted, and similarly, a range of allowable speeds in the horizontal dimension. In the simplest example such an envelope would be rectangular, but as for an operating envelope, there is no reason it would have to be.

Relative comparisons benefit from some *measure of effectiveness* (MOE) or system of units. A mental construct for first-cut descriptive *units* to describe connectivity envelopes could be the envelope's *area* (in foot-knots; perhaps the most absolutely meaningless units since *barn* was defined as the probability measure for neutron absorption by a nucleus). Of note, it would do the Submarine Force and its customers a disservice to even intimate that within the next several decades any HDR connectivity envelope would have a foot-knot MOE so large that it would not impact that platform's mobility to some degree. It is difficult to

imagine a case where the foot-knots of an HDR connectivity envelope would ever equal the foot-knots of a platform's operating envelope.

Submarine Operational Needs

Much has been said and written about the data rate at which a submarine must be able to communicate. The value most typically heard is the *T1 rate* (about 1.5 megabaud—VHDR by the standards above). It should first be realized that T1 is just an AT&T designator for a quality level of land-line service, and has little justification in practice to set a submarine operational requirement. If instead, real mission requirements are addressed in conjunction with an appreciation of onboard assets available to reduce the communications requirements (e.g., the need to quickly transmit high resolution *processed and compressed* still imagery), required rates drop to more reasonable and technically achievable values. As the quantity of raw *data* expands, it becomes more and more important to reduce it to *information* at the point of origin (fortuitously the means to do just that continue to become smaller, faster and cheaper) before transmission. Ship the wine, not the grapes.

Maintaining the covert nature of submarine operations also remains a high priority, if not so much for platform survivability as it would have been in war with the Soviet Union, certainly to maintain ubiquitous uncertainty in the minds of potential adversaries. Because of that, a real need exists for transmission from the submarine to have the greatest LPI (low probability of intercept) characteristics possible. Several techniques exist to enhance LPI transmission, not the least of which is to *clear* the transmission as quickly as possible and/or to have as narrow a beamwidth as possible so that the transmission can be *pointed* at the intended receiver with little energy propagating in other directions. It is proposed that, given a level of circuit discipline which would result in transmission of information and not just data, two-way HDR connectivity as defined above will meet the needs of submarines and their chains of command well into the 21st century. To slightly modify another favorite statement of Jerry Holland, "Real information in time is better than information (data) in real time."

Supporting Equipment Concepts

If HDR connectivity will likely meet all of the submarines downlink needs and uplink responsibilities, just what type of hardware is needed to provide that rate and in what connectivity envelope? Certainly, the most traditional submarine *thing* and posture for bilateral communications is at periscope depth with a hull-mounted retractable antenna mast. This option remains a viable, if not critical one, and programs are well along to provide mast-mounted HDR connectivity at EHF frequencies to orbiting MILSTAR satellites. Since EHF permits very directional but compact antennas, transmissions by this means would be LPI to a large degree, since it would be unlikely that any but the intended receiver would be in the narrow and positionally stabilized beam. The disadvantage of this means is that it provides a very small connectivity envelope (perhaps 15 feet by 8-10 knots).

A parallel option, being pursued through a joint effort between Naval Underwater Warfare Center and the Spears Communications Group, Ocean Systems Division of Sippican, Incorporated, and with which the writer has been involved, involves development of enhanced versions of the *legacy* Buoyant Cable Antenna. These concepts exploit a higher loading density of in-line electronics, and imbedded arrays of antenna transmit/receive elements. In one such conceptual system, a buoyant antenna module some six feet long and six inches in diameter, and at the air-water interface, would be towed by the submarine to provide HDR connectivity through an envelope of perhaps 200 feet by 6 knots, an increase of about an order of magnitude by a feet-knot MOE. Although such a HDR buoyant cable antenna certainly *could* be made retrievable and even replaceable while submerged by use of a new lockout/streaming mechanism, the mechanical engineering and physical installation considerations of such a capability could likely become the longest path of development/deployment. An alternative approach would be to develop a *clip-on* capability to rapidly provide CINCs with much improved SSN connectivity while better but longer term options were developed, not unlike the way 1970s STASS towed acoustic arrays provided much needed acoustic advantage years before retrievable acoustic towed arrays were fielded in number.

To continue the STASS/retrievable towed array analogy, two-way communications through 15 knots and 400 feet (a connectivity envelope of some 350 feet by 12 knots)—much more in line with

what is considered *operational speed and depth* for most submarine missions—could likely be obtained from yet another legacy technology which, like the BCA, was upgraded to what increased electronic component density and advanced materials can bring. In one such concept, being independently investigated by Sippican/-Spears, the remotely actuated sensor platform (RASP) would be a retrievable hydrodynamic body tethered to the ship via a BCA-like fiber optic cored high-strength cable. While externally reminiscent of the communications *buoys* so many of us have towed at one time or another, this device "would not be your Father's Oldsmobile". For example:

- With autonomous control surfaces, it would maintain its own depth rather than constantly being winched in and out from the ship.
- It would provide the VLF/LF link but also have an erectable mast with an HDR phased array antenna, electro-optical and in-air acoustic sensors and ESM capability.
- It would provide a significant degree of above layer acoustic sensing.
- Information, not data, would flow up and down the fiber optic link since most processing and modulation would be done in the buoy rather than aboard the ship.
- The spatially stabilized, narrow beamwidth HDR phased array would provide a similar degree of LPI to uplinks as that obtainable from the HDR mast.
- A standard bus architecture would allow extraordinary mission/sensor flexibility while also providing an easy communications upgrade path to accommodate the rapid expected changes in commercial and military satellite constellations.

Intuitively, there is a greater degree of technical risk associated with the development of a RASP when compared to an HDR BCA, but a RASP would probably benefit significantly from BCA-oriented developments in off-board electronics, antenna elements and lightweight/high strength tow cable construction.

Conclusions

Submarine connectivity at HDR rates is essential if Joint Forces are to fully exploit the special attributes that SSNs offer. These rates should properly first be achieved through the current develop-

ment of mast-mounted directional antennas. However, for many years during the Cold War, when U.S. submarines enjoyed an extraordinary level of acoustic advantage, a continuing concern by the Force was to remain aware enough of emergent technologies not to be *surprised* by the arrival of viable non-acoustic detection methodologies. In fact, the Submarine Force was among the leaders in investigating candidate phenomenologies, and took early engineering steps to defeat many. Prudence dictates that this same awareness and concern still be exercised, particularly as post-Cold War mission sets have submarines communicating more, closer to shore, and in shallower waters. Whatever above-surface, non-acoustic detection methodologies might be enabled by the same extraordinary and relatively inexpensive improvements in signal processing which are affecting so many other endeavors, they would probably be significantly mitigated if the large hull of the submarine had the choice of remaining further from the air-water interface while meeting its communications requirements. The continued contribution to U.S. forces of an SSN's stealth, mobility, firepower and endurance will be enhanced by an accelerated near term development of a clip-on HDR BCA and the midterm development of an HDR RASP.■

LOOKING FORWARD—SUBMARINES IN 2050

by Joseph J. Buff

Editor's Note: One of the toughest problems facing defense planners and programmers today lies in predicting the warfare requirement which will be faced far enough in the future to permit appropriate design of platforms with gestation periods measured in decades using technologies which may be at an embryonic stage in the development process. There are very few cases like the development of the nuclear submarine or the Submarine Launched Ballistic Missile where a crystal-clear priority requirement existed in close proximity to perceived near-term technical attainment. They were classic cases of perfect coupling between ***requirement pull*** *and* ***technology push.***

While most developments involve more reliance on the ***pushing*** *from below rather than the* ***pulling*** *from above, there are several ways to approach the problem by considering both sides of the equation. One method is to wait for someone to have a* ***great idea;*** *unfortunately, all too often it seems that the bosses, or the committees, do come up with a brain storm which turns out to be less than well-founded. Another approach, and the one which most successful programs follow, is to create a credible view of the future (a vision, if you will) on which to quantify a set of requirements which can be used to particularize the design of a weapons system within bounds of the technologically foreseeable. The success of those programs is usually dependent on the depth of effort put into examination of both military needs and industrial capabilities. The New SSN program looks to be a winner in that category on all counts.*

When it comes to longer-range projection, however, it may be useful to fall back on the ***Jules Verne School of Prediction.*** *When a novelist, such as Verne, has need of a futuristic view he usually learns all he can about his particular subject and also about the various sciences which act on that subject. He then proceeds to put the obvious trends together, treats the technical hurdles as presolved accomplishments and binds the package tightly with human nature. To give a submarine-specific example of such projection,* ***THE SUBMARINE REVIEW*** *asked a writer working on a submarine-related project to employ his novelist's craft in a look at the world of undersea warfare in the mid-21st century.*

Most members of the submarine community during World War Two could hardly have dreamed of nuclear propulsion, or titanium hulls, or supercomputer sonar signal processors. But apprentice torpedoman and squadron commander alike would have often yearned for the *benefits* such engineering marvels provide: longer submerged cruising endurance, greater test depths, and more powerful combat sensors. That was 50 years ago, and 50 years is a very long time, long enough to see both dramatic technological advances and major repositionings on the world geopolitical stage. What might naval submarines be like, and why may they be needed, if we project forward *another* 50 years?

This article will offer some suggestions and speculations, at once pragmatic and progressive, about the U.S. Navy's nuclear powered submarines in the year 2050. Qualitative projections and suggestions will be offered as to future hardware capabilities, operational usage, and overall missions assigned, three factors that are always intimately related in naval submarine development and employment.

Hull Materials and Test Depth

The continuing trend for many years has been toward greater *test depth*. Recent advances in materials science may lead eventually to improvements dramatically beyond today's roughly 1500 feet for steel (enough to stay below the Deep Scattering Layer) and 3000 feet for titanium (penetrating the upper reaches of the Deep Sound Channel).

Alumina ceramic composites, now being experimented with for research minisubs, combine tremendous strength with densities low enough to *approach neutral buoyancy*. Utilizing such materials to build a fleet submarine, one might obtain a hull that is extremely thick yet avoids excessive displacement, permitting SSNs and SSBNs to achieve an order of magnitude increase in operational depth without sacrificing useable internal volume or machinery and payload weight capacity. Let us begin to examine what such subs could achieve.

First, there would be two potential sources of *enhanced quieting* just from the hull design itself:

1. A very thick hull may enhance acoustic isolation of the sub's internal machinery.
2. The rigidity that comes with great thickness might prevent the hull popping sounds given off by conventional subs during rapid depth changes. (A thick and stiff hull might also avoid the need for internal ribbing, and might prevent hull resonances sometimes induced by internal machinery or external insonification, thus reducing active sonar cross section as well as passive signature.)

In addition, *cavitation of the propulsion system* at high speed would be reduced because the critical rotor RPM rate at which cavitation begins, everything else being equal, rises roughly with the square root of the depth. This would raise top quiet speed, and might raise top *maximum* speed as well. That may become increasingly important in the future, not just for rapid transits to the battle area, but to achieve engagement supremacy (water superiority?) once there against surface craft with ever higher flank speeds of their own. SWATHs, pump-jet driven freighters, ASW hydrofoils, and perhaps other propulsion breakthroughs hard for us to imagine, will all make it harder and harder for an attack sub to intercept an enemy carrier battle group or merchant convoy and do useful work against it.

Within 50 years we may see both the need for and the available funding to permit constructing what we might label an *FSSN*, a future SSN, or *FSSBN*, a future SSBN. It is tempting to imagine a vessel able to dive routinely to, say, 15,000 feet, which is deeper than the average depth of all of the world's oceans. Here are some of the advantages for both offense and defense that such a capability would bring:

1. Enhanced *stealth*, and thus *survivability*, relative to emerging ASW detection methods such as surface wake analysis, thermal plumes, magnetic anomalies, and blue-green laser scanning (lidar). (More sophisticated methods to reduce such signatures while at *shallow* depth can also be anticipated in the years to come.)
2. Greater survivability through the thicker, stronger hull, which would be more resistant to enemy warheads both conventional and nuclear.

