APRIL 2001

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EDITOR'S COMMENTS

As American submarining enters its second century two *issues* are emerging to create a seemingly insolvable paradox-and a significant challenge for the Force, industry, the community at large, and even the National Leadership. At the same time, there are strong indications of impending change in national security strategies and the makeup of the forces needed to implement them. All of this is taking place while looking into a future about which few are confident, but many have widely divergent views. In addition, new attitudes about the place of nuclear weapons in that future may well impact the Submarine Force, in its role as the nation's leading nuclear arm, more than any other branch.

The first *issue* concerns the number of submarines we now have as a result of the post-Cold War "right-sizing" and the difficulty of funding a return to the level now recognized as necessary for "peacetime presence". The conflicting and converging *issue* has to do with the still-to-be-widely-accepted view that the strategies of the next few decades will require more, rather than less, submarines for "war fighting" than the nationally-mandated missions of peacetime.

The **Force Level Issue** is addressed in this issue by Admiral Skip Bowman, Director, Naval Nuclear Propulsion Program and the Navy's senior submariner. He details what we can expect from the shipbuilding program and describes what the Submarine Force can do to make up somewhat for the resultant *submarine gap*. Also in this edition of **THE SUBMARINE REVIEW** Rear Admiral Jerry Holland takes on the **Relative Vulnerability Issue** in his article A Fleet to Fight in the Littorals. The argument presented has to do with *access* and the difference between asking surface or air units to operate offensively in enemy controlled air and sea space or sending a force of submarines to do what has to be done. It can be reasoned from that argument that *any foray* into the backyard of someone unfriendly will *have to be* led by a group of submarines strong enough, and fast-acting enough, to suppress the defenses which can make untenable the entry of our other forces.

The very turbulence of the moment in national security affairs,

fortunately, has prompted several authoritative and knowledgeable commentaries on the other submarine-related subjects mentioned above. The changes to be expected from the ongoing defense-related studies and reviews, the most probable future we will face over the next few decades, and some little appreciated consequences of the specific changes in the character of U.S. nuclear arms are discussed by those members of the League closest to each of their chosen subjects. Robin Pirie, once the skipper of SKIPJACK and now the Acting Secretary of the Navy, spoke at the Submarine League's Corporate Benefactors' Luncheon about how the Submarine Force had faced previous challenges and how challenges had forged our modern Navy. Mr. Pirie's wide experience at the upper reaches of the Defense establishment resoundingly recommends his words to us for deeper consideration, and even for seeing signs of light at the end of this long tunnel of under-appreciation of submarine worth.

The matter of the future is taken up by Captain Sam Tangredi, no stranger to the more sophisticated discussion of larger defense issues in these pages. He is working currently at the National Defense University on preparations for the forthcoming Congressionally-sanctioned Quarterly Defense Review. His efforts there have resulted in a most interesting, and very thorough, review and analysis of most of the public sector thinking about the near and mid term future we should be accounting for in our strategic planning. Part I of his summary of that work appears in this issue and he will follow up with a Part II, treating outliers from his conclusions, in the July issue of **THE SUBMARINE REVIEW**.

The final part of this five-leafed look at the challenges facing today's Submarine Force, and its larger supporting community, has to do with nuclear weapons, specifically the impact of a further reduction in warheads on the size of the Trident force. Captain Bill Norris, now at Sandia and very conversant with nuclear force issues, points to the possibility of either negotiated or unilateral reductions, well below that which used to be considered *rock-bottom* requirements. His stated hope is that the Submarine Force, speaking for the Navy, has seen this coming also and has a position which adequately states the pros and cons in force-specific terms meaningful to the national-level debate.

In addition to these big picture concerns there are a number of interesting articles in this issue about the inner workings and hidden mechanisms of the submarining world. So read and enjoy!

Jim Hay

FROM THE PRESIDENT

On 1 January 2001 I relieved Dan Cooper as your President. I am honored to have been selected for this position and strongly support the objectives of the League. I look forward to hearing your suggestions for new programs and improvements as the United States Navy's Submarine Force, the finest Submarine Force in the world, writes the record book on the second hundred years of achievement.

December 31, 2000 closed the year long celebration of the Submarine Centennial. The successful execution of the schedule of events throughout the country is a tribute to all who contributed to the effort. Your Naval Submarine League played a major role in supporting the Centennial through services of the staff, officers and Board of Directors and through a significant financial contribution to the Commemorative Committee. My personal thanks to all who helped make this celebration a resounding success.

March 31st marked the end of the Naval Submarine League's fiscal year. More importantly, we are within a few days of completing the first year in ***The Second Hundred Years*** of the Submarine Force's contribution to national security. Now it is time to look ahead to new challenges and achievements. The heroes of

the first hundred years will not be forgotten but will be joined by new heroes. The Submarine Force is ready, willing and able to continue its vital role in the country's defense. Your League is poised to move forward with the Force into the second century of achievement.

One of our goals for the next year is establishing a new Chapter in the Chicago area that can serve our 150 members in the five-state area surrounding Lake Michigan. Another goal is to increase League participation in Chapter activities across the nation as we improve services and visibility to our members. Finally, our new website should be operational by the time this issue is in your hands. It provides us a place to post submarine related news and articles of interest in a timely manner. Make **www.navalsubleague.com** your one stop for submarine matters. We will have links to all of the pertinent sites that you would normally browse.

Coming up are the Submarine Technology Symposium at John Hopkins University Applied Physics Laboratory on May 15-17, and the Annual Symposium at the Hilton Alexandria at Mark Center on June 13-14. Both of these events have an excellent slate of speakers and will be a great start in developing the professional expertise and technologies to support our second century of submarine operation.

J. Guy Reynolds

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ISSUE: FORCE LEVEL

REMARKS TO CORPORATE BENEFACTORS

by ADM F.L. Bowman, USN
Director, Naval Reactors
5 February 2001

What I'd like to do tonight is talk about a question Rick Newman poses in a recent article he wrote for Air Force Magazine.

Rich Newman is the senior editor of U.S. News & World Report and apparently Mr. Newman wrote this article to stimulate discussion within Air Force ranks. As Figure 1 shows, the question Mr. Newman posed is, "How did the submarine community get to the front of the requirements queue?"

Air Force Magazine
January 2001
Pg 60

Submarine Salesmanship

How did the submarine community get to the front of the requirements queue?

By Richard J. Newman

Figure 1

I find it interesting that Rick Newman would write this for Air Force Magazine. But I think the article does present the facts correctly. In essence, what the article says is that we got to the head of the military requirements queue by simply telling the truth. And those of us who have been associated with this business for more than a few years know that's pretty high praise—that you can win by simply telling the truth.

So, if I may, I'll present the case we've been making for the past two years, which I believe led to Mr. Newman's article.

Last year, we rode the euphoria of the Submarine Force's Centennial year and all that was involved with that wonderful year

of celebration. And many of you were involved with one or more pieces of that great year: beginning with the New Year's Day parade—with the two submarines being interviewed at sea, underway, making way; and with a contingent of submariners marching in the Rose Bowl parade.

So we did have last year's public affairs opportunity to leverage, but we also had the simple truth. And here's the story.

REQUIREMENTS		SSN Force Level
1989	Cold War Ends/Berlin Wall Down	96
Continuous	Navy Fleet CINCS requirements	68-72
1992	JCS SSN Study (wrong k-factor)	52-68
1993	JCS SSN Study Update (same wrong k-factor)	51-67
1993	Bottom Up Review	45-55
1997	QDR – Contingent on reevaluation of peacetime overseas presence requirements	50
1998	Defense Science Board – called for more, not fewer SSNs, "crown jewel" of defense	>65
1999	JCS SSN Force Level Study	68 (2015) 76 (2025)

FORCE STRUCTURE REALITY

Options Available:	Refuel all (five) SSN 688's currently scheduled for early inactivation Convert 4 SSBNs to SSGNs (not a one for one replacement for SSNs Increase VA Class build rate – only solution to maintain long-term force
Results in:	54-65 in 2001-2015 (if include 4 SSGNs as SSNs) Fewer than 50 in 2025

RECOGNIZE / ADDRESS TENSION

Improve the K-factor:	Additional Service Life Extension Forward Basing Dual Crew
Make each SSN more effective:	Future Studies Group Employment Concept Technology Thrusts
Drive costs out of VA Class	MYP Block Buy (with EOQ) Accelerate 2 per year

Figure 2

Figure 2 shows that there is an honest-to-goodness requirement for these submarines. And that requirement has been validated over and over and over, since the Berlin Wall came down back in 1989, by almost everybody willing to do a legitimate study.

If you look carefully at this information, you'll see a couple of the studies listed at the top that look like the numbers are not quite what we recently saw from the Joint Staff study and from the Defense Science Board proclamation back in 1998. But there's an explanation.

When those earlier studies were done in 1992 and 1993, the Joint Staff incorrectly applied the submarine *utilization factor* (k-factor). *Utilization factor* merely says how many submarines do you need in the overall inventory to have a submarine on station. The folks doing those early studies assumed that there was no time during a deployment when the submarine *wasn't* on station. That is, there were no port calls and no maintenance availabilities—so a submarine *out there* was a submarine on station. Those first studies also incorrectly applied the turnaround ratio requirements that we have to factor in to the *utilization factor*.

If you use the right *utilization factor* or k-factor, the number of submarines in those early studies—52-68 and 51-67—come out in the same ballpark—68 SSNs—that the Fleet CINCs have been saying all along.

Then last year—really at the end of 1999, but rolled out in January 2000—the Joint Staff conducted yet another study that said we need 68 attack submarines to do our nation's peacetime presence in 2015, and we need 76 by 2025. That study was done differently from the others. It was done by actually polling the unified commanders: General Tony Zinni, the Marine Corps general in CENTCOM; General Wes Clark, the Army general in EUCOM; and Admiral Joe Prueher, the Navy admiral in Hawaii watching over the Pacific. Those unified commanders said that these are the kinds of numbers we need. Truth be known, the original numbers that came in from that polling were much, much higher than 68 to 76. But through negotiations, the Joint Staff worked down to the more realistic numbers reflected in the final version of the study.

So, I say, let's not do any more studies; Submarine Force structure has been studied and validated to a fare-thee-well. There's no need to question whether this requirement is legitimate. The requirement is there, it's solid and it's meaningful.

Another reason that the submarine requirements have gone to the head of the military requirements queue is that we have also been telling the truth about the reality of reaching those kinds of large numbers. And I'm going to present to you tonight a case that says it's not realistic for us to think we can get to 76 attack submarines in 2025. We can't do that without exhausting the treasury. We would consume about two times what today's SCN budget is in the

Navy if we tried to do it on the back of the new attack submarines. We just can't get there from here.

So, I'm going to show you what is possible if we pull out all the stops. We could take an approach that we have to have 76 attack submarines by 2025 and run around in tight little circles, waving our arms until we get our way. But of course that's not a realistic or responsible approach, so I want you to know what is possible.

First, there are only five Los Angeles class submarine that are available to refuel that we don't plan on refueling already. If we refuel those five, it will give us a total of 20 of the first half of the 688 class—that is, out of the first 31 688s, which all had 20 year cores, we will have refueled 20 if we refuel these remaining five submarines. The other 11 are gone—they're decommissioned, inactivated, being cut up. So we have a total of 20 that we can play with.

Then we have a possibility of adding to the *SSN numbers* by refueling and converting Tridents, as they go out of service, to SSGNs. I emphasized *SSN numbers* because we all know that SSGNs are not really SSNs. But I would argue that those SSGNs would free up one SSN each if they were on station with a load of Tomahawk missiles, so that SSN, which is on station today with her Tomahawk missiles, can go do other SSN things. So, I accepted that argument and said that we will count those SSGNs in the attack Submarine Force structure numbers.

Finally, increasing the Virginia class Build rate to match the build rate that was sent to the Congress in June 2000, I think is the panacea. I don't think we can go beyond that. If we do those three things—if we refuel all five of the 688s that are available, convert all four of the SSBNs to SSGNs, and go to this increased build rate—we still will not reach the number of attack submarines —68 and 76—contained in the Joint Staff study. So, what can we achieve then?

The choices are few. We can scream bloody murder. We can hold our breath, kick our arms and legs, say the requirement, the requirement, the requirement, ... we've got to have this money, ...we've got to have this money or democracy as we know it will fail, ... and all that stuff. Or we can look at what else is in our

toolkit that we can do as a community to ease the tension between the nation's valid requirement for attack submarines and the reality that we can achieve. We can look at what can we do, without passing the hat again, without asking to get rid of the DD-21, without asking to get rid of the school teachers in Omaha or police and firemen in Denver, without asking for anything that's going to test the national budget.

That's what my last few sentences are about. Let's recognize that there is a delta, a difference between the attack submarine force structure requirement and reality. We can fix some of this delta through this *utilization factor* that I've already talked about. We can fix it by making every one of our SSNs a little bit more effective. And we might even be able to help by making the Virginia class submarine cost less that we have been talking about.

Now, I want to go back and build my case in chronological order so we're in synch with where we are today. Consider a year or two ago, following the Quadrennial Defense Review, which said the Navy only needed 50 attack submarines but included an important contingency statement that allowed for re-evaluation of attack submarine force structure based on changing peacetime security requirements. That was the genesis of the 1999 Joint Staff study.

Following the Quadrennial Defense Review in 1997, the Defense Planning Guidance (SECDEF's marching order to the Secretary of the Navy) said to reach and maintain 50 attack submarines. So the Secretary of the Navy passed that guidance to his planners and said, "Decommission submarines as necessary. Continue to build at a reasonable rate that keeps industry on track and at a rate that modernizes the Force. But get to and achieve 50 submarines as quickly as possible."

At that time, the QDR required the build-rate numbers shown at the bottom of Figure 3. That build rate included a number of years of three Virginia class submarines per year, just to maintain 50. I'm sure some of you are asking, "What changed from the build rate at the bottom of the slide to the build rate just above it?" Very simply, the submarine community undertook a study in 1999 to determine if we could extend the life of these attack submarines by three years—10 percent in other words—from 30 years to 33 years.

We found out that we could, and it's a powerful accomplishment.

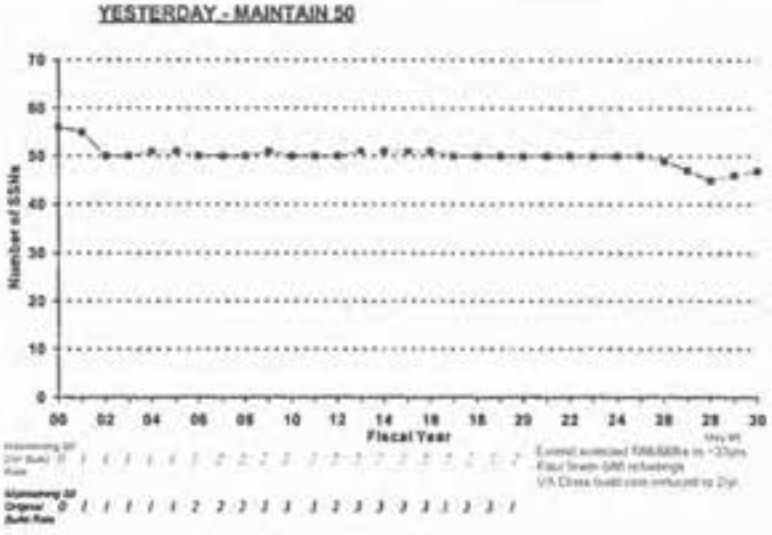

Figure 3

Look at the differences between the build rate requirement to maintain 50 if you go to 33 years (for those submarines that can get to 33 years) versus the build rate to maintain 50 if you don't go to 33 years. The years requiring a build rate of three Virginias per year went away and made everybody breathe a sigh of relief.

Chronologically, the next thing that happened, shown in Figure 4, was the spring 2000 rollout of the Joint Staff study. And here are the numbers that we've already mentioned. You can see the 688 SSNs in 2015 and the 76 SSNs in 2025. Here is a number I haven't mentioned yet—also required in the Joint Staff study—18 Virginia class submarines specified in that study by 2015. And you can also see where we would be with the build rate that was rolled out in June 2000, the one that I mentioned earlier that went over to Congress. This figure suggests that if the Joint Staff study is true, The Office of the Secretary of Defense (OSD) needed to reconsider their force structure guidance provided in the Defense Planning Guidance. And that's exactly what they did in May of 2000. The

revised Defense Planning Guidance said, "You don't have to constrain yourself to 50 submarines; you can go to 55."

Fifty-five seems to have magic to it, because it's both the war-fighting requirement that came out of the Joint Staff study—and it's also a number that the Joint Staff study says, below which, the nation will have no flexibility to handle contingencies and world situations. It does not imply that there is an acceptable range from 55 to 68; but nonetheless, the number 55 has incorrectly taken on that kind of meaningfulness to some people.

Figure 4

But in any case, the difference between Figure 4 and the previous Figure 3 is that the Navy can now maintain 55 submarines. And in doing so, we will allow every one of our current inventory of Los Angeles class submarines, that has the fuel to get there, to go to 33 years of service life.

But now look at what happens in the out-years. We see that allowing those submarines to go to 33 years doesn't help, and we drop back down to below 50 for a long, long time. The Defense Planning Guidance said, "That's no good—we need 55 attack

submarines."

Therefore, the only way to stay at or above 55 SSNs is through a new build rate. Notice the difference between Figure 5 and the previous Figure [4] is a new line. This line reflects a Navy Force Structure 30-year build rate that the Secretary of Defense sent to Congress in June 2000. It includes a Virginia class build rate of three ships per year in some years. Also notice that in the out-years, where we were previously dipping down to 50 and 49 attack submarines, we're no longer doing that.

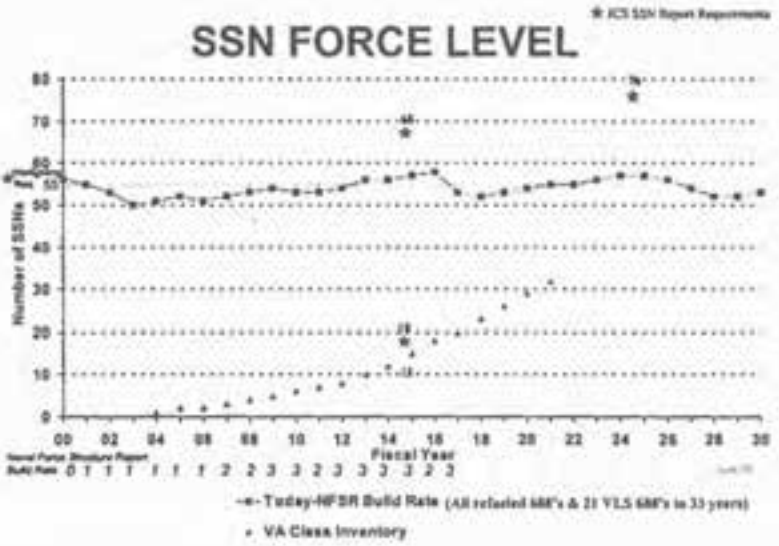

Figure 5

This is about all we can hope for from the Virginia class build rate, I think. There are a couple of puts and takes that I'll talk about a little bit later that might improve the situation, but I don't think we can do much better than the Naval Force Structure build rate that was rolled out in June of last year.

Now, let's take a look at that same profile in Figure 6 and add those five 688s that I talked about—and then, on top of those, add the four SSGNs. This is about all we can do to fix the delta

between our valid requirement and what is realistically possible given a limited budget. This is the *pulling out all the stops*.

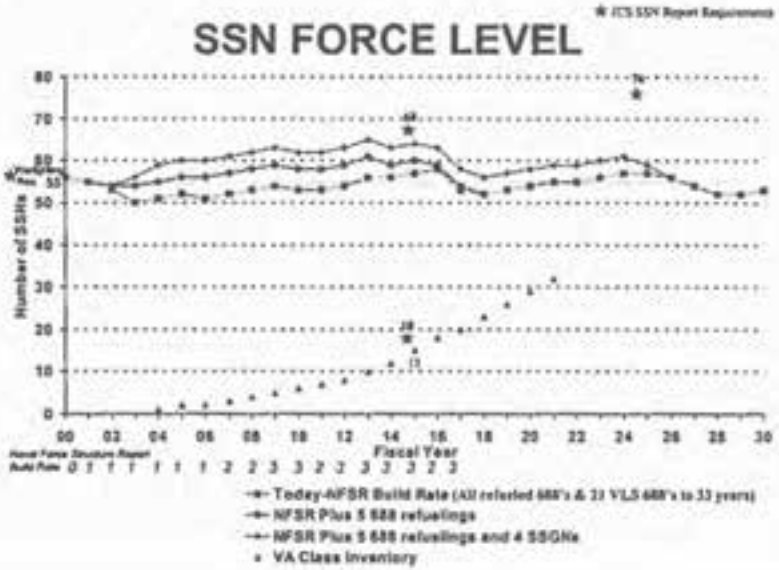

Figure 6

Figure 6 uses all the 688s that are currently not scheduled for refueling; it uses the four SSGNs; and if you look at the line at the top, you can see that it also still uses the Naval Force Structure build rate that I talked about. Unfortunately, as you see, we don't get to 68 attack submarines here either. Plus, we don't get anywhere close to 76 submarines in 2025. This is the crux of the problem. Figure 6 clearly shows the requirement-versus-reality dilemma that I talked about at the beginning.

What can we do about that? As a digression, I want to show you how impossible our task would be, if we were really wedded to those two force structure numbers: 68 and 76. Take a look at the hypothetical build rate shown in Figure 7 that would be required to pass through 68 and 76 if we were to go ahead and do the other two things that I said—refuel all five of the 688s and convert the SSGNs.

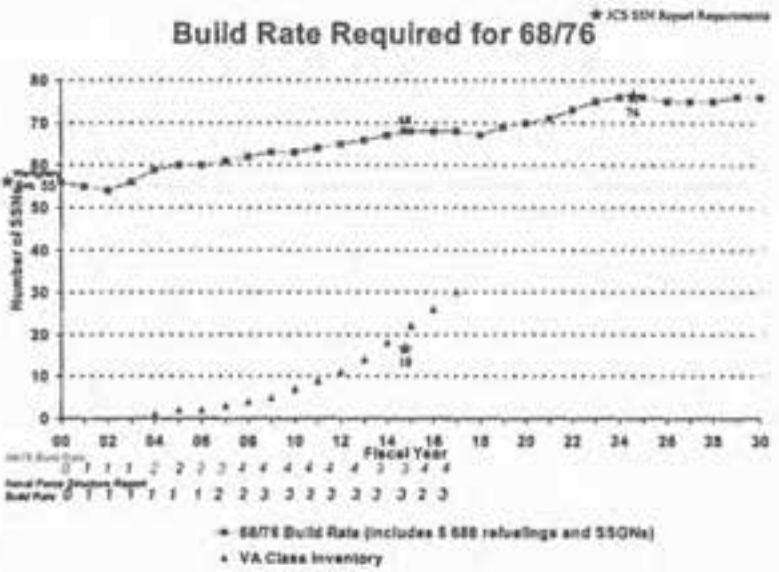

Figure 7

I call this build rate unrealistic. You can see that this unreachable build rate would require us to build four Virginia class submarines per year. I don't see the Navy building four Virginia class submarines a year in my lifetime, unless we come up with some miraculous improvement in contracting and a new method of reducing the cost of those submarines.

So, just to remind us, Figure 8 is the more realistic Naval Force Structure build rate. It's pulling out all the stops, with five 688 refuelings and the four SSGNs. So, this is what we've already looked at—just to remind us that there is a delta.

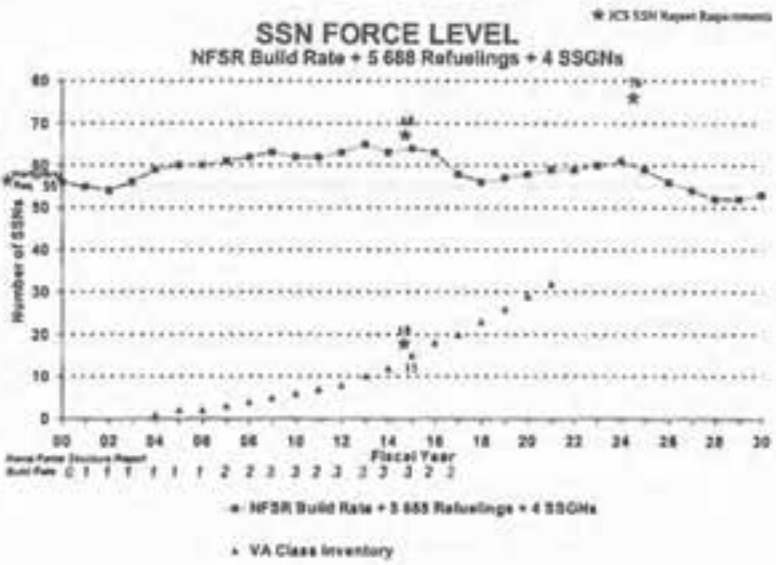

Figure 8

Given that we have this delta between force structure requirements and what we can realistically achieve with today's limited resources, what more, if anything, can we do to help? We're not going to pass the hat, and we don't want to destroy the rest of the Navy's force structure, ... or wreck the Army's modernization plans, ... or destroy the social plans that are all so important in this country. What's left?

Well, shown in Figure 9 are three things that people have suggested we should look at. And we are evaluating the merits of all three of these. One of them in particular is very appealing—the homeporting of attack submarines in Guam—and has now been approved by Secretary Danzig as one of his last official acts before leaving office. I'll talk more about Guam in a few minutes.

K-FACTOR
ALTERNATIVES TO INCREASING BUILD RATE TO 4 PER YEAR

1. EXTEND LIFE-BEYOND 33 YRS
2. FORWARD BASING - Guam
3. DUAL CREWING
4. SOME COMBINATION OF ABOVE

Figure 9

First, I want to discuss the prospect of extending the life of our current submarines beyond 33 years. We might be able to do this with the submarines that have enough fuel to go beyond 33 years. Remember that the Seawolf- and Virginia classes are built with *life-of-the-ship* cores that were originally designed to support a hull life of about 30 years. So they're not going to go beyond 33 years to 38 years. Therefore, it's only those 15 to 20 Los Angeles class submarines that I mentioned earlier, which will have been refueled, that would fall into this group. Those 15 (almost guaranteed because they're paid for) to 20 could go out to 38 years. We ought to look at it and we're going to.

Figure 10 shows some of the technical issues that we need to address as we work through this concept. Sorry for the details withheld on this slide because of classification. That's all Naval Reactors stuff. It's problems having to do with neutron embrittlement, with thermal fatigue, with cyclic stresses, with things that the U.S. commercial nuclear plants are looking at in trying to extend their lifetimes. It's not a walk in the park, but we ought to look at the engineering feasibility of it and do what's best for the Navy and the country.

Figure 10

On the non-nuclear side, Figure 10 also shows a list of problems. In essence, it has to do with the impact fatigue cycling has on the hull. It's all about making sure that our submarines can safely continue unrestricted operations throughout their life, and I'm not sure the engineering analysis will prove we can get there, either. I'm not sure that there is any more blood in that turnip to squeeze out that might give us some more life from those 15, and hopefully 20, refueled 688s.

Now, here's a concept that we like. We asked ourselves, what could we do to improve this *utilization factor*—that, in essence, won't cost you, ... won't cost me, ... won't cost the taxpayer a penny, ... and won't cause us to have to go back and re-work other people's programs. But something that would also make sense, ... that our people can live with because we're not going to solve this problem on the backs of our people, either.

So the question became, "What if we took some number of submarines and put them out on Guam?" And we started pursuing that. Putting submarines on Guam, of course, in this day and age, would help a heck of a lot. Many people believe the majority of the

security challenges we'll face over of the next several decades will originate in the Pacific. And the Joint Staff took this into consideration as they did their recent study. If you look into the details of the study, you'll find that a considerable portion of the *68* and *76* numbers are based on Pacific Rim scenarios. It's some of the new countries that we're paying attention to a whole lot more today than we used to in the Cold War. And Guam is heck of a lot closer to those areas of interest than San Diego, or even Pearl Harbor.

In fact, it's so much closer, and you get so much out of this, that—depending on how you operate these ships—you get about a factor-of-three improvement in their mission/days on station.