3. Increased flexibility to play hide-and-seek below the Deep Scattering Layer, and within and even *well below* the Deep Sound Channel itself.
4. *Nap-of-Seafloor* maneuvering over much of the ocean bottom. Submerged terrain such as seamounts, mid-ocean ridges, and trenches can form an ultimate battleground with respect to: a) stealthy approach toward an enemy coastline or operational area, b) concealment laterally from enemy active and passive sonar using intervening bottom contours, c) concealment vertically by hiding in sonar *ground clutter* or by lurking beside an old wreck, and d) ability to lie in ambush with *look up* sensors watching for enemy submarines and surface craft. In the submarine warfare of the year 2050, there could be real advantages to commanding the low ground. Additionally, the tactical need or desire to *stay off the skyline*, while coping with bottom topography in close proximity to the boat, gives nap-of-seafloor combat some of the flavor of submarine littoral warfare.
5. Availability of more horizontal seawater layers of varying density and reverberation characteristics, for enhanced concealment from enemy ASW forces and their weaponry. Deep ocean currents and marine life concentrations can create such layers well down in the bottom isothermal zone.
6. Reduced effectiveness of conventional enemy torpedo and depth charge warheads with greatly increased depth. (Of course this would apply to one's own weapons directed against deep targets as well, suggesting the need for R&D on explosive charges and delivery platforms that would work well at pressures of three or four tons psi.)
7. Reduced cavitation of high-power active sonars. The critical wattage at which the water outside the dome begins to boil is higher with greater depth. This obviously improves effectiveness of the system.
8. Ability to exploit *vertical* temperature/density *sonar terrain and weather* features found around volcanic vents and black smokers as their super-hot exudations rise and then disperse. An inverted cone would result that, given apex temperatures of 500 or 800 degrees Fahrenheit, would have profound effects on sonar propagation.
9. Avoidance of the noise resulting from long-wavelength

surface waves, which can penetrate down to 1000 feet and impair passive target detection.

10. Greater vertical separation, and hence greater passive (and also active) sonar signature transmission losses, relative to enemy ASW surface forces (or shallow-diving submarines) that may have localized the FSSN. Assuming spherical attenuation, ten times the depth implies one one-hundredth the received signal strength.

Let us consider next some additional technological advances that may improve submarine quieting during the 21st century.

1. Development of permanent or semi-permanent hull coatings (as opposed to continually discharging long-chain polymers from the nose of the vessel), to more effectively reduce water resistance and flow noise. This would benefit speed, quieting and sonar sensitivity.
2. Increasing use of hull coatings and/or *tile* coverings to reduce active and passive *sonar cross sections*.
3. Development of hull materials whose compressibility is equivalent to that of water, thus becoming almost transparent to sonar.

We can probably expect the competition between more capable sonars and quieter subs to continue indefinitely. More sensitive hydrophones, more sophisticated array designs, faster computers with bigger memories, and new signal processing algorithms, will all make it harder to hide when a sub wants to hide. Clearly, greater test depth provides an important advantage. Also, it seems likely that continuing research into marine biology, geology, and oceanography will have ever greater importance to national defense, if and when the deep ocean becomes (perhaps tragically) a theater of warfare. And what better platform to develop such vital data quickly and covertly, than an FSSN which can easily traverse the area in question?

Sensors

Beyond these sonar considerations, other *new and emerging sensor capabilities* may become important. Consider three related

ways a submarine might literally *visualize* the sea around it while well below periscope depth:

1. Active imaging through blue-green laser line scanners. Increasingly powerful lasers, charge-coupled intensifying detectors, and image enhancement algorithms, may permit a sub's CO and crew to *see* the ocean in their immediate vicinity. (Non-reflective coatings would be desirable to reduce one's own detectability by such lidar emitters carried by enemy submarines or enemy surveillance satellites, aircraft, or surface ships, including lidar and lidarbuoys.)
2. Passive imaging through electronic intensification of *natural bioluminescence*. Many marine species emit such electromagnetic energy, especially when disturbed by intruders or as a method of luring prey. Certain bacteria living near hot vents also emit weak bioluminescence. The *natural lighting* in the ocean depths could have important military uses some day.
3. As in 2., except, at relatively shallower depths like as 200 or 1000 feet, electronically amplifying and using for illumination whatever sunlight (or moonlight!) does manage to penetrate.

Since light is rapidly attenuated in seawater due to suspended particulates, these methodologies would apply only over relatively short ranges. However, since the density of marine life attenuates with depth, there may be areas of the ocean where *visibility* can be made better than near the surface. Great technical challenges would have to be overcome to create sensors capable of operating under ambient pressures of dozens or hundreds of atmospheres. Perhaps by the year 2050 it will be possible to "look around" to a range of 1000 feet or 1000 yards (ten boat-lengths?), even more. What benefits might this bring?

1. Greater ability to *detect and stalk enemy submarines*, in several ways:
   a. Another submarine would in some sea conditions leave a *trail* of underwater bioluminescence that may persist long enough to be detected by electronic means. Analysis of this trail might yield data on course and speed as well.

b. Another submarine's passage might also leave a trail of damaged or shredded marine life, which could also be detected by active or passive visual means. This would be true of both conventional screw-propeller and pump-jet powered vessels.
c. Nap-of-seafloor maneuvering might stir up bottom sediments, again leaving a *spoor* which innovative tacticians might exploit.
d. Persisting wake vortices left by the passage of enemy subs might reveal themselves through lidar doppler effects, in an analogy to how aircraft radar now detect wind shear.
e. At short ranges, using reflected light, a submarine might be able to **directly observe** by *visual* means another submarine, even when the latter fails to show up on passive (or even active) sonar because of intervening acoustic scattering and diffraction. Enemy submarines might also be detected passively by their *obscuration* or blocking of available light, which relates to the sonar *hole in the ocean* issue alluded to below.

2. New means to detect, avoid, and **clear submerged or floating mines**, using lidar with variable intensity and beam width. An FSSN with such imaging equipment would be better prepared to map or penetrate enemy minefields, which might sometimes have a more obvious visual signature that either an active or passive acoustic one. Unmanned (or rather, uninhabited) underwater vehicles (UUVs), or even robotic grapnels attached to the parent sub, might then be used to disarm the mines or move them aside.
3. Improved ability to detect and **avoid deep-draft surface vessels**. This is a significant hazard when a sub is operating shallow near a harbor or along coastal or mid-ocean shipping lanes.

The limited range of light underwater is not entirely a disadvantage, since it enhances the security of active visual scanning by an FSSN operating in the face of the enemy. Sometimes, as hinted above, an additional detection means that is only operative over short ranges can still be a powerful complement to existing methodologies (especially when it possess better inherent directivi-

ty). For instance, an FSSN which localizes an enemy boomer through a sound transient may then be able to track down that target, by proceeding to the original datum to pick up and follow the trail of effects the target's passing had on the surrounding medium. Complex tactics could evolve, including the intentional creation of a false trail, with doubling back to lie in ambush against one's pursuer. Again, the basic characteristics of the ocean and its contents and boundaries become an important subject of measurement and analysis. Underwater *meteorology*, with its attendant understanding and prediction of both acoustic and visual conditions in different places and at different times, will remain a relevant topic for the submarine community in the future.

Next, speaking of the ambient noise environment of the sea, **ambient** sonar may eventually become a routine operating mode of acoustic surveillance. This technique uses the constant background noise of the oceans, resulting from surface waves, passing ships, marine life, and other sources, to *illuminate* targets and terrain features that may be surrounding one's submarine. This is a hybrid of active and passive sonar: the listening submarine does not transmit, but it is listening for *echoes* off of targets rather than just their self-noise. Ambient sonar can also be thought of as a version of bi-static sonar, in which one vessel pings and another listens for the echoes.

The flip-side of ambient sonar is listening for *holes in the ocean*, obstructions to ambient sound resulting from enemy submarines in the vicinity. More powerful and subtle sonar equipment would permit detection in this manner at greater ranges with a lower false alarm rate. A very competent future submarine might defeat this mode of detection by actively transmitting a *replica* of local sea noises in the direction of a suspected listening enemy.

Other recent articles in **THE SUBMARINE REVIEW** have discussed approaches to the *man/machine interface* that cope with the potential information explosion resulting from new and multiple types of sensor data. Undoubtedly, we can look forward to ever more sophisticated virtual reality and/or holographic visual presentation modes that integrate optical and acoustic information (including three dimensional target motion analysis situation displays). This would be vital in high-speed nap-of-seafloor maneuvering, to avoid impact with bottom terrain or entry into

canyon cul-de-sacs that leave one cornered by enemy SSNs or their torpedoes. The old concept of *highway in the sea* helm displays becomes relevant again. Accurate large scale (i.e., finely detailed) seafloor maps will become quite important too, as will high-precision submerged navigation systems, since crashing into a seamount can spoil your whole day, and a sub doing 60 knots (not impossible) advances 1000 feet every 10 seconds. On a more positive note, observe that deep diving subs, with proper maps and using acoustic and/or optical sensors, could obtain valuable pinpoint updates of their inertial navigation systems by referring to submerged terrain features for a kind of *orienteering*. This would be especially relevant for a futuristic boomer, whose survivability *after* launching would certainly be enhanced by an ultra-strong hull capable of diving to great depth.

Some of these thoughts suggest that submarine warfare may in the future become even more dynamic, three-dimensional, and fast paced. This will probably require an evolution beyond the traditional *course log and bell book* approach to conning the ship. Eventually, a closely-knit team might work under direction of the commanding officer to make *continual changes* to course, speed, and depth, striving to maintain the initiative in a complex underwater ballet not entirely unlike engagements between fighter aircraft or fighters and bombers. Simulations and wargaming could be used to get a better handle on this issue.

Part II will appear in the October issue of ***THE SUBMARINE REVIEW.***■

APRIL 1900: INVENTOR-BUILDER JOHN P. HOLLAND DELIVERS FIRST U.S. SUBMARINE

Part One

by John Merrill

Mr. Merrill retired from a long and distinguished career at the New London Division of the Naval Undersea Warfare Center. He currently writes historical works involving that lab and its accomplishments.

As the new century began, John P. Holland (submarine builder and inventor whose concepts revolutionized naval warfare) was nearing the pinnacle of his success with the United States Navy purchasing his successful submarine HOLLAND VI.

Holland descended gradually from this high point of his career. It had taken Holland 25 years and the construction of five submarines to arrive at his current design of a practical submarine. True recognition of his accomplishment was not realized until after his death in 1914.

At this time Theodore Roosevelt (former Assistant Secretary of the Navy and strongly favorable for a better Navy) was concluding his governance of New York State and within months of his presidency (1901-1909); and American submarine builders were embarking on a century-long development of the submarine as a significant weapon.

In 1899, the recently incorporated Electric Boat Company (EBCO) included the Holland Torpedo Boat Company in its acquisitions. EBCO provided needed fiscal and business support to Holland during the final pre-delivery stages of the three years of intensive testing, modifying and establishing the value of HOLLAND VI to the Navy and others. EBCO went on to become one of the world's foremost builder of submarines, by 1995 delivering more than 260 submarines to the Navy. The EBCO sale of a $150,000 submarine in 1900 was a modest beginning for a 20th century military/industrial relationship of enormous importance.

President Roosevelt's international ambitions and the need for a growing modern Navy provided impetus to acceptance of the fledgling submarine. Holland's successful submarine provided the starting point; what became the American submarine industry with

the essential ingredients of private profit motivation and industrial knowhow. Also it took on an international flavor, thrusting the submarine into prominence both at home and abroad.

The submarine represented the increasing trend toward the use of new and more complex technologies for sophisticated armament. The research, development and fabrication for the new approach to armament was often beyond government abilities. In procuring technical armament, institutional experience for buyers such as the Navy during procurement became an essential requirement. Then and in the years ahead this was not always available; sometimes this created awkward consequences.

Roosevelt's enterprising role and experience as Assistant Secretary of the Navy (1897-1989) made for an opportune time to bring the submarine in as an addition to the Navy's growing arsenal. On April 10, 1898, while HOLLAND VI was undergoing its long testing and acceptance program, he wrote to then Secretary of the Navy John D. Long (1897-1902):

> "I think that the Holland submarine boat should be purchased. Evidently she has in her great possibilities for harbor defense. Sometimes she doesn't work perfectly, but often she does, and I don't think that in the present emergency we can afford to let her slip. I recommend that you authorize me to enter into negotiations for her, or that you authorize the Bureau of Construction to do so, which would be just as well."[1]

The Navy's 1900 purchase of a submarine was more than the end product of naval contracts and the culmination of a quarter century's intensive effort by a motivated and talented Irish immigrant, John Holland. The beginnings of the tangle of circumstances which brought to fruition this then-world class submarine resulted both from the determination of the country and the Navy to grow nationally and internationally and in Holland's resolve to build the right submarine.

In 1878, Secretary of the Navy Richard Thompson (1877-1881) was told of the minimal size of the current serviceable Navy (33 cruisers, 13 monitors, and two gunboats). This marginal fleet placed the United States Navy 12th worldwide in ironclad strength below Chile. The next 20 years saw the Presidents, Congress and

general public favorable toward developing a larger and better Navy. As the Navy's needs were gradually fulfilled, the collective efforts became identified with the expression *New Navy* or *Steel Navy*.

President Grover Cleveland's Secretary of the Navy, New York lawyer and businessman, William Collins Whitney (1885-1889), observed on the day he took office that "the United States Navy had no one vessel of war which could have kept the seas open for one week as against any first rate naval power."[2] The Navy's ships were still mostly wood with a few obsolete ironclads.

In 1898, by the end of the 100 day war with Spain, United States naval successes reflected the beginnings of that New Navy, standing sixth in the world. The end of Theodore Roosevelt's second presidential term saw a growing Navy ranking second or third in the world. Submarines comprised a small part of the Navy's modernization and growth, which focused on battleships, an isthmian canal, and possession of Hawaii.

Acceptance of the submarine was slow, but unlike the acceptance of steam over sail which required decades. In 1900, with centuries of surface ship tradition, priority and budgetary decisions of the predominately surface ship officer corps did not particularly favor the infant submarine technology and an energetic exploitation of the submarine's tactical and strategic potentials. A further impediment for submarine acceptance was the torpedo boat acknowledged as the mainstay of coast defense. Further, torpedo boats were not excessively expensive and could be built in a few months. Roosevelt, as Assistant Secretary of the Navy, ordered 75 to be constructed.

Prior to 1900 and United States' purchase of HOLLAND VI, France was the only nation to have a submarine fleet. In 1863 a not-too-successful French submarine, 140 feet long, LE PLONGEUR, was in operation. The French Navy continued to encourage French designers and by 1886 began ordering large numbers of submarines, expending government resources for a particular strategic need. Further, France saw the submarine's offensive as well as defensive value and regarded the submarine as a safeguard against an attacking British Navy in the event of war.[3] By 1880, there were 42 separate submarine projects under way in various nations, 15 of which led to finished boats.[4]

The French and international view of the submarine as a coastal

defense weapon remained entrenched until World War I, when Germany's successful submarines destroyed naval as well as merchant ships in an unforseen offensive role.

John Holland

To describe Holland, words such as visionary, persevering, gifted, insightful, daring, and hardworking seem appropriate. Born on the coast of Ireland in 1841, Holland lived his early life in very limited circumstances. Early, he demonstrated aptitude for the physical sciences but was restricted in vocational directions by poor health, nearsightedness, and lack of funds. At 17, in 1858 he joined the Irish Christian Brothers, a teaching order, becoming a teacher. Under the Brothers' tutelage his mechanical aptitude, drafting skill and mathematical abilities developed.

As a child witness of the Irish famine (1846-51), Holland saw his father, uncles and male relatives succumbing to hardships and disease (possibly Asiatic cholera). Further, he would have been aware of the spectacle of mass emigration primally to America as a result of the famine and general economic conditions.

In his later teen years, it is probable that Holland's views of his homeland were also influenced by the ongoing political turmoil related to Ireland's desire for independence in which his brothers were involved. His younger brother, an active member of the secret Fenian Society established in Ireland in 1858 to challenge English rule, found it desirable to leave for America in 1869. In the years ahead, the Fenians played a decisive role in Holland's submarine-inventing and -building career.

Holland's mother and older brother left Ireland for America in early 1872. With few ties remaining in Ireland, Holland withdrew from the Christian Brothers and took steerage passage to Boston, landing in November 1873.

Shortly after arrival, he slipped on the ice, broke his leg and spent time convalescing. Later, in an interview with the Washington Star in 1900, he recalled that during his recovery he reconsidered his earlier thoughts on basic problems of submarine navigation. In 1874, he was again teaching with the Christian Brothers, this time in Paterson, New Jersey.

Holland's Six Submarines (1878-1900)[1]

In addition to teaching, Holland developed plans for an original one-man self-propelled submarine. He found investors to support him in the event that he could obtain a government endorsement. In 1875, he submitted his plan for a 14 foot submarine to President Grant's Secretary of the Navy George M. Robeson (1869-1877). The Navy's reply agreed technically with Holland but did not believe that anyone could be convinced to operate the submarine underwater.

Private submarine building occupied Holland for the following 10 years. As engineer and innovator with hands-on direction and experience, he launched three submarines: HOLLAND I in May 1878, FENIAN RAM in May 1881, and FENIAN MODEL in November 1883. Fenian Society activists in the New York area provided the funding, intending that these submarines would be transported to Europe and used to inflict damage on the British fleet. It is important to note that these Fenian boats were equipped with Brayton internal combustion engines and not the steam that was in vogue. The boats met specifications, but none found its way beyond the New York area for the intended purpose.

Two years later in 1885, based on Holland's designs and efforts at the Nautilus Submarine Boat Company, the privately financed 50 foot wood and steel ZALINSKI BOAT was launched. During launching, the submarine was critically damaged and later discarded. This disaster temporarily brought Holland's submarine development efforts to a standstill. At that time, he held several submarine-related patents.

In 1888, with encouragement by naval officers and Secretary of the Navy Whitney, Congress appropriated $150,000 for a submarine. Whitney invited submarine developers to submit their designs and competitive bids. Holland's design, reviewed with those of five other competitors from the United States and overseas, won. The government then canceled the plans for submarine procurement. The following year, there was a second call for bids. Holland's design again triumphed and Secretary of the Navy Benjamin Franklin Tracy (1889-1893) reallocated the submarine funds to complete surface ships.

During this period of turndowns by the Navy, Holland obtained a position with the Morris and Cummings Dredging Company as

an equipment designer. While with Morris until 1893, Holland made the acquaintance of a company lawyer, Elihu B. Frost.

Initially this was fortuitous for Holland. Naval historian Albert B. Christman, in writing about Holland commented concerning Frost that "Besides knowing the law, Frost had Washington connections, a keen sense of business and politics, and uncommon admiration for John Holland's technical skill and determination."[6]

As a result of Frost's efforts, energy and enthusiasm, early in 1893 the John P. Holland Torpedo Boat Company was formed, incorporated in New York state, and stock issued. Holland became the company manager. Holland then held United States patents for "a gun patent, a steering apparatus for submarine vessels (patented early in 1893), and another submarine design for which a patent was still pending."[7]

Because of the Navy's reluctance to move forward with submarine construction, Frost took action abroad to obtain foreign patents for Holland's designs. Patent sales were sought in European capitals, Japan, and the South American countries of Peru, Chile, Ecuador, and Argentina. Sales of Holland's patents to foreign nations potentially provided opportunity for submarine building abroad while the United States Navy procrastinated. Later foreign patents played a formidable role in Holland's demise as a submarine builder.

Congress appropriated $200,000 in March 1893 to reopen design competition for an experimental submarine. April brought a call for submarine design. For the fifth time Holland submitted his submarine plans and when the bids were opened June 30, Holland again was first. Supporters favoring construction of the submarine included President Grover Cleveland. However, others in the Washington bureaucracy stalled award of the contract.

To justify a technical question regarding submarine habitability, an experiment was conducted at Newport, Rhode Island in which a cat, a rooster, a rabbit, and a dove were submerged in a water-tight metal container. Explosions of gunpowder were made increasingly closer to the container, each with a larger charge and finally, at 30 yards distance, 100 pounds of gunpowder. The cat and the rooster survived. The metal container was not damaged, yet the favorable test results did not fully convince all who were concerned.

Pro-Holland efforts to obtain the release of the Congressionally

appropriated funds by convincing Navy Boards, Senators, the Secretary of the Navy and others were successful. Finally, almost two years later on March 3, 1895, Frost gained the $200,000 contract for a Holland submarine torpedo boat. This incessant assault on the bureaucracy was an essential ingredient in obtaining the contract. This was seven years after the first naval competition for submarine design and 20 years from Holland's first approach to the Navy with a submarine design.

The position of the Navy with regard to the implementation of the new submarine contract has been inferred by some as being adversarial. Another author saw the Navy's attitude as "The Navy had lost the war, but it remained resolute in its determination to be anything but cooperative in defeat."[9]

At the Columbia Iron Works in Baltimore, the scene of the new construction opened with a keel laying in 1896 for the new submarine called PLUNGER. Even at the start, design concepts were put in place contrary to Holland's experience and design. Two of his previous submarines were propelled on the surface using the Brayton internal combustion petroleum engine with a single propeller. The 85 foot PLUNGER required a 1500 horsepower engine to obtain the specified speed on the surface.

Steam was the only viable way to meet the substantial horsepower requirement, yet steam had already been shown to be impractical by European submarine builders. On PLUNGER, engine heat in the fireroom at 130 degrees F made it extremely difficult for the crew. The specifications for the new submarine called for five propellers, three for forward motion and two that (it was hoped) would allow the boat to hover at fixed depths. These issues alone can be described as anti-Holland.

During PLUNGER construction, differences between Holland and onsite Navy personnel continued. Holland's decades of experience included design, construction, and operation of four submarines. Involved Navy personnel proved limited in submarine knowledge and oriented to conventional shipbuilding. A fully maneuverable submarine with ease of submerging and surfacing similar to a dolphin's performance was dominant in Holland's operating requirements. The Holland hull configuration would be fishlike, not that of a surface craft.

The PLUNGER design was moving in directions not in tune with Holland's concept. The continuing flow of changes by the

Navy made construction difficult and tended to make PLUNGER look more like a surface vessel, contrary to Holland's goal of a hull design enhancing underwater maneuverability.

Launched in August 1897 with unresolved technical problems, PLUNGER did not get beyond dock trials at the Iron Works. Steam propulsion and its difficulties were overtaken by internal combustion engine advances. The same year, the Otto engine, a new internal combustion petroleum operated engine, was acclaimed at an international exhibition in Paris. The horsepower was adequate for submarine surface operation for a smaller submarine. Holland was aware of this development.

Prior to the launching of PLUNGER, Holland initiated a parallel submarine enterprise in adjacent New Jersey at the Lewis Nixon's Crescent Shipyard in Elizabethport, to build with private funds a smaller submarine of his design, incorporating the latest technology, a 45 horsepower Otto engine, and without interference from the Navy. The new submarine, HOLLAND VI, at 54 feet in length was more than 30 feet shorter than the 85 foot PLUNGER with its 1500 horsepower steam engine requirement. Almost four years later in April 1900, the Navy purchased its first submarine, HOLLAND VI.■

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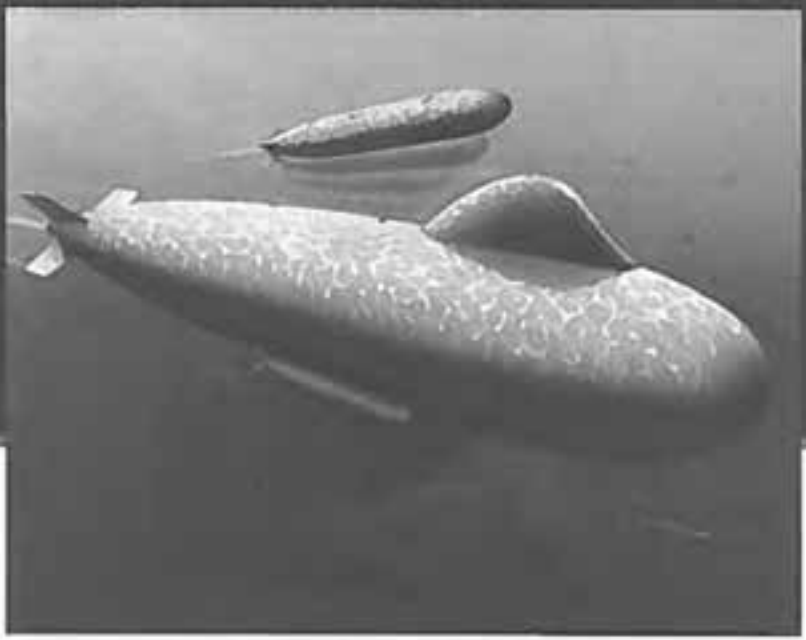
THE POTENT PEACEKEEPER.



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SALMON SURVIVES HARROWING ORDEAL

by CAPT R.A. Bowling, USN(Ret.)