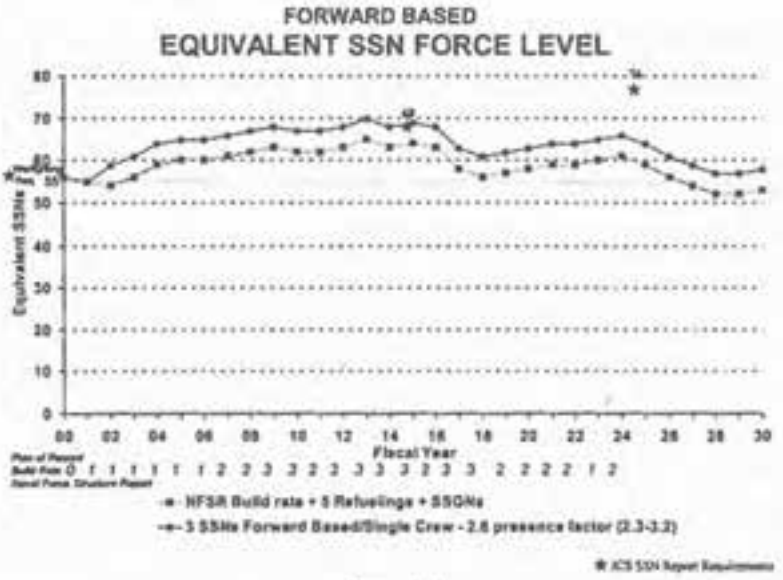

Figure 11

So if we put three of these submarines in Guam, it would look like close to nine submarines operated out of San Diego. That adds almost six to that delta that we generated earlier, and that's not bad. Plus, it adds those six equivalent submarines to our force structure all the way through their life and Figure 11 shows that improve-

ment.

We asked ourselves, should we do that? What are the Guamanians going to think about it? And, why Guam? Figure 12 shows some of the answers to that question. We decided to do this and the Navy's senior leadership is completely onboard with it.

Figure 12

I went to Guam last fall. I talked with the Governor of Guam, I talked with the Speaker of the House of Guam, and I talked with the Agana Chamber of Commerce. They were very supportive of the concept of once again homeporting submarines in Guam. So, it was not only "yes," it was "Heck, yes, please come on in!"

We happen to have a submarine tender in Guam. That's nice. We happen to have a history of prior submarine culture in Guam. I lived there two years myself when I served on the Squadron 15 staff. So it'll work. And it's going to happen pretty soon. The new commodore of Squadron 15, Dick Corpus, was in my office today. He's en route to Guam, and most of his staff is already there. The first ship will be there in April 2002; the second ship will be there about seven months after that; and the third ship will be there sometime after that.

Each of these three ships that we're sending to Guam, forward

deploying on Guam, will have just completed a refueling overhaul. So they will have already left their previous homeport for about two years' worth of shipyard overhaul. They have already cut ties with that previous homeport, and instead of sending them back to their old homeport, we are going to drive them to the Pacific.

Are there any questions about this, because we are going to do it.

Question: Admiral, with a factor of three and one could get from 68 to 76, would it make sense at some point, if it worked well, to consider making it six submarines in Guam?

That's a good question. I should have said something about that. When we first started to look at this issue, Admiral Al Konetzni, SUBPAC, was talking about putting as many as five submarines in Guam. During my visit to WESTPAC last fall, Admiral Joe Krol, SUBGRU 7, and I looked carefully at the shore-based infrastructure on Guam. We determined that the current facilities on Guam could support three submarines, but if we wanted to put more than three submarines on Guam, it would be necessary to increase the infrastructure, which would generate a big MILCON cost. The housing is suitable for, and can accommodate, three crews' worth of 50 percent married Sailors and 50 percent non-married Sailors. Likewise the Naval Hospital and DoD school can handle three crews' worth of Sailors and dependents. If you go just a little bit beyond these three times 140 people or so, you start generating a big MILCON bill. That's why we drew the line at three.

Now, even with the cost of that *big MILCON bill*, if you compare that cost to the $1.8 billion it costs to build a Virginia class submarine, it might still be a better deal. So we haven't ruled out that we may eventually put more than three submarines on Guam—absolutely not. But for now, we plan to go easy and not disturb the equilibrium. This is essentially free.

We're also going to put 220 extra people onboard USS FRANK CABLE, the submarine tender that's in Guam, because the tender now spends 50 percent of her time out of Guam at other ports in

WESTPAC, servicing the surface ships in WESTPAC. As a result, we'll need a more permanent maintenance capability on Guam. So, we are going to put 220 extra people onboard the tender to allow them to stay behind to take care of submarines while the tender's at sea.

Question: Is there any possibility of qualifying the shipyard at Guam?

I looked at that. I crawled through the shipyard. Tom Beckett, my deputy is here tonight—he also crawled through the shipyard and looked at the infrastructure. That infrastructure has crumbled a good bit since we last had SSBNs refitting on Guam 20 years ago. Right now the plan would be to have submarine maintenance done completely by the tender. Flyaway teams from Puget Sound or Pearl Harbor would do any non-routine maintenance that comes up and is beyond the tender's capability, which is just like we do it today.

Question: Is there an existing shore-side IMA structure for these 220 folks you would leave behind?

There is. And the good news is that, again, there is a zero MILCON bill to do this because, already in the budget is a MILCON funding line to make that shore-based infrastructure a little bit better. When I was stationed on Guam in the early 70s, there were T-sheds and Quonset huts and that kind of thing to use for storage and temporary maintenance facilities. They were destroyed by one of the two super-typhoons that hit the island in the years since then. So there was already a MILCON proposal to erect shore-based maintenance support structure, so the answer is yes.

Question: The lack of a drydock scared me when I was a squadron engineer out there.

You bet. And it bothers me, too. What we have agreed to do, and what we have done for the last several years in WESTPAC, is

if something should happen that requires drydocking a submarine, we send the submarine back to Hawaii on the surface. That's not an ideal situation, but fortunately we haven't had to exercise that option very often.

So forward basing was a good idea. Figure 13 shows an idea that's not good in my view.

Figure 13

Dual-crewing—at first blush, it really seems keen, it really seems nifty, and of all warfare communities who might know how to make dual-crewing work, the submarine community ought to know all about it. Because, after all, we have been doing this from the very beginning on our SSBNs.

And that's part of the problem, indeed, we have been doing this from the beginning on our boomers because we recognized at the start of the SSBN program that we needed a sizable infrastructure ashore for training during the off-crew period. And it's worked well. However, we don't have that luxury with the SSNs. We

can't replicate the missions of the SSNs ashore for the off crew's training without a hefty MILCON bill.

Furthermore, the off-crew time for a SSN is longer than it is on an SSBN. The off-crew on an SSN could be as long as a year if we don't change the way we operate today. Six months' worth of POM work-up to hone the crew's war-fighting skills, which has gotten even more important in recent years because of our better integration with to the carrier battlegroups, and then six months' worth of deployment.

How do you keep an off crew gainfully employed for a year, ... back on shore, ... without a pretty robust training infrastructure - simulators, trainers that we don't have.

Furthermore, and this is somewhat counterintuitive, we don't get twice as many mission-days on station from two crews over the single-crew situation. In fact, you only get on the order of 40 percent more. So you get a factor of about a 1.4 mission-time-on-station improvement by going to a dual-crew system for our attack submarines—not two times.

Plus, where are you going to start? I don't have, and nobody else has, an extra set of submarine crews in his bottom desk drawer to throw at this problem. When the British submarine community looked at doing this, not too long ago, ... for three ships, ... for only three ships, ... they figured it was going to take them 8 years to recruit, train, and get into the assignment queue people that could be applied to the problem.

So, it's not a walk in the park. Figure 13 identifies some additional concerns that I just think make dual crewing not appealing, ... not attractive. So, right now, we're not pursuing it, but we'll continue to maintain an open mind, of course.

Now, I want to move beyond a strict discussion about Submarine Force structure and talk about how the Submarine Force is going to harness the technology that's on the horizon. Figure 14 gives a list of submarine effectiveness measures. Those of you who have attended these seminars in the last year will recognize that these words are from the Future Studies Group work—that group of submarine captains that got together to help chart the community's course in the 21st century.

EFFECTIVENESS MEASURES

FUTURE STUDIES GROUP EMPLOYMENT CONCEPT

- **GAIN & SUSTAIN BATTLEFORCE ACCESS**
  - UNDER ENEMY DEFENSIVE UMBRELLA
- **DEVELOP & SHARE KNOWLEDGE OF BATTLESPACE**
  - COVERT AND CONTINUOUS
  - BOTH AS AN ADJUNCT TO WARFIGHTING AND, IDEALLY, AS AN ALTERNATIVE TO WARFIGHTING
- **PROJECT POWER WITH SURPRISE FROM UP CLOSE**
  - NECESSARY BUT NOT SUFFICIENT
- **DETER & COUNTER WEAPONS OF MASS DESTRUCTION**
  - ACTIVE PREEMPTIVE MEASURES

Figure 14

The big word here is *access*, ... guaranteed access. If I went back to my very first Figure, which said, "How did the submarine community get to the front of the requirements queue?" I would say it's because people are beginning to recognize that in this day and age of cheaply linking satellite surveillance with surface-to-surface missiles, the submarine represents a platform that can guarantee access to denied waters for all our forces.

And so, it's access, ... it's access, ... it's access. I think that the brochures, or information guides, that the Submarine League printed start off with, "Submarines matter because access matters." And that really is what it's about. You've heard me say in some of my speeches that there is no such thing as "enemy-controlled waters" in the submariner's mentality. And I do say that in a little bit of a tongue-in-cheek manner, but those of us who have been there, you know what I'm talking about. We'll go. If we need to go, we'll be there. So the *guaranteed access* part is key.

The next part of this Figure may look like something we have always been doing: develop and share a dominant knowledge of the

battlespace. It's not. This is talking about linking sensors and information systems like we have never linked before, both from a communications standpoint and from a sensor/tactical standpoint. How about these things that DARPA is developing at the micro-, and even nano-scale that can swim ashore, fly ashore, link back, and send video? This is not too far off.

Microprocessors today cost *pennies*, ... pennies. You open up one of those calling cards, it sings "Happy Birthday" to you—that's a microprocessor. That's not exactly the level of sophistication that we're looking for, but the cost for such items continue to go down, so we're going to be able to do this. What I mean by this is that we are going to be able to provide, covertly and continuously, the battle force commander and the National Command Authority guaranteed access to figure out what's going on ashore. The access to get into the bad guy's do-loop, ... his thinking loop, ... and then link that information back to the decision makers. That's the second bullet.

The third bullet is *projecting power*. Now, this is almost like what we've been doing, but it's not exactly. Because we are talking about projecting power from under the other guy's defensive umbrella, knocking down key nodes, recognizing where those key nodes are, and again, trying to deter, deter, deter, before we ever have to really pull the trigger.

And that deterrence generated by the possibility of a submarine lurking inside the defensive umbrella of a potential bad guy can even extend to weapons of mass destruction.

The four points made on Figure 15, all *gets*, support these four elements of this future submarine world: getting connected, payload, modular, and electric. They intertwine. The *connected* is not just about radio communications, it's about linking to those sensors I talked about. It's about getting knowledge and not just a data stream of zeroes and ones. We're headed in this direction, and we are very serious about it.

TECHNOLOGY THRUSTS

- GET CONNECTED
  - REAL TIME
  - KNOWLEDGE – NOT JUST DATA
- GET PAYLOAD
  - MORE OF IT AND MORE VARIED
  - TO INCLUDE SENSORS, AUTONOMOUS VEHICLES, WEAPONS
- GET MODULAR
  - FLEXIBILITY AND ADAPTABILITY KEY TO MAINTAINING WARFIGHTING ADVANTAGE AND MEETING EVOLVING GLOBAL THREATS
- GET ELECTRIC
  - KEY ENABLER FOR ALL THE ABOVE
  - ONLY WAY TO ACHIEVE NEXT LEVEL OF STEALTH IMPROVEMENT

Figure 15

The DARPA/N77 partnership that was formed with the two industry partners this last year and half, I think was dynamite. And we are very, very serious about proceeding down the path that those two teams developed. It represents a great number of you in this room: I know that. I was very, very happy with what we saw.

The 2006 or so appropriated Virginia class submarine will start seeing things like I'm going to show on Figure 16.

We're going to look very carefully at, and in fact, likely will change the sail design completely from anything that I've seen since I have been doing this for 35 years. More room available for the payload that the payload study talked about. More opportunity to put additional things of value in this unusable volume that the Defense Science Board brought to our attention in their 1998 study. Look at USS JIMMY CARTER, if you think we're not serious about this. We're delaying the delivery of JIMMY CARTER by almost two years, so that we can prove the concept of finding volume that hasn't been used before for payload. And this is one example of where we're going in the bow and the sail.

We're also looking very carefully at that modularity concept that I talked about on the previous Figure.

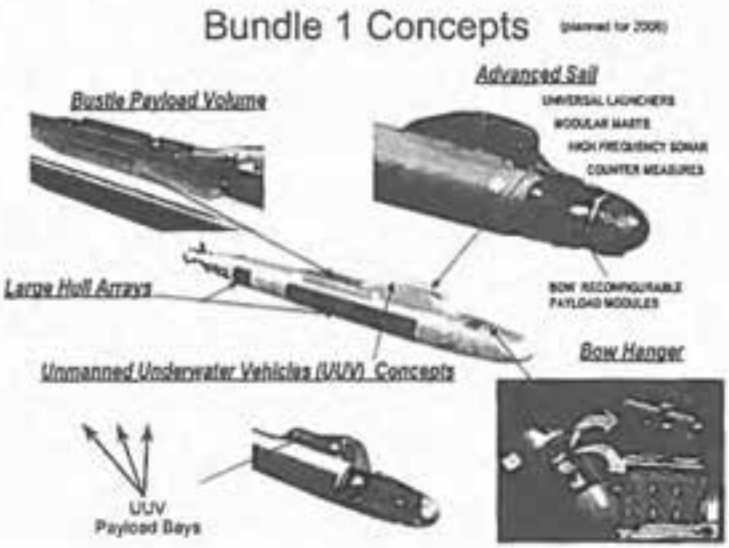

Figure 16

How about a bundle, called here a *bustle* for missiles that could be specifically tailored for the mission at hand? And where could they go? Is there room? Are there buoyancy and volume and weight accommodations on today's Virginia class design to pull this off? The answer is, yes, we have the design flexibility to do this. So this idea would incorporate exactly some of the thoughts that came from the DARPA/N77 partnership that we worked on this last year and a half.

How about a hangar bay for an Unmanned Underwater Vehicle (UUV) or two? That might make sense. Or even Unmanned Aerial Vehicles (UAV)? I still have a challenge out to my aviation-industry friends to build these UAVs so that they can be launched and recovered from a submarine. There's no reason they can't do that. UAVs are that small already, and it's a simple matter of adapting the technology to make a UAV work from a submarine. So, we're headed off, looking at this as a conceptual study.

Lots going on in the sensor world, too—these are organic sensors, obviously. We still care about maintaining an acoustic advantage. One way to do it is to get quieter, and another way to do it is to hear him *better* and process that information better. So, the Wide Aperture Array and this Large Flank Array are just around the corner on this 2006-timeframe submarine.

Bundle 2
Expanded Warfighting Capabilities

- **Significant Volume for New Payloads and Sensors**

Figure 17

The 2010-timeframe submarine, shown in Figure 17, is a larger step forward. It's a bigger deal, also, and it has dollar signs attached to it. But this 2010-timeframe appropriated submarine is our target. It's our target for instituting electric drive, an integrated electric ship with an integrated propulsion system. We may also look at a larger hull diameter than the current Virginia class submarine, if the larger hull diameter is the right answer to support the advances in payload and acoustic stealth we think are possible.

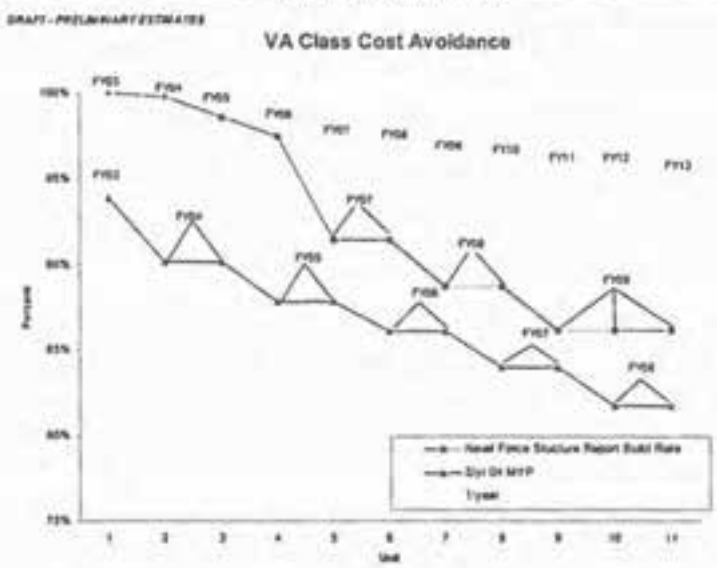

Figure 18

The last thing I want to talk about is the cost of the Virginia class submarine. If you follow the dotted line up at the top of Figure 18, it says if you build Virginia class submarines at one a year, you will achieve some savings over time as a result of a learning curve. We get smarter with each one and there are fewer design changes, so we'll get the kind of savings shown just through learning as we go.

If, however, you depart from a one-a-year build rate and move to the Naval Force Structure build rate that I've talked about, which has us going to two submarines a year in 2007, ... two a year in 2008, ... and *three* a year in 2009, you achieve these additional economies as you build submarines. This additional savings is the result of getting the learning curve down faster, but also for the same reason we buy stuff at Costco's—it's cheaper when you buy in quantity. If we were to shift the *two a year* first appearance from 2007 to 2004, we would achieve the lower line additional efficiencies and improvements in cost.

If you couple some of these notions with what's being talked about on the Hill and other places, and think about different ways to buy submarines through multi-year procurement, batch buys with

economic ordering quantity, you get the even more impressive savings shown in Figure 19. In fact, Electric Boat and Newport News, who have studied these ideas, have said that you get about one free Virginia class submarine for every nine to ten that you buy, if we pull out all the stops and maximize our savings through making the most of these efficiencies.

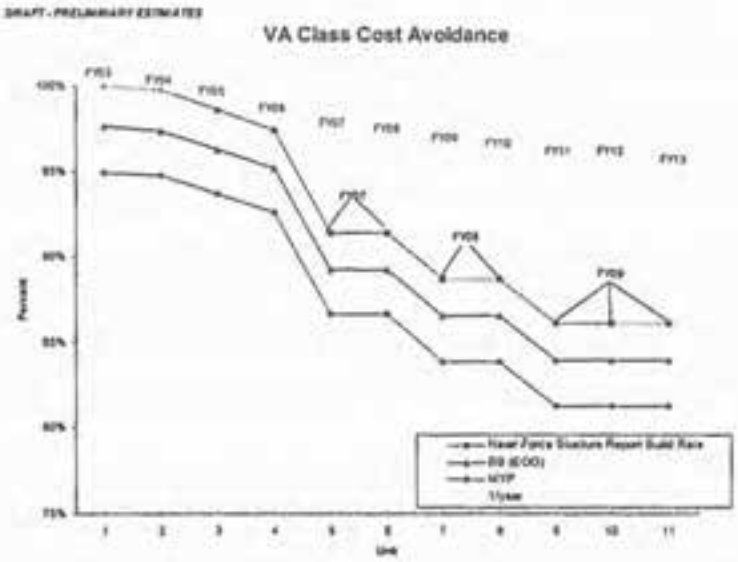

Figure 19

In summary, what have I said here? I've said that there's a legitimate requirement for attack submarines that has been validated through numerous studies, and that this requirement can't quite be reached, even if we pull out all the stops of refueling the five remaining 688s and converting the four SSGNs. However, it is imperative that we do those two things to get as close as we can, cheaply—and that we go to the accelerated, or the 30-year force structure build rate. And even doing all those things, we are going to fall short. And therefore, it behooves us, ... it is incumbent on us, ... to go look at other ways we can improve the efficiency—the operating efficiency and the deployment tactical efficiency—of these

submarines. And then finally, can't we make these things a little bit cheaper just by looking at the contracting methods? And the answer is: you bet—a lot cheaper. A 15 percent savings starts mounting up on a bill of almost $2 billion.

And I think that answers Rick Newman's question. This is our story, we stuck to it and we *told* the truth. And this isn't going to change.■

IN MEMORIAM

RADM Ralph Carnahan, USN(Ret.)
W.F. Donnelly
CAPT Francis J. Farino, USN(Ret.)
RADM Harry Hall, USN(Ret.)
CAPT Donald Henderson, USN(Ret.)
LCDR Hugh F. Glynn, USN(Ret.)
CAPT Allen E. May, USN(Ret.)
CDR Kevin Rogers, USN(Ret.)
CAPT William Rosebrough, USN(Ret.)
LCDR Kar Sax, II, USN(Ret.)
Roger F. Smith
COB Marshall T. Steves, Sr.
CAPT George H. Whiting, USN(Ret.)

ISSUE: RELATIVE VULNERABILITY

A FLEET TO FIGHT IN THE LITTORALS

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

Today the United States Navy can carry the fight to the enemy and can operate easily in most littorals because these areas are virtually undefended. This safe environment will not last forever. In the next two decades the proliferation of sensors and weapons around the world will threaten ships operating close to most shores, severely limiting expeditionary operations. Building a fleet to fight in these contested littorals starts now. Three options have been suggested, the Land Attack Destroyer, *Streetfighter*, and the Virginia class submarine. Tradeoffs between these options are difficult because they cross sponsor lines within the Navy staff, require changing accepted attitudes, and threaten to reduce or eliminate existing programs.

In making selections from this menu, avoiding the trap of a specific scenario is as hard as it is important. This dilemma has never been expressed better than by the editor of Jane's Fighting Ships, Captain Richard Sharpe.

> "Warships with a life span of up to 30 years should never be designed with specific scenarios in mind, even though defining exact uses is so appealing to the bureaucratic mentality. Utility is a navy's strongest contribution to national defense, and many tasks performed during a ship's life bear little relationship to the operational requirement document which justified its existence".[1]

Sharpe's advice is important in making our choices because not all options are equally useful and history demonstrates that the least expensive option almost never is a *best buy*.

The Land Attack Destroyer, now planned for authorization in FY2005 but slipping, wallows along in the trough of declining funds, growing requirements and conflicting demands. Beyond the normal difficulties of development and funding a new class, the ship

is unlikely to satisfy much of the land attack portion of its mission even when delivered. Two conditions will limit her utility in the strike role: magazine loading in face of the theater ballistic missile threat and, as with its predecessor, the Arsenal Ship, access to the littoral with an acceptable degree of risk in time to significantly influence events.

Much of the utility of sea-based missiles depends on the magazine loading of the ships carrying them. In a contested littoral, these magazine spaces will be most valuable for missile and air defense weapons—not strike missiles. While DD 21 is not being designed as an air-defense ship, her magazine is described as sharing ". . . space with the Navy's latest anti-air missiles".[2] Cooperative Engagement will enable AEGIS ships in company to shoot the DD 21's missiles so these weapons will be significant ingredients in the Battle Groups' air defenses and the theater's missile defenses. Because other platforms with strike weapons will be available while other missile defense platforms will not, loading ships capable of air-defense with strike weapons is a mismatch of means and ends.[3]

The threat from theater ballistic and cruise missiles will continue to grow as the information for targeting becomes more available and as seekers on the weapons improve. Because the deployment of the Army, the Marines, and the Air Force's tactical air into the theater all depend upon access to areas threatened by theater ballistic missiles (TBM), the priority for TBM defense will be very high—especially in the earliest stages of action. At the start of any conflict where the United States does not have a permanent military presence, anti-ballistic missile and anti-aircraft weapons can be brought to bear only by ships. Army anti-air warfare (AAW) assets will enter the region much later than naval forces while defense by the Air Force's eventual airborne laser will be limited to intermittent intervals of short duration. Until the enemy's missile inventory is destroyed or exhausted, the demands for Navy missile and air defense weapons will be very high.

If the value of this missile defense seems overstated, consider the proposals by National Ballistic Missile Defense (BMD) proponents who would station **all** the Aegis cruisers around America's coasts as the national ballistic missile defense system.[4]

Such proposals indicate the high value of missile defenses in the minds of policy makers. The concerns of the Theater CINCs will be just as strong when engaging enemies who have the potential to use offensive missiles against theater staging areas. While both strike and AAW missiles will be loaded in routine deployments for surface ships, the priority for defense will lead to predominance of anti-missile/anti-air-weapons in load-outs when operations in a defended littoral are expected. [5]

The risk to surface ships operating in a contested littoral is the second serious restriction that will inhibit using the Land Attack Destroyer as a strike platform. In addition to submarines and mines, the same technologies that threaten the land bases and ports of entry multiply the threats to surface ships trying to operate in the littorals. Defense relies on mobility, hardness, defensive arms and/or a reduction of signature. Each of these has advantages and limitations. But the littoral warfare for which the DD 21 is being designed brings special considerations in using each of these characteristics.

Conflict in the littorals fixes the location of ships fighting—the mission reduces the space available for mobility. Kamikazes were so effective at Okinawa mainly because the Fifth Fleet was tie to the support area. Conventional submarines and mines pose inordinate risks when ships are confined to narrow seas or restricted operating areas. [6] As wide area sensors and weapons with searchers as well as seekers become available, land based missiles will pose significant dangers to surface ships and airplanes. Even coast artillery will gain an effectiveness it hasn't had since the Civil War. In the coming decades, deployment of these kinds of capabilities around the world can be expected.[7]

Hardening ships to withstand direct attack was abandoned after World War II. Hardening to withstand torpedo attack or mines is virtually impossible today. Protection against cruise and ballistic missiles is difficult and expensive. Most sensors and all communications antennae are located high in superstructures where heavy protection is not feasible so while a ship might survive a topside hit, continuing to function effectively as a fighting unit afterwards is unlikely.[8]

Defensive measures against short duration-of-flight cruise missiles and torpedoes are expensive and difficult. Though Phalanx can be effective against missiles if alerted early enough, similar defenses against torpedoes continue to defy researchers. Ships entering a contested littoral will have to bring robust ASW and mine avoidance capabilities with them. Mines can be avoided or swept if the investment is made in survey vehicles and the opposition fields are not too dense. But no matter what efforts are engaged, mine countermeasures, like ASW, always take a long time. Because time is at a premium in a crisis, the time necessary to conduct ASW and mine clearing will be very dear, perhaps politically unacceptable.

Reduction of signature is very expensive and, as demonstrated by the F-117 in the Balkans, is a consumable. When the vehicle begins to conduct its mission, its presence is evident: "In the case of the F-117, the ability to foil radar detection vanishes the instant the pilot opens his bomb-bay doors. With the doors open, the F-117 causes a radar screen to "light up like a Christmas tree."[9] Regaining invisibility after detection is almost impossible without some cloaking mechanism. Submarines can clear datum to regain their stealth advantage: no similar natural cloak exists for surface ships.

Of all of these mechanisms, DD 21 will employ primarily mobility and signature reduction. Yet the mission will limit mobility and signature reduction cannot promise an enduring advantage. Surface ships reveal their presence performing the mission no matter what technology is used to conceal or deceive and once datum is established, a surface ship has little ability to open datum surreptitiously. The growing dangers to surface ships operating in a contested littoral will inhibit their employment there no matter what their sponsors' claim in program presentations.

These facts do not argue that DD 21 is an unwise investment or a ship without utility. Modernization of the fleet demands investment in stealth techniques and exploration of tactics that might allow surface ships to take advantage of technology to reduce their signatures. However these considerations do limit the expectations of what the eventual ship will be able to accomplish. Further, this analysis suggests that the investments to try to make her *invisible*

ought to be limited. Expectations that she will be a *do-all* man of war are overly optimistic.

On the other hand, *Streetfighter*, a small, fast ship with little defensive armament or protection and limited offensive arms that uses only proliferation and mobility for defense builds on a history of failure. In the past, small ships have proven to lack the reliability, sustainability, agility, endurance, internal volume and resilience to be effective or reliable. [10] Some of the historic defects may be alleviated by technological developments but the relative disadvantages of a small ship on long and distant deployments are intrinsic. Proponents argue that by distributing firepower among a number of platforms the loss of some will not cripple the engaging force.[11] But building ships to be expendable is politically untenable and tactically dubious.