Subsequent to World War II, the Bureau of Ships issued a series of four confidential—since declassified—publications which summarized the war damage to U.S. battleships, carriers, cruisers and destroyers; and two appendices related to submarine war damage and losses respectively. Appendix I resulted from a survey of war patrol reports and other available information which indicated that during World War II there were 110 separate instances in which United States fleet type submarines survived damage from attack by the enemy or friendly forces where the damage received may have been more than negligible or where the circumstances of the attack or the nature of the damage was of sufficient interest to warrant reporting.[1] Of the 110 cases, the survival of USS SALMON (SS 182) has to have been one of the most harrowing.

On the night of 30 October 1944, about 100 miles south of Japan, USS SALMON (SS 182), Commander H.K. *"Ken"* Nauman commanding, attacked a tanker previously damaged and stopped by TRIGGER. At the time, the tanker was being closely guarded by four alerted A/S vessels. Nauman fired a spread of four fish, got two hits and went deep to evade the inevitable counter-attack. As SALMON leveled off at 310 feet—she was a *thin-skinner*, safe operating depth 312 feet—the escorts launched a ferocious barrage of some 30 depth charges. One of the last almost had her number on it.[2]

Estimated to have been a Type 2 with 357 pounds of Type 98 explosive, it exploded an estimated 45 feet above the after engine room (A.E.R.). With the main induction piping crushed flat, the pressure hull indented as much as two inches over the A.E.R. and taking on water rapidly from a score of sources, SALMON's crew spent the next 17 harrowing minutes attempting to stem the flooding and repair machinery in order to regain depth control. During that time, SALMON sank out of control three times to depths far beyond her designed operating depth. Finally, with the battery depleted, limited high pressure air remaining, water in the A.E.R. reaching the main motors and increasing, depth control impossible, and the boat at 578 feet and still sinking, the decision

was made to battle-surface and shoot it out by gun action.

Those harrowing 17 minutes are depicted in the accompanying brief descriptions as SALMON alternated between safe operating depth and supposedly crush depths.[3]

- A total of 30 depth charges were dropped on SALMON while she was running at 310 feet—safe operating depth 312 feet. One or more charges detonated close over the after engine room and caused the complete collapse and flooding of the engine air induction piping and possibly some or all of the pressure hull deformation between the tank tops over the engine rooms. The closest charge is estimated to have detonated about 45 feet above the after engine room as shown.

- Depth control was lost and the boat started to settle fast for the following reasons: (a) loss of buoyancy due to the collapse of the main engine air induction system, (b) flooding of three after deck access hatch trunks, plus profuse leakage into various compartments, (c) jamming of the stern planes on the *hard dive* position, (d) loss of 7000 gallons of fuel oil from F.O.B. No. 7 and (e) downward flow of water from the detonations of depth charges. The decent of the boat was initially checked at about 400 feet [safe operating depth (SOD) 312 feet] by going ahead at emergency speed, with a 20 degrees up angle, and pumping the auxiliary tanks.

- Salmon then rose to about 300 feet, but when an attempt was made to level off and reduce speed to standard, the boat again settled rapidly.

- Emergency speed and a 20 degree up angle were again ordered. In addition, safety tank was blown. This time descent was not checked until SALMON sank to about 500 feet [SOD 312 feet].

- Once again SALMON started to rise and reached 150 feet. But she started to drop again when another attempt was made to level off and reduce speed.

- This time the boat went quickly to about 500 feet, in spite of again resorting to emergency speed ahead and a 20 degree up angle. She then gradually settled to a reported depth of 578 feet and still increasing [SOD 312 feet]. At that point, with batteries depleted, water in the after engine room still rising and having reached the main motors, and depth control impossible, the decision was made to surface and shoot it out by gun action against the escorts.

- SALMON battle-surfaced 17 minutes after first being attacked. On surfacing, the boat assumed a 15 degree starboard list with the main deck awash due to leaking ballast tank vent valves and the inability to start the low pressure blowers. High pressure air remaining on surfacing was 1,200 pounds in one bank only and could not be recharged since the motors for the H.P. air compressors had been flooded out.

Subsequent surveys at Saipan, Pearl Harbor and Mare Island Navy Shipyard determined that SALMON had suffered the following major damages:

- The main induction piping was completely collapsed [flattened] causing an increase in weight of 13,500 pounds.
- The pressure hull plating between tank tops was generally depressed between frames 95 and 170. The area of heaviest deformation occurred between frames 130 and 145, with a maximum deformation of about two inches at frames 137 and 139 [over A.E.R.].
- The master vent valves for Safety Tank and M.B.T. Nos. 2A, 2C and 2G could not be closed. The vent risers for M.B.T. No's. 2C, 2E and 2G, and F.B.T. No. 7 were ruptured. All starboard emergency vent valves leaked. The low pressure blow lines to F.B.T. No's. 7 and 9 were ruptured. This damage caused SALMON to assume a 15 degree starboard list on surfacing.
- Seven thousand (7000) gallons of fuel escaped from F.B.T. No. 7 through a ruptured vent riser and was displaced by heavier sea water, thus tending to make the boat heavy aft.
- The upper hatch of the After Torpedo Room access trunk

was forced open to a 30 degree angle. The trunk flooded but the lower hatch held and saved the ship. Similarly, the upper hatches of the Forward Engine Room and the Crew's Mess were sprung and the trunks flooded. But the lower hatches held. [These lower hatches served a second purpose: the trunks served as vegetable lockers, *e.g.*, spuds. Fortunately, none of these back-up hatches, particularly the one in the A.T.R., had been removed for *spuds* at the time of the action.]

- Power steering was lost due to the rupture of the supply piping at the steering hydraulic manifold in the After Torpedo Room. Manual steering control was not regained until the shift was made to hand operation four minutes later.
- The stern planes were jammed in the *hard dive* position because the hand-tilting shafting along the top of the After Engine Room was frozen by the local indentation of the pressure hull on top of it; and the stern plane drive shaft coupling in After Torpedo Room was shattered.
- The bilges were flooded in both engine rooms, primarily through damaged fuel ballast tank riser inboard vent lines, which could not be controlled because the stop valves had been torn [loose] from their holding studs. Water reached the main motors and the main generators (at a 20 degree up angle) and could not be controlled by pumping because the bilge drain line suction strainers were clogged by debris.
- No's. 1 and 2 main engines flooded through the exhaust piping system. No. 2 generator flooded by water in the bilge.
- All of the main engine outboard double-seal conical type exhaust valves leaked.
- Both periscope head staunching plates fractured and the tubes flooded.
- At depths below 200 feet, profuse leakage occurred into the Conning Tower through the stuffing boxes of both periscopes, the steering wheel shaft packing, and from around the upper Conning Tower hatch. The Conning Tower bilges overflowed and the water drained into the Control Room and the Pump Room.
- The Pump Room flooded waist-high at the after end (at a 20 degree up angle) from the Conning Tower and hull ventila-

tion drains.

- Various auxiliary motors in the Pump Room flooded out. The low pressure blower volume tank flooded.
- The main hydraulic plant was secured due to excessive leakage in the hydraulic system pipping and fittings throughout boat.
- There was a small amount of flooding in the Crew's Mess from hull ventilation which flooded out the electric ranges.
- All of the bridge instruments were damaged and flooded.
- The bow planes rigging motor panel was damaged. On surfacing, bow planes had to be rigged in by hand.

Epilog

The courage and fighting spirit of SALMON's crew after surfacing in the face of overwhelming odds—4:1—is a stirring tale in of itself that warrants a separate accounting. For now, however, it deserves at least a summary account. SALMON surfaced with a 15 degree starboard list, no engines immediately available and limited battery propulsion. For some unknown reason the escorts did not attack aggressively. SALMON took advantage of this to correct the list while holding the escorts at bay with her 4-inch deck gun and 20-mm machine guns. Then, after some three hours, with trim, main engines propulsion and communications restored, SALMON turned on her tormentors and took the offensive. Leaving one escort ablaze and DIW, she raced into a rain squall and made good her escape, bound for Saipan, later joined by TRIGGER, STERLET and SILVERSIDES as escorts. At Saipan she received voyage repairs, thence on to Pearl for additional repairs to make her seaworthy, and thence on to Mare Island Navy Shipyard where she was declared too damaged to justify restoration as a fighting unit and was retired from active service. But the crew was not through fighting—not yet at least.

At their request, Captain *Ken* Nauman, requested and the Bureau approved the transfer of the crew as a whole to new construction rather than ordering them individually as replacements to other submarines in accordance with then current policy. And so it was that when the war ended, the SALMON crew was again on patrol in their new boat STICKLEBACK, Commander H.K. *Ken* Nauman again in command, in the last bastion of the Empire,

the Sea of Japan, as part of *Operation Barney*. Such was the breed of fighting men who served in our *silent service* during World War II.■

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IN MEMORIUM

CAPT Roy E. Goldman, USN(ret.)

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DAVID WANKLYN OF HMS UPHOLDER: A DISAPPOINTING DEBUT

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

The Victoria Cross, Britain's highest military award, has been won by a total of 14 Navy submariners in both World Wars. The VC, a bronze cross simply inscribed **For Valour**, *compares with the Congressional Medal of Honor. This is Part 7 of an eight-part series.*

Heroes are not born perfect: there is hope for all of us when we recall the painful climb by Lieutenant Commander Malcolm David Wanklyn from failure to fulfilment with a Victoria Cross, and three times awarded, the Distinguished Service Order.

Wanklyn, as a boy and young officer, was remembered by contemporaries as a reserved and austere loner, undistinguished and quiet except for strangely uncharacteristic outbursts of crude humour. A solemn child at school, probably despised as a *swot*, he displayed no enthusiasm for the team games and manly activities considered so essential for character building by the British middle classes. He held back when brothers Jack and Peter raced adventurously up rock mountain slopes; and his hobbies were decidedly unadventurous—bird watching, stamp collecting and photography.

As a fully fledged officer he did not present the conventional image of a young naval lieutenant, and he had companions rather than friends. He tried, dutifully, to be *one of the boys* when the occasion demanded; but his sole contribution to the obligatory postprandial excesses of wardroom guest-nights was to sit on his hand and arse (he eschewed less frankly anatomical terms), and, yoga-like, wrap both legs around his neck. Although tall and lanky he was practically double-jointed and easily able to bend his back—although that did not save him from continually banging his head, and cursing loudly, in submarines.

Late at night, in harbor between wartime patrols, he might be persuaded to sing a dubiously worded comic song; but only, one suspects, if he was a bit Brahms and Liszt. In that connection he was famously tolerant, and skillfully helpful, towards ratings who had over-indulged ashore.

As a seagoing submarine captain Wanklyn looked like an untidy Old Testament prophet, blackly bearded over keen, studious features and wearing trousers shiny with age below a disreputable monkey jacket with its two and a half gold stripes tattered and torn. He by no means personified the archetypal leader of men: nevertheless his ship's company was totally trusting, and sailors described him as a "a great gentleman": several *hard cases* were drafted to his boat for reform.

He sometimes seemed more at ease on the lower deck—the forends in a Royal Navy submarine—than in the wardroom; but he was never accused of being overly familiar although he awarded nicknames to ratings, such as *Fred the Bear* for a Leading Stoker who remembered him as "very caring and considerate".

The traditionalist Royal Navy reckoned that David Wanklyn was a nice enough chap but poorly placed in the promotion stakes. Certainly, nobody foresaw him perfecting the basic skills of underwater warfare in HMS UPHOLDER to the point where he became the ace of aces—and that in a bare 16 months from early 1941 to April 1942 while operating from besieged Malta in the middle of the Mediterranean.

Today, accustomed to automated modern technology and wide oceans, we need to appreciate the niceties of operating a slow thin-skinned boat, with primitive sensors and DIY fire control, in a confined and highly hazardous arena before we can glimpse the genius of this modest, unglamourous submariner.

The U class submarines were originally intended as cheap, unarmed *clockwork mice* for anti-submarine training. But in 1937, with war in the air, the Admiralty ordered the addition of bow torpedo tubes: UPHOLDER had four, with space for four reloads, together with a 12 pounder gun.

Readers will recall that, for no identifiably sound reason, and unlike American submarines and German U-boats, the straight running torpedoes in British boats could not be continually angled in the tubes: instead, the fish were discharged in hosepipe salvoes, with torpedoes following one astern of another at calculated intervals. A target's own movement across the single track created spread and spacing equivalent to a fan.

The whole submarine was pointed, like a multi-barreled rifle, with a substantial aim-off (director angle or DA), at the future position of the oncoming enemy. If the target zigged the attacking

submarine had to maneuver afresh—if there was time before *losing the DA* entirely.[1]

Unless the range was very short—a few hundred yards—two torpedoes (let alone a single shot) were seldom sufficient to allow for the discrepancies which were bound to occur.

The DA calculation was largely dependent, when dived, on the captain's observations through the slender attack periscope which could only be raised for a few seconds at a time. During those brief glimpses, which often included an all-round look for escorts, the captain had to mark a relative bearing (converted to true bearing by gyro—a ready source of error); judge target inclination by angle-on-the-bow; and measure the range on a part of the target whose height was known, funnel or masthead as a rule, by means of the miniature range finder incorporated in the periscope.

Plotting these observations by hand resulted in the most reliable estimate of enemy speed.

The figures selected by the captain were fed to an elementary DA calculator known as the Fruit Machine; and a spread with appropriate spacing for range and target length was applied to the DA.

The optimum range for a 45 knot fish was 1200 yards on a 100 degree track. But getting through a screen to the right position, at the right time, on the right course for a hosepipe salvo against a zigging target demanded exceptional skill, steel nerves, and a fair measure of luck.

Night attacks on the surface were doubly hard. British boats had no attack center in the conning tower, and the captain on the bridge was remote from (admittedly rudimentary) instruments and displays in the control room. The DA was seldom better than a guess, although oldsters vowed it was *always* ten degrees.

David Wanklyn had no experience of attacking and very little practise in shiphandling during his submarine apprenticeship which he served from 1933 until starting the *Perisher* command course in January 1940.

However, at the end of 1938, six months after he married Betty (said to be his first and only girlfriend) he had spent a year as First Lieutenant (Exec) in the minelaying submarine PORPOISE captained by the farsighted Commander G.W.G. *Shrimp* Simpson. It was the most significant move of Wanklyn's career to date: although gentle by nature and constantly prone to self doubt, he

gained *Shrimp's* lasting confidence, understanding and friendship; and he was an excellent foil to the man who would soon be his flotilla captain.

On his second-in-command's first wedding anniversary, *Shrimp* Simpson sent Betty a deliberately inappropriate present accompanied by a little poem ending, "...Just flatten him, devoted wife! And please accept this rolling pin."

Wanklyn's maiden commands were the World War One H32 and then H31 for patrols in the North Sea. In July 1940 Wanklyn sighted three German trawlers apparently sweeping for submarines off Terschelling Island. Patiently he manoeuvred until the craft—individually small and difficult targets—were grouped in his line of sight: a single torpedo fired from 900 yards sank the submarine chaser UJ126.

Drawing blood doubtless bolstered his faith in himself; but this fortunate hit with a lone shot on a 125 degree track angle may well have swayed Wanklyn later against employing adequate spreads to cover fire control errors and torpedo failures.

In August 1940 Wanklyn, now in his 30th year, was appointed in command of HMS UPHOLDER, still building at Barrow. A single hull 730 ton boat limited in depth to 200 feet and in speed to 11.7 knots on the surface (usually 10.5 knots in practice) and a little more than 8 knots dived (for one hour) UPHOLDER normally had a crew of four officers and 29 ratings, but there was just room for a couple of Army commandos if special operations ashore were planned.

Given the severe limitations of the U class, and indeed of all Royal Navy submarines in terms of speed and fire control when compared with the U.S. Navy's fleet class, it is apparent why British commanding officers would never be able to create havoc on the surface in the midst of convoys at night in the style demonstrated, for example, by Commander Lawson P. *Red* Ramage of USS PARCHE in July 1944.

UPHOLDER arrived at Malta on 14 January 1941 to be welcomed by *Shrimp* Simpson commanding submarines (to be formed into the Tenth Flotilla in September) from their base at Lazaretto on the beleaguered island. The second great siege, fiercer by reason of attacks being delivered by German rather than Italian aircraft, had started a month earlier; submarines in harbour were subjected to special attention. The construction of safe pens

in excavated caves had been halted before the war on grounds of economy: the entire project would have equaled the cost of one medium sized submarine.

The prime task of submarines from Malta was to prevent supplies and reinforcements from Italy reaching Rommel's Afrika Korps. The Axis Commands were curiously helpful in routing convoys consistently, and distances from Lazaretto Creek to the enemy lines of communication were not great; but anti-submarine forces were abundant and continually strengthened by the latest German equipment training. Moreover, submarine torpedoes had to be husbanded because nobody knew when a ship or store-carrying submarine might next be able to break through the blockade; the U-boats had disturbingly noisy auxiliary machinery, although this feature of the class was not fully appreciated until mid -1942; and, on a calm day, a submarine was visible down to 60 feet from the air. UPHOLDER's periscope depth was 27 feet measured from the waterline in those days or about 40 feet from the keel.

Wanklyn took his boat out after dark on 24 January 1941 for an initial patrol off Tunis. Two two-torpedo night attacks on supply ships, from 2500 and 3000 yards respectively, both missed ahead: target speed, the crucial component of DA, had been grossly overestimated at 15 knots when intelligence suggested that eight or nine knots was more likely. Soon after dawn on the next day an 8000 ton merchantman appeared, escorted by an armed merchant cruiser. Wanklyn closed to 900 yards and again fired two fish: one hit and badly damaged the German transport.

During the afternoon of the 30th two more supply ships came in sight escorted by a pair of destroyers. Wanklyn did not attempt to shorten the range from the near-extreme 4000 yards because one escort was dangerously close: he claimed a hit (not confirmed) but the destroyers raced down the torpedo tracks and pounded UP-HOLDER. The depth charge hammering caused no more than superficial damage and, on balance, was beneficial: it proved to the crew that their captain could get them out of trouble.

Wanklyn had no successes during the following three patrols. By the middle of April he had fired 30 torpedoes with only one certain hit. Simpson agonised: could he afford to keep such a poor shot in the Flotilla?

Why was UPHOLDER so unproductive? First, Wanklyn heeded the order to conserve torpedoes too literally: his salvoes

should have been larger and spread wider. Second, some of the fish were antique and unreliable, and they particularly resented being discharged on the surface into a rough sea; third, his surface approach DAs were apt to be based on ill formed estimates.

Wanklyn reasoned out where the faults lay, and the spell was broken. In future he would not be so miserly with his salvoes. With regard to torpedo reliability it is conceivable that *Shrimp* contrived to ensure that higher quality fish were supplied to his favourite officer; and maybe shore staff and UPHOLDER's own torpedomen started to take more care with the weapons. Or perhaps Wanklyn just suddenly got the knack and everything started to work for him—for that has often enough been the way in submarines.

Above all, though, Wanklyn became privy to ULTRA intelligence which not only enabled UPHOLDER to intercept valuable targets but gave a good indication of their speed. Simpson, publishing his memoirs[2] in 1972 when ULTRA was still an unmentionable word, had tongue firmly in cheek when he wrote: "Wherever Wanklyn was sent the enemy appeared, and noteworthy targets too..."

The results, whatever the reasons, were spectacular. On the fifth patrol he made all four bow tubes ready for a full salvo to sink the 5500 ton supply vessel ANTONIETTA LAURO despite the range being down to 700 yards. The first fish hit amidships (suggesting, incidentally, that he had underestimated target speed) and, although the second torpedo could not be stopped, he had the presence of mind to cancel the automatic firing of numbers three and four tubes.

Chances for UPHOLDER multiplied and Wanklyn took them all, as symbols sewn on the Jolly Roger testified. But St. Ambrose, patrol saint of submariners, wandered off watch for a spell in May 1941, and UPHOLDER's Asdic set went u/s at sea. Thus Wanklyn had no idea of what was happening on the roof when his boat was below periscope depth. A lesser man would have returned for repair to Malta—only a day or so away—but not Wanklyn when an important convoy was expected to emerge from the Straits of Messina.

On 20 May a pass was made at two tankers from the absurdly long range of 7000 yards, possibly damaging one. However, the Vichy tanker CAPITAINE DAMIANI, working under Italian

charter, took a torpedo in the stern when it passed obligingly close, in convoy, three days later.

Stealing away from the ensuing mêlée, with only two torpedoes remaining, Wanklyn found himself at sunset in the path of a much bigger target—the 18,000 ton liner-troopship CONTE ROSSO packed with soldiers bound for North Africa. The selected prize, making 18 knots (thank you, ULTRA), was in company with three other big ships, and the convoy was surrounded by at least five energetic destroyers.

A deep swell made periscope work, as well as depth-keeping, difficult. Asdic was still silent.

The submarine would have to fire from a very close range if the last two torpedoes were to find their mark, and time did not permit deviating from the optimum approach course to dodge menacing escorts. Wanklyn decided to act as if the destroyers did not exist: he ran a major risk of being rammed on the way in—and once, after glimpsing a sharp bow, he ducked for a few moments—but he refused to be distracted from his aim.

The loss of life, after both torpedoes struck and CONTE ROSSO sank, was heavy: of 3000 Italian troops on board only 1432 were saved.

A counterattack lasted for half-an-hour before the escorts were obliged to rejoin the convoy. None of the charges fell within the lethal 30 feet of UPHOLDER's fragile hull; but the express train sound of destroyers racing overhead, all too clearly audible without artificial Asdic ears, signified each time that another shattering, perhaps fatal pattern of charges would detonate in an exact number of seconds which could be ticked off on the fingers.

One man's nerve broke. He dashed to the lower conning tower lid and started to ease back the clips—a futile gesture, of course, because 20 tons of sea pressure was keeping the upper hatch shut. In due course the man was reverted to General Service—the worst, in fact the only, punishment on board UPHOLDER.

Wanklyn was asleep at Lazaretto when the award of a Victoria Cross was eventually announced for the CONTE ROSSO attack. A steward slipped into his cabin unnoticed and sewed the purple ribbon on the monkey jacket hanging over a chair. Typically, Wanklyn was disgusted at what he took for a bad joke when the new ribbon was pointed out to him: modest as ever, he could not believe that he had won the highest decoration.

UPHOLDER's destruction of enemy shipping continued unabated. The victims of 24 patrols comprised two Italian U-boats and a destroyer sent to the bottom, a damaged cruiser and destroyer, and 19 sunk or damaged Axis transports and supply vessels. The total bag amounted to 134,000 tons including a luckless trawler which fell to the 12 pounder gun.

UPHOLDER was due to return to the UK for refit when she came back from her 25th patrol; but she did not return. She was seen from the air while making a submerged approach off Tripoli on 14 April 1942. The Italian torpedo boat PEGASO sped to the spot an dropped depth charges without gaining firm contact. The random pattern was fatal.

With reticence akin to Wanklyn's, Captain di Vascello Francesco Acton (descended from the old English family of that name) did not claim a kill; but there were no survivors from the Royal Navy's most hard-hitting submarine.

The Admiralty communiqué announcing the loss of HMS UPHOLDER concluded with words which might serve as a memorial for all wartime submariners who are still on patrol:

"The ship and her company are gone, but the example and the inspiration remain."■

REFERENCES

1. See, also, Richard Boyle's excellent on page 99 of the October issue of **THE SUBMARINE REVIEW**.
2. *Periscope View* by Rear-Admiral G.W.G. Simpson, CB, CBE, published by Macmillian, London in 1972, SBN 333 13700 0.

WALDO LYON: A LEGACY OF DEDICATION

by Richard Boyle

The Navy lost a giant when Dr. Waldo K. Lyon died suddenly of a heart attack on 5 May 1998. He was in his 84th year.

His 55 years of dedicated service to our Submarine Force is a testimonial in itself, but his genius, objectivity, humility, indefatigability and resourcefulness shine through the mists of more than half a century of technological progress.

It is impossible to do justice to his innumerable contributions to readiness in this short tribute, but we must never forget that his stock in trade was support to his customer—operators in the fleet.

Dramatic advances (particularly in sonar and inertial navigation) were made between 1958 and 1960. Guided by Waldo's expertise and experience with diesel boats (1946-1953), NAUTILUS paved the way with her trans-polar crossing in 1958. SKATE first broke through winter ice in 1959. During early 1960, SARGO pioneered shallow winter transits and broke through three feet of ice in 170 feet total water depth in the Bering Sea. That summer, SEADRAGON conducted a high speed transit among icebergs and became the first ship in history to transit the Northwest Passage via Parry Channel.