Small ships may be useful for nations bordering on narrow seas but to fight in distant waters requires getting there and staying there. Getting small ships to distant scenes of action takes time and either a series of bases or a mother ship to supply fuel and logistics support. Deployment of the very modern mine countermeasures ships to the Mediterranean was possible only because of the support of their mother ship, USS INCHON (MCM 1). Expecting small ships to arrive in distant waters, ready to conduct offensive operations after a long sea voyage—particularly if the sea en route is more than a state two—is unrealistic. To expect them in a timely fashion is fanciful. [12]

The proponents of *Streetfighters* argue that, "contested coastal waters have been taboo for capital ships and the *nearly exclusive province* (Italics supplied) of flotillas of small, swift, lethal, fast-attack craft" [13]; completely failing to recognize submarine operations in such waters since World War I. [14] There is **nothing** in the *Streetfighters*" attributes that is not duplicative of the submarines' capability but without the high speed, great endurance, unmatched record of reliability and proven operational performance demonstrated by nuclear powered submarines. [15] The submarine is able to do all of the missions outlined by the proponents of *Streetfighter* without the risks that surface ships of any type will meet in the littoral.

Contested or not, submarines have been and will continue to be the first units into the battlespace. Historically in times of war or crisis, submarines have deployed earlier and in greater numbers than any other ship type. Their high transit speed and independence of support or weather allow them to arrive quickly. Their invisibility allows them to operate in areas otherwise dominated by an enemy. Because they have such a low profile, they can remain for long periods of time acting as the forward most tactical node of the sensor grid. This facet of their character allows their exploitation as sensors. As scouts, submarines bring capabilities that cannot be duplicated by other sensors: operating in all weather conditions, gathering visual and electronic reconnaissance against low power emitters and small forces, and when coupled with Special Forces, conducting surreptitious entry, observation and attack.

Battles are sequential, not consecutive. Until the enemy threat to staging areas is thwarted or reduced to manageable proportions, Army, Marines and Air Force tactical air won't even get into the theater. Until the threat to the littoral is brought into manageable proportions, carriers and surface ships either will stand clear or will serve as aim points to exhaust the enemy missile inventory. Amphibious groups will not be able to close the coast until the enemy's coastal defenses are eliminated or his surveillance capabilities degraded or destroyed.

When the littoral is contested, the first units in must clear the ocean and the adjacent lands of threats to follow-on forces. These threats start with enemy submarines but include mines, and shore based weapons. Sensors ashore, command centers and communications nodes are other targets that need to be taken under fire early. In most conflicts, political pressures will demand quick action. So the first part of the campaign will be fought by forces that can defeat the enemy's attempts to isolate himself or the land battle with a variety of threats—in other words, units with multi-mission capability, low vulnerability and great robustness.[16] Of the warship options on the table, only the submarine qualifies.

In contrast to the missile threats, no effective ASW force exists in the world—even in littorals and even in waters less than a hundred fathoms. And there is no evidence that anyone, including the United States, is building such a force. For those who have

operated in the near presence of surface and air ASW forces for many years, the suggestion that submarines suddenly become vulnerable upon launching a missile demonstrates an egregious ignorance of the tactics associated with that evolution as well as the technical difficulty and operational realities of developing such a capability.[17] One analyst characterizes this condition,

> "Fast quiet nuclear submarines will remain the least vulnerable of all basing modes because anti-submarine warfare is least effected by technical trends that will potentially transform other warfare areas. Thus, ASW against modern nuclear submarines will remain both technically demanding, very expensive, and still a largely fruitless endeavor."[18]

That happy condition is not true for vehicles operating on the surface of the earth or above it. The submarine is the only platform that will be able to operate freely in a contested littoral through the next half century and probably longer. The submarine combines both sea control (ASW and ASUW) and land attack capabilities. Conflicts in the foreseeable future will not involve maritime environments that are target rich in either submarines or surface ships so submarines can devote most of their magazine capacity to strike weapons without losing their ability to dominate the maritime environment in which they operate.

The submarine not only dominates the sea in which it operates but, immune to coastal observation or artillery, can operate closer to shore than any other combatant. The resulting reduction of the range to targets reduces the time-of-flight between weapon launch and target impact, reducing target warning and reaction times. When coupled to network centric concepts of command and control, this shortening of time is of great advantage against time-urgent targets, i.e., those that can move, e.g. mobile missile launchers or aircraft on an airfield, or those that pose high order immediate threats, e.g. weapons of mass destruction.

In many scenarios, it is likely that the Rules of Engagement probably will allow an opponent to shoot first. Because the submarine can lie close aboard the enemy, it has the potential with

very short time-of-flight weapons to ***shoot second but hit first***. This will be especially valuable if the enemy has not moved his relocatable targets before starting the conflict in an attempt to conceal his intentions.[19]

Attacks early in the campaign on missile launchers and aircraft are particularly advantageous because their destruction reduces the number of weapons that pose the greatest threats to the rest of the fleet, the ports of entry and theater staging areas. The inventory of TBMD/AAW defense missiles is limited so that weapons that can strike the time-critical targets that are the mobile missile launchers and airfields are at a premium. As enemy raid sizes are reduced, the challenge facing the theater missile and air defenses decreases measurably and the effectiveness of the theater's air defense resources is significantly enhanced. In this regard, the submarine launched short-time-of-flight missiles possess a utility unmatched by any other littoral based system.

Early suppression of air defenses similarly increases the effectiveness and lowers attrition of air strikes. Such raids also improve the probability that cruise missiles reach their targets. Interdiction of enemy AAW is accomplished most effectively by weapons arriving immediately in advance of the raid and from an axis not coincident with the incoming raid. Submarines, positioned close to the coast, can orchestrate such attacks precisely.

Not all targets ought to be taken under fire by the submarine—in fact anything in the enemy target mix that can be attacked by other than the submarine weapons should be. All fixed land targets are essentially indefensible from U.S. forces, most should be left to forces that are easy to reload, i.e. bombers, or have large inventories, i. e. arsenal ships.[20] For situations calling for small or discrete strikes, using submarine tube loaded weapons—the only cruise missile launcher that carries reloads—makes sense to save weapons needed for large salvos. The submarine missiles should be saved for those missions where time of flight is important. Not all missiles are equal. Only those launchers with short time of flight are able to get inside the enemy operational cycle.

The submarine comes with a number of unique advantages—high sustained speed, no escorts or logistics platforms required at any time, no additional lift requirements, assured access to any ocean

area or littoral including polar areas and heavily defended straits, and twenty years of fuel paid for in this-year prices. Nuclear power allows one ship to cover many bases. USS MIAMI (SSN 755) for example fired on both Iraq and Kosovo in the same week. This kind of mobility allows the submarine to strike from any axis bordered by the sea.

The simplistic analysis that "It is significantly less expensive to carry missiles in surface ships than in submarines" is true only if the area in which the ship is to operate will be free of any threat. When the surface ship may be the object of attack, then the missiles available for land attack must be decreased by those necessary for self defense— or escorts must be provided. Defensive weapons, i.e. anti-air/anti-missile missiles, presently occupy sixty to seventy per cent of the Aegis ship's VLS tubes. [21] In that situation then, the submarine, which operates without escort or defenses against missile attack, equates to the offensive fire capability of two or more destroyers.

The virtually invisible platform presently operating as a submarine is the best reason that the DD 21 ought not to try to become too stealthy. The submarine is a better buy than DD 21 for a warship to fight early in the conflict in a contested littoral and vastly better than *Streetfighter* if that littoral is not in the Gulf of Mexico or the Caribbean Sea. The immense costs of stealth for a surface ship and the fleeting advantage obtained at these very high costs mean that any surface ship will always be burdened by an undue risk in the littoral. Trying to make a surface ship into an invisible attacker is an expensive and losing proposition.

The submarine is likely to become cheaper and more ubiquitous than tactical air as littoral defenses grow. As the battle group must stand further out and as it must use more resources for its own defense, it is less and less capable of conducting the strike missions until the enemy missile inventory is depleted or eliminated. Air Force expeditionary tactical air will be restricted in their access to a particular region more than carriers. Long range bombers will be less limited than tacair but distance, sortie rate and defenses make them an ephemeral force. But submarines will continue to operate with a high degree of impunity. Even when faced with the most

intense threats, submarines may reduce their risk by reducing their rate of fire but they never lose their offensive payload. [22]

Unfortunately, programs are assigned by platform rather than by mission or system, so comparisons like this one between types are rarely made within the service. In this case, a truly stealthy platform able to operate in the littorals against any conceivable threat in the next half century is not only available but operating. The culture of the Navy, the fractionation of its officer corps into warfare specialties, its officer personnel assignment system and the organization of the Department of the Navy headquarters are major obstacles in building a proper fleet for future warfare. When considering enhancing the later Virginias' land attack capability, only the submarine portion of the budget is considered as an investment resource. The real question should be the selection of the best ships able to operate in a contested littoral, and the best systems to effectively strike targets ashore while operating there. In that context, the next generation fleet to fight in the littorals should have a strong submarine component.■

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SYMPOSIA INFORMATION

The Submarine Technology Symposium (SUBTECH) will be held at Johns Hopkins Applied Physics Laboratory May 15-17, 2001. The scheduled banquet speaker is Steve Forbes. Register online: www.jhuapl.edu/sts.

The annual NSL Symposium will be held June 13-14, 2001. The scheduled banquet speaker is Peter Maas, author of The Terrible Hours. Registration packets will be mailed to NSL members in April.

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

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FEATURES

ACTING SECNAV'S ADDRESS AT CORPORATE BENEFACTORS DAY

by The Honorable Robert Pirie
6 February 2001

When I agreed to speak here rather a long time ago, I believed that I would be able to get away with a discussion of the sorts of issues that a former Assistant Secretary of the Navy for Installations and Environment would be most concerned with. That is, I would be able to subject you to a harangue on the subject of environmentalism and increasing encroachment on ranges and other facilities, and the like. I could thus escape talking about things in which I am far from current—submarine issues, for instance. Alas, my excuses for pleading ignorance are stripped away. To further lower expectations on the grandeur and sweep of my remarks it has been a while since I've been actively associated with submarines. Twenty-eight years to be precise. I can assure you however, that in getting reacquainted with submarine concerns, I've been very wary of jumping to the wrong conclusions based on my somewhat dated experience.

I'm reminded of the story of an old priest who was riding in a subway when a man staggered toward him, smelling like a brewery, with lipstick on his collar. He sat down in the seat right next to the priest and started reading the paper. After a few minutes, the man turned to the priest and asked, "Excuse me, Father, what causes arthritis?"

The priest, tired of smelling the liquor and saddened by the lifestyle, said roughly, "Loose living, drink, contempt for your fellow man and being with cheap and wicked women!"

"That's amazing," said the drunk and returned to his newspaper. A while later, the priest, feeling a bit guilty, turned to the man and asked nicely, "How long have you had arthritis?"

"Oh," said the man, "I don't have arthritis, I was just reading that the pope did..."

So, I've tried not to draw the wrong conclusions about where the submarine community is going based on limited information...

Now that I've properly calibrated your expectations, you may ask, what new, helpful and/or interesting insight is a guy like this going to add to these proceedings? Believe me, I was asking myself the same question only a few days ago... But on reflection, I do have some observations that may be worth sharing. Mostly they are questions about some areas that I think may be important to the well-being of the submarine community, the Navy and the nation.

It seems to me that the community has much to be proud of today—from its illustrious history—to its current operations—to its future plans... The virtues that brought the community to preeminence sixty years ago—courageous leadership, relevance, adaptability, and technological innovation—are still at work today. And to me they represent the community's greatest hope for the future.

When Bill Smith and I graduated from the Naval Academy in 1955, the Secretary of the Navy at the time, Charles Thomas, delivered a commencement speech entitled, "In the Shadows of Tomorrow." In it, he recounted how different the Navy had been 39 years earlier, in 1916, when Josephus Daniels was Secretary. In fact, he quoted some of "cup a joe's" words from a similar graduation speech.

> "Who shall say that before you become captains, naval warfare will not undergo a revolution as great as the one that followed the construction of the MONITOR and the MERRIMAC? ... the appeal ... is to fearlessly discard the worship of things that are old and to adopt courageously anything that is new the moment that some new development convinces that the old way is no longer the right way, or that the new way points to the path of victory...keep an open mind; investigate new methods... there never was a ship that could not be improved, and it will be your duty to find the way... Everyday some new thing in naval warfare arises... with what weapons, by what strategy shall we meet the terror of the submarine and the still unrevealed possibilities of the airship?..."

The thrust of both Secretaries' messages was to paint a picture of the future filled with dramatic change, particularly of the technological variety, that could be met only through tremendously adaptable leadership and strategic thought. This, they believed, was crucial if the service was to remain relevant and if the nation was to be central in world affairs. The submarine community has consistently met this challenge. Courage, relevance, adaptability, and technological innovation have defined the parameters of its success.

Certainly submarines and submariners have shown remarkable adaptability in the past. We entered World War Two with submarines being viewed primarily as a scouting force, that would help the main battle fleet to carry out its Mahanian function of crushing the enemy's fleet, ensuring our decisive victory in the war. It didn't turn out that way at all. Instead our submarines, counselled by necessity, conducted a brilliant guerre de course against the Japanese that was a main contributor to bringing that empire to its knees.

At the end of World War Two we kept 105 diesel-electric submarines in commission, mainly because Admirals Nimitz and Carney thought it would be a good idea, and told the Congress so. Because a guerre de course didn't seem to be anything of much use against plausible opponents, we tried a variety of uses, such as radar pickets. But it wasn't until the Cold War intensified, and we learned of massive Soviet submarine building programs that the vision crystallized. Antisubmarine warfare. Sensors, weapons, tactics, training, successively quieter nuclear propulsion plants all followed in rapid succession, until by the mid-sixties the Submarine Force was seen to be a major contributor to what was increasingly expected to be a successful campaign to prevent the Soviets from closing the sea lines of communications to Europe and Asia. This wasn't done by hidebound conservatives fearful of how new technology would upset comfortable arrangements about budget shares. It was done by brilliant people who actually did what old Joe Daniels said they should.

We can tell the same kind of story about adapting submarines in support of our nuclear deterrent. We'll just cut an attack boat in

two on the building ways, stick in a missile compartment that will require launchers, propulsion, guidance, warheads and the like, such as have never been seen before on the planet, and we'll do it in a couple of years. Then we'll have created a system that will be the backbone of our nuclear security for four decades or more. Piece of cake.

That was then. This is now. What next? The problem is no longer sweeping 1000 Whiskey class submarines from the seas, or blowing down every kulak's outhouse in Siberia. Instead we face a chaotic world without a Soviet naval threat, but with even more demand for peacetime missions. I do not believe that as a nation we have yet come close to a paradigm for producing and maintaining military forces in support of our national interests. Maybe the next quadrennial defense review will fill this bill. You are looking at a skeptic.

Nevertheless, the Navy, and that means the Navy/Marine Corps team, has taken significant steps to provide relevant capability. For the first time in history, a naval force attacked landlocked countries—Afghanistan and Kosovo. Tomahawks fired from a submarine were integral to these operations, and Marines were the enabling force for the Kosovo operation.

The Submarine Force provides serious and relevant capability today. The demand from the CINCs and requirements for both Tomahawks on station and ISR missions clearly reflect this. We must continue to ask ourselves though, what are we doing to be relevant in the future? Are we prepared for littoral warfare? Will the nation continue to get value from our configuration and activities?

The dilemma over whether to use limited assets to refuel SSNs or to convert SSBNs to SSGNs is just one case in point. Of course I think we should do both. But if we can't which should we choose? This will test the best minds and best hearts we have. But there is more. The pivotal question, unfortunately, is what will fiscal realities allow? We have staggering bills to pay if we want to execute the program that would meet the CINCs requirements and modernize the Force. In a perfect world we would be building more boats, to get economical order quantities and to get on a glide path to smooth out the 688 block obsolescence problem. Even the

Trident D-5, which we tend to take for granted, will shortly be in need of modernization funding—just to maintain our current capability. And when should we start thinking about successors to the Trident force?

There are some obvious ways to live within our present means. Forward basing is one. An SSN forward based in Guam delivers several times the days on station in support of the CINC that one stationed in Pearl Harbor can. But forward basing requires support. Does this argue that we should rethink the tender question?

Commercial-off-the-shelf items, especially computers and communications gear, and the open architectures that permit most effective adaptation and use are also part of an affordability strategy. What I've seen so far strikes me as encouraging in this area.

In the end, we'll also need to grapple with the issue of whether we can afford the industrial base we have to support the Submarine Force, or whether more consolidation is in order. Can we really afford the number of building and repair yards we have?

Ultimately, it will come down to the nation deciding how much capability it's willing to pay for. We must be prepared for the answer to be, "Not that much more." I think that we are currently taking intelligent measures to get there. Reducing redundancy and concentrating expertise by designating various government yards to solely perform certain functions is a sound idea. Squeezing more life out of existing 688s—from 30 to 33 years will provide tremendous value to the nation.

Overall, while I'm pessimistic about whether the QDR will produce a compelling vision of the country's need for military forces, I'm optimistic about how submarines will fare in the review. During the last decade they have proven their relevance to our CINCs, national command authority and nation, in ways that no other asset could. The demand for submarine services demonstrates that more clearly than any requirements argument. The submarine community has remained relevant through these uncertain years because it has continued to be adaptable. The willingness to change and the inherent flexibility of this weapons system have once again

brought unique value to the nation. Fundamentally, this has sometimes meant swallowing favorite notions about what submarines *should do*, and embracing a new purpose. This is not a novel experience for submarines—shifting from coastal and harbor defense to scouting to guerre de course to ASW to deterrence to ISR to strike warfare and battle group operations. Is there any more resilient asset in the U.S. military?

The only real difference today, is that many of these missions have become cumulative—we must do them all, albeit with shifting priorities. The crucial question we must ask now is whether, as we press ahead to be more relevant to a new strategy of littoral warfare are we building in the flexibility and do we have the headroom to engage other opportunities as they emerge? Again I am encouraged by our progress in some areas, like improvements that have been made in battle group integration, and our progress with the UUV master plan.

I think it's important however, that we continue to press ahead with even more energy in modularity, mine warfare efforts and electric drive/IPS—all avenues that will generate more value from submarines in the littorals. Some of these efforts will require changes within the community, but we must be building the systems that best suit our doctrine.

The lifeblood of our ability to adapt to changing circumstances over the years has been technological innovation. The fundamental question today is: are we taking the best advantage of new technologies?

There's no question that the R&D initiative shifted years ago from the military to the private sector, and it has taken us longer than it should have to capitalize on this shift. I think we are really striving to do this now, especially with respect to computing power. But we need to consider this in all things we do. From navigational equipment to basic data entry and log taking and analysis software, we could still make better use of COTS technology.

I think that modularity (not just modular construction, but modularity of operational spaces) and off board sensors hold particular promise for us. Modularity allows us to adapt to rapidly changing requirements, and off board sensors give us greater flexibility and help minimize risk in these areas.

I have no doubt that submarines will keep delivering for the nation. This is not to say that the path ahead won't be fraught with obstacles—the CINCs' demands can't be met by current numbers and build rates, there is a need to press ahead with modernization, and we can't relent in our technological innovation. All the while we must stay true to our overarching strategy of operating from the littorals to influence events ashore. Clearly we are faced with a wealth of opportunities and problems and a paucity of funds. I don't know exactly what the new administration will do, but I imagine they will quickly see the value of submarines, and act accordingly. We have many causes for optimism—the JCS study and QDR among them. Ultimately though, the community must balance and demonstrate a realistic and relevant vision and execute it by staying true to its time-tested virtues.

I return to the advice given during my 1955 graduation. These words were on the mark about the changes to come and particularly the values necessary to cope with them. In 1955 there were no fleet ballistic missile submarines, the BQR-2B was brand new, and mostly didn't work, we had only the Mk 27 torpedo for ASW, no shipboard digital computers, indeed, it wasn't until 1955 that NAUTILUS sent its famous "Underway on nuclear power" message. But in that year, there were people determined to make the submarine relevant to the emerging challenges, to find solutions, to adapt new technology, and to deal with the changes to come. I see the same sort of people in the Submarine Force and in industry today, and I know that they will not fail to serve our country as they always have—wisely and well.

Thank you.■

FUTURE SECURITY ENVIRONMENT 2001-2025
Part I: The Consensus View

by Captain Sam J. Tangredi, USN

Editor's Note: In anticipation of the 2001 congressionally-mandated Quadrennial Defense Review, the Chairman of the Joint Chiefs of Staff chartered a small working group at National Defense University to "identify probable issues and build intellectual capital for the upcoming QDR." The group, which began work in September 1999, was led by a former Principal Deputy Assistant Secretary of Defense and consisted of one officer from each military service. Results of the working group have included a public conference held at NDU in November 2000, two monographs, and an edited volume. One of the monographs has attracted considerable attention, and ***THE SUBMARINE REVIEW*** *invited its author, a past contributor to our journal, to summarize its conclusions. This is Part I of that summary of one of the monographs. Part II will be published in the July issue of* ***THE SUBMARINE REVIEW****. For brevity, footnotes and references have not been included. The complete work is available on the web at www.ndu.edu/inss/macnair/mcnair63/m63cvr.html. Whether or not the Bush Administration decides to conduct QDR 2001 in the same manner as QDR 1997, or elects a different type of defense review, the debate over the characteristics of the future security environment will undoubtedly affect the future Submarine Force.*

Planning always involves an assessment of the future. Thus, it is natural for any comprehensive defense review—such as the Congressionally-mandated Quadrennial Defense Review 2001 (QDR 2001)—to begin its work with an explicit or implicit assessment of the future security environment. The intent of this article is to outline the nearest to a *consensus* view of the future security environment in which the United States will conduct its international relations from now until the year 2025.

Futures Studies and the QDR

Theoretically, there should be no shortage of *futures studies* that

could potentially be used to form the basis for the future security environment assumptions of QDR 2001. However, there are severe problems in attempting to apply the results of these *futures studies* to effective policy-making. Among the difficulties is the lack of coordination between these studies; the significant differences in their methodologies and the time periods examined; the broad and divergent scope of topics; the presence of underlying and often unidentified biases; and the wide range of contradictory results. Many of the individual studies are constructed *from a clean slate*, taking scant interest in previous, related work. An unedited compilation of these studies would be capable of generating much debate, but with an apparently limited basis for the construct of policy.

To construct a policy requires a baseline consensus from which implications and issues can be examined in an analytical context. In order to develop a baseline, thirty-six existing studies (unclassified or with pertinent unclassified sections) concerning the future security environment and published between 1996 and 2000 (with two exceptions) were selected based on standardized criteria. Conceptually, these studies are representative of views from the range of organizations involved with or interested in national defense issues. The requirement for a 1996 or later publication date was chosen based on the assumption that earlier themes would have been examined and potentially incorporated into the results of QDR 1997. [The studies selected are identified and discussed in detail at www.ndu.edu/inss/macnair/mcnair63/m63cvr.html]

The thirty-six studies were then surveyed, analyzed in detail, and compared on a subject-by-subject basis in order to identify agreement or disagreement between the sources concerning common subjects. From this comparison, sixteen points of *consensus* and nine points of divergence are identified. The points of *consensus* do not necessarily represent absolute agreement between all sources, but do represent a majority agreement. Points of divergence do not necessarily represent a fifty-fifty split, but indicate that there was no clear majority position.

After the consensus and divergence points were developed, they were tested for validity against the conclusions of over three

hundred other sources, most of them specialized studies of the individual *common* subjects. The purpose was to identify *dissenting* positions on the points of *consensus*, as well as validating the fact that the *consensus* represents a majority view.

Additionally, both the primary and consulted sources were surveyed for the identification of *wild cards*—events that could not normally be predicted, but could present a considerable challenge if they were to occur during the 2001-2025 time period. Combined with the *dissenting* positions, the *wild cards* indicate changes in the security environment that may require the development of *hedging* strategies.

Caveats

Of course, there are limitations, both conceptual and practical, to providing a consensus view of the future. First is the difficulty in comparing a mixture of assessments that use differing techniques and methodologies not designed to be compatible. More importantly, while an assessment of the future security environment is the essential starting point for all strategic planning, history cautions against both its inappropriate use and a belief in a high degree of certainty. Other factors also justify caution including the problems of normative assessments, institutional bias, emotional reaction of individuals, and feedback effects, or the effects of taking action.

The limitations of futures analysis and the historical caveats concerning its use mean that the acceptance of any assessment entails risk. As a starting point for defense planning, the assessment of the future security environment is essential, but it cannot guarantee the success of any policy based on its premises. Compiling a comparative assessment from a balanced mix of representative sources thus appeared to the NDU Working Group to be the best method of mitigating this risk.

Aspects of an Anticipated Future

Using the comparative analysis generated by the survey of the thirty-six identified studies, a series of sixteen propositions can be identified that represent a general consensus of the sources concern-

ing potential threats, emerging military technology, and opposing strategies. However, almost every consensus point has a corresponding dissenting or contrary view which are also briefly discussed.

1. There will not be an ideological competitor to democracy on the scale of Cold War communism. The propellant of the Cold War was the ideological struggle between democracy and communism as embodied in the United States and Soviet Union, ending in dramatic victory for the West. The majority of future security environment studies—both governmental and private—do not identify any other ideologies with global appeal, and thus do not foresee a competing ideology before at least 2025. The expansion of democratic values appears to be a by-product of globalization. That does not mean there will not be authoritarian nations that claim to be democracies, when in fact their political structure falls far short. However, with a significant dissent—Samuel P. Huntington's "clash of civilizations" thesis—the consensus remains that the future will be one of an evolutionary increase in democratic states. But the consensus view does include room for the potential for public discouragement and disillusionment in democracy and market capitalism.

2. There will not be a rival coalition of states to challenge United States militarily. The consensus view is that economic and political globalization makes it unlikely that a rival coalition could form to militarily challenge the United States. Various nations may express their displeasure at particular U.S. foreign policies or the overall specter of American cultural imperialism, but most would have much to lose and little to gain in an anti-U.S. alliance. There have been no credible forecasts that the European Union's interest in developing a unified military force independent from NATO will lead to a potential military confrontation with the United States.

Supporters of the view that a rival coalition is unlikely argue that the desire of lesser-developed nations, as well as Russia and China, to join the economic *First Tier* mitigates anti-Western hostility. The closer both nations are economically tied to the West, the consensus view argues, the less likely that an anti-United States coalition will be formed. However, a representative dissenting view postulates a

loose rival coalition driven by "an increasingly more assertive China aligned with a much weaker, authoritarian Russia." A primary driver could be U.S. action to deter a PRC pressure on Taiwan, potentially including a naval blockade, in the 2010 timeframe. Although this is an unlikely scenario, there has been evidence of a desire on the part of the Russian leadership for a symbolic rapprochement with China as a way of countering "global domination by the United States," especially U.S. criticism of Russian military actions in Chechnya. Russia also sought, in late 1999, to recharge its diplomatic relations with the so-called *rogue states*. Likewise, there have been suggestions that China would seek to put together alliances that "can defuse hegemonism by the U.S." Since the publication of the original version of the study, several commentators have suggested a loose linkage between Russian, Chinese, and rogue state interest in reducing American political influence with that of France and other potential economic rivals in reducing American "cultural and economic arrogance." But this remains distinctly a minority view.

3. There will be no conventional military *peer competitor* capable of sustained, long-term power projection beyond its immediate region. Whether the term *military peer competitor* is defined in terms of a *Soviet Union- equivalent* or by the capacity to sustain global power projection, the consensus view is that such a peer competitor cannot develop prior to 2025. It is not simply a question of pursuing the development of power projection capabilities; rather, twenty-five years appears insufficient to duplicate the unique U.S. logistics and alliance networks. However, the QDR 1997 report held out the possibility of the emergence of a "regional great power or global peer competitor," with Russia and China "seen by some as having the potential to be such competitors, though their respective futures are quite uncertain." Additionally, a Russia-China-led alliance could pose the possibility of simultaneous conflicts in multiple regions, which would severely tax the ability of U.S. forces to respond. This would be the closest equivalent to a global peer competitor, but it would still not match U.S. power-projection capabilities.

4. Economic competitors will challenge United States domination of the international economic system, but this will

not lead to war. Propelled by the perception of increasing trade competition between the United States and Japan, the 1990s saw a series of publications suggesting the potential for military conflicts based on economic rivalry. Although the particular controversy was effectively smothered—for at least the time being—by the Asian economic downturn of the late 1990s, the view of a linkage between economic conflict and war has remained. A staple of Marxist theology and post-First World War assessments, it resurfaced in the view that the Gulf War was "all about oil." The potential for China to become an economic power, along with the evolving European Union, have also been cited as precursors to politico-military confrontation with the United States.