Dr. Lyon initiated and pursued at least 65 major undertakings between 1946 and 1996. His ingenuity was tempered by an approach that echoed that of John P. Holland, father of the American submarine: "Keep it simple." The spirit of fleet support has been best described by advice he gave to a new staff scientist: "Go see the submarines, find out their problem, and fix it. *Remember, they may not know they have a problem.*"

Between 1955 and 1997, Waldo received 24 major awards in recognition of his accomplishments, including The Presidential Award for Distinguished Federal Service (1962), two Presidential Unit Citations (NAUTILUS 1958 and WHALE 1969) and nine Navy Unit Commendations. His quiet demeanor reflected genuine humility on all occasions involving recognition. Satisfaction came from making the fleet better rather than personal fame.

His stamina is legendary. A normal work day at the lab was 12 hours (0600-1800). He participated as Senior Scientist in 23 major submarine deployments between 1946 and 1981. At sea, he never

slept more than four hours at a time, and was always available for consultation and advice. He could restore energy with short catnaps.

Fleet support involved designing equipment in the lab, taking it to sea on workup, and on deployment to ensure that the operators were given *in situ* guidance. If there were problems, riders helped to correct them at sea. If redesign was required, performance at sea was re-evaluated as soon as possible after modification. Interpretation of high resolution ahead-looking sonar and topsounder displays under ice is an esoteric business, and riders provided guidance to operators around the clock if necessary.

Dr. Lyon's Senior Scientist's Reports, appended to each patrol report, were insightful, perspicacious and gave the chain of command in the Submarine Force a realistic appreciation of problems, progress and requirements for the future.

Waldo was an expert scavenger. Early most mornings at the Arctic Submarine Laboratory (ARCSUBLAB) in San Diego, he would scan Government surplus lists, looking for hardware that he could use in support of various projects. Millions of dollars worth of piping, valves, bar stock, etc. came to the lab for the cost of shipment from the source. Grad A clean stainless steel valves and piping, for example, were ideal for seawater systems he designed for the pools at the laboratory complex.

Dr. Lyon know the critical importance of the environment on submarine and sonar performance; he pioneered bathymetric and water column surveys throughout arctic and subarctic seas. Special sensors, e.g., expendable sound velocity profile devices, were developed and used for seasonal surveys in important Marginal Ice Zone (MIZ) areas.

Waldo felt that he wasn't doing his job if he spent more than 10 percent of his time on management. He also shielded his engineers and scientists from any administrative responsibilities so that they could concentrate on supporting the fleet. We learned from his example. If the fleet called for help, we did not feel that we were doing our jobs properly unless we responded with a solution to their problem within 24 hours.

The odyssey of Dr. Lyon's stewardship of ARCSUBLAB is an account of periodic fortune under management procedures gone mad. Some managers seem to put semantics of function, pedantry, neatness of organization charts and outright covetousness above

serving the fleet. There were peaks of dramatic accomplishment over the years that were interspersed with valleys of poverty and discontent. Through it all, Waldo held steadfastly to his objective analysis techniques, and, when funds were short, made do with what he could dig out of the dustbin.

In March 1991, ARCSUBLAB was placed in jeopardy by a massive laboratory reorganization plan. *Arctic Warfare* was transferred to the newly created Naval Undersea Warfare Center (NUWC) Newport. Essentially, this was the final death knell for arctic R&D.

Between March 1991 and July 1997, seven Memoranda of Concern were put forth pointing out the consequences of the forthcoming demise of R&D at ARCSUBLAB. Sadly, the hierarchy largely ignored them. Dr. Lyon was devastated.

He continually reminded superiors that we were adapting open sea submarines to operate in ice covered seas. We came close to designing a truly arctic operational submarine in 1981, but although R&D funding was provided and used to improve facilities at ARCSUBLAB, a small highly maneuverable boat that could operate in ice was not to be.

Dr. Lyon was co-author of an article, *Arctic ASW: Have We Lost?*, which appeared in the June 1998 issue of the Naval Institute Proceedings. Recognizing that it would not be possible to gain support for a unique arctic-capable design, a recommendation was made to start development of a highly maneuverable, relatively small prototype capable of operating submerged in fresh water. This would mean reconstitution of arctic R&D, and hopefully re-opening ARCSUBLAB to guide development on an interim design that could regain our capability in the shallow MIZ, which will be lost when the last 637 class is decommissioned (about 2001). Although Waldo never realized his dream of producing a submarine that could support effective ASW in the MIZ, he never gave up trying to be heard.

It is unfortunate that no one listened to Dr. Lyon during the last several years of his life. We hope fervently that the hierarchy will listen to him in death.

A first step should be to support archiving the fruits of Waldo's labors.■

RIDING OUT THE STORM

by CDR Glen Dilgren, USN(Ret.)

Commander Dilgren served as Commanding Officer of USS WOODROW WILSON (SSBN 624) from August 1989 until April 1992. He is now retired in Charleston, SC and is Vice President of SIGNAL Corporation.

I went topside during the eye of the hurricane and it was dead calm, just like they say. It was dark and it was obvious that Charleston was without power. The three story crew's living barge (YTB) which had been moored across the pier was missing, but the most surprising thing was that **the pier itself was underwater**. Our lines were stretched downward and there was a list on the ship. For a moment, I wondered what might happen when the storm surge subsided, but my attention was drawn to tugboat lights downriver. I could just make out the hull of a submarine banging into barges and piers as a tugboat struggled to get control. I would later learn that this was a deactivated SSBN, which had been ripped away from the pier during the first half of the storm.

Two months into my command tour on USS WOODROW WILSON (SSBN 624), I found myself facing a challenge in *seamanship* which was never discussed in PCO School or at my command qualification board. It was September 21, 1989 in the Charleston Naval Shipyard and Hurricane Hugo was bearing down fast. The community was evacuating, and the base and shipyard were in full scale hurricane preparation. All of the ships in Charleston which could get underway were long gone, but there were five submarines in overhaul and none had propulsion capability other than the EPM. My primary concerns had been repair and testing of the diesel generator, disconnecting shore power and the portable effluent tank, and topping off on pure and potable water. Fortunately, all hull cuts had been closed a few weeks earlier. I had planned for an augmented duty section with extra diesel operators, an extra chief, the Engineer Officer and extra crewmembers for linehandling, phone talking and damage control. The majority of the duty section were bachelors who volunteered since families were either evacuating or battening down their hatches at home. Most members of this duty section would find themselves on board for four days.

Meanwhile, USS BILLFISH (SSN 676) was in drydock and had some unique and pressing problems of their own. The shipyard was racing to patch several hull cuts and get the drydock flooded. They finished in the nick of time, but there were leaks that night and the crew had to wear EABs below decks while gas-powered P-250s were used to keep up with the leakage. The shipyard itself was faced with the insurmountable task of securing many years of accumulated equipment and material throughout the yard. They accomplished much, but ran out of time.

At about 1500 (the eye would pass over Charleston harbor at midnight), I was leaving the ship to go to a final meeting with the Shipyard Commander and the Naval Reactors Representative. As I crossed the brow, it occurred to me that the shipyard-provided wire lines were plenty strong, but would not provide the flexibility or yield that might be needed when the storm hit. The ship's nylon lines had been offloaded and were locked in a warehouse somewhere in the shipyard. I called for Chief Quartermaster Tony Copeland, and told him to find at least four nylon lines and to install them over the wire lines. By 1800, he had the nylon lines in place (I never asked where he got them!). The Engineer Officer, Lieutenant Commander Mark Speck, reported that the snorkel safety circuit problems had finally been corrected and the diesel was carrying the ship's electrical loads. I had been pushing the diesel repairs even before Hugo became a threat and it bothered me that the crew had become complacent about the diesel engine because of the shipyard's fairly reliable dual-source shore power.

I lifted the brow and sealed the ship in the evening as conditions rapidly deteriorated. Amazingly, we were able to listen to the local radio stations until they were abandoned and we had phones until about 2300. We knew we were in for a rough night when flying debris began to pound the hull. Periodically, we heard what sounded like gunfire against the hull, which later proved to be the parting of our own wire lines.

At first light, conditions improved enough to go topside. The devastation was shocking. It looked like the shipyard had been bombed. The decommissioned SSBN's wire lines had all parted, but she was now secured two piers downriver thanks to daring actions by the Naval Station tugboat crew during the eye of the storm. Only the top of the sail of USS NARWHAL (SSN 671) was showing, because the ship's wire lines had all parted and the

CO decided to **submerge in the Cooper River.** USS BATFISH (SSN 681) had lost all her wire lines except the bow line and she was swinging between two piers until the tugs could assist. Luckily, BATFISH was in a relatively protected berth at the landward end of the pier. A shrimp boat was high and dry across the river on Daniel Island. The YTB was found sunken in her berth, having been smashed against the pier by the storm after her wire lines had all parted. The YTB had broken several pilings and knocked large chunks of concrete from the pier, which was impassable to vehicular traffic. There was even a fish on top of a safe which had been inside a small building on the pier. Most of the building was later found underwater between WOODROW WILSON and the pier. **All of WOODROW WILSON's wire lines had parted, but the nylon lines had done their duty.** From our exposed position towards the end of the pier, we could have been swept down the river by an 8 knot current and 180 mph winds if Chief Copeland had not found the nylon lines. In fact, any of these submarines could have done severe damage to other ships and piers, could have damaged the Cooper River Bridge or gone hard aground somewhere along the river during the eight foot storm surge.

It was a long night, but for the next two weeks, we lived like kings because we were one of the few places in town with power, food, showers, water and air conditioning. The shipyard, like the city, was out of commission for about two weeks, but our diesel engine purred on. Since there were two crews assigned, the manpower pool was big enough to help the community with several large cleanup and repair jobs including restoration of a junior high school weeks ahead of schedule. WOODROW WILSON was later awarded the Humanitarian Service Medal for assistance to the Charleston area. The lesson learned again is that even modern nuclear submarine crews cannot forget the importance of the basics: advance planning, healthy skepticism, good housekeeping, proper mooring practices, reliable diesel engines and aggressive chief petty officers. There is also great wisdom in conservative and early dispersal of ships when a hurricane is approaching. These are awesome storms and the duty section will never forget the night they spent riding the storm out.■

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LETTERS

TUNNY AND THE DETERRENT PATROL PIN

April 2, 1998

I am a former Commanding Officer of USS TUNNY (SSG 282), the Navy's first Regulus guided missile submarine. I had the honor of commanding her for 2+ years (1957-1959), and commanded her when, in July 1958, she made an emergency deployment to the Northwestern Pacific when the U.S. went on a worldwide alert during the first Lebanon crisis. This was the first-ever deterrent missile patrol made by a submarine. My ship relieved an attack carrier on station and covered its targets, so that it could speed to the Indian Ocean to support the Marines.

I learned last spring that COMSUBLANT awarded the five Regulus Missile submarines the SSBN Deterrent Patrol Insignia for the 41 scheduled patrols they made commencing in September 1959. Vice Admiral Mies was unaware of the earlier unscheduled patrol made by TUNNY in 1958. When he got my letter describing that patrol, and had the facts verified, he awarded the SSBN Deterrent Patrol Insignia to my ship for that patrol. Recognition is only 39 years late, but better late than never!

I am now trying to notify all those crewmembers who made that pioneering patrol in TUNNY. If you could somehow include the attached notice (see page 15) in **THE SUBMARINE REVIEW**, I'm sure it would do much to get the word out to my crew. Thank you very much for your consideration.

Vice Admiral Bud Kauderer suggested to me (we were shipmates in putting ROBERT E. LEE in commission—I was his XO) that I write up the story of this patrol and send it to you for publication in a future issue of **THE SUBMARINE REVIEW**. That I will do at a future date, if you think the story would be of interest to the membership.

Sincerely,

Marvin S. Blair, CAPT, USN (Ret.)
24 Rubi Circle
Hot Springs N.P., AR 71909-3515

SUBMARINES IN THE MOVIES

April 22, 1998

American Movie Classics
ATTN: Programming
150 Crossways Park W.
Woodbury, NY 11797

Gentlemen,

I am quite certain that you receive many letters requesting you air this or that movie. However, I am not so certain that this letter is in the same vein.

The catalyst for this letter is Lawrence Sud's Sailing on the Silver Screen: Hollywood and the U.S. Navy, which was published by the USNI Press in 1996. Although not considered a *genre* film, those films produced prior to the 1940s depicting submarine service are aired little, if at all. I am attempting, in my own way, to have you consider airing the following films—some of which were *landmark* films in their own way:

Title	Date	Studio	Director
Hell Below	1933	MGM	Jack Conway
Men without Women[1]	1930	20th Century	John Ford
Submarine	1928	Columbia	Frank Capra
Submarine D-1[2]	1937	Warner Bros	Lloyd Bacon

Surprisingly, I viewed a segment of Capra's Submarine last evening during *Real to Reel* on AMC. All the more reason to air one of Captra's early directorial efforts. I seriously doubt any of the above will ever reach the retail or rental market due to limited marketability. Some may even require preservation.