Despite popular concerns, the consensus remains that economic competition need not lead to military confrontation, and that it is very unlikely to do so in the 2001-2025 period. The particulars of U.S.-Japanese economic conflict are largely seen as "reconcilable differences," that will not affect security arrangements. The prevailing view of the phenomenon of globalization is that such greater economic interconnection decreases, rather than increases, the potential for military conflict. There remain, however, contrarian views.

5. Regional powers may challenge the United States militarily. The threat that regional powers will challenge the U. S. militarily and seek to prevent the United States from projecting power into their regions is universally considered the primary challenge that U.S. foreign and defense policy will face in the first decades of the 21st century. *Regional dangers* is the term used over and over again to describe the potential for "the threat of coercion and large-scale, cross-border aggression against U.S. allies and friends in key regions by hostile states with significant military power." There is, however, disagreement over which power will pose such a challenge.

Initially, the first prime regional threat was thought to be the unpredictable actions (or collapse) of North Korea, the world's last true Stalinist state. The second was the actions of Saddam Hussein in Iraq, or the simmering hostility of Iran towards its Arabian Gulf neighbors and the West.

However, these two major theater wars or MTWs do not necessarily represent the most demanding future threats. Nations that can sustain sophisticated defense industries and produce significant quantities of relatively modern weaponry, and have access to a large pool of trainable manpower, would be the most formidable foes. From that perspective, there is clearly a rank order of potential (and current) regional military powers. Within this order, almost every futures assessment identifies Russian and China as having the greatest potential for regional dominance.

One or more of the *rogue states* (North Korea, Iraq, Iran, Libya) may seek to militarily challenge the United States in the near term. Such an assessment is based on current hostilities, plans or desire for regional dominance, propensity for aggressive military action, or a pattern of anti-U.S. military activity. In a longer-term view, the potential for conflict with a major regional power may grow, with Russia or China as the most difficult potential military opponents. However, there is no consensus as to which regional power or rogue state is likely to take action at any particular time, or whether or not effective U.S. actions, along with a well-trained and technologically superior military, could deter such conflict.

6. There will be more failing states, but U.S. involvement will remain discretionary. The terms *failed states* or *failing states* have been increasingly used to describe nations that cannot provide law, order, or basic human necessities to their population. Such states may be wracked by civil war, ideological or ethnic hatreds, or other conflicts that prevent the central government from providing internal security or promoting general welfare.

While the internal consequences of such disorder have long been recognized, the external effects within the international environment have not always been considered a security threat to distant, stable nations. The question of exactly where the United States has vital or important interests fuels the argument that American efforts to restore order in failed states is largely a humanitarian effort that has little positive impact on U.S. national security. However, there are still compelling arguments for American intervention to stop genocide or massive loss of life. Such arguments contributed to the American decision to prompt NATO intervention in Kosovo. But given the nature of democratic politics, such intervention ultimately

remains discretionary.

7. There will be more non-state threats to security, but they will increase gradually, not dramatically. The term *non-state threats* is used to denote those threats to national security that are not directly planned or organized by a nation-state. Today, foremost among these threats are acts of terrorism other than those sponsored by a rogue state. A loosely defined spectrum of non-state threats includes humanitarian disasters, mass migrations, piracy, computer network attack (hacking), organized international crime and drug trafficking, terrorism with conventional weaponry, and terrorism with weapons of mass destruction. *Non-state actors* includes international organizations, non-governmental organizations, multi-national corporations, and multi-national interest groups.

Alarmist predictions that non-state actors, issues, and threats would overwhelm and break the abilities of most nation-states to deal with them have not materialized. Nations that have collapsed into anarchy have largely been victims of civil wars, a phenomenon that long preceded the current definition of non-state threats. Many of these civil wars have been fueled or supported by foreign parties, international actors, or other nations. To that extent, non-state or transnational threats do contribute to such internal collapse, but in ways that are not unprecedented historically.

The consensus of the sources is that non-state threats will increase in number and intensity in the future. Yet, this anticipated increase parallels vulnerabilities that are by-products of the evolutionary process of globalization. Non-state threats may seem more potent due to the advantages modern technologies may bring to the perpetrator. But the same or other modern technologies can be used to strengthen defenses. However, some sources do view the rise of these threats as exponential rather than gradual, with more alarm than the consensus view might imply. Of particular concern is the possibility of terrorism with WMD, also known as *catastrophic terrorism.*

8. Advanced military technology will become more diffuse. The category of advanced military technology constitutes a spectrum of technologies or innovative uses of technology developed during the last few decades: from emerging biological

weaponry and other weapons of mass destruction, to new forms of non-lethal weapons including information operations using mass media. It includes highly accurate ballistic and cruise missiles; fourth-generation combat aircraft; complex surveillance, detection, tracking and targeting equipment; surface-to-air missiles; nuclear powered submarines; and other relatively high-cost systems.

The consensus of the sources is that advanced military technology will continue to be diffused through sales, modification of dual-use systems, and indigenous weapons development programs. Although international export control regimes may exist for certain types of advanced weapons, these agreements appear to be easily circumvented. Iran, Iraq, North Korea, Pakistan and India have all effectively foiled the efforts of the such as the Missile Technology Control Regime (MTCR). Under current circumstances, proliferation of advanced systems appears to be simply a matter of time and resources.

9. Significant operational intelligence will become commercially available. Given the current trends in space launch and commercialization, the consensus is that operational intelligence—primarily satellite imagery—will become more and more commercially available. Yet the consensus is that the United States will "maintain a preponderant edge, using its technical systems to produce timely and usable information." The consensus viewpoint concerning militarily-significant commercial information is that it would be available to a potential aggressor until the commencement of hostilities, but would be voluntarily or covertly shut down upon the initial attack. But the fact that operational intelligence would not remain available during conflict may be of little consolation, since the information obtained before hostilities would be sufficient to target fixed sites, such as land bases, in advance. The use of WMD might also make the need for real-time targeting information moot.

None of the sources surveyed suggested that operational intelligence will not become commercially available in the 2001–2025 timeframe. Opposition to the consensus view revolves around two points: (1) that satellite information is largely irrelevant to the most likely threats the U.S. military will face, such as Third World anarchy and small-scale guerilla warfare, or (2) that a cut-off

of commercial imagery during hostilities cannot be presumed.

10. Other nations will pursue a *revolution in military affairs* (RMA), but the United States will retain the overall lead in technology. A number of advances in military technology are frequently cited as evidence that a Revolution in Military Affairs (RMA) is underway, and even skeptics concede that these advances have had a tremendous effect on warfighting. Advances in information processing and command and control are cited most frequently, with increasing availability of real-time information at the command level expected. Some proponents claim that new Intelligence, Surveillance, and Reconnaissance (ISR) technology and battle management systems can dispel the *fog of war* that has previously prevented commanders from having a thoroughly accurate picture of the battlefield.

Critics concede that the advances in military technology have greatly increased the striking power of modern militaries. However, they argue that such advances have not changed the fundamental concept of warfare, and that victory ultimately requires closing with the enemy, and occupying territories or destroying centers of gravity.

Potential opponents may pursue an *RMA* through the development of advanced weaponry, but—barring a catastrophic economic disaster in the West—they cannot surpass the overall U.S. lead in advanced military technologies in the 2001–2025 timeframe. Certain niche technologies, such as advances in chemical and biological warfare, or the development of miniaturized *nano-weapons* that would be easier to transport and deploy in space or on earth, could provide a temporary technological lead in specific areas. Developing such a niche could give a state with limited resources more bang for its buck, but such a development would be unlikely to make the entire U.S. arsenal obsolete, or completely paralyze U.S. decision-making.

At the same time, the overall U.S. technological lead would facilitate the development of defenses against these advantages, or at least methods of mitigating the threat.

While conceding America's current overall lead in military technology, several sources point to alarming trends. Other sources

argue that the United States is not taking the RMA seriously enough, and is squandering our technological lead. In this view, the U.S. Department of Defense continues to spend money on *legacy* systems, while underfunding both basic and advanced R&D and experimentation. This combination could give opponents an opportunity to *leapfrog* over the capabilities of our formidable arsenal and make our overall technological superiority moot.

11. If there is a *technological surprise* innovation, it is likely to be developed by United States or an ally. A consensus of the sources examined views a truly unanticipated development in military technology as unlikely in the 2001–2025 period. But if one were to occur, the consensus view holds that it would most likely be the product of a Western or developed nation, not a nation hostile to the United States. If a technological surprise were to occur in a hostile state, it is likely that it could be quickly replicated somewhere in the West. Infrastructure, knowledge base, and commercial incentive appear to be the drivers of new, *surprising* technologies, these are centered in the democratic capitalist states.

Among those assessments of the future security environment that identify potential wildcards, a major technological surprise was listed as an occurrence of potential concern.

12. U.S. control of the seas and air will remain. The consensus is that the size and level of operational experience of the U.S. Navy and Air Force make it nearly impossible for potential opponents to mount a serious challenge in the waters and air space over the worlds oceans. This is likely to continue until 2025. Even if potential opponents are not deterred from direct competition against these American strengths, it would take at least 20 years for any competitor to build to the numbers and sophistication of the U.S. naval and air fleets. That is not to say that an opponent would not seek to contest U.S. sea and air control in its own region, or even individual force-on-force engagements outside its region. However, the investment needed to challenge the United States on a global basis in areas that the United States has long maintained operational advantages is staggering.

No source suggests that the U.S. naval and air fleets could be decisively defeated, and particularly not within the *global commons* in the 2001–2025 period. However, concerns are frequently

expressed that the United States could become complacent with its current margin of superiority and elect not to replace aging systems with more technologically advanced first-line platforms. Over a long term, the cumulative effect of a *procurement holiday* might make the bulk of U.S. naval and air forces obsolete. The concept of block obsolescence for legacy systems also appears in the arguments of proponents of transformation.

Critics of American complacency also point to the continuing development of high-technology weaponry for export by technologically-advanced nations.

Others argue that general American dominance of sea and air is largely irrelevant in dealing with the more likely future threats of terrorism, chemical, biological and information warfare, and failing states, as well as against the prepared anti-access or area denial strategies of regional opponents.

13. Regional powers will use anti-access and area denial strategies. The potential use of anti-access or area denial strategies against American power-projection capabilities has been a focal point of research in the OSD Office for Net Assessment since at least the mid-1990s. Originally these studies had a maritime focus. In the logic of the anti-access approach, a potential opponent would not seek to engage the U.S. Navy at sea, where the United States holds absolute dominance. Rather, it would seek to prevent U.S. maritime forces from entering its littoral waters by massive attrition attacks using *asymmetric weapons* such as WMD. However, these studies were soon expanded to include examination if all U.S. overseas presence and power projection forces.

The obvious first step in such an area denial effort would be to neutralize any existing lodgment that U.S. forces already have within the region by destroying U.S. forward-presence forces while simultaneously attacking the regional infrastructure for follow-on power projection forces. With regional land bases destroyed and maritime access denied, the potential regional opponent would have effectively extended its defenses out to the entry points of its region. The United States will find itself in the position of having to undertake potentially costly forcible entry operations. Even in this war of attrition, it is likely that the United States would

eventually breach the anti-access defenses, particularly through the use of stand-off weapons stationed outside the region or in CONUS. However, the real goal of an anti-access strategy is to convince the United States or its allies and coalition partners that the cost of penetration is simply too high. Perceptions differ concerning the actual ability of regional aggressors to carry out regional closure in the 2001–2025 time frame. Several sources suggest that, before 2025, most potential opponents will be unable to use ballistic missiles effectively against moving targets, leaving U.S. air and naval forces free to attack the weak points of an anti-access campaign. Other sources suggest that the ability of rogue states to coerce potential American allies into denying U.S. access to their territory has been overstated.

14. Large-scale combat involving U.S. forces is likely to include the use of weapons of mass destruction (WMD). The desires of certain states for WMD arsenals, the rate of actual proliferation, a seemingly growing disregard of the laws of armed conflict, and the lessons of the Gulf War suggest a potential for integration of WMD into military operations. Most sources assume that proliferation will continue in the 2001–2025, and that many of the international control regimes seeking to prevent the spread of WMD will break down, or be ignored. Terrorist groups also appear interested in purchasing or developing WMD. Underlying technologies, particularly from dual-use systems, are becoming available to potential aggressors and provide cover for weapons development. Humanitarian NGOs report that the law of war appears to be increasingly disregarded, with less and less discrimination between attacking military forces and civilian non-combatants. Tyrannical regimes facing potential removal by outside forces—such as those of the United States or a U.S.-led coalition—appear increasingly tempted to use WMD in combat.

The majority of the sources surveyed view the likelihood of use of WMD during large-scale conflict in the 2001–2025 period as quite high. The consensus is that chemical or biological weapons use would be more likely than nuclear war. Many sources view WMD use as the primary future threat to American security. There seems to be agreement that, if certain rogue states have weapons of mass destruction, they would be used for survival of tyrannical

regimes.

The potential of WMD in the hands of terrorist groups is considered a more frightening situation by many sources. Terrorist attacks could be directed against vulnerable civilian populations as well as military forces.

There is also a perception, however, that use of WMD against the United States in conflict can be deterred. The rate of increase in nuclear arsenals during 2001–2025 does not suggest that more than perhaps two or three states, if any, could threaten the United States with mutual destruction. Because chemical and biological weapons are routinely categorized along with nuclear weapons as WMD, there is, by definition, ambiguity as to whether use of chemical or biological weapons would provoke a U.S. nuclear retaliation. Thus, the use of WMD against forces in large-scale armed conflict with the United States might be deterred by the U.S. nuclear arsenal.

15. The U.S. homeland will become increasingly vulnerable to asymmetric attacks. The perception that the U.S. homeland will become increasingly vulnerable in the 2001–2025 period can be traced to the National Defense Panel report of 1997. It has subsequently become an almost universal forecast. In 1999, the U.S. Commission on National Security/21st Century echoed the prevailing perception that "America will become increasingly vulnerable to hostile attack on our homeland, and our military superiority will not entirely protect us."

With the end of the Cold War and the agreed de-alerting of nuclear forces, along with reductions in overall U.S. and Russia nuclear arsenals, it would actually appear that the American populace is much less directly vulnerable than they have been in at least thirty years. However, others point to the balance of terror that made a nuclear war between the United States and Soviet Union irrational. Rogue states, they argue, are less likely to be deterred from making asymmetric attacks on the U.S. homeland in the event of a conflict. Indeed, asymmetric attacks may be the most useful—perhaps only—military tool in the hands of potential opponents.

The consensus is that the U.S. homeland will in the future

become more vulnerable to new threats, particularly chemical and biological weapons in the hands of rogue states and terrorist groups. The ability to transport such weapons in small packages that can be easily smuggled is often cited as a contributing factor. In addition, rogue regimes such as in North Korea are attempting to develop ballistic missiles capable of reaching the continental United States. States that do not possess fissile material could opt for chemical or biological warheads.

The consensus position differs from more alarming forecasts on questions of the degree of future vulnerability. The majority view is that such threats are evolutionary, rather than exponential. As use of the Internet continues to penetrate society, the vulnerability to disruption increases, but so will redundant and protected systems. As globalization causes a rise in transnational or non-state threats, such as massive migrations, its economic benefits may mitigate such threats.

But several sources suggest that the rate of development of future threats—fueled primarily by the malicious use of new technologies—is indeed increasing dramatically. From this perspective, increasing homeland vulnerability is inevitable, particularly if active defenses, interagency cooperation efforts, redundancy, and reconstitution do not receive substantial funding increases within the U.S. defense budget.

16. Information warfare will become increasingly important. Information warfare refers both to the use of various measures to attack the information technology (IT) systems on which a military opponent may depend, and to the control and manipulation of the information available to the civilian populace of an opposing state. Computer network attack (CNA) might be aimed at systems providing ISR or command and control capabilities, functions necessary for modern, high-technology warfare, or it might be an asymmetric strike on the civilian infrastructure of the opponent's homeland. Additionally, an information technology-based public relations war would have a less lethal and more indirect effect on the populace than computer infrastructure attack, but as seen in the Vietnam War experience, it could have a more direct effect on the government's willingness to prosecute a war. The U.S. government has recently addressd computer network defense (CND) and critical

infrastructure protection, but in the face of an emerging and somewhat indistinct threat, defense necessarily lags offense.

An aspect of concern to some is the potential anonymity of attack and the possible use of information warfare by non-state actors, particularly terrorist groups. Hackers and terrorists could use multiple paths of entry to disguise their identities and intentions. Although it is possible to trace these paths to a source, such efforts take time and resources. The question remains whether a hostile state could mask an information attack to such an extent that the United States would be unable to determine the source and take timely defensive or retaliatory actions.

In classical military terms, the use of information is an attempt to lift the "fog of war" that envelops the battlefield. Commanders have always tried to acquire accurate information; what is different is that modern IT appears to provide a greater opportunity to clear away the fog than ever before. Thus, it is natural for U.S. forces to strive for "information dominance" or "knowledge superiority" in any conflict. The fact that there are more tools to make more information available suggests that information has become more important to victory. This also implies that deception, disinformation, and the use of media are also of increasing value as military tools.

While there is no overt disagreement with the proposition that information will be a critical element in future warfare, there is disagreement over the extent to which information—and, by extension, information warfare—will be the dominant element.

Conclusion

The sixteen points of consensus form a generally acceptable baseline from which an effective debate on defense planning priorities, during QDR 2001 or any other defense review, could proceed. Likely issues of such a debate can be identified from the diverging views and contradictions among the thirty-six surveyed sources.■

Part II will examine diverging points of debate and wildcards.

THE COMING THREAT

by CAPT William L. Norris, USN(Ret.)

Captain Bill Norris is a retired submariner who commanded USS MEMPHIS (SSN 691) and Submarine Squadron THREE. He is currently at the Sandia National Laboratories.

There is growing rumor in the nuclear weapons community that last year's Congressionally mandated new Nuclear Posture Review will start later this year after the new administration is more fully in place. Already I see and hear of preparations by STRATCOM and the Air Force to have their positions solidified. I see or hear of no such actions by the Navy or the Submarine Force. And one, especially a cynic like me, might ask if the Navy has an interest, because a reduction in Submarine Force requirements would mean more money for the rest of the Navy.

There should be no doubt that this year's review will have lasting affect on the U.S. nuclear policies or its force structure. Besides taking on the very key and difficult issue of balancing defense (National Missile Defense (NMD)) and offense (Mutual Assured Destruction (MAD)), one might expect this review to lay the theoretical foundation for a second Bush *Nuclear Initiative*. If one tries to read between the lines in today's news and tries to figure out what SECDEF Rumsfeld is doing with his very close hold defense reviews right now, the answer may even be provided without a new Nuclear Posture Review. Recall that George W.'s father surprised many with his unilateral 1991 pronouncement that eliminated nearly half of the existing U.S. nuclear arsenal. The just completed campaign rhetoric would lead one to believe that George W. might have similar plans. With Colin Powell at State, this would be within his previous leanings to reduce the nuclear dangers. And SECDEF should welcome added theoretical basis and strategic policy to support the NMD development.

Just as in 1991, the world is ripe for such an initiative. The START II Treaty, written in 1992, is still unratified and clearly a hostage in the US negotiations over the 1972 Anti-Ballistic Missile (ABM) Treaty to push NMD forward. Even if the Russians ratify

it, the version their legislature is considering is different than the one the Senate has already ratified. The Russians find their existing deterrent force crumbling and are probably really unable to financially support an offensive force of much more than 1500 accountable warheads. Their posturing over actions they might take if the US goes forward with NMD in violation of the ABM Treaty must be viewed as mainly *hollow* threats. Just as the 1991 Nuclear Initiative remaining nuclear forces were, *coincidentally*, the same as those to be negotiated into START II, George W. could take a similar lead in defining the new START III.

Recall also that the Pentagon and STRATCOM have taken the position on the Clinton administration's START III proposals that roughly 2000 weapons was the lowest they could support and assure that they could carry out the existing directions in the nation's recently modified nuclear deterrence strategy. The key words are "existing strategy." Should this new nuclear posture review propose a different or revised strategy, then the military's objection to going below 2000 could be resolved. A convincing argument could be made that based on the Russian economic predicament, that a new number of 1500, or even less, with some form of NMD, might be a deal maker for a new START III.

For those of you have read my past rantings in this periodical, you will remember that my predictions for the future were always no more than 10 Trident submarines. I would not expect the Air Force to walk away from their need to justify 20 B-2 bombers (320 accountable weapons). Nor would I expect STRATCOM to abandon their fixation on a Triad, and therefore, expect at least 2 missile fields (300 accountable weapons). Can the Air Force convince itself to finally part with the B-52 Bomber (and cruise missile capability) and thus, not further cut into the remaining share left for the Submarine Force? If they do, then the submarine share of 1500 would be 880. If they don't, the Submarine Force share may be even less. Options that come close to this 880 requirement are listed in the following table.

Accountable Warheads	Tridents	Tubes	Warheads per Missile
720	10	24	3
846	9	24	4
864	12	24	3
960	10	24	4

There are no provisions in any of the existing START treaties that allow for de-tubing although a good sea-lawyer *might* be able to reinterpret one of the protocols. Therefore I have attributed 24 tubes to all options because negotiation of a reinterpretation or new terms with the Russians could well prove to cost more than the U.S. is willing to give. This is the same reason that I do not believe they will accede to letting the U.S. keep Trident submarines for cruise missile platforms since under existing treaties, the only way an exiting SSBN doesn't have to be counted is if its missile compartment (in toto) is removed or the SSBN is decommissioned. As an aside, I am ignorant as to whether the three-option warheads per missile have ever been flight-tested. Keep in mind that many may take this opportunity to reopen the singlet option. I do not believe that is a saleable option because while one can consider it stabilizing for an ICBM silo, it does very little for a 24-tube submarine.

As Jim Hay would be wont to remind me, so far I have not mentioned anything about what this nuclear posture review might decide about non-strategic nuclear weapons. Last time the Navy stole a march on the Air Force and was able to remove all non-strategic nuclear weapons from ships and do away with the capability of our surface warships to employ nuclear weapons (i.e. Tomahawk). The Air Force believed that what should have been given up was the Dual Aircraft Capability of F-15's and F-16s. That position will be further reinforced now by the Air Force desire to reduce costs for the F-22, Joint Strike Fighter, and any other new designs by removing any nuclear capable requirements. The proven capability of precision guided missiles will undoubtedly be

pushed by the Air Force as an adequate replacement, and possibly even a viable part of nuclear strategy.

If the Air Force were to give up the B-52 and thus, airborne cruise missile capability (many would say this is an untenable or unacceptable premise), will/should the new national nuclear strategy require a cruise missile capability? It is amazing to think that this 1950 era designed airframe, whose life has seemingly been extended without limit by cruise missile capability, can continue to be a effective platform. (Could you otherwise compare it to a WWI Spad fighting a Korean War Sabrejet?) Even if the Air Force were to give up nuclear cruise missiles, the Air Force might still want the B-52 to carry conventional cruise missiles, and thus treaty compliance and verification would be a real problem. A nuclear cruise missile requirement without B52s would then leave it to the attack submarines, and the semi-dormant Tomahawk that they could carry. Again, from what we can read here in the desert, the force level requirements for attack submarines do not rest on this capability. But as the Air Force learned in 1994, it could be a mission that the Submarine Force is mandated to maintain, and add to the probably already full plate for present and future platform designs.

Does, or will, the Navy and, more importantly to us, the Submarine Force have a position before this critical review begins, or will it again let STRATCOM carry its interests, as Admiral Chiles did so well in the 1994 Nuclear Posture Review? If Admiral Mies isn't extended, that would mean relying on the new, as yet unnamed, Air Force General, who might be expected to take over STRATCOM this summer, to carry the Navy's and the Submarine Force's nuclear future. Are we willing to risk it?■

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ARTICLES

RETAINING THE SUBMARINE JUNIOR OFFICER .....A MODEST PROPOSAL

by CDR Mark Gorenflo, USN
CO, USS PARCHE (SSN 683)

The Challenge

We are in a war for personnel. So says Vice Admiral Ryan, the Chief of Naval Personnel. Admiral Clark, the new Chief of Naval Operations, places Personnel as the top challenge he will face during his tenure. This challenge includes recruiting, training and retaining the high quality Sailors the Navy needs to man its ships, aircraft and submarines. Here, in the Submarine Force, our challenge is to retain the Sailors we receive on our deckplates.

How is the Submarine Force doing in this regard? As far as the enlisted Sailor goes, we can claim a fair record of success. We certainly benefit from Navy wide initiatives. The increases in Selective Reenlistment Bonuses, the expansion and increase in Special Duty pays, Pay Table Reform and improvements in housing allowances all put more money in our Sailors' pockets and make the retention challenge manageable. But, we have also worked to help ourselves as well, focusing on Sailor quality of service. Intense efforts on the part of our Type Commanders, working with Naval Reactors, have allowed almost all submarines to achieve 5 section duty rotation fore and aft. This may not seem much of an achievement to surface Sailors for whom 8 section duty is considered spartan, but for our lean submarine crews, for whom 3 section duty was the norm not more than 2 years ago, this represents a tremendous improvement. Watchstander liberty policies, Rope Yarn days (half day workdays allowing Sailors to conduct personal errands during normal working hours), aggressive leave management and improvements in daily work planning by our Chiefs' Quarters are also making better use of Sailor time and energy and allowing Sailors to spend more and better time with their friends and families while in port, improving what Vice Admiral Giambastiani liked to call "inport tempo" during his tenure as COMSUBLANT. In

addition, again with the leadership, support and encouragement of our Type Commanders, particularly Rear Admiral Konetzni, Vice Admiral Giambastiani and Vice Admiral Grossenbacher, the Submarine Force has aggressively attacked the causes of attrition among first term Sailors. The numbers speak for themselves:

- Retention is up, well above sustainment rates, throughout the Submarine Force;
- Attrition among first term Sailors has dramatically dropped, and is now half that of the Navy at large.

In all of these areas, while challenges still exist and the importance of deckplate leadership remains paramount, the Submarine Force appears to have *cracked the code* on retaining Sailors.

The same cannot be said for retaining our invaluable junior officers. The nominal *sustainment* retention rate is 38 percent, measured at the seven year point, and is a simple mathematical derivation from the number of junior officers we need to retain to serve as Department Heads (the nominal submarine has eight junior officers and three 1120 Department Heads). The Submarine Force has not met this goal in several years. In 1999, the retention rate was 31 percent; in 2000 it was 32 percent; in 2001 it looks to be about 31 percent. Using traditional measures, submarine personnel managers have worked hard to increase Nuclear Officer Incentive Pay, which has increased from$15,000 in 1998 to $19,000 in 2000. This has stopped the hemorrhaging, but it has not yet resulted in the desired increases in retention the Submarine Force needs to maintain personnel stability over the long term.

Why are submarine junior officers leaving at unacceptably high rates? What can we do to attack this problem? I argue that a three-pronged approach is required. Specifically:

- Compensation, in all of its forms, must continue to be competitive
- Technology insertion must come to the aid of overworked junior officers
- Submarine senior officers should be encouraged to mentor junior officers.

Today's Junior Officer

Today's junior officer has a life experience and a set of career expectations considerably different than those in command today. Before I continue, I want to be clear about one key point. This is not an essay about the shortcomings of the youth of today. Such jeremiads are as old as the tales of Aesop and, in my opinion, just as fabled. My entering argument is that today's junior officer is just as patriotic, just as dedicated and just as committed to excellence as any officer that has served in our Navy. But their differing life experiences must be attended to if we are to succeed in retaining these bright, enthusiastic and enterprising young officers in our Submarine Force. The experiences and expectations of their leaders will be poor guides to analyzing the forces pulling our junior officers from our wardrooms and into corporate boardrooms.

A Generation of Plenty. Our nation has been blessed with 8 years of unprecedented growth. Over a slightly longer term, the United States has enjoyed at least 16 years of prosperity in the last two decades. Today's junior officer comes from a generation that has known little but upward mobility and tremendous economic opportunity. As a result, they have excellent opportunities outside the Navy at cutting edge, fun and interesting firms. And they know this. An engineer-qualified submarine lieutenant, drawing sea pay, submarine pay and nuclear officer incentive pay, can, right now, get a job in a high tech firm which will pay him as much or more in take home pay than he gets from the Navy. This was emphatically not the case when I was a lieutenant. Nor is this fact likely to change, despite the best intentions of our nation's leaders or even a slight hiccup in our economic march forward.

A career is not a job, and vice versa. Combined with tremendous opportunities outside the Navy is a mindset among young professionals of all stripes about what constitutes a career. The traditional ideal of working for one concern throughout a career and being rewarded for diligence, loyalty and experience is obsolete. First of all, few companies view their employees in such a paternal fashion—the Navy is ever more unique in this regard. More importantly, today's professional regards his set of skills as his career—and feels neither fear nor compunction about changing

companies as frequently as he changes cars. In fact, in today's working environment, many companies value such versatility in their employees and many professionals are amply rewarded, in terms of signing bonuses, increased equity stakes and higher salaries, when they switch employers.

The portable compensation package. Finally, professionals today expect many key elements of their compensation package to be either portable or easily switched. Retirement plans are frequently in the form of 401k plans, which move easily from one employer to another. Stock options are vested much more quickly than a Navy 20 year retirement. Comprehensive medical and dental plans are taken for granted. And, in the most desirable labor markets, employers use their imagination to provide day care, transportation assistance, tuition assistance and even more esoteric fringe benefits (casual dress codes, in house health spas, even staff massage therapists) to attract and retain their employees.

So the typical junior officer, whose college was paid for by the Navy and who has finished his initial sea tour, may naturally feel that he has completed the first *phase* of his career and looks elsewhere to maximize his compensation, to enhance his set of professional skills and improve his enjoyment of life, at work and at home. As leaders, we need to understand this point of view and figure out how we can continue to compete for their services.

Maintaining the Navy's *Market Share* of Talent

So how do we retain this new breed of junior officer? Let me propose three areas of emphasis.

Competitive Compensation

This is perhaps the easiest or at least the most familiar element in my retention *triad*. And it fits in well with Navy wide pay and compensation initiatives. Here are specific points to address:

- Nuclear officer incentive pay needs to keep pace, in some sense, with compensation trends in high technology labor markets. While we may never win a bidding war for talent

on money alone, we need at least to make a credible bid.

- Submarine pay should be indexed to inflation. It has remained fixed for 12 years and is losing its buying power.
- Junior officers should get sea pay as soon as they qualify in their warfare specialty. Why should they wait for 3 years? I've never been able to answer this question. Pay them for their expertise at sea when they demonstrate it.
- Navy medical and dental plans must continue to improve their service to the Sailor and his family. In the past, these benefits were clear selling points to an officer, particularly one with a growing family. Today, they are, as often as not, a source of frustration. If they are viewed as simply another kind of HMO, they will lose their retention appeal altogether.
- Retirement reform is a requirement. In particular, the rapid adoption of an attractive Thrift Saving Program can be a key selling point. Right now, with retirement vested only at the 20 year point, many junior officers feel considerable financial pressure to leave early in a Navy career to maximize their retirement options later on. A Thrift Savings Program can allay that pressure and provide an immediate retirement plan to every officer from the day he takes the oath of office as an Ensign.
- More and better graduate education opportunities. Continuing education is viewed as an absolute requirement for today's professional. We need to make room in the submarine officer career path for the master's degree, and we need to find ways to pay for it. The days of expecting a significant percentage of submarine officers to get their degree on their own time should end.

Technology to the Rescue

For years, the Submarine Force was at the cutting edge not only of Navy technology but world technology. The advent of the information age has changed all that. Any submariner who has tried to understand and employ the Submarine Force Mission Program Library (SFMPL) or make SNAP work for them will

understand this. Computer networks on submarines are merely adequate; Internet and SIPRnet connectivity is next to nonexistent; administrative and technical burdens are not sufficiently ameliorated by the productivity possibilities of information technology. Furthermore, many of the time and labor saving initiatives which have paid such dividends in improving Sailor quality of service have left junior officers with little relief in their workload, particularly their administrative workload. As a result, they're working as hard as ever with dysfunctional information technology. This must change throughout the ship. Here are some ideas:

- Work to automate as many reporting requirements as possible. Good progress has been made here in the supply world (Focused Logistics Training) and in the engineering field (Automated Quarterly Data Report, Automated Diesel Trend Analysis)—more can be done.
- More fully implement information technology in the propulsion plant. Classification issues prevent a full discussion here, but let me outline some thoughts. First of all, I'm most emphatically **not** talking about automating reactor or propulsion plant controls. We have the most reliable and safest reactor plants in the world due to appropriately conservative design and operating principles and highly trained operators. My ideas surround propulsion plant administration such as:
  - Automated, digital material history records
  - Use of automated 3M scheduling programs for reactor plant preventive maintenance
  - Use of PDAs (personal digital assistant) for logtaking, with the data displayed graphically to allow for easier trend analysis by watch officers
  - Implementation of CVN proven computerized tagout database programs for generating maintenance tagouts
- Improving submarine connectivity while in port must immediately improve. The rest of the Navy is moving to web based information dissemination systems that leave submarines in a black hole. As examples:

- The Submarine School has opened a SIPRnet web site to promulgate training material to the Force. I literally have no way of accessing this information aboard my ship, so this site is labor lost as far as I'm concerned.
- Most communications with the Bureau of Personnel are most easily effected through email or web sites. My junior officers have to go home to access these sites or communicate via email with their detailer.
- Many Navy regulations or instructions are best accessed over the web; again my junior officers have no means of easily getting this data while at work.

These initiatives can capture the productivity improvements driving our economic growth in the private sector; they can reduce junior officer workloads and they can reposition the Submarine Force again as a technologically advanced, challenging profession.

The Importance of Leadership

The final point which drives junior officer retention is the deckplate leadership they encounter on their first submarine—in particular, their first chief, their first department head and their first commanding officer.

- The Chief. An untapped retention resource. We don't usually think of chiefs as officer retention assets. But they are, especially today where the chiefs have a key role in the daily running of a submarine. They can teach the division officer how to lead and manage his troops and, in the process, find ways for the division officer to add value to the ship. This is key in today's Submarine Force, where the growing influence of the Chiefs' Quarters can lead division officers to feel that they're superfluous, except as watchstanders. In fact they're not —a good division officer can greatly aid his division in work planning, in running interference with the chain of command and outside agencies and in using his native intelligence to improve the chief's plan. But the chief is best placed to teach his division officer

how to do this and we should be explicit about this responsibility.

- The Department Head. Really, this section should be titled *The Engineer* for he is almost always the first department head for whom a junior officer works. His leadership style, his ability to spend time mentoring a junior officer and his enjoyment of his job all powerfully influence his division officers. While some junior officers look ahead to their ability to command a submarine someday, all junior officers look at their engineer and ask themselves:
  - Can I do his job?
  - Do I want to do his job?

Most can answer "yes" to the first question; many answer "no" to the second. What do we do to help the engineer in his junior officer retention role? In most cases, almost nothing. We load him up with repair work, expect him to manage a large department's personnel and material challenges, as well as train, mentor and retain impressionable junior officers. He needs more help now—he needs a nuclear, submarine-designated limited duty officer assistant. Such an officer in a submarine wardroom would bring instant relief to an engineer. He could take on many of the engineer's refit planning, Quality Assurance and material management issues based on his years of submarine maintenance experience. He could easily qualify fore and aft, adding a watchstander to the wardroom duty section rotation. He could add stability to the engineering division officer rotation. He could also be an invaluable mentor to the 1120 junior officers by providing them with ideas and suggestions on how to tackle their challenges from an independent and objective perspective, informed by years of submarine experience. This would be a great boon to a submarine engineer and a terrific opportunity for any limited duty officer, who could take his deckplate submarine repair experience and put it to good use on tenders, intermediate maintenance facilities and naval shipyards.

- The Commanding Officer. Clearly, the command climate and leadership techniques employed by a commanding officer influence all aspects of his command, including junior officer perception of a Navy career. A CO who enjoys his job, who

spends time training his junior officers and who demonstrates his concern in their career development and opportunities will obviously positively influence his junior officers. Furthermore, he must also strive to find unique and rewarding ways for his junior officers to add value and contribute to the command, without having to rely on their chiefs' technical expertise or having to vet everything through their department head. Here are some ideas —they are by no means an exhaustive list or even the best ideas, but they give some concrete examples of my point:

- Use junior officers for landings and underways. Driving the ship as OOD in these situations are great boosts for their professional confidence, as well as great fun. But they have to actually drive—not act as the CO parrot.
- JO shootouts. Shooting torpedoes in attack centers as an approach officer can be great fun, as well as the best way to demonstrate how much any CO must depend on his junior officers as members of the Fire Control Tracking Party.
- Imaginative use of collateral duties. Many collateral duties are tedious nuisances. But imaginative use of them can give junior officers a chance to own their own program, make hard decisions and contribute to the ship in a unique way. Some of these jobs could include Ship's Drill Coordinator, Intelligence Officer for submarines engaged in Intelligence, Surveillance and Reconnaissance missions or Ship's Coordinator for special events like INSURV inspections, post-availability Sea Trials or PCO operations. Again, my examples may not be the best, but clearly giving junior officers a unique and important task at which they can excel is a great way to convince them that submarining is a career worth pursuing

Conclusion

The Submarine Force's success in retaining great Sailors has not yet extended to junior officers—we have yet to fully *crack the code* in officer retention. I maintain there is no single silver bullet.

Rather, it's the entire package we present to the junior officer—from competitive compensation through improved working conditions through finding ways to share the sheer fun of driving a submarine—that will determine them to make submarining a career. As a Force, we need to explore ways to tackle all of these problems, include novel (some may say heretical) ways of organizing our wardrooms and operating our submarines. Increased resources will clearly be necessary. But it's a challenge that we can meet. As nukes, we're renowned for cold, clear analysis, identification of root causes and assignment of appropriate corrective action. Let's put those skills to use as we seek to man the Submarine Force entering its second century of contribution to the Navy and the nation.■

REUNIONS

USS BOSTON (CA-69/CAG-1/SSN 703) July 20-22, 2001 in Andover, MA. Contact: Arthur L. Hebert, P.O. Box 816, Amherst, NH 03031-0816; (603) 672-8722.

USS BUMPER (SS 333) ASSOCIATION August 22-26, 2001, Drury Inn & Suites Convention Center, St. Louis, MO 63102. Contact: Edward W. Stone, Secretary, 308 Merritt Avenue, Syracuse, NY 13207-2713; (315) 469-3825; e-mail: ews-w2eer@juno.com.

USCGC BURTON ISLAND (WAGB 283) June 20-24, 2001, Imperial Palace Hotel/Casino, Las Vegas, NV. Contact: Greg Reel, 2900 NE Park Lane, Kansas City, MO 64118-5928; (816) 454-7991; e-mail: gbreel@swbell.net.

A PERSPECTIVE ON SUBMARINE OFFICER RETENTION

by LT Bryan C. Still, USNR

Lieutenant Still's paper won The Naval Submarine League Essay Contest for Submarine Officers' Advanced Class 00070. He is currently Weapons Officer on USS KEY WEST (SSN 722).

The Summer 2000 issue of *Perspective* reported, "At press time, the [Submarine] DH Detailer will be finalizing the recall of an officer to be a Submarine DH." I was surprised that the story of my recall created something of a stir in the submarine community. I have spoken to several officers who expressed surprise that I would leave civilian life and return to active duty. This essay describes my rationale for leaving active duty, and for returning. By sharing my story, I hope to provide some insight into the issue of submarine officer retention, and perhaps sway other junior officers who are considering their options and wondering what to expect from life in the private sector.

Why I Left Active Duty

I served onboard USS SANTA FE (SSN 763) from 1992 to 1995, taking her through new construction, shakedown, and a change of homeport. I was next assigned to United States Strategic Command (STRATCOM), where I served as a watch officer. My first son was born shortly after my arrival at STRATCOM, an event that caused me to reconsider my priorities and reevaluate my career goals. I ultimately decided to leave active duty because I perceived that continued service was inconsistent with being the type of involved father that I wanted to be. I was also concerned with the force reductions proposed by the 1997 QDR, and the effect they would have on OPTEMPO and promotion opportunity. I submitted my resignation and left active duty in July 1998.

The Private Sector

I had little trouble finding a job in the private sector. I was fortunate to have several good job offers. I accepted a position as

a design engineer at a commercial nuclear plant near Omaha. A short while thereafter, I was offered a supervisory position at a nuclear plant in Massachusetts. I took the new job, relocating the family to New England. Then, in October 1999, I received a letter from Rear Admiral Hinkle, the Chief of Naval Personnel, encouraging me to consider returning to active duty. The letter was part of an effort by the Submarine Department Head Detailer to address the shortage of department heads by inviting officers who had recently resigned to return to active duty.

I initially gave the letter little thought, dispatching it to the bottom of my file drawer. I had just started a year-long training program to prepare me for the Nuclear Regulatory Commission's Senior Reactor Operator (SRO) license. The SRO license is required for individuals who supervise the operation of commercial nuclear plants. The responsibilities are similar to those of an Engineering Officer of the Watch (EOOW) on a nuclear powered submarine, but the plant is significantly larger, and thus more complicated.

I initially dismissed Rear Admiral Hinkle's letter because it seemed that nothing had changed that would affect my reasons for leaving active duty. Over the next few months, however, I began to take a critical look at my reasons, my personal and career situations, and my overall sense of satisfaction with my life. I realized that I was not totally satisfied with my civilian career—that I missed the challenge and excitement that submarining offers. I missed the feeling of being part of something bigger than myself, and the feeling that I was using my abilities to *make a difference*. I also realized that my dissatisfaction was affecting my personal relationships in subtle but significant ways. I was stressed out, short tempered, and generally unhappy.

In his book titled Principle-Centered Leadership, Stephen Covey describes the alternate "centers", such as family, work, friends, church, etc., on which people often focus their lives. Covey contends, "Focusing on alternative centers ...Weakens and

disorients us."[1] Instead, he advocates a so-called principle-centered approach.

> "When we center our lives on correct principles, we become more balanced, unified, organized, anchored, and rooted. We have a foundation for all activities, relationships, and decisions. We also have a sense of stewardship about everything in our lives."[2]

In retrospect, I realize that my decision to leave the Navy was actually a reaction to changing circumstances. It seems commonplace for work to rule the lives of most junior officers. The initial training and qualification process demands hard work and long hours from officers reporting to their first command. Our culture rewards early qualification, and young officers set high expectations for themselves. As a junior officer, I often felt consumed by work. My life was truly work-centered. When my son was born, I realized the importance and magnitude of my other responsibilities. I reacted by shifting my *center* from work to family. I perceived that submarine service was inconsistent with being an involved father and attentive husband. I later realized that Covey is correct—that a balanced, principle-centered approach provides security, wisdom, and power. A quote from Liddell Hart summarized my dilemma:

> "Man has two supreme loyalties—to country and to family...so long as their families are safe, they will defend their country, believing that by their sacrifice they are safeguarding their families also."

Hart's quote helped me realize that serving the Navy and serving my family were not exclusive or inconsistent goals. I evaluated my

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[1]Covey, Steven R. *Principle-Centered Leadership*. New York: Simon and Schuster, 1991, p. 21.

[2]Covey, p. 22.

values, centered myself on what I considered to be correct principles, and decided to return to active duty.

Observations and Lessons

Looking back on my experience, one concept seems particularly significant: *quality of service*. By that, I mean the belief that one's service makes a difference—the idea that the sense of accomplishment gained from a job well done can adequately compensate the personal sacrifices required by that job. Discussions of officer retention often focus on *quality of life* topics such as pay, medical benefits, or the inter-deployment training cycle. Quality of life plays a significant role in an officer's decision to leave or stay in the Navy, but the key to retention is quality of *service*. Men and women join the Navy for many different reasons—education, travel, experience, or the challenge. But the common factor is their desire to *serve*, to use their skills to *make a difference*, and contribute to something *bigger than themselves*.

While serving in the Naval Reserve, I attended the two-day Reserve Force Officer Leadership Course. The course included a topic on understanding people, during which we spent a significant amount of time discussing the differences between baby boomers (those born between 1946 and 1964) and generation-X (those born between 1965 and 1983). I had never considered myself to be part of generation-X, but I fit into that category chronologically and the generation-X profile described my values and beliefs reasonably well. In particular, I agreed that I wanted to be part of something *bigger than myself*, a value attributed to generation-X. I discussed the generation-X profile with other reserve lieutenants who had also recently left active duty and found agreement that we all had joined the Navy, in part, because we sought *something bigger*. We also agreed that we had each left active duty because the quality of our service no longer compensated for the personal sacrifice required. Simply stated, we no longer felt that we were *making a difference*.

Quality of service can prove difficult to define because, like quality of life, it means different things to different people. Junior officers often complain in general terms about inspections (such as

the Operational Reactor Safeguards Exam or the Tactical Readiness Evaluation) or administrative requirements. These are easy targets. No officer enjoys evaluations, or the inevitable corrective actions that follow. Likewise, no officer thrives on paperwork. Most junior officers have an anecdote about how they felt overwhelmed or dominated at some point by such requirements. In some cases, an officer loses the sense that his service matters, and he decides to leave the Navy. Other factors certainly enter such a decision, but my own experience indicates that quality of service is the single most important factor.

It may initially seem impossible to address this vague and hard-to-define concept of quality of service, but there is one simple approach we can use. In one of my civilian jobs, I had a boss who constantly emphasized what he simplistically called the *main thing*. He defined it as *the safe and efficient nuclear production of electricity*. In our field of endeavor, it is even simpler: the *main thing* is mission accomplishment. The mission can change—it may be strategic deterrence, strike, undersea warfare, or any of the other missions the submarine performs. In some cases, the mission may be to overhaul or refuel our ship. We may find some missions unappealing, but that does not diminish their importance.

We can improve our focus on mission accomplishment by asking a simple question: "How does this (activity, task, project) improve readiness or support mission accomplishment?" The question applies to virtually any activity onboard a submarine, or in the Submarine Force. It applies to all levels in the command structure, from junior officers to the type commander. As I prepare for my Department Head tour, I have committed myself to focusing on mission accomplishment, and encourage my peers to do the same. If we focus on mission accomplishment, we can help them fulfill their desire to *make a difference* and to be part of *something bigger*. Simply put, we can contribute to an overall high quality of service and positively impact the retention of officers that will soon relieve us.■

.... DON'T FORGET THE ARCTIC

by CAPT George B. Newton, USN(Ret.)
Chairman
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History

During the last forty-three years of the 20th century (1957-2000) the Arctic Ocean was the exclusive operating area of the military. Specifically, the operating area of the submarines of three nations: the United States, the Soviet Union/Russia and Great Britain.

It has been told many times how the submarine USS NAUTILUS made its historic transpolar Arctic voyage from the Pacific to the Atlantic in 1958, following an aborted attempt under the ice in the summer of 1957, which ended when the main gyrocompass failed. During the 1958 trip, the actual time NAUTILUS spent under sea ice was relatively short (4 days) when compared to the later Arctic Ocean deployments by submarines. However its impact was great. First of all, it clearly demonstrated to the world the fine attributes of nuclear propulsion and the submarine: speed, endurance and freedom from the outside atmosphere. Secondly, the trip was a tacit declaration that the Arctic Ocean was truly an international body of water, not a lake belonging to the Soviet Union, as that country had implied in various international discussions. Lastly, the NAUTILUS voyage, made public soon after its completion, provided the U.S. (and the rest of the world) with convincing evidence that the nation had the necessary skills and technological acumen to conduct a bold and unique exploration successfully. It was a dramatic event at the leading edge of research—one that generated great national pride and confidence in our military capability.

Following the NAUTILUS voyage and over the remainder of the century, the United States Navy made repeated research deployments to the Arctic. These deployments, sometimes supported by ice camps, icebreakers and aircraft, were planned to improve our understanding of the unique ocean environment and to develop submarine operations, military tactics, and sensor systems that were

effective in the under-ice domain. In the early years the primary research focus was very basic: to define the performance limits of the submarine platform itself, in and under sea ice.

In 1962, a November Class SSN surfaced at the North Pole, evidence that the Soviet Union intended to be a player in the Arctic. Nine years later the United Kingdom Royal Navy operated in the Arctic Ocean under the ice when HMS DREADNOUGHT deployed to the central Arctic basin.

It seemed that during the Cold War the Arctic Ocean would always be an area of potential confrontation, because the U.S. and the Soviet Union were separated by distances in the Arctic that were easily within the capability of modern weapons. In the Bering Strait individuals on Little Diomede Island (part of the United States) and Big Diomede (part of the Soviet Union) literally faced at one another across the International Date Line. But because of the forbidding nature of the environment nothing happened. (Cold, long periods of darkness, rugged inpenetrable ice, and remoteness were inhibiting). The Arctic Ocean was little more than a very cold *potential hot spot*. Then in 1989 the international political environment in existence for over 40 years underwent radical alteration.

A Dramatic Change

The Soviet Union collapsed and became the Russian Federation. The new nation inherited a Navy in rapid decline—more from decay than from planned force reduction. Beset with low pay (or no pay) for its officers and men; undermined by an inability to fund proper maintenance for its remaining active ships; and faced with a huge number of abandoned and deteriorating vessels, the Russian Navy is but a shadow of its former self. Russia's dominating geographic presence is no longer supported by a strong navy.

With the Cold War at an end and the Russian Navy in essential disarray, Congress extracted the peace dividend from the military. The Submarine Force did not escape the dramatic reduction in size mandated by Congress. As a result, we in the United States can forget the Arctic. Right? No need to worry about that remote, limiting and hazardous ocean (about which we know very little). No strategic importance. Let us concentrate on what our Navy can

do in the warmer climates and in the shallow littoral areas.

Wrong! This country cannot ignore the Arctic Ocean. A number of events have come to pass in the past three years that collectively create a need for the United States to pay serious attention to a growing strategic importance of the Arctic, and not forget it. The events come from four factors: (1) the aforementioned, recent force level reductions actions forced on our Navy by the Congress; (2) the continued presence of a hostile maritime threat under the Arctic Ocean sea ice; (3) new and dramatic environmental changes recently observed in the area; and, (4) because of these changes, the emerging importance of the exploitable geography of the Arctic. In fact, given the recent trend, it appears the Arctic will play a bigger role in our lives than ever before—environmentally, commercially, militarily and politically. The growing relevance of the Arctic is subtly developing.

This unfolding chain of events had its start in the early months of the Clinton Administration. The Congress and the White House, attempting to extract the peace dividend while at the same time trying to balance the budget, forced dramatic reductions on the military. The *600 Ship Navy*, originally defined by President Reagan, never got much above 550 ships and submarines. With the end of our confrontation with the Eastern Bloc, Navy force levels were pushed into precipitous decline. In 1993 the Bottom Up Review (BUR) was presented to Congress by then-Defense Secretary Aspin. Battle Force combatants, which numbered 546 in 1990, were programmed to decline ultimately to 346 in the BUR.

Four years later, Secretary of Defense Cohen prepared and delivered to Congress the Quadrennial Defense Review (QDR). The QDR projected further reductions in Navy force levels to 298 battle force capable combatants. Essentially the Navy was to be cut to one-half its 1990 size in a decade.

Attack submarines did not escape the cuts. After achieving an Attack Submarine Force level zenith of about 100 in 1990, the QDR directed a force level 50 SSNs. Quite naturally, the first submarines in the queue to be retired were the oldest: the SSN 593 and 637 classes and the first flight of the SSN 688 class. Of critical importance to the country's capability for Arctic operations was the

SSN 637 (Sturgeon) class. These SSNs were designed to operate under sea ice safely, and to penetrate up to three feet of sea ice. They repeatedly demonstrated that capability by conducting numerous exercise and research deployments to the Arctic Ocean over the life of the class, 1967-2000. (The total number of Navy ice exercises (ICEXs) and science ice exercises (SCICEXs) by all classes is well over 90.) The Arctic Submarine Laboratory, led for many years by Dr. Waldo K. Lyon, planned and provided technical direction for each of these deployments during which the Arctic performance of the SSN 637 class was repeatedly evaluated and constantly improved. Supporting Arctic equipment and tactics were also steadily advanced. The capability of the 637s to operate effectively in the Arctic, even in the early deployments, was clearly robust. To reinforce our capability during the '60s and the early '70s, the SSN 578 (Skate) class were also regular Arctic deployers.

The USS Nautilus and the Skate class were retired long ago. And as of January 1, 2001, almost all of the Sturgeon class was gone as well. What Arctic warfighting capability is our country left with? It will be very limited. It effectively resides in two SSNs of the 688I class, USS SAN JUAN and USS PASADENA, plus the two commissioned ships of the SSN 21 Class, USS SEAWOLF and USS CONNECTICUT. That's it. And unfortunately, as the dynamics of global politics have evolved, there has been very little time to *break in* either the SSN 688I or SSN 21 classes in the operational intricacies and environmental effects of the Arctic. There have been very few opportunities to evaluate the performance of the under ice sonars on each class, to refine shipboard Arctic procedures, and to identify requirements needed to operate those ships under sea ice throughout the Arctic. Nor has there been a proper opportunity to develop an understanding of just how the classes handle in the variable, unpredictable and often confined Arctic. The newer SSNs have been deployed quite appropriately to world hot spots where their VLS capability and other attributes could be better employed.

One asks, "Why do we need a credible submarine capability in the Arctic?".... At present and for the foreseeable future the submarine is our country's only Arctic-capable fighting force. Lacking a robust, Arctic-capable Submarine Force, this country

cedes the Arctic Ocean to any nation that decides to take it. More on this critical issue later.

At this point it is appropriate to broaden the discussion to cover several non-military/non-naval subjects that will be factors in defining national security and strategy in the Arctic in years ahead.

Significant Environmental Changes in the Arctic

During the decade of the '90s, a significant quantity of environmental data was collected in the Arctic Ocean. This was due, in large part, to the unique and recurring support from the Submarine Force through the six dedicated science ice exercise (SCICEX) cruises, conducted by SSN 637 class platforms with members of the science community aboard.

Large, unprecedented changes were detected in the ocean's parameters and its circulation. Most notably, the first SCICEX cruise, conducted aboard USS PARGO in 1993, confirmed the significant advance of warm Atlantic Ocean water into the western Arctic basin, reaching westward beyond the Lomonsov Ridge which bisects the Arctic from Greenland to the Siberian Islands. Since the 1950s the ridge had been identified as the location of the meeting point (or front) for the waters of the Atlantic and Pacific Oceans. The front had also rotated counterclockwise by nearly 40 degrees. This frontal movement was not the only change noted, however. The core temperature of the Atlantic Ocean water in the Arctic was observed to have warmed by one to one and one-half degrees Celsius (1-1.5°C/=1.5-2.3°F) during '90s. Clearly the Arctic Ocean was undergoing environmental change.

Other changes were detected. It was the direct result of data on sea ice draft collected aboard the six SCICEX cruises and comparing it to similar historical data, that enabled another researcher to detect the environment's reaction to the ocean warming. The average thickness of sea ice in the western Arctic Ocean had decreased by 40 percent since the 1950s with most of it occurring in the '90s. Concurrent satellite imagery also revealed that the real extent of the ice had decreased by 5 percent. A similar reduction in sea ice has been recently detected in the eastern Arctic Ocean in

the area north of Svalbard and Franz Josef Land.

The downstream impacts of such a reduction in the mass of Arctic sea ice are many. For the submarine, less sea ice means it might be easier to gain access to the surface should it be required. A 40 percent decrease in one year's growth of ice would statistically mean the submarine would have a better chance to find a surfacable feature and to conduct a successful surfacing. That in turn would imply a submarine with less built-in sea ice breakthrough capability could operate effectively in the Arctic for the next few decades.

These changes will also have commercial impact. Stated briefly, the Arctic Ocean with less ice cover and more open water, will allow routine merchant marine commerce to move more freely east and west, particularly along the coasts of Russia and North America. However, logic says that in the near term some ice strengthening of surface ships will be necessary.

The fact that 9 out of every 10 people in the world live on the continents that border the Arctic Ocean naturally concentrates ocean commerce in the Northern Hemisphere. For western Pacific nations trading with northern Europe countries, use of Northern Sea Route (NSR) along the Russian Arctic coast reduces the time and distance between the two areas by over 4,000 nautical miles (nm) when compared to the Suez or Panama Canal routes. This saving is roughly a 40 percent reduction. At 12 knots the transit time will be reduced by almost two weeks. Similar savings would be realized between the U.S. east coast ports and Korea (for example) through passages in the Canadian Archipelago. A navigable Arctic Ocean is like having a new inter-ocean canal constructed at no cost.