As Mr. Sud so aptly states at the end of his book, "If Sailing on the Silver Screen serves no other purpose, perhaps it will stimulate the release of some of the early movies."

As I seriously doubt this will come to pass, is it not in AMC's charter to foster an appreciation of all American film, regardless

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[1]Sound version is held by the Museum of Modern Art

[2]Rights for this film is controlled by Turner Enterprises

of film content or lack of critical, public, or industry acclaim? I would feel that these films merit, at the very least, a review of your programming staff to determine a future airing. Trusting that it may, I remain

Cordially,
Ronald L. Stem

cc: Naval Submarine League

ON SUBMERGED BACKING DOWN

22 May 1998

I read with great interest the article *Submerged Backing Down* by Captain Gordon Enquist, USN(Ret.) in the April **REVIEW**. While many submarines in the 50s and 60s regularly submerged with no way on and usually leading to a controlled hover, only a few were able to submerge with sternway and no others that I know of other than SPINAX (SS 489) could continue astern at will with very good depth control and maintain that control while moving from *all back full* to *all ahead full* without the aid of blowing ballast, necessary at slow speeds.

The secret of accomplishing this maneuver and doing it well and freely was, first, having an installed retractable whip antenna which could tend either forward *or* aft, the radioman pumping the antenna vertical and then releasing it again as a no-way-on state was reached when reversing from headway or going ahead from sternway. The little fin that would make the antenna lie *flat* worked find in either direction! SPINAX had one of these antennas. Second, the battle station planesmen became astonishingly adept and proficient at maintaining depth control when faced with the challenges of going from full reverse (in SPINAX 6-8 knots) to full ahead and sometimes turning with full rudder as well. One secret here quickly learned was that when going astern at any speed, as soon as the ahead bell was rung up, the sternplanesman, handling his planes as bow planes, had to suddenly again regard his planes and their effect as *stern planes*. The result of this was the ability to maintain less than a 5 degree up or *down angle until headway was regained*. The competition amongst watchstanding planesmen and the pride shown by them when regular practice proved their skills was fierce, as was similar competition among SPINAX diving officers.

This extraordinary capability was used frequently and practiced often. It was especially useful during exercises and almost always successful in evading close-in surface units. Once I was called to the pre-sail conference for a final week's training/graduation exercise for a squadron of destroyers about to deploy to WestPac. SPINAX was to be the target. The blustery (read highly confident) Squadron Commander asked me to "try his boys to the limit" and noted that the final day's freeplay would be hard fought. I replied that SPINAX always tried to bring the surface units up to the edge of their capability during the week and that we too enjoyed the freeplay and would he like to wager a case of his favorite on the outcome. Considering the audience he *had* to agree.

All the ops officers had briefed their captains on the SPINAX listing in Jane's which noted "fleet type, modified sail, max 8.5 kts submerged". SPINAX could, in fact, with the high capacity battery left over from SSR days, do almost all that *in reverse* and well over 12 knots submerged for a while. In the tradition of the Silent Service, I did not enlarge upon our capabilities at that moment.

The week of training came, SPINAX kept them at their edge all week and the final exam came. I proposed to the Squadron Commander that he form his four *cowboys* in a 5000 yard ring and that SPINAX would submerge in the center of that ring. He agreed and at COMEX we submerged in the center with no way on. As we went down we started backing with a slight amount of turning rudder, then straightened out as we slowly passed 200 feet. You could almost hear the sonar chiefs urging the sonarmen on and confirming "solutions" up above. We increased speed to full astern and soon reached over 8 knots. As the DDs all sent to short scale and one increased speed to start his initial run, we rang up *all-ahead-full*. Our sternway slowed and stopped, the radioman pumped up the antenna and released it and our hugely cavitating screws built a mammoth knuckle of turbulence behind us. As we picked up headway you could again imagine the surface units plots and solutions going suddenly to hell with the attendant *guidance* from chiefs, ops officers, captains and surely that of the Squadron Commander becoming more and more incisive! As we passed through the hole in the ring we, now nearly at full speed ahead, slowed and coasted to a spot nearly 8000 yards away where we eased up to periscope depth and were able to watch them all feverishly working over that huge bubble of turbulence and with

our radio antenna up, could hear the frantic Squadron Commander berating his hapless units. After an hour of observing the tumult, we radioed our posit to the Squadron Commander and broached a bit for visual confirmation. As we did, he called his units together and steamed off, hopefully to a positive and productive deployment after the undoubtedly unpleasant critique! He never paid his debt!

Once again, SPINAX and her sisters showed that proficiency, attitude and imagination served well to keep the submarine *alive* for another day of battle.

Sincerely,
CDR Jay K. Davis, USN(Ret.)
4619 102nd Lane NE
Kirkland, WA 98033

SUFFOLK, NY SUB BASE

June 1, 1998

Per request in last issue I suggest the Committee help the Long Island Base of U.S. Submarine Veterans, Inc., with their project to establish a better public awareness of the first U.S. Sub Base at New Suffolk, NY. Contact John R. Saeli, 100 Skidmore Rd., No. Babylon, NY 11703 for an update on their work. It's certainly appropriate as HOLLAND was there!

I also think we should name the New Attack Submarine the Holland class.

Regards,
P. Cushing, Jr.

THE KILO AFFAIR

by Craig L. Etka
American Literary Press, Baltimore, MD 1998
Reviewed by John Pritzlaff

As a sequel to The Scorpius Connection, author Craig Etka has again captured the Tom Clancy-Clive Cussler approach to the techno-thriller novel. The plot revolves around the efforts of the hero, Captain Robin Roberts, USN, to destroy the two Russian Kilo submarines that were "stolen" by the villain, Manny Rodriguez, for use in the Colombian drug trade. The high tech use of high powered underwater lasers for torpedo defense contrasts with the low tech use of a wire rope in the Kilo's propeller to immobilize it in the fitting conclusion to this tale of intrigue and underwater adventure. This book will appeal to the submarine community as well as to classified/covert program people. Current and future technology is utilized to achieve a fast paced but realistic story. It would be well if readers had first read The Scorpio Connection by author Etka (1994), as there are many direct and indirect references to the prior actions and activities of the hero and the villain.

[John Pritzlaff spent eight years in the Navy. His industrial career covers 10 years with General Electric Co. and 30 years with Westinghouse where he was Engineering Manager of their Deepstar, Deepsubmersible Program. He has produced four books on submersible and offshore safety.]

COMMANDO: THE M/Z UNIT'S SECRET WAR AGAINST JAPAN

by A.B. Feuer
Westport, CT: Praeger, 1996
172 pages, ISBN 0-275-95408-0
Reviewed by CDR Sam J. Tangredi, USN

Commander Tangredi currently serves as Branch Head, Strategy and Concepts Branch (N513), Office of the Chief of Naval Operations. This review was completed during his last deployment as

Commanding Officer, USS HARPERS FERRY (LSD 49).

When the strategic vision articulated in *...From the Sea* and *Forward...From the Sea* was first unveiled, defense analysts thought it a sad day for submarines. After all, the U.S. Navy's Submarine Force had been a prime warfighting element—in fact, the prerequisite for success—in the scenario envisioned in the Maritime Strategy. But with the collapse of the Soviet Union, the Maritime Strategy was proclaimed *dead*. U.S. Naval Institute Proceedings even went so far as to publish a photo showing a copy of their Maritime Strategy supplement burning in a fire. With defense budgets soon to be slashed, the most up-to-date pundits were quick to question the role of submarines in a *littoral warfare* environment.

However, what the pessimistic estimates forgot is that nuclear submarines remain the ultimate stealth platforms—and therefore are critical assets in a variety of warfighting missions that transcend the SSN versus SSN battles envisioned in the global anti-Soviet war. Quite frankly, there is simply no better platform for covert operations in the littoral regions than a nuclear submarine, a fact that is evident even to a professional amphibian like myself.

I have personalized this review because I write it while transiting to participate in Exercise TANDEM THRUSH '97, held in an area with the none-too-comforting name of Shoalwater Bay, Queensland, Australia. Brisbane, Queensland's capital and port visit of choice, is still a submariner's city. You can still imagine the sortie of World War II boats out the long channel and to war patrol; a vision that was enhanced by the passing of a Royal Australian Navy submarine during our own sortie towards Shoalwater. Along the track from Brisbane to Shoalwater lies a remote, but no longer inaccessible spot called Fraser Island where Australia trained its World War Two M and Z commando units for their insertion via submarine into Japanese-held territory. Fraser Island is the starting point for A.B. Feuer's Commando!, an anecdotal history of several of the M/Z missions.

Feuer's title does not reveal the true essence of the book. Only four of his fourteen chapters detail the specifics of commando operations themselves. His real focus—deliberate or not—is on submarine-commando joint effectiveness and Australian-American cooperation. Much of his narrative is a depiction of the less-than-

glamorous efforts of sneaking into enemy littoral waters and getting small groups of men—most of whom trained on Fraser Island—out the hatch and into rubber dinghies before being detected by Japanese aircraft or coastal defenses. Submarine patrols described include those of USS BREAM, BLUEGILL, BOARFISH, ROCK, PERCH II, and HAWKBILL.

Relying on memoirs and interviews, Feuer captures the participant's eye-view—or shall we say periscope view—of the insertion operations. Commando! functions as a tribute to the bold deeds of brave men whose efforts are generally overshadowed in the torpedo attack-focus of most submarine histories and in the Euro-centrism of most accounts of WWII clandestine operations. In this fashion, the book fills in important gaps in naval and military history.

It is, however, a quirky history. Because Feuer relies almost exclusively on oral testimony, each graphically described mission seems unrelated to the next. The depth of research into each individual mission also varies, dependent on the amount of testimony available. For example, BOARFISH's mission to the Indo-China coast receives only two pages since the witness runs out of words. In contrast, BLUEGILL crew's record-keeping of their "capture" of Pratas Island is much more extensive—even if their original tongue-in-cheek request to have "invasion medals issued immediately" was denied. With the exception of very entertaining reminiscences of Australian commandos living among the head-hunting Dayak people of Borneo, the majority of information comes from the submariners who transported them rather than the commandoes themselves. It seems that submariners tend to keep records, commandos do not.

Unfortunately, the author provides no overview for the reader. Thus, it is impossible to assess the overall effectiveness of the submarine-commando effort from this source alone. As stated in the Forward, Feuer "has done a superb job of letting the men who fought this lonely war tell their stories in their own words... [and adds] just enough text to give continuity and context to these wonderful tales." From this reviewer's perspective, he does this job too "superbly" and the reader is left to try to figure out his or her answer to the basic contextual question: Did these operations have any *real* effect on the outcome of the war?

Here is where we need to fast forward to the present. Whether

or not these particular missions had an effect on the trans-global Second World War, they *could* have considerable effect on much smaller contingencies—such as the scenario scripted for TANDEM THRUST. Feuer's book does a considerable service in identifying the difficulty of conducting covert operations from the sea against an alerted enemy. As Feuer points out, General Douglas MacArthur convinced the Joint War board to let him make a last attempt to save the Philippines in 1941 by convoying American National Guardsmen from Brisbane via surface transports. Fortunately for the Guardsmen, their voyage ended in Darwin with the recognition that surface forces could not then penetrate the Japanese tide without considerable losses. Commando missions via submarine seemed the only viable option in getting forces ashore behind the lines.

Technology may have changed, but the basic problem of stealth has not. If ground and ocean surface forces are as detectable from space as some authorities claim—though, admittedly, some of these claims are overstated—then the primary platform for these operations is still the submarine. Given the operational difficulties described, it seems incumbent on the Submarine Force to go beyond lip service in staking their claim to be a part of expeditionary warfare and figure out how to coordinate such operations with Amphibious Task Forces.

Feuer also does considerable service in reminding the history-reading public of the tremendous amount of courage and skill required of submariners. As the Australians themselves recall, sweating out a Japanese depth charge attack took even more nerve than the clandestine operations ashore. As a "rescued" commando leader half-jokingly asked Command Sam Dealey of HARDER in the midst of a two hour depth charge and aerial bomb attack: "I say old man, would you mind taking us back to [Japanese-controlled] Borneo."

Limits aside, Commando! Helps complete a library of submarine history. Hopefully, it may also herald a trend of historical, theoretical, and practical illustrations of what submarines have done and can do in amphibious and expeditionary missions *forward from the sea.*

GHOST OF WAR
The Sinking of the AWA MARU and Japanese-American Relations, 1945-1995

by Roger Dingman
Naval Institute Press, Annapolis, MD 1997
373 pp., Notes, Bibl., Index, 20 Photos, 2 maps
ISBN 1-55750-159-9 $35.00

Reviewed by CAPT Prentice Cushing, Jr. USN (Ret.)

Watching a TV presentation of the Memorial Day Concert from the Capitol made me think I had lost my memory, there having been numerous photographs and references to WWI, European operations in WWII, Korea and Viet Nam with special emphasis on the Holocaust but no mention whatever of the fact that there had also been a slight war in the Pacific. Reading this book also me question my memory; I remembered reading brief references to the incident in question and note that VADM *Uncle Charley* Lockwood's book Sink 'Em All relates it, but I had no idea that it was of the major importance that Professor Dingman imputes to it. He truthfully observes the knowledge of the event has all be disappeared from Japanese memory and is virtually unknown to Americans.

Maybe I have missed something. From this book I learn that:

1. The inadvertent sinking of AWA MARU by QUEENFISH on 1 April 1945 was not only "the greatest submarine error of World War II" but colored Japanese-American relations for half a century;
2. Lockwood dominated all writings of the Pacific submarine war until 1951 and his protégé, Rear Admiral (then Captain) Richard G. Voge, was able to influence Samuel Eliot Morison and Theodore Roscoe to the extent that the incident was relegated to a mere paragraph in Victory in the Pacific and 2-1/2 pages in United States Submarine Operations in World War II, whereas these authors should have damned QUEENFISH and her crew;
3. The latter Naval Institute book had "the ostensible purpose of informing the next generation of submariners about their predecessors' deeds" and "listed Theodore Roscoe as its author", but actually was merely a Lockwood-induced

rewrite of NavPers 15,1784 (US Submarine Losses World War II) by "Roscoe, a professional writer of adventure stories" and which "Voge had polished during the last months prior to his death";

4. Despite the poor seamanship on the part of AWA MARU's captain and the fact that the Japanese had filled her with contraband cargo and aboard was not one pound of the POW relief supplies for which she had been granted safe conduct, QUEENFISH's skipper, C. Elliott Loughlin, whose error in sinking an unseen target which he believed to be a warship, was a tragedy which remains a wound in the heart of Japanese-American relations to this day;
5. Unrestricted submarine warfare against Japan was immoral and only excused by the Germans' use of it;
6. Admiral King and State Department officials who insisted on Loughlin's court-martial and U.S. indemnification of the families bereaved by the loss of over 2,000 Japanese citizens were right but Lockwood went too far in defending Loughlin. The officials who declined to approve indemnity payments made a terrible mistake and caused the Japanese to regard it as a symbol of their victimization by the USA during and after the war;
7. BOWFIN Park, US Sub Vets of WWII memorial shrine at Pearl Harbor, is faulty as it does not give "the sinking of the AWA MARU the prominence it deserves" among the 52 markers dedicated to lost US boats. In a note, Professor Dingman is gracious enough to state that he does not believe the designers consciously excluded errors such as the sinking of the AWA MARU but had "unquestioning acceptance of the heroic view of American submariners", a "perspective whose genesis" was instigated by Lockwood's imperfect "morally judgmental framework in which the Japanese bore the ultimate responsibility for all of the evils that flowed from the war in the Pacific."

Although Sink 'Em All was widely praised and is an essential part of any submariner's historical reading, Professor Dingman says that "the work was important less for the detail it provided than for the way it wove the AWA MARU story into a broader triumphal and inspirational interpretation of the Pacific submarine

war" and that the "ending of the book's AWA MARU chapter pointed toward a positive moral that Lockwood drew from the story of the Pacific submarine war as a whole". Aside from the fact that the incident is not the subject of a chapter but of less than half of a chapter and only 5 of the 393 pages in the book, the statements that the Admiral "put his gloss on the AWA MARU story" and "was directly responsible for the creation of visual images that others used to tell **and modify** the story of the submarine war against Japan" (emphasis added), such as Victory at Sea, The Silent Service and Hellcats of the Navy appear to be derogatory, a judgment of Lockwood with which not all NSL members will agree. Apparently he was rehabilitated in Professor Dingman's estimation by having suffered "an amnesia of sorts which healed Lockwood's bitterness" during his last trip to Japan. This also applied to QUEENFISH crew members who served in postwar Japan and "did not come away from that experience hating the Japanese or haunted by the memory of having mistakenly caused the deaths of so many of them". Draw your own conclusions!

Dr. Dingman is regarded as an expert in American-Est Asian relations; he served in the Navy in Japan 40 years ago, is fluent in Japanese and obviously knowledgeable in (and entranced with) the Japanese culture. His repeated references to "the Pentagon" and such usage as calling Ambassador William H. Standley "Admiral Standley" or references to "clever uniformed men" barely conceal an implied distrust, if not dislike, of "brass hats".

To his credit, he tries to present both sides of any story in the book and reaches a final reasonable conclusion that "if younger generations appreciate that war is the province of error as well of achievement...that it brings tragedies...as well as victories in battle and triumph of the human spirit, then perhaps they will not have to learn from bitter experience, as the generation that fought the Pacific war did". Before reaching that point, though, the various episodes are so frequently interspersed with opinion, pontificating and moralizing that it is sometimes difficult to follow the factual portions. His analysis of the political actions taken both before and after the incident is interesting, as are the stories of the various attempts at salvage, successfully accomplished by the Chinese (although, save for some contraband tin and rubber, he conveniently omits any research except from Japanese sources as to what

munitions and other war materials were discovered by them).

The narrative/editorial itself is 256 pages long, whereas the notes (many are repetitive) and bibliography occupy 105 pages, which is presumably indicative of scholarly research. They will assist other writers who wish to delve into this or related subjects and are of some interest to the ordinary reader but are somewhat overwhelming. The index is excellent and helpful. Older members of NSL who wish to undertake the fairly arduous task of threading through this book are advised to have Valium handy.■

THE NAVY TIMES BOOK OF SUBMARINES: A POLITICAL, SOCIAL, AND MILITARY HISTORY

by Brayton Harris
Walter J. Boyne, Editor
Berkley Publishing Group/Army Times Publishing Group 1997
ISBN 0-425-15777-6

Reviewed by Donald M. Hamadyk

As noted in the title, this book is not a run-of-the-mill survey of submarine design, and does not profess to rival the technical detail typical of Submarine Design and Development and other works. Rather, Mr. Harris uses technology as a framework to explore the personalities, societal issues, and history associated with submarines. The result is a mosaic of characters and struggles that shaped the submarine landscape as we know it today. In contrast to other works, the most interesting facets of the book are the *failures, shortcomings, and dichotomies* that ultimately led to the *success* of the submarine as a military platform. My only hesitation in writing this review is that it will not convey the richness and uniqueness of the book.

The first highlight of the book is the parade of very early submarine shapers and experimenters, such as Borelli, Giannibelli, Drebbel, Halley, Bushnell, Fulton, Colt, and Maury. Readers may be surprised at the cast of submarine characters whose notoriety is generally derived from other areas. The *globalness* of the market plied by some of these individuals should also open a few eyes. Robert Fulton, as an example, was actively pursuing Britain, France, and the U.S. as potential submarine customers at various times.

My opinion is that the first half is the most enlightening. The dynamics of pre-WWI submarine evolution as revealed here are fascinating. These were the seminal years of submarines, and each major step and setback left its indelible mark upon the culture. The second half covers more well-trod territory with added nuances that are likely new to some readers.

One of the more striking mannerisms of this book is its non-linearity. Mr. Harris weaves a story that shows the submarine coming into its own not on the strict basis of a need-to-solution sequence, but rather a more chaotic churning and clash of ideas, with fits, starts, and seeming dead-ends. For those who are fans of the PBS television series *Connections*, Mr. Harris' story also links people, places and thoughts in much the same intriguing fashion. My first reaction on finishing the book was to start reading it again immediately; I knew I had missed some of its finer points, as there are many.

Early views that submarine warfare was dishonorable, "damned unEnglish", and was a means of "secret murder" are interspersed at appropriate points in the book, highlighting a major cultural change that had to be overcome. Descriptions of the day for Nordenfeldt's submarine as "Uncle Sam's devil of the deep", the "monster war fish", and the "hell diver", also give a flavor for how the platform was perceived. The fortitude and grit of early submarine crews in the face of outlandish conditions and risks is also well described. The twentieth century has smoothed these rough edges, and although submarine conditions are still not luxurious, and the rigor of the lifestyle still exists, those harsh condition will likely never prevail again.

The evolving linkage and overlap of submarine bombs, mines, torpedoes, and submarines themselves, as well as how each of these were used, proves to be very enlightening. Similarly, early debates over the use of "porpoising" vice a periscope to scan the surface are an interesting element. Descriptions of frequent competitions and demonstrations of submarine warfare and capability are another highlight of the book. Here the reader will discover many of the less frequently revealed sinkings, slip-ups, and technological and tactical failures alluded to above. Mr. Harris also points out instances in which the Navy tended to be its own worst enemy in not pursuing or even blocking pursuit of submarine capabilities. The book does a nice job of building to the first culmination, albeit

bittersweet, of the submarine's utility (the CSS HUNLEY's 1864 sinking of HOUSTANIC) as "threads of technology converged around the Civil War experience".

Without revealing major high points, here is a small sampling of typical offerings from the book:

- A very fascinating transcript is provided of the 1917 German internal operational orders for "unrestricted warfare" giving explicit U-boat tactics that were to be used.
- The irony of HOLLAND VI with control surfaces aft of the propeller being judged not controllable, modified to reverse this, then the hydrodynamic ALBACORE later returning to this configuration.
- The interesting but macabre use of a cat, rooster, rabbit, and dove in early submarine shock testing to gauge human survivability, albeit quite politically incorrect in today's value system, and the white mice carried aboard as oxygen "indicators".
- The Germans' use of "milchcows" (submarine supply vessels that accomplished replenishment at sea for multiple German U-boats in one location simultaneously), and the Japanese Kaiten (suicide submarines) and I-400 class submarine aircraft carrier.

The final chapter is about the only place I found the book less than sparkling. The cursory overview of modern submarine development is not bad, but could leave the more informed reader unimpressed. This is a very minor point in the context of the whole work. Even this section has some good anecdotal parts, such as the brief interesting description of the first (unsuccessful) ELF program, and a concise chronology of SSBN development.

The mechanics of the book are outstanding, in my opinion. The 50-plus black and white photographs include a few gems. Some examples are a close up shot of the first HOLLAND crew, a Japanese S-1 aircraft carrier submarine, and a chilling photograph of the THRESHER wreckage. Those who tend to sit up in the middle of the night with a gnawing question can easily locate and return to specific passages via the detailed table of contents and index. Mr. Harris even takes time out to explain a few basic naval architecture terms, which should prove helpful to some readers

early in the book. A deep bibliography and extensive acknowledgments which are educational in themselves round out the peripherals. The frequent colorful quotations and verses embedded in the text are worth a good part of the price of the book alone. There are many good leads for further reading here!

In summary, Mr. Harris has charted somewhat new territory (to my knowledge) by getting more to the heart and soul of submarine evolution and revolution than the technical essence, which has been addressed more extensively by others. In so doing, he has painted a landscape that includes dead ends, failures, ethics and morals that came into question, and challenged paradigms. In the Epilogue, Mr. Harris muses over the submarine nuclear power versus diesel power question. The questions we are left with are: how many paradigms remain to be challenged, and which ones, when shattered, will lead to the next revolution in submarines?

As stated above, upon finishing the book I was compelled to read it again as soon as possible.

Highest recommendation!■

THE SUBMARINE REVIEW

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

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

A stipend of up to $200.00 will be paid for each major article published. Annually, three articles are selected for special recognition and an honorarium of up to $400.00 will be awarded to the authors. **Articles accepted for publication in the REVIEW become the property of the Naval Submarine League.** The views expressed by the authors are their own and are not to be construed to be those of the Naval Submarine League. In those instances where the NSL has taken and published an official position or view, specific reference to that fact will accompany the article.

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

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

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