Other areas of exploitable ocean commerce are in the transportation of Arctic-based coal, oil, natural gas and other resources that were previously not accessible or not transportable via the ocean. Northwest Alaska contains proven reserves of low sulfur coal that exceed all other reserves in the United States. Russian natural gas reserves in the Arctic exceed the total of all other known gas reserves in the world. Oil in the Arctic is a proven asset for the United States, Canada and Russia. With less ice these resources become easier to recover and less expensive to get to market. Less ice also means the Arctic coastal shipping season, which now runs

from mid-July to early September (and has so for years) will gradually lengthen.

Political Ramifications

For nearly four centuries explorers, shipping executives, merchants, and politicians have dreamed of northern trade routes, across the top of the globe. It was the Far East that was notably attractive to the Europeans. (It is essentially the same now.) The *Arctic shortcut* was the subject of many voyages, starting as early as the 16th century.

Today there still remain great environmental challenges to using either of the two coastal routes. The Northwest Passage is still extremely difficult to navigate at any time of the year. It is usually impassible at the western end, McClure Strait. It wasn't until 1946 that the first successful west-to-east voyage was made through the Canadian archipelago. Fewer than 50 surface ships in history have completed the full passage in either direction. The SS Manhattan, configured with an icebreaker bow, was thwarted in 1969 in its attempt to traverse the wide McClure Strait and demonstrate a viable commercial route to get Alaskan North Slope oil to the eastern market. It eventually succeeded in reaching the Beaufort Sea by taking the narrow Prince of Wales Strait east and south of Banks Island, a route not considered acceptable because it was/is so restricted and narrow. There are political and sovereignty issues in the archipelago as well.

Canada claims total sovereignty over all passages within the Canadian Archipelago, including the Northwest Passage. The United States conversely holds that the Northwest Passage is an international strait. However, the two nations, as neighbors, do have an Agreement on Arctic Cooperation signed in 1988 which addresses coordinating research in the Arctic marine environment during icebreaker voyages off Arctic coasts of the two countries. Important to all this is that there exists a dialogue on the matter.

On the other side of the Arctic Ocean, the Russians have long husbanded the Northern Sea Route (NSR), considering it their domain and under their tight control, whether ships are inside

Russian territorial waters or not. While many commercial voyages have been completed over small portions of the NSR for nearly 50 years, it was only in 1999 that the first foreign flag (non-Russian) commercial ship completed a transit of the entire NSR from east to west. Use of any territorial portion of the NSR mandates that the ship be accompanied by a Russian ice pilot and at least one icebreaker under an expensive fee system. At present the cost and the short shipping season inhibit the NSR from being a competitive trade route when compared to other routes. A warmer Arctic will increase political pressure in both Canada and Russia to revise or at least reevaluate their current nationalistic and monetary concepts that now prevent greater routine use of the Arctic shortcut.

Another emerging international factor to consider in the Arctic is the right of coastal states, under Article 76 of the Law of the Sea, to extend their exclusive economic zones (EEZ) beyond the current 200 nm limit, if their continental shelf similarly extends beyond the 200 nm limit. Such an extension gives these coastal nations sole rights to resources on or under the ocean bottom beyond the 200 nm EEZ. The Arctic Ocean contains 25 percent of all the continental shelf area in the world, even though its total surface area is but 3.7 percent of the world's oceans. Five countries ring the Arctic. Their continental shelf areas hold unknown quantities of fossil fuel resources, but experts believe them to be significant. Thus, the Arctic rim countries will be forced to negotiate with their neighbors and the U.N. Commission on the Law of the Sea to define acceptable limits of each claim. Of interest in this regard is a draft Russian claim for their outer continental shelf extension. It was first made public in June 2000. The draft claim shows one boundary point at the North Pole! Not surprisingly, Russia is expected to be the first to submit a formal claim in the Arctic Ocean.

Taken in sum, these issues have created growing international political interest. To reinforce political interest, as articulated many years ago by U.S. Naval sea power strategist, Alfred Thayer Mahan, a nation must have a military presence in the area.

Military Issues in the Arctic Ocean

Even though ice strengthened commercial carriers may be confidently using either of the Arctic Ocean trade routes within the next couple of decades, it is improbable that the U.S. Navy could design and build surface warships or aircraft carriers possessing the necessary attributes to permit them to operate and be combat ready in the extreme cold weather (and drifting ice) of the Arctic. Steaming steadily on a transit between two ports is very much different from protecting (or interdicting) a sea lane or projecting sea power into the ocean. Inevitably, however, the expansion of commerce in the Arctic will mean another ocean for nations to protect.

One might make the point that if the Arctic is exploitable for commercial shipping, then existing surface warships could establish proper levels of presence and sea control. Not likely. For even though the climatologists talk glibly of an ice-free Arctic Ocean in the future, it will be a very long time before the ocean is ice-free all year round. The Navy has taken no consideration for real Arctic operations into the design of its ships. Low temperatures, superstructure icing and floating ice are genuine hazards to current and projected surface combatants and aircraft carriers. Dramatic environmental changes in the Arctic will not occur so quickly that the Arctic Ocean will be anything but the exclusive province of nuclear submarines for the next several decades.

In fact a recent (November 2000) issue of Lloyd's List, the house publication of the British insurer, Lloyd's of London, stated that the Russian Navy had the mission to protect the NSR. The article added that the recent loss of the submarine KURSK occurred in an exercise demonstrating that capability.

In summary—things have changed. The United States now has fewer submarines, and those the nation has are of somewhat lesser demonstrated Arctic capability than their SSN 637 class predecessors. And yet there are reasons for this situation. The demands placed upon submarines by the unified commanders-in-chief have been and continue to be high. These demands have substantially reduced opportunities for Arctic operations by the *next* class of

SSNs.

There is good news: the Arctic IS warming. That fact mitigates somewhat the reduced numbers and capability of our submarines. However, there is also bad news. These environmental changes are creating eye-opening interest on the part of other nations. If that interest matures, as would seem to be inevitable, there is a genuine national security need that dictates we as a nation must maintain a capable presence in the Arctic. Surface ships cannot do it. Aircraft carriers cannot do it. Submarines are our only Arctic-capable force...as they have been since 1957. But it will not be effective without continuing advance preparation. We cannot afford to forget the Arctic Ocean.■

MORE REUNIONS

USS DIABLO (SS 479) October 11-13, 2001 in Groton, CT. Contact: Tom Lambertson, P.O. Box 86, Port Aransas, TX 78373; (361) 749-4598; e-mail: tlambertson@centurytel.net.

USS POMPON (SS 267) August 22-26, 2001, in conjunction with the National Convention of the U.S. Submarine Veterans of WWII in St. Louis, MO. Contact: H. Henderson, 1670 Magnolia Avenue, Clovis, CA 93611-5963; (559) 322-1360, fax (559) 322-0351; e-mail: hhen@pacbell.net.

USS SARGO (SSN 583) September 30-October 3, 2001. Contact: Frank Monroe, e-mail: munrofh-@telebyte.net or John Nicholson, email: jhpani-cholson@earthlink.net.

DICK LANING AND SEAWOLF

by CAPT Willis A. Matson, USN(Ret.)

Editor's Note: See also Dog Fighting Submarines by Captain Dick Laning in the April 2000 Submarine Centennial Issue of ***THE SUBMARINE REVIEW*** *and I Remember Dick Laning by Captain Chuck Carlisle in the October 2000 issue.*

I reported to SEAWOLF from its West Milton prototype on the day she was commissioned, March 30, 1957. The next 21 months were an opportunity to observe the most extraordinary Commanding Officer of my career, the late Dick Laning.

I had served on a destroyer in the Korean War, a wooden-hulled minesweeper and a Guppy II diesel submarine and had known five commanding officers but none had prepared me for someone like Dick.

My first underway submerged as OOD on SEAWOLF is illustrative. It was a 2000-2400 watch and I was still familiarizing myself with where the phones and indicators were under red lighting conditions. We were operating as opposition to a carrier and her destroyer screen. COMEX was given and I so reported to the Captain. He said "Proceed". It dawned on me that I was in charge and that I had better start thinking like a commander. The next few hours were a blur of activity. Dick Laning monitored from his stateroom and never gave me any instructions.

As I got to know him better I realized that a great deal of his operational philosophy came from his pre World War II experience. He was extremely frustrated by the emphasis on Battle Efficiency Competition that had the effect of restricting submarine diesel engines to four hours at full power per year and conducting torpedo firings under the most favorable conditions. He vowed as Commanding Officer of our second nuclear submarine that he would operate SEAWOLF at her limits to prepare for war.

A few days after my operational baptism, SEAWOLF embarked a large number of observers and went to sea to demonstrate her capability against a variety of our newest destroyers and frigates. Robert (Yogi) Kaufman, our Executive Officer, was in charge of a

most realistic demonstration of our ability to shoot torpedoes accurately and often. Dick's function was to describe what Yogi was doing—almost as a disinterested observer. It was an extraordinary performance that reflected on the talented officers and men assigned to SEAWOLF, as well as the many hours spent at the Attack Teacher at Submarine School.

Dick lived and breathed submarines and dreamed of the future of submarine warfare. No meal with him in the wardroom ever lacked for intellectual stimulation and challenge. How would we fight the Russians and the sheer number of ships they would build in the future? Should we have a fleet of 50-100 small SSNs in a barrier in the GIUK gap? Could we deploy remotely-controlled airborne weapons from submarines? All this in the mid '50s.

Dick had an infectious exuberant personality and would quickly make a lasting impression on people he met. A group of high level U.S. Air Force personnel toured SEAWOLF to become exposed to our technology. The Air Force was seriously embarked on building a nuclear powered airplane and was evaluating a sodium cooled engine. Dick managed to get a reciprocal invitation to visit Westover Air Force Base to be given a tour of SAC's B-52 bombers. Shortly thereafter we went and, in short order, became convinced that our bombers could penetrate the Soviet borders and were a credible deterrent.

Besides being a visionary, Dick was frequently a maverick. Once he received a request for contributions from all hands for the construction of the Navy-Marine Corps football stadium at Annapolis. He responded that he thought it inappropriate to solicit Sailors and a far better cause would be a fund drive for a new submarine torpedo! In another arena he rejected an NR inspection team as not having the right technical background to examine the SEAWOLF engineers. On a more personal note, as the eighth senior officer on board, I was surprised to be assigned as Navigator. Subsequently Dick was questioned at an Administrative Inspection for his noncompliance with Submarine Force Regulations which stipulated that the Navigator should be the Executive or Third Officer. His reply was characteristic. "If you wish to assume responsibility as Commanding Officer, then you can name the Navigator; otherwise I will select whomever I wish."

The most vivid memory I have of my being Navigator was coming back from a month long operation only to surface south of Long Island in a dense fog. It was a Sunday afternoon in May and our ETA was in late afternoon. Dick did not like to miss ETAs. After establishing a firm position by radar and soundings, Dick ordered full speed. The next two hours seemed like a lifetime. The OOD could barely see the bow but could hear the buoys, which I would alert him to as we passed by. We never saw Race Rock but finally saw Southwest Ledge at about 100 yards when we slowed to 10 knots. Dick listened to all communications from his stateroom and never interfered. My greatest concern was not position but happening upon a sailboat not detectable on radar. Fortunately there was no encounter and Dick had made his point: using all our sensors we could prevail.

Dick had the honor of embarking President Eisenhower in SEAWOLF at Newport, Rhode Island in September 1957. We were told the President had only an hour for the cruise but would like to submerge. Dick said "Fine, we could do that". We were rigged for dive when he came aboard and we quickly took him to periscope depth as soon as we had the minimum depth to submerge. It turned out that SEAWOLF was not his first submarine trip. He had embarked on a gasoline engine powered submarine when he had been stationed in the Canal Zone early in his career. He said he felt a lot safer on SEAWOLF. The President's warm personality and ready smile made it clear how he managed to get disparate allies to work together to win the war.

Later in December 1957 the ship became involved in NBC's *Wide Wide World* TV program which appeared live on Sunday afternoon. The program was ambitious, highly rated, and generally covered three stories at different sites throughout the U.S. With Dick's enthusiastic support we were outfitted with a TV transmitter on one of our masts, embarked an NBC production unit, lots of equipment, and several cameramen. The theme of our segment was to demonstrate a dive on live TV and to transmit interviews with Dick Laning and Dennis Wilkinson, the CO of NAUTILUS. I was assigned as ship's liaison and sort of Assistant Director.

SEAWOLF proceeded to a position off Provincetown, Massa-

chusetts on Cape Cod where we could safely submerge within a mile or so of land. TV transmission distance was limited, forcing us to be very constrained operationally. 1957 was well before the days of hand held cameras so we had four large dolly-mounted cameras. We located them in the Conning Tower, Control Room, Crew's Mess, and Torpedo Room. A script was produced and we ran through several rehearsals. A final dress rehearsal was fed to New York via Provincetown and Boston. All was well until about a half hour before the program was to begin, when one of the cameras failed. We had to rewrite the script for three cameras. There was not time left to practice so the producer in New York had to decide whether to go with the video of the dress rehearsal or hope the live feed would go well. Everyone decided to go live and NBC got a fine segment. The young TV reporter who interviewed Dick and Dennis was the late John Chancellor who eventually became NBC's anchorman. Years later I met him and asked if he remembered his experience. He said he would never forget his *bunk* in the Torpedo Room and the thrill of being on SEAWOLF.

The summer of 1958 was an extraordinary time for nuclear submarines. Bill Anderson in NAUTILUS made the trans-polar voyage and Jim Calvert in SKATE surfaced at the pole. SEAWOLF's contribution was the 60 day continuous submergence during the first nuclear submarine special operations. In 1958 we carried enough oxygen for about 21 days.

In the early days of nuclear attack submarines we carried a doctor, Jack Ebersole, and he and Dick came up with a plan as to what to do when we used up all our oxygen supply. We had the early models of a CO-H_2 burner and a CO_2 scrubber but no oxygen generator capability. Dick's research led to coal miner's use of oxygen candles in times of emergency. He was able to determine that the use of one candle per hour would support the oxygen requirements of 100 men. Somehow he procured several hundred candles and distributed them throughout the ship.

Everything went well on our long submergence. The candles, scrubber, and burner worked; but, at about the 40th day, our trash disposal unit (TDU) jammed. We were unable to get the outer door shut. This casualty gave us obvious operational limitations, as well as an ever increasing amount of trash and garbage that had to be

frozen or stored. After several days of futile efforts to solve the problem, Dick proposed a bold plan—pressurize the Operations Compartment at periscope depth, equalize with sea pressure, open the inner TDU door, clear the outer door and restore the TDU to operation. Sounds simple, but it wasn't—it took careful planning and meticulous execution.

Detailed Reactor Plant Manual-type procedures were prepared for all compartments and participants. Everything that could be effected by increased pressure had to be removed from the Operations Compartment, e.g., canned goods, cathode ray tubes, etc. When Dick was convinced that the plan was sound, we waited for a calm day without too much swell. Obviously depth control was of paramount importance or a catastrophe could occur with sea water pouring into a compartment that contained the battery.

In a few days conditions were favorable. We were at Battle Stations, it was daylight, and the operation commenced. When the Operations Compartment was pressurized and equalized to sea pressure, the inner TDU door was opened and a cleaning brush was found jamming the outer door. The brush was removed but before shutting the outer door, we jettisoned all the built up trash and garbage to sea. It certainly went quickly with both doors open. Observers at the TDU stared in fascination at the rise and fall of seawater in the tube. There was a slight swell but our planesmen's control had been superb.

With the TDU operational we were in the final days of our 60 day submerged goal but we had used up all our oxygen. Dick and Jack's plan went into effect—to slowly bleed high pressure air from the ballast tanks into the ship to raise the partial pressure so that enough oxygen to sustain life was provided. The pressure was eventually raised to 40 inches of mercury. As the real percentage of oxygen diminished, matches and lighters would not sustain combustion, so our intrepid smokers designed the equivalent of automobile lighters to ignite their cigarettes.

As we were headed home, we lost the use of one of our turbine generators due to the electrical failure of a circulating sea water pump motor. This casualty had the effect of preventing the ship from making full speed. Once again Dick chartered a plan to

provide another source of seawater cooling. A modification was designed using a 2-1/2 inch fire hose. It was implemented, the rig subjected to test depth pressure, and enabled the ship to operate at full speed submerged.

When SEAWOLF surfaced after this historic voyage, all hands were at Battle Stations to insure everyone could be observed as we equalized with atmospheric pressure and quickly ventilated. Momentarily oxygen content was very low but there were no ill effects. Some weeks later, upon review by the Bureau of Medicine and Surgery, they said "Don't do that again". Fortunately oxygen generators were developed, became reliable, and long unlimited submergence became routine.

Dick operated SEAWOLF during those 60 submerged days as if we were on wartime patrol. His planning, resourcefulness, and imagination enabled us to overcome adversities and accomplish our mission goals.

Admiral Rickover's decision to abandon the sodium cooled nuclear reactor was made when I was still at the prototype and was based on two elements. The pressurized water design was successful and was easier to build and operate. The sodium cooled reactor had inherently greater risk stemming from both nuclear physics and chemistry. As high school chemistry students know, sodium and water are an explosive mixture and difficult to keep separated in a naval steam generator. Also, sodium, as it passes through the reactor, becomes highly radioactive and decays at a half life of 15 hours following shutdown. Pressurized water also becomes highly radioactive but decays with a half life of about seven seconds. Therefore, any sort of casualty requiring access to the reactor compartment is easier and safer to do on the pressurized plant. No one knew how well the plant would operate, but it turned out the reactor plant was trouble free and no access was required during her entire commissioned service. Nevertheless, a decision was made to convert SEAWOLF to a NAUTILUS-type pressurized water plant starting in December 1958.

After our return from the 60 day submergence, Dick went to Washington to brief the CNO and others on our trip. At the time, we had just a handful of nuclear submarines and Dick pointed out the reliability of the ship and that fuel for SEAWOLF existed that

could extend her operation for another year. A short time later, the CNO made the request to extend operations to Naval Reactors. The response was "the plan was not feasible as the fuel had been reprocessed!" Dick's command tour came to end shortly thereafter, and he went on to use his ingenuity and skill in the Polaris program commanding PROTEUS.

I remained with SEAWOLF and became the Engineer Officer for her conversion. My encounters with Dick in the ensuing years were infrequent. Whenever or wherever it was—a technical conference or at Submarine League meetings—he was always a presence, an innovator, a questioner, a man always ahead of his time.

I last saw him at a wonderful SEAWOLF reunion in San Diego in August 1997 that attracted officers and men from her 30 years of service. Dick was forced to carry a small oxygen bottle with him to cope with his deteriorating health. He dismissed this discomfort as a mere inconvenience and turned his attention to the future and his next project, remaining as ever; indomitable, enthusiastic, and courageous. Dick once told me, "Never run your submarine the way I did; you won't have the talent". Fortunately for once he was wrong. I was assigned as the first Commanding Officer of NARWHAL and was entrusted with a very talented crew. I was fortunate to have been given the example of such an outstanding leader and friend. We will miss him—truly a man for all seasons.■

NAVINT NEWS

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From NAVINT issue 1 December 2000.

Swedish Submarine *Wins* Atlantic Exercises

Last month, the Royal Swedish Navy (RSwN) Gotland class submarine HALLAND swept the board in exercises with Spanish and French naval units in the Atlantic, according to the submarine's builder, Kockums. During a submarine hunting exercise, in a *duel* with Spanish naval units, HSwMS HALLAND recorded a victory, Kockums says. In a similar duel against an unspecified nuclear powered attack submarine (SSN) of the French Navy, HALLAND was also said to have won. The exercises were carried out in the Atlantic and therefore qualify as *blue water* operations, the company said, clearly making a point about the capabilities of the Baltic-based and relatively small Swedish submarines.

HALLAND was sent to the Mediterranean on 16 September to take part in NATO exercises, after a major refit at Kockums, which included modifications to enable her to participate in international peacekeeping operations. The conversion of HALLAND was said to be highly significant to the future of Sweden's submarine force, which has thereby enhanced its reputation. Her outstanding performance during these exercises is claimed to have made a considerable impression on naval observers. The U.S. Navy has now decided to despatch USS HOUSTON (SSN 713), A Los Angeles class SSN, to participate in a hunter-killer exercise against HALLAND, whose commanding officer is Gunnar Wieslander.

While the triumphalism of the Kockums statement about these exercises may be discounted by some commentators, the fact that such a statement was made suggests that the exercise success was regarded as significant enough to make a press statement. It will also go some way to restore the damaged reputation of Swedish submarine designs in Australia, seriously (if unfairly) harmed by

the tribulations of the Royal Australian Navy's Collins class.

News in Brief

The UK Ministry of Defence (MoD) is to canvass the views of the public to identify the best options for future land-storage of redundant submarine reactor cores, Defence Minister Lewis Moonie announced on 15 November. An MoD study concluded earlier this year that the current practice of storing submarines afloat at Devonport and Rosyth remains safe, but the lack of alternative sites means that storing the cores on land is the best long term option.

South Korea Picks Type 214 SSK

The Republic of [South] Korea Navy (RoKN) has opted for the Howaldtswerke-Deutsch Werft (HDW) Type 214 diesel electric patrol submarine (SSK) for its next order of three SSKs under the KSS II project, to be delivered before the end of 2009. A Defence Ministry spokesman said the German Submarine Consortium (GSC) design was superior to the *Scorpène* design from France's DCN International. "Our evaluation showed that the German model excelled (sic) its French rival in terms of price and logistics support," he said.

HDW has already been involved in South Korea's submarine construction programme. Daewoo Heavy Industries has already built eight of HDW's Type 209 design under licence. The Type 214 will have an increased diving depth of over 400m because of improvements in the pressure hull materials. Performance of the Air Independent Propulsion (AIP) system has been increased, with two Siemens PEM fuel cells which produce 120kW per module and will give the SSK an underwater endurance of two weeks. The hull shape has been optimised for hydrodynamic *stealth* and a low noise propeller combines to decrease the boat's acoustic signature.

The Integrated Sensor Underwater System (ISUS) from STN Atlas Elektronik integrates all sensors, command and control functions on the boat. The sensor suite of the Type 214 consists of

the sonar systems, an attack periscope and an optronic mast. The SSK's electronic support measures (ESM) system and Global Positioning System (GPS) sensors are also installed on the optronic mast. The RoK Ministry of Defence was to select a local builder by the end of November to team with HDW to build these boats.

Plans to buy the Russian Project 636 Improved Kilo design were dropped some time ago because the Rubin Bureau could not offer a proven AIP system. The Russian proposal had political backing because it was seen as a way of offsetting Russia's huge indebtedness to the RoK, but there is growing disillusionment about the Kilo design from existing operators, something of which the RoKN technical specialists could hardly remain in ignorance.

From NAVINT issue 15 January 2001.

RAN's Fleet Base West Strengthened by Updated Collins Class SSKs

Fremantle, WA — The Royal Australian Navy's (RAN) submarine HMS COLLINS docked at Fleet Base West on 8 December, following a record deployment with her sister HMAS WALLER. The two newly upgraded submarines left HMAS STIRLING at the Garden Island base in Fremantle on 9 June on a marathon 183 day deployment to Hawaii and Alaska. This voyage was the equivalent of a voyage around the world, both east-west and north-south.

During the deployment COLLINS became the first RAN submarine to visit Alaska, where she carried out acoustic ranging trials over the U.S. Navy's Behm Canal South East Alaskan Facility Range. She and WALLER were the first pair of RAN submarines to operate from Pearl Harbor in 15 years. During these operations COLLINS launched a live UGM-84C Sub Harpoon on the Barking Sands Missile Range off Kauai on 25 July, hitting the target-ship at long range. The missile firing was part of the Potential Commanding Officers Course, involving COLLINS and WALLER and USS CHICAGO (SSN 721) and USS SANTA FE (SSN 763), as well as various U.S. Navy submarines and Australian and U.S. maritime patrol aircraft.

Although Garden Island has been an RAN base since the First

World War, the modern base began as a feasibility study in 1966-67. In November 1968 the Federal Government announced the intention to develop the existing facilities into a base capable of supporting surface ship and submarine operations in the Indian Ocean. Despite some delays the new base opened in 1975, and the firstshiip , the destroyer HMAS HOBART, docked on 11 August that year. The first submarine, HMAS OXLEY, docked ten days later, and she later became the first submarine permanently based at Garden Island. HMAS STIRLING was formally commissioned in July 1978, and since then has seen a steady increase in the number of ships based there. Now known as Fleet Base West, the facility is now the Headquarters of the Australian Submarine Squadron, and will eventually be the home port for all six Collins class submarines.

A major improvement to submarine support was the construction of a Submarine Escape Training Facility, the only one in the Southern Hemisphere. This includes an escape tower and a 10 man decompression chamber, as well as the Submarine Squadron Headquarters, and the new Diamantina Pier.

Much of this activity has been generated by the Government's *Two Ocean Navy* policy, which was endorsed by the Chiefs of Staff in 1986. Australia is a huge continent with widely separated centres of population, and the original policy of basing the main strength of the RAN at Sydney was unsustainable.

End of an Era for RAN's Submarines

Friday, 15 December was a sad day in the history of the Royal Australian Navy (RAN), with the decommissioning of the RAN's last Oberon type submarine, HMAS OTAMA.

The Maritime Commander Australia, Rear Admiral Geoff Smith, AM RAN, hosted the decommissioning ceremony on the Diamantina Pier at HMAS STIRLING. The guest of honour was the navy's senior submariner, Rear Admiral Peter Briggs, AO CSC RAN, who is retiring from the Navy after a career spanning 39 years. Other guests included the Chief of Navy, Vice Admiral David Shackleton, AO RAN, former Commanding Officers of

OTAMA and members of the various submarine associations.

UK LAUNCHES NATO RESCUE SUBMERSIBLE PROGRAMME

A £700,00 contract for the first phase of a project to replace the UK Royal Navy's 22 year old LR5 submarine rescue submersible was awarded to WS Atkins of Bristol last month. The future NATO Submarine Rescue System (NSRS) will provide a rescue capability for the four NATO countries: France, Norway, Turkey, and the UK, which are involved in this project. Along with a new U.S. rescue system, NSRS will form the cornerstone of an emerging worldwide submarine rescue capability, the UK Ministry of Defence said.

This contract follows the loss of the Russian submarine KURSK in August, which cost 122 lives. The LR5 was sent to help a Russian rescue effort but was never used. The nine month project-definition contract will identify and assess technology needed to procure, operate, and support a new system due in service from 2005. The estimated through-life cost for one system is in the region of £120 million over 25 years.

News in Brief

The UK Royal Navy's fourth and final Vanguard class Trident-armed nuclear submarine (SSBN), HMS VENGEANCE, has completed her magnetic treatment at the U.S. Navy's Magnetic Silencing Facility at King's Bay, Georgia. The process minimises her magnetic signature, a precaution against magnetic influence weapons. The new SSBN has since joined her three sisters in the First Submarine Squadron at Faslane.

Russia's Northern Fleet has decommissioned 109 nuclear powered submarines, and nearly all submarines of the first and second generations are now being written off and broken up at the Severodvinsk Naval Shipyard. Special trains haul nuclear waste from stricken submarines from Severodvinsk to the Mayak plant in the Chelyabinsk Region for processing. The present production facilities in Severodvinsk can scrap eight to ten nuclear submarines

annually, reported Itar-Tass last month.

From NAVINT issue 25 February 2001

Keel of SSN ASTUTE Laid

Barrow in Furness, Cumbria - The formal keel laying of the first of the UK Royal Navy's (RN) Astute class nuclear powered attack submarine (SSN) was laid here in 31 January by Baroness Symons, Minister for Defence Procurement. Although fabrication of the hull is well advanced, including major hull sections and the forward dome bulkhead, the ceremony centered on the 300t section which will contain the nuclear rector.

After the keel laying ceremony, Baroness Symons unveiled a plaque commemorating the start of the Centenary of the RN's Submarine Service, a year-long programme of events to celebrate the achievements of the service. She Said, "Laying the keel of HMS ASTUTE takes the Royal Navy into its second century of submarine operations. I am sure ASTUTE, her sisterships, and the crews who sailed in them will build on the proud tradition we are commemorating today.

"HMS ASTUTE is the biggest and most powerful attack submarine to be built for the Royal navy, and, and under our Smart Acquisition programme, she is being built about one-fifth more quickly than earlier boats, will have lower running costs, and will have a much smaller ship's company. She will also have massively increased firepower, and will be equipped from Day One to operate cruise missiles...". The Minister also confirmed that Batch 2, consisting of up to three more boats, is under consideration.

First steel for ASTUTE was cut about 14 months ago, and she will be launched in 2004, followed by about 18 months of trials. Construction of her sistership AMBUSH is planned to start later this year.

Particulars of Astute Design

Displacement: 7200t (submerged)

Dimensions:	97m x 10.7m x 10m
Armament:	6.533 mm launch-tubes for 38 weapons; Spearfish Mod 1 torpedoes; Sub Harpoon anti-ship missiles; Tomahawk Block III land-attack cruise missiles
Machinery:	single-shaft Rolls-Royce nuclear plant/Alstom steam turbines, with PWR 2 reactor and auxiliary electric drive (2 motors)
Speed:	29kn (submerged)
Command system:	SMCS
Sensors:	Type 2076 integrated sonar suite (bow, flank, and towed arrays) UAP(4); ESM CM010 non-penetrating periscopes; I-band navigation radar
Complement:	12 officers, 86 ratings + 12 supernumaries

One of the key elements in reducing through-life cost is the new reactor core developed by Rolls-Royce. It will not be replaced during the life of the submarine, avoiding an extremely expensive procedure which has resulted in the early retirement of many U.S. Navy SSNs.

No special provision is made for women in the Astute design. The RN says it has an open mind on the subject, and will respond to any change in public policy or opinion inside the Navy in the future. Experience in other navies suggests that the alternatives are a unisex manning scheme, in which women and men share accommodations, or pregnancy-testing for all female personnel before the start of a patrol, to reduce the risk of medical emergencies. Unisex manning finds no favour with naval wives, although the lack of space and privacy on board submarines would seem to militate against what the U.S. coyly refers to as *interaction between the sexes*.

Update

On 24 January the UK Ministry of Defence (MoD) confirmed that the repairs to the reactors of seven attack submarines (SSNs) is running to schedule. There was a slight delay to HMS TORBAY

but welding is now complete. Welding has started in HMS TIRELESS at Gibraltar, and the work is to be completed by 31 March.

TORBAY is also undergoing modifications to operate the prototype Long Range Mine Surveillance (LRMS) unmanned underwater vehicle (UUV). The technology-demonstrator *Marlin*, developed by the Defence Evaluation & Research Agency (DERA) is being evaluated. It uses a Spearfish torpedo body, but the warhead is replaced by active and passive sensors to allow an SSN to reconnoitre and map minefields. It is recoverable by the parent submarine.

According to a separate MoD statement the final decommissioning dates for existing SSNs are as follows:

SPLENDID	to decommission in 2003
SOVEREIGN	to decommission in 2005
SUPERB	to decommission in 2006
SPARTAN	to decommission in 2006
TRAFALGAR	to decommission in 2007
TURBULENT	to decommission in 2008
SCEPTRE	to decommission in 2010
TIRELESS	to decommission in 2011
TALENT	to decommission in 2015
TRIUMPH	to decommission in 2017
TORBAY	to decommission in 2020
TRECHANT	to decommission in 2022

This results in a force of 12 SSNs in 2002, 11 in 2003-2005 (assuming HMS ASTUTE enters service as planned in June 2005), 10 in 2006-2007 (assuming HMS ARTFUL enters service that year). The MoD's *Major Projects Report 2000*, released on 22 November last year states, "It is anticipated that an order for a further three Astute class will be placed in late 2002".■

SUB-PAR SUB-PAY

By LCDR Joseph Thompson, USN
Senior Submarine Tactics Analyst
ONI (SWORD)

United States Code, Title 37, Chapter 5, Section 301c provides for Submarine Duty Incentive Pay— commonly known as SUBPAY. The Department of the Navy policy (as specified in SECNAVINST 7220.80E) is to use SUBPAY to "attract and retain personnel in the submarine service on a career basis." Over the past few years, a tremendous effort has gone into improving virtually all military pays to "attract and retain personnel"—with the notable exception of SUBPAY. SUBPAY rates have not changed since January 1, 1988. Accordingly, the incentive offered by SUBPAY has declined considerably.

Consider the case of a Lieutenant with over 6 years of service. In 1988, his SUBPAY would have been $595/month and his Basic Pay would have been $2354.40/month. SUBPAY amounted to a premium of more than 25 percent over Basic Pay. Today, for a similar Lieutenant, SUBPAY is still $595/month, but Basic Pay has increased to $3656.40/month. As a result, SUBPAY now amounts to only a 16 percent premium. Not since 1980 has the incentive value of SUBPAY been so low.

If an increase in SUBPAY is not made, its incentive value will continue to degrade even further. President-Elect Bush has proposed a 7.3 percent pay raise that would become effective January 1, 2002. This means that a Lieutenant with 6 years of service could look forward to earning $3923.32/month. In order to restore the *value* of SUBPAY to its 1988 premium level, the Lieutenant's SUBPAY would need to be raised to $990/month.

The time has come to raise SUBPAY before its value erodes further. Action should be initiated to increase the SUBPAY limits specified in 37 USC 301c in conjunction with other proposed military pay raise bills that will be considered by the 107th Congress. The time has come to restore the incentive of the Submarine Duty Incentive Pay.■

GANGWAY—THE ELECTRIC REVOLUTION IS COMING!

by LCDR Jules Verne Steinhauer, USNR(Ret.)

This paper expands on an unclassified talk given by Mr. Scott Forney to the Nautilus Chapter of Naval Submarine League on March 24th 2000. Mr. Forney is program manager of the electric drive project for the Electric Boat division of General Dynamics. He is responsible for the installation of electric drive systems in Los Angeles, Seawolf and Virginia class submarines. Any errors of fact are mine not his. Author.

A couple of years ago, several major corporations banded together to form a research consortium to:

- design and build an entirely new family of electric motors based on a completely different approach than the traditional induction motor.
- develop an integrated electric power system for all naval platforms regardless of whether gas or steam turbines were the primary source of power. Separate ships service generators will be eliminated. All electric power would be provided by either the main steam or gas turbine.
- develop an electric drive system that would, in the case of submarines, eliminate the need for reduction gears, propeller shafts and shaft alleys. A major hull opening (for the shaft) would be eliminated.

The Consortium, consisting of the Electric Boat division of General Dynamics, Westinghouse Electric, Newport News Shipbuilding and at least one other company now are seeing the light at the end of the tunnel.

Each of the above facets are discussed separately below.

The New Family of Electric Motors

The new design is called the Permanent Magnet Radial Field

Motor. It is commonly referred to as the permanent magnet motor.

The research consortium considered axial field, induction and radial field machines. Axial field machines didn't provide the efficiency needed. Induction motors, commonly used for pumping applications on submarines, proved to be too big, heavy, expensive and didn't provide the efficiency being sought. So, as a starting point, the consortium looked at a transverse flux permanent magnet motor developed by Rolls Royce.

The permanent magnet motor emerging from consortium research has multi-pole permanent magnets embedded in the motor rather than being surface mounted. Moreover, the permanent magnets are embedded in the rotor rather than being mounted on the stator.

To overcome the brittleness normally associated with permanent magnets, Mr. Forney said it was necessary to "break the magnets into chunks and shot qualify them" during rebuilding.

Early on, the new design showed promise. In its second iteration, the permanent magnet motor was half the size of an induction motor of comparable power and gave a fourfold improvement in performance.

The current iteration is the "most torque dense ever built. It produces the same torque at one RPM as it does at 3,000 RPM". It weighs slightly more than a quarter of the weight of an induction motor with comparable power rating, is cheaper to build and operate and provides a large improvement in performance at peak loads.

According to Mr. Forney, two different topologies have been developed and patented in the development of the permanent magnet motor. These topologies are:

- a modular-based, pulse width modulated, 3,000 horsepower single phase portion of the drive. Six of these modules are used.
- an advanced soft switching technology.

Using both topologies, power densities of 14 KW/cubic foot have been achieved. Mr. Forney said: "In today's submarines power densities are nowhere near that. Both topologies, when tested, produced a very quiet electric motor. Acoustic issues of the motors of the past are gone."

Another improved feature of the new motor is the reduction of voltage stress, an undesirable characteristic of today's electric motors. "The new motor has 1,000 times less stress."

Mr. Forney mentioned one small example of the innovative thinking that has gone into the new generation of electric motors. The bulky cooling unit, customarily accompanying large induction motors has been built in the frame of the permanent magnet motor, saving precious space.

The test prototype of the permanent magnet motor has completed testing at Westinghouse and will undergo shipboard testing on the LSV-2, a quarter-scale model of the Virginia class submarine, under construction (April 2000) at the Newport News shipbuilding facility.

The Integrated Power System

The new family of permanent magnet motors will become the starting point for a new integrated power supply system.

At present, electric power aboard ship is provided by separate turbogenerator systems. This is true across all types of ship platforms.

In almost all our nuclear submarines, propulsion is provided by steam turbines connected to reduction gears and a single propeller shaft. A portion of the steam output of the reactor is diverted to the ships service turbogenerators to produce the necessary electric power to run the boat.

This arrangement has reached its limits according to Admiral Bowman, Director of Naval Reactors.(1) About 75 percent of available reactor output is being used for main propulsion. Yet, at the same time, new applications, in addition to existing needs, require more power than is available from the current system. These inadequacies pointed to the need for a new power system.

Under the new integrated power system, all available steam output from the reactor plant is used to generate electricity. Main steam turbines and attached reduction gears are eliminated. Indeed, the long-familiar propeller shaft and the shaft alley also are eliminated. Electric propulsion will replace the present direct

turbine drive.

According to Mr. Forney, with the new system, as much as 80 percent of the power now going into propulsion could be diverted to other purposes for varying periods of time. The flexibility inherent in being able to divert power to whatever purpose is necessary is one of the major goals of the new integrated power supply system.

The same approach of an integrated power system is being sought across other platform types. Destroyers, for example, will have their gas turbine plants only producing electricity. As in submarines, they will have a turbo-electric system. Again, an integrated power system will vastly increase system flexibility, providing whatever electric power levels are required (within the capacity of the plant.)

Moreover, commonality of power system components in integrated power systems across platform types implies a great reduction in system costs (presumably because of the possibility of ordering components in larger quantities than would be the case now). These cost savings are in addition to the savings from the new family of permanent magnet electric motors that are much more efficient, lighter, smaller and cheaper (both to operate and build) than the induction motor family currently in use in the fleet.

Mr. Forney stated that research findings show that fossil-fueled ships would save an estimated 23 percent in operating costs from the introduction of integrated power systems alone, without taking into account the savings from the new permanent magnet motors.

The ability to combine computer commercial off-the-shelf technology (COTS) with a modularized, integrated electric power system and a new family of better electric motors has made possible significant advances in other areas.

In damage control, for example, it becomes possible to envision reacting to system failures in real time. Failure in a system component can be detected almost immediately because computer monitoring of the system thousands of times a second is now feasible. Immediately, long before a systems operator becomes aware of the system failure, the failed unit has been swapped out of the system and been replaced by a redundant unit.

The implications are revolutionary: Ships with an integrated

power system will be more robust and with have greatly enhanced survivability, partly as a result of vastly improved and automated damage control procedures.

Submarines, as well as surface vessels using the new technology, will eliminate reduction gears and propeller shafting. The implications are clear: Engine room maintenance is greatly simplified; hull openings for propeller shaft alleys will not be needed; all ships so equipped will have stronger hulls.

The Electric Drive

The electric drive, according to Mr. Forney, involves wrapping a permanent magnet electric motor around the propeller.

Beyond pointing out that the propeller shaft and shaft alley normally connecting vessel and propeller is eliminated in the electric drive system, Mr. Forney did not discuss in detail the electrical connection between ship and drive nor any details of the drive.

Mr. Forney did state that the permanent magnet motor driven propulsion system "...weighed 40 percent less (than the current system) and produced 40 percent more flow area." More importantly, he pointed out that stealth is greatly enhanced and that propeller cavitation should not be the problem it has been in the past.

The resulting drive has been tested to depths of 110 feet in increments of ten feet to determine its performance and acoustic behavior. These tests were completed in December 1999.

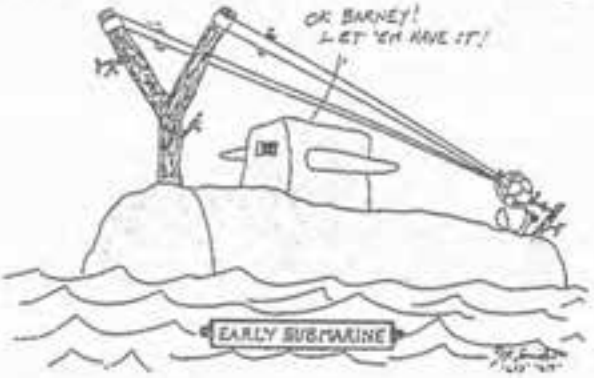
In conclusion, Mr. Forney did point out that commercial cruise ships have already begun to use electric motor driven propulsion systems because of their obvious advantages.■

(1) Speech by Adm. F. L. (Skip) Bowman on 18 Feb. 1999 at a meeting of the Long Island Council of Navy League.

2001 Dolphin Cartoon Contest

Starts March 1, 2001

It's time to get your creative juices flowing!



CONTEST RULES

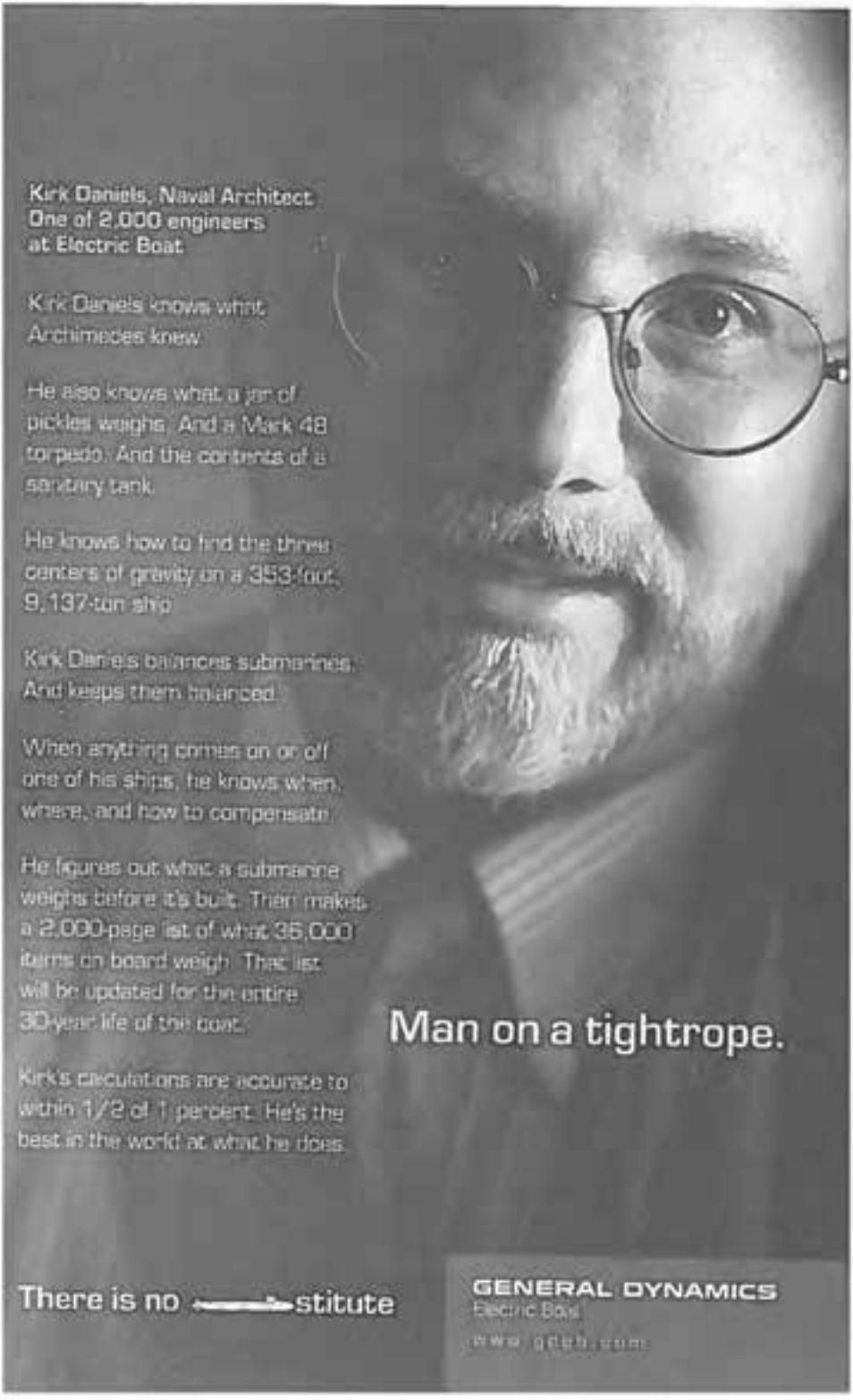
1. A total of 13 drawings will be selected for the 2002. (The extra cartoon is for the cover of the small calendar.) A $25 award and a complimentary copy of the large and small calendars will be awarded to each winning artist.
2. Drawings are to be of a humorous nature depicting life in the Submarine Service.
3. All drawings must be originals in black ink on white paper measuring 8 inches vertically and 10 inches horizontally. Copies will not be accepted.
4. All drawings become the property of the Dolphin Scholarship Foundation and are non-returnable.
5. All drawings must be accompanied by the following information:

PLEASE PRINT ON BACK OF YOUR ENTRIES

- Artist's name (dependents should also include sponsor's name)
- Rank/Rate (dependents should also include sponsor's)
- Duty Station (dependents should also include sponsor's)
- Mailing address and telephone number
- Send drawings to the following address:

2001 Dolphin Calendar Cartoon Contest
Dolphin Scholarship Foundation
5040 Virginia Beach Blvd, Suite 104-A
Virginia Beach, VA 23462
Entries Must Be Received on Premises by May 31, 2001

For more information contact your local Dolphin Calendar Chairperson or Ann Maliniak at (757) 671-3200.


Kirk Daniels, Naval Architect
One of 2,000 engineers
at Electric Boat
Kirk Daniels knows what Archimedes knew.
He also knows what a jar of pickles weighs. And a Mark 48 torpedo. And the contents of a sanitary tank.
He knows how to find the three centers of gravity on a 353-foot, 9,137-ton ship.
Kirk Daniels balances submarines. And keeps them balanced.
When anything comes on or off one of his ships, he knows when, where, and how to compensate.
He figures out what a submarine weighs before it's built. Then makes a 2,000-page list of what 35,000 items on board weigh. That list will be updated for the entire 30-year life of the boat.
Kirk's calculations are accurate to within 1/2 of 1 percent. He's the best in the world at what he does.
Man on a tightrope.
There is no stitute
GENERAL DYNAMICS
Electric Boat
www.gdeb.com

NEW SUBMARINE SURVIVAL GEAR

by Robert A. Hamilton

Reprinted with permission from the New London Day of December 9, 2000.

Groton - During a just-ended repair period, USS PROVIDENCE became the sixth U.S. Navy submarine equipped to use new survival gear that can bring a Sailor up 600 feet or more from a disabled boat. On Friday, Commander Scott B. Bawden watched as the last 17 members of his crew were trained to use the suits.

As he watched them bobbing in fluorescent orange suits in the 90 degree water of the dive training pool in Momsen Hall at the Naval Submarine Base, Bawden, the captain of PROVIDENCE, compared it to training men to fire Tomahawk missiles or torpedoes—you hope you will never have to use the skills.

"There's a lot of parts of this job that people don't want to dwell on. But you can't deny that there are risks in what we do, and we have to be prepared," said Bawden. "Survivability is very important these days, because we're spending a lot more time in shallow water."

By 2007, all attack and missile submarines are expected to have the Submarine Escape and Immersion Equipment. The Navy is planning to adapt its escape trainers at the base to the new standards by 2002, and construct a 50 foot dive tower on the base for training in the suits by 2006 or 2007.

In addition, the Navy is considering designating a commando team to specialize in submarine rescue, and putting an aircraft on constant standby with rafts, medical supplies, food, and other equipment that could be rushed to the scene of any submarine disaster.

Instructors made each of the men don one of the practice suits and get into a life raft. Machinist Mate Second Class Roger M. Squires got hung up a little when his raft was flipped by one of the instructors, but quickly got it righted and climbed back in.

"I've done some kayaking, and I've flipped in them, so that's what I thought about when it was happening," Squires said. He

said the survival gear is considerably better than the Steinke hoods that are being replaced, and the training is a lot better as well; when he was trained as a submariner he got to don a Steinke hood in a classroom, not a pool.

"If it was shallow water in a warm place, it wouldn't be too bad," Squires said. But he added with a grin, "if it was cold, deep water, I wouldn't want to leave the boat too early."

Boatswain's Mate Second Class Robert T. Sandoval, who taught Friday's class, agreed that the new suits should only be used as a last resort, if there is no chance the crew can survive until a rescue can be mounted, but he said the suits increase the chances that a crew will survive.

But he also noted that of 170 peacetime submarine sinkings since 1910, 19 out of every 20 involved accidents in water that was shallow enough for the submarine to survive the descent. But escape, even from relatively shallow depths, is dangerous.

In August 1988 the Peruvian submarine PACOCHA, the former USS ATULE, sank in less than 140 feet of water. Of 22 crewman trapped on board, 20 suffered decompression problems, and two more were killed when they tried a free ascent.

Steinke hoods provide a covering for a Sailor's head only , but they could easily be filled with water if the Sailor became inverted, and they provided no protection against hypothermia, a real concern in the northern Atlantic waters that submarines frequent, because water chills 24 times faster than air at the same temperature.

"The Steinke hood was designed to get you to the surface, and it worked,"Bawden said. "But once you got there, you had to find your own way to survive."

The new gear, which folds into a pouch smaller than the backpacks carried on most high school campuses, contains a bright yellow thermal suit worn under the orange exterior garb, and a one-man inflatable life raft attached to the left leg.

Sandoval warned the Sailors they have to exit the escape trunk quickly, because they can get the bends, which is always painful and is potentially fatal, if they ascend too quickly after being pressurized for even a short time. At 600 feet, you have about 30 seconds from the time you start pressurizing the escape trunk until you have to be on your way to the surface, he said.

"Don't hold your breath—breath normally, relax, and enjoy the ride—it's going to be the best one you ever had," Sandoval said. Since the suits are inflated, Sailors bob to the surface at a rate of about 725 feet per minute.

"It feels unnatural for a diver," said Hull Technician Second Class Travis Swink, one of the instructors who tried out the suits in a 100 foot dive tower in Great Britain. "Our whole career we're taught to follow a certain feet-per-minute ascent rate, and with this thing you're just screaming to the surface."

One advantage of the SEIE gear, said Chief Boatswain's Mate Barry Hurst, is that they can be used as long as the hatch from the escape trunk isn't in the mud. Some of the rescue vehicles in use today cannot hook up to a submarine that is at a sharp angle on the bottom.

"If the hatch can be opened, you can make an escape," Hurst said. "The angle is almost irrelevant."

After an escape, he said, crew members should tie their rafts together, the instructors said.■

CONTACTS FOR BOAT REUNIONS

The following submarines will be having reunions during the 2001 National Convention of United States Submarine Veterans, Inc. on 11-16 September 2001 in Peoria, IL.

USS ANDREW JACKSON	Sam Eddy	500 E. Warren LeRoy, IL 61572 (309) 962-2509
USS BLACKFIN	Don Brown	13730 Algonquin Dr. Reno, NV 89511-7220 (775) 853-5309
DFASs	Rick Rowe	736 Juniper St. Twin Falls, ID 83301 (208) 734-6540
USS DIODON	Glenn Booche	4281 Ralph Lane N. Fresno, CA 93727 (550) 291-5330
	Don Remily	30860 Oakstream Lane Lebanon, MO 65536 (417) 532-1676
USS FLASHER	Larry Weinfurter	9332 Vermillion St. Milladore, WI 54454-9700 (715) 853-5309
USS GEORGE WASHINGTON	Walt Liss	55 Miller Road Preston, CT 06365-8516 (860) 886-9268
USS MEDREGAL	Mike Burkholder	3201 Center St. Greensboro, NC 27407 (336) 854-3730
USS ODAX	Rudy Diaz	709 Alexander Drive O'Fallon, IL 62269-6134 (618) 632-8566

USS ODAX	Ron Gibson	640 Gennessee St. San Francisco, CA 94127-2333 (415) 239-5490
USS PLUNGER	Lou Maruzo	105 Aviary St. Warrenton, VA 20186-3637
	Dave Patrick	P.O. Box 2436 Hollister, CA 95024 (734) 516-3187 (cell)
USS RONQUIL	Richard Osentoski	3701 Brookshire Trenton, MI 48183 (734) 671-3439
USS SAILFISH	Glenn Jackson	249 South Street Medfield, MA 02052-3108 (508) 359-8588
USS SALMON	L.T. Mick (COB)	2075 County Rd. 24 Kemper, TX 76359
USS SCORPION	Dene Rogers	2012 Guardfish St. Silverdale, WA 98315 (360) 396-4111
USS SEA LION	John Clear	2800 Applewood Ln #29 Eugene, OR 97408-1542 (541) 4846483
USS SEA OWL	Roy Purtell	4 Garden Ct. Troy, NY 12180 (518) 272-8614
USS SEADRAGON	Ron Waldron	915 Chola Ct. Lady Lake, FL 32159 (352) 753-5393
	"Tiger" Scheide	3008 Wolf Creek Road Clearlake Oaks, CA 95423
USS SEAFOX	George Arnold	822 Wester Air Drive Jefferson City, MO 65109 (573) 635-6033

USS TAUTOG	George Boyle	2541 Tarkiln Oaks Dr. Pensacola, FL 32506 (850) 492-3781
USS TIGRONE	Frank Hill	895 S. Indiana Ave. French Lick, IN 47432 (812) 936-2892
USS TRUMPETFISH	Bob Berry	630 S. Judson, Ft. Scott, KS 66701-2325 (316) 223-6789

SUBMARINE COMMUNITY

THE USS BOWFIN SUBMARINE MUSEUM AND PARK

by Susan K. Morrison

Mrs. Morrison, a freelance writer living in Hawaii, is the wife of a submariner and a frequent visitor to Bowfin Park.

USS BOWFIN extends into Pearl Harbor from its mooring between the old Ford Island ferry landing and the new Ford Island bridge. From her tranquil setting adjacent to the Pearl Harbor Naval Base, she bears witness to the silent grave of the sunken USS ARIZONA, which marked the beginning of World War II for the United States, and to USS MISSOURI beyond, which signaled its end.

A Balao class fleet submarine, BOWFIN was launched on December 7, 1942, at the Portsmouth Naval Shipyard and nicknamed the *Pearl Harbor Avenger*. During nine war patrols in the Pacific, she lived up to her name, sinking more than 40 enemy craft and meriting a Presidential Unit Citation and a Navy Unit Commendation. Later, the ship saw duty in the Korean conflict and as a Naval Reserve training ship in Seattle before the Navy struck her from the Register of Commissioned Ships in December 1971.

Through the efforts of Admiral Bernard *Chick* Clarey, CINCPACFLT, and Rear Admiral Paul Lacy, COMSUBPAC, BOWFIN was towed to Pearl Harbor and then to the U. S. Navy Inactive Ship Facility in Middle Loch. While the ship awaited a permanent berth, Hawaii's Senator Daniel Inouye was asked by a constituent to have BOWFIN sunk off Waikiki as an undersea habitat for reef fish. Senator Inouye's staff member, Rear Admiral Alvey Wright, USN(Ret.), suggested a better plan. He and the president of the Honolulu Council of the Navy League, Harold Estes, along with other members of both the military and civilian community, came together to form the non-profit Pacific Fleet Submarine Memorial Association (PFSMA). Its mission was to realize the dream of restoring and preserving the World War II submarine, to create a lasting memorial to all submarines and their

crews, and to educate the public about the contribution of these valiant submariners.

In August 1979, Under Secretary of the Navy, James Woolsey, signed the deed of gift transferring BOWFIN from the Navy to the PFSMA.

The ship was moved to Pier 39 at Honolulu Harbor. Restoration began, initially funded through private and corporate loans and continued through volunteer efforts. The ship opened to visitors in 1980.

A permanent location was eventually approved by the Navy, and BOWFIN was moved to its present berth at Pearl Harbor near the Arizona Memorial Visitor Center.

At first, the PFSMA met under tents rigged alongside the submarine to plan and expand the organization's vision. Through admission fees and funds raised from donations and loans, construction of on-site facilities began under the guidance of the PFMSA Board of Directors and Captain Harvey Gray, USN(Ret.), the newly named executive director. The Bank of Hawaii played a key role in providing loans to sustain the organization's efforts. Other large corporations gave gifts or forgave debts, and many dedicated individuals provided financial support. The new Bowfin Park facilities were dedicated in September 1986. In this same year USS BOWFIN was designated a National Historic Landmark.

The park occupies nearly four acres of land bound on two sides by the harbor. The main attraction, USS BOWFIN, is med-moored, with a gangplank leading from its bow to the park's covered lanai. Fully restored in 1987 when she was dry docked for the television mini-series, *War and Remembrance*, BOWFIN is now kept shipshape by the employees of the park. The deck is spotless and the brass is polished to a high sheen. The voice of CAPT Alexander Tyree, USN(Ret.), commander for the seventh, eighth, and ninth war patrols, takes visitors through the submarine, compartment by compartment on individually programmed headphones. Audio translations are available in Japanese, with written handouts in French, German, Spanish, and Hungarian. BOWFIN staff members are on hand to provide security and respond to visitors' questions.

The 10,000 square-foot museum houses an extensive collection,

including COMSUBPAC's archived copies of more than 1200 original war patrol reports of Pacific fleet submarines. The centerpiece of the museum is a large model of USS BOWFIN donated to the museum by Sandy Gaston, a member of the Navy League of the United States and a long-time friend of the PFSMA's efforts to provide an outstanding submarine museum and memorial. The model is the most accurate of a fleet-type submarine, meticulously crafted to show the construction and interior in great detail.

The museum also contains an exhibit honoring the seven submarine Medal of Honor recipients of the World War II, and memorabilia of various World War II submarines and submariners. Models and equipment from nuclear submarines represent the submarine efforts of the Cold War.

Lockheed Missile and Space Company has provided the Poseidon mockup missile that was used for component fitup and procedural verification during the C-3 program. Broken into stages to permit viewing of all components, this mockup missile gives the BOWFIN visitor a unique look at the strategic deterrent program. This is the only such missile on exhibit in a museum.

Historic photographs, World War II recruiting posters, and original Pacific fleet submarine battle flags line the walls, as well as paintings of submarines in action by well-known artists Tom Freeman, Arthur Beaumont, and Fred Harris. A library of submarine-related literature, photographs, and video documentaries offers opportunities for research, and a small theater continuously screens submarine footage, including episodes from the 1950's series, *Victory at Sea*.

The third major component to the Bowfin complex is the Waterfront Memorial honoring the 52 submarines lost at sea during World War II. Dedicated in 1991, this double ring of ceramic and stone tablets set on the edge of the harbor commemorates these submarines and their crews, still on *Eternal Patrol*. Each plaque includes pictures of the ship it represents, a brief history of operations, and a list of all who were lost. The memorial is often the focus of ceremonies and receptions held on the lawn beside it, with the individual monuments bedecked with leis.

The conning tower of USS PARCHE, on the park grounds,

gives visitors an opportunity to stand inside an original World War II configured conning tower and to operate the two periscopes. A monument dedicated to non-World War II submarine losses, Polaris and Regulus missiles, an Imperial Japanese kamikaze torpedo, a McCann submarine rescue chamber, and various torpedo and submarine weapons add to the park's displays.

The park's covered lanai is bordered on three sides by the ship, the administration building, and the museum. On the fourth side, a gift shop offers nautical and submarine-related books, clothing, and gifts. The lanai itself, set with tables and chairs, offers a pleasant place for visitors to relax or picnic, while viewing the submarine nearby and the historic harbor beyond. The lanai, with its view of the sunset over USS ARIZONA and USS MISSOURI, is a favorite setting for evening catered dinners and receptions.

Bowfin Park welcomes more than 200,000 visitors a year. Admission is $8 for adults, $3 for children (four and older), and the museum is free for children under four. (Children under four are not allowed on the submarine for safety reasons.) A package that includes a trip to Ford Island to visit the USS MISSOURI is available for $18. Trams leave Bowfin Park about every 20 minutes for the trip across the bridge to the Missouri's mooring.

Ticket sales, proceeds from the gift shop and food stand, donations, and the occasional rental of the facilities for private receptions and parties fully support Bowfin Park. There is no government financial support provided. These funds sustain the grounds and a staff of 53 who operate and maintain the facilities, including continuing restoration and maintenance work on the submarine.

Some of the proceeds go to fund the BOWFIN Scholarship, which annually distributes more than $20,000 to college-bound students. These scholarships are awarded to Hawaii area submariners, local retirees, and their dependents to promote advanced education. PFSMA partners with the Submarine Officers Wives Club Pearl Harbor in selecting and awarding these scholarships.

Through its Adventures in History Program, as part of PFSMA's educational outreach, the staff sponsors evening lectures on a variety of topics relating to submarine history and oceanogra-

phy of the Pacific Rim. It hosts groups of school children and Elderhostel tours, provides resource materials through the museum's library and archives, and sponsors military change-of-command ceremonies and other military and community events. These events include submarine crew reunions from both World War II and the Cold War, which are integrated into the museum's oral history project to record the recollections and experiences of this aging group of heroes.

BOWFIN's latest project is an improved website, www.bowfin.org. The core addition is a *Science of Submarines* section that provides five examples of submarines from TURTLE to the latest Trident submarine, illustrating five different scientific principles. These examples demonstrate practical applications of every day science. Teachers can download information to use in the classroom. A virtual tour of BOWFIN is featured, as well as the new *Kiddies Tour*, which highlights the visit of the popular Flat Stanley, a character from children's books. The website was developed in conjunction with the Maui High Performance Computing Center, operated by the University of New Mexico at Kihei, Maui, and now enables BOWFIN to become known to interested viewers and students around the world.

Bowfin Park, under the leadership of the present Executive Director, Captain Jerry Hofwolt, USN(Ret.), reflects the countless hours and tireless efforts of PFSMA members, staff, and volunteers over a twenty-year commitment to build a premier Pacific submarine museum—one that provides thousands of visitors an authentic look into the world of the Silent Service.■

MARYLAND AND TORSK
KEEPING THE LEGACY ALIVE:
SSBN CREW PROVIDES TLC TO EX-USS TORSK

by CDR Keith Bowman, USN
CO USS MARYLAND (SSBN 738)(Blue)

In January 2001, fifteen members of the crew of USS MARYLAND (SSBN 738) (BLUE) crew traveled to Baltimore, Maryland to assist local volunteers in their preservation efforts in the ex-USS TORSK, a WWII fleet submarine. The visit provided a tangible example of continuing projects that can capitalize on the momentum of the submarine centennial. It also highlighted the success and the limitations of restoration efforts aboard these venerable fighting ships.

USS MARYLAND is homeported in Kings Bay, Georgia, the base for all ballistic missile submarines in the Atlantic Fleet. Armed with 24 Trident II missiles, she and her sister ships are the most powerful war machines ever built. Like several other Atlantic SSBN crews, both the Blue and the Gold crews of MARYLAND make it a standard part of their pre-patrol training to make community service trips to their namesake states. With this ongoing commitment, teams of volunteers visit Maryland three or four times a year. These trips are modestly funded by the public affairs office on the staff of Commander Submarine Force, U.S. Atlantic Fleet. The public affairs office provides $1000 per year for one visit by each crew for namesake visits. In the case of crews like MARYLAND that send teams to their namesake twice a year, some of these trips are completely unfunded. Even when funds are available, $1000 shared among 15 crewmembers does not go very far. Fortunately, local groups always provide food and shelter as a pre-condition of the volunteer visit. These trips support the local community, provide an outlet for service-minded Sailors, and generate valuable exposure for the Navy. The visit to TORSK resulted in a prominent article in the Baltimore Sun. The ongoing efforts of both crews of MARYLAND were recognized in April 2000 by Governor Parris Glendenning with a special volunteer service award. The presentation was timed to coincide with the centennial anniversary of the Submarine Force.

The visit to TORSK was the first by a MARYLAND team.

Previous visits had been coordinated through the Governor's Office on Service and Volunteerism. While this form of coordination has effectively supported visits throughout the state, the very obvious tie-in with TORSK volunteers through the Submarine Force called for a more direct liaison. As a key, but small exhibit within the context of the larger Baltimore Maritime Museum, the TORSK *Bandits*, as the volunteers like to call themselves, arranged for MARYLAND crewmembers to live aboard the ex-USCGS TANEY, another historic ship in the collection.

Accommodations were spartan, but comfortable. Simple, but satisfying meals were provided by the museum out of TANEY's galley. For our Sailors, this location was appropriate. TANEY was moored close to our work aboard TORSK. At the same time, living in the center of Baltimore's Inner Harbor provided all of the attractions (restaurants, pubs, museums, tourist attractions) that a guy could want.

The aft battery well of TORSK has been converted into a well-stocked storeroom. Our crew was able to find most of the parts and supplies needed to make a lot of progress on the *Bandits*' equipment deficiency list. The local volunteers who came to support us during our stay continually vocalized how impressed they were by the productivity of our team. I learned a long time ago to never underestimate the capability of the American Bluejacket. After three days, we had largely completed the wish list that had been intended to keep us busy all week. The skills of our auxiliarymen proved to be the most useful. Freeing manual valves, greasing hatch operating mechanisms, repairing toilet ball valves—it was just like refit. The twist was that the work they were performing was retracing the efforts of warfighters from past generations of submariners. Every volunteer performed what work his experience and skills would allow. It would be accurate to say we enjoyed it.

Some of us had very little experience in actually refitting a submarine. I, for one, can plan and execute a refit with the best of them, but my crew can only imagine how dangerous I am with tools. I decided to tag along with my Senior Chief Electronics Technician as we tried to refurbish TORSK's radar. As it turned out, neither one of us was well-suited to repair this type of

equipment. Vacuum tube technology is no longer even taught in our service schools. We studied the operating manual on a vacuum tube tester dated 1967. The procedures seemed straight-forward enough. We proceeded to test the approximately 80 tubes in the set, a slow process requiring each tube, in turn, to slowly warm up to normal operating temperatures. The *Bandits* hoped we could develop a list of tubes that were needed. Armed with this list, they could focus their search on the internet for these rare components. Their overall objective was to restore the radar set to full operation. After two and a half days of testing and cleaning, we determined that about a dozen tubes were probably bad.

It was at this point that the futility of our effort slowly set in. We soon realized that even if we had the tubes, we could never hope to energize the equipment. The radar runs off of 400 Hz power, a distribution system that is completely inoperable on TORSK. This example illustrates the limitations of casual restoration efforts. We put a great deal of time and effort into the task, but without an integrated and expansive plan, without extensive repair parts and technical skills, our efforts were leading nowhere. Considering the stripping-down process that the ship went through during its decommissioning, a lot of the gear considered salvageable at the time was not even present.

The basic question that remains is: "To what extent can and should a ship of this vintage be maintained?" Two basic approaches occupy different ends of the spectrum. One field of thought would suggest that restoring everything to the operational status of its days in commission is the only objective worthy of such a treasure. This is a lofty and idealistic approach, but one that appeals to many people. It is just the kind of grand vision that can energize a group of volunteers. Searching the internet, making foraging raids on the Navy's mothball fleets in search of rare repair parts (thus the name *Bandits*), now that is the stuff that makes for an enjoyable volunteer experience. The other end of the spectrum concedes the futility of restoring equipment to its operating prime and focuses instead on making the ship as presentable to the visiting public as possible. This approach focuses on cleaning and preservation (i.e., chipping and painting), the bane of any Sailor's existence. Hardly the kind of activity that keeps volunteers coming back for more.

The TORSK *Bandits* largely aspire to the first line of thinking.

Regrettably, they do not have the resources to make a truly serious attempt at comprehensive restoration. An intermediate aspiration of the group is to one day host groups of Scouts or students onboard the ship for overnight *cruises*, tied fast to the pier alongside the National Aquarium. This objective seems attainable. To support overnight guests, a limited number of improvements need to be made. These would include refurbishing the plumbing systems and updating the galley equipment. With this more modest focus, I estimate that the on-going efforts of the *Bandits* could achieve this goal.

As for other systems, I would discourage costly and time-consuming initiatives to restore electrical systems and electronic equipment. It is extremely difficult to garner the parts and skills necessary to tackle these sorts of jobs. Additionally, energizing sixty-year old cables and equipment that have been dormant for thirty years raises serious safety concerns.

Though not glamorous, the biggest commitment needed to preserve this type of ship is inevitably housekeeping. While the *Bandits* completed a successful refurbishment of the ship's wooden main deck recently, the underlying steel superstructure is in need of attention. Areas throughout the ship would benefit from a thorough cleaning. Expanded interpretational displays would enhance the learning experience for guests. Installing lights to give the appearance of operability to electrical equipment, without committing the extraordinary effort to restore functionality, would be an achievable goal that would add to a visitor's appreciation of what the ship looked like in August 1945 as she inflicted the last shipping casualties of World War II.

The efforts of the *Bandits* and volunteer groups throughout the country are laudable. Working on a shoestring budget, typically supplemented by their own money, these workers engage in a labor of love as they strive to perpetuate the memory of our decisive Silent Service. Many of these volunteers have never served in submarines; most were not old enough to serve during WWII. Nevertheless, these patriots strive patiently, usually on weekends and during their vacation time, to keep the memory alive. They deserve all the support we can give them.■

REFLECTION

SUBMARINES, SEAGULLS AND SEA LIONS

by CDR Richard Compton-Hall RN(Ret.)

During the 1914-18 war German U-boats were rammed, mined, netted, ambushed, decoyed, depth-charged and surprised on the surface—but these events were mostly fortuitous rather than planned. Systematic hunts by destroyers and drifters employing the novel science of ultra-sonics were seldom successful.

In high hopes of underwater discoveries, however, special hydrophones were designed to listen for distinctive submarine noises in the 400-1000 cycles per second (Hz) range. They were non-directional (or omni-directional, if that sounded better) until 1917: Lieutenant Hamilton Harty RNVR (later Sir Hamilton, conductor of the Hallé Orchestra) then matched pairs of directional diaphragms and tuned them personally. Significantly, priority for directional equipment was given to the Royal Navy's submarines, but the 17 (or possibly 19) U-boats which the latter torpedoed were all in plain view on the surface when they met their fate.

Active echo-ranging by ASDIC[1] was not seriously considered in Britain until towards the end of the war, although Professor RA Fessenden's electro-magnetic oscillator, developed for the Submarine Signal Company of America to avoid another TITANIC disaster, detected an iceberg at a range of two miles on 22 April 1914.

Anyone with a musical ear was an asset to researching the vagaries of underwater sound in those days, but Sir Richard Paget deserves immortality. He sensibly reckoned, by 1916, that the key to appropriate hydrophone design was to establish submarine propeller frequencies. Accordingly, he arranged to be suspended by his legs over the side of a boat in the Solent while a submarine circled around him. After a suitable period submerged (and before he actually drowned) this devoted scientist was hauled up humming the notes he had heard, whereupon—safely back to the boat—he related them, by running up the scale, to the standard G sharp which he obtained by tapping his skull with a metal rod.

He duly reported his findings to members of the Board of Invention and Research who conducted their business at the optimistically named Victory House in Cockspur Street, London SW. The BIR was, in fact, the forerunner of all those R&D organisations that have since proliferated—often as not to our considerable cost as taxpayers. Amongst other things the BIR, officially formed on 5 July 1915, was tasked to find an effective solution to the U-boat peril. It never came close to its objective and was disbanded in 1917: its failure was largely due to Prime Minister *Squiff* Balfour's inept decision, quite possibly made after his customary glass or three, to appoint the irascible and no longer wholly rational seventy-four year old Admiral Lord Fisher as Chairman. Fisher's outspokenness and cruel criticisms, by no means always based on scientific fact, turned senior officers and distinguished scientists against the BIR which consequently became known as the Board of Intrigue and Revenge.

Section Two of the Board dealt with submarines and wireless telegraphy (W/T)—a combination stemming from the relationship between wireless waves and underwater sound waves. Indeed, Section Two investigated submarine detection methods far in advance of relatively simple acoustics: proposals included the exploration of anomalies in the earth's magnetic field (which did not bear fruit as MAD for another twenty-six years), thermal variations in seawater caused by the outflow of propulsion plant coolant (i.e. thermal scarring), and sub-surface optical detection methods which did not at the time include blue-green lasers.

No possibility was wholly ignored. Sir Oliver Lodge, the well-known psychic researcher, was on the Board; he investigated remote dousing, but only expenses—not fees—were paid for extra-sensory experiments.

Some 14,000 suggestions for dealing with U-boats were submitted by the general public, and more than a few bordered on the bizarre.

For example, Mr Thos. Mills, a rich Australian businessman, was convinced that seagulls were natural anti-submarine detectors and, with these in mind, he importuned the BIR incessantly. His initial letter, dated 27 February 1917, read:

"... a decoy should be used to train the seabirds to locate submarine periscopes. Have a small float containing a dummy periscope; the float to contain a quantity of rough food, say dog or cat's flesh or any other food that will float on the water. ... Discharge small quantities every few minutes ... if the experiment was tried first near some port, or near where enemy submarines were working, I believe that the birds in about two weeks would be thoroughly trained to fly around a periscope or over the wake of a submarine ..."

Thos. Mills, and other hopefuls who proposed the use of giant magnets to draw U-boats to the surface, were given short shrift. Another idea—to pour green paint on the sea to blind a U-boat commander's periscope and—here was the brilliance of the scheme—make him think he was still too deep to see, whereupon he would bring the submarine shallower until it was fully exposed, was also rejected. (However, as a last-ditch defense, it is true, even today, that pouring oil or paint into a harbour can be quite effective in blinding midget submarines and swimmers).

Although seagulls were evidently classed as non-combatants, extensive experiments were carried out with anti-submarine sea lions. On 17 May 1917 Admiral SC Colville wrote from the Admiralty to the Flag Captain, Fort Blockhouse at Gosport (the foremost British submarine base, where Rear-Admiral Submarines had his headquarters):

"Sir,

I am commanded by My Lords Commissioners of the Admiralty to acquaint you that they have approved the series of trials being carried out in the Solent in regard to the capabilities of sea lions in tracking submarines.

2. Rear-Admiral BA Allenby (Ret.) is in charge of these trials, and Their Lordships desire that you will place a submarine at his disposal for trials and furnish it with all necessary facilities for this purpose.

3. Rear-Admiral Allenby's requirements for the trials are as follows:

- A stable or shed with water laid on, salt for choice.
- A **suitable** launch with small boat in tow, which launch could carry a cage with two animals. The launch should be as noiseless as possible. A suitable cage would require to be built, with a sloping gangway to be fitted for the animals to climb on board, unless the launch has a low gunwhale (3ft).
- A submarine of any class would suffice to train the animals. Preliminary trials at anchor on the surface, later submerged. There are no data to enable a definite opinion to be expressed as to how long the training with submarines would continue, but a decision might be arrived at, one way or another, in about a fortnight provided weather conditions were favourable.

4. You are requested to report to the Admiralty by telegraph when this trial would be ready to commence, observing that the sea lions will not be ready before 25th inst."

Dr EJ Allen, Director of the Marine Biological Laboratory at Plymouth, was the physicist appointed as the Board's representative. He immediately put himself into correspondence with the self-styled Captain Woodward, a trainer of performing sea lions who was said at this time to be investigating the power of these creatures to hear sound in water. He claimed to have established already that "they could hear quite weak sounds, such as the tinkle of a bell that is put on dogs' collars, at speeds up to 9 knots, and they could tell the direction."

Dr Allen studied the structure of the animals' ears and set himself to compare the listening ability of a sea lion with that of a hydrophone. A good deal of experimental work was continuing with advanced hydrophones at this time; but those which were most sensitive tended to relay their own characteristic frequencies. Sea lions, it was thought, should have better faculties.

Captain Woodward clearly realised that he was on to a good thing. He was only too glad to supply sea lions *which were available in very large numbers* to the Admiralty. The trials were promptly put in hand and progressed at commendable speed. Ever

helpful, Sir Richard Paget (of the G-sharp cranium) devised a muzzle made of wire with a small trap-door in front through which the animal could be fed. This prevented any sea lion so equipped from catching fish and thereby being distracted from its duty.

Several animals were chosen for the experiment, foremost among them being Millicent, Billikin, Queenie and Dorande. The last named was getting on in years, dim-sighted and a little hard of hearing; but short-sightedness made him less prone to pursue fish and he was able to work unmuzzled. Unfortunately, though, he was so nearly blind that the trainers had difficulty in teaching him to jump accurately on to the boat from which the trials were directed. But, with plainly spoken commands, he soon managed quite well: ultimately the most reliable worker in the team, he was quite happy to tow a large cigar-shaped float so that his course could be followed by eye from above.

The animals were encouraged to chase the target submarine by rewarding them with herrings, but on one occasion these were bad. The unusual failure of Billikin, during a hot spell, was attributed to this: he was off colour and disinclined to chase submarines for quite a while thereafter.

Conclusions following the trials were vague, but the Board thought that "the sounds made by a submarine at rest or moving slowly are of very feeble intensity and not easily heard by the animals". Nor was a sea lion's normal sustained speed (about 5 knots) great enough to overtake a submarine while "passing vessels, as well as fish, proved a serious obstacle to success."

Such, apparently, was the awe in which Fisher and his Board of Invention and Research was held that 14 years elapsed before the Admiralty ventured to ask how the trials had progressed. It was not until 1931 (by which time, of course, BIR members had long dispersed or passed to their reward) that Their Lordships enquired from Rear Admiral (Submarines) whether any reports and photographs were readily available about the matter at the Submarine Headquarters. They were not.

Nor, sadly, is there any record of how Millicent, Billikin, Queenie and the dedicated deaf Dorande spent their declining years. It can only be hoped that Captain Woodward maintained them in the naval comfort to which they had become accustomed. ■

ENDNOTE

1. Most historians, author included, have believed that the acronym ASDIC stood for Allied Submarine Detection Investigation Committee; but research by Willem Hackmann, discussed in his definitive and recommended work *Seek and Strike* (HMSO 1984), has revealed no committee of that name. It is more likely, as Hackmann suggests, that it stood for "pertaining to the Anti-Submarine Division" (or "anti-submarine division"-*ics*), the Admiralty department which had initiated research.

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NAVAL SUBMARINE LEAGUE
HONOR ROLL

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CAPT Thomas R. Tucker, Jr., USNR-R

LETTERS

SEARCH FOR SWORDFISH (SS 193) INFORMATION

I'm asking for information on USS SWORDFISH (SS 193) and her crew members. I am writing a history of SWORDFISH from its launching in 1939 to its sinking in 1945. My uncle, Michael Billy (MoMM2c), was lost with his fellow crew members on that last patrol. In addition, I'm seeking back issues of **THE SUBMARINE REVIEW** which I'll use for research. If anyone has advice on this project, I'm open to all suggestions. I'm a member of the Naval Submarine League, and I will be most grateful to anyone who can supply information for this book. Please contact me at the following: Dr. George J. Billy, Chief Librarian, Bland Memorial Library, U.S. Merchant Marine Academy, Kings Point, NY 11024. My telephone number is (516) 773-5501; fax (516) 773-5502; e-mail: billyg@usmma.edu.

Dr. George J. Billy

MIGHTY MINE DODGERS REUNION

February 5, 2001

The World War II Submarine Veterans are planning a reunion of the crews from the group of 9 submarines that converged on Tsushima Strait at the southern tip of Japan and, on June 4, 5, and 6, 1945, entered the Sea of Japan through the deadly mine fields. The nine boats consisted of BONEFISH (SS 223), BOWFIN (SS 287), CREVALLE (SS 291), FLYING FISH (SS 229), SEA DOG (SS 401), SKATE (SS 305), SPADEFISH (SS 411), TINOSA (SS 283), AND TUNNY (SS 282).

BONEFISH did not return. The purpose of this trip was to enter the Sea of Japan and destroy the remaining supply lines for vital supplies and to demoralize the Japanese people.

This reunion will be at the United States World War II Submarine Veterans Convention in St. Louis, Missouri from August 22 thru 25, 2001. The Convention will be held in the Regal Riverfront Hotel, 200 South Fourth Street. All persons that served on the 9 boats, their families, grandchildren, relatives, and close friends are

cordially invited to attend this reunion.

This reunion of the Mighty Mine Dodgers is primarily for the purpose of preserving the legacy of the deeds accomplished by the group of submarines for our children, grandchildren, and their children. If we do not do it now, it will be gone forever and can never be captured again. Come and help us preserve this legacy for generations to come.

It would be of great value to us if all of you could pass this information onto others and request that they pass it on to all persons that they can. This way it will help others that are not in touch to hear of the reunion. Look for us in the area of the hospitality room.

Willie Z. Noble

CORRECTING SOME MISCONCEPTIONS

18 February 2001

I thought the History Channel program, *The Silent Service*, was generally excellent, but I did notice two errors that might be of interest to the readers of **THE SUBMARINE REVIEW**.

In one place it was stated that ARGONAUT had no stern torpedo tubes, which contributed to the loss of the submarine. Actually, four external tubes were added during the boat's major modernization—two forward and two at the very stern. This was done before she was converted to a transport and the mine gear was removed. Whether these deck tubes would have been of much help during the final attack by Japanese destroyers is, of course, questionable, but she did have them.

In the section on the loss of HARDER, it was indicated that she was sunk by patrol boat P-102, the former U.S. destroyer STEWART. This made for dramatic and poignant television but maligned the ex-STEWART, which was indeed present but not responsible for sinking HARDER. The real killer was an Escort and Patrol Vessel Type D, usually listed by the U.S. as Coast Defense Vessel CD-22, a far more effective anti-submarine ship than the old ex-STEWART.

The early standard references (Morison, Roscoe, Holmes, Blair, DANFS, U.S. Submarine Losses, et al) all attribute HARDER's sinking to the Siamese destroyer PHRA RUANG and a minesweeper. This was based on the patrol report of HAKE, which described the ships as an old three-stack destroyer and a minesweeper, and went on to say that the destroyer left the area heading for port while the minesweeper stayed and later was heard to drop the depth charges that apparently sank HARDER. The references cited above also repeat that the destroyer left the scene before the depth charge attack. The only three-stack destroyer that was known to exist at that time was the Siamese ship, so it was identified as the one seen by HAKE. It was only after the war that we found out that the Japanese had salvaged STEWART, which had fallen off the blocks while in drydock at Surabaya, been hit by a bomb during an air raid, and finally been blown up by demolition charges and abandoned. The Japanese trunked two of her four stacks together, making her the only three-stack destroyer in the Japanese navy.

Postwar Japanese records confirm that the two ships present were P-102 and CD-22 and that the latter dropped the depth charges which brought up debris and oil indicating the sinking of a submarine, after P-102 had left. This information has been published in at least one reference that I know of (*The Last Patrol* by Harry Holmes, published in Shrewsbury, England by Airlife Publishing Ltd. in 1994). I have been unable to find a reference actually blaming HARDER's loss on STEWART but her presence at the scene was well enough known to have found its way onto the television program.

Incorrect information has a way of spreading and becoming accepted as fact, so I offer the true story in hopes of keeping the record straight.

Sincerely,
John D. Alden
49 Tamarack Drive
Delmar, NY 12054

BOOK REVIEWS

SUBS AGAINST THE RISING SUN

by Keith M. Milton
Yucca Free Press, Las Cruces, NM
2000, 376 pages, $30
ISBN: 1-881325-45-8
Reviewed by CDR John D. Alden, USN (Ret.)

When I read the flyer advertising this book, I had high hopes. Promoted as "an encyclopedia of the activity of our subs and their personnel during World War II," its main features were said to include: (1) records of all patrols made by 249 submarines in the Pacific, including date, captain, duration, base, location of patrol, and sinkings claimed and confirmed; (2) *Victory records* (actually ships sunk) with date, ship, size, and location; (3) data on builder, boat's history, awards, and final disposition; and (4) appendices ranking boats and skippers by both numbers and tonnage of ships sunk and providing lists of wolf packs, Presidential Unit Citations, Navy Unit Commendations, and other data. In addition there were photos of every boat, a section on the "torpedo scandal," and other features of potential interest. This promised an impressive amount of data. Although I was aware that everything was available elsewhere, it had been presented piecemeal in various publications at different times and was not readily available to submarine buffs or the general reader. The book, therefore, offered considerable promise as a convenient source of data on U.S. submarine activities during World War II.

The author, identified as the brother-in-law of a former FIN-BACK sailor, has indeed pulled together a massive amount of data, apparently as a labor of love. He has also added a couple of nice touches for the sake of completeness by including photos of the SEALION (SS 195) and DORADO (SS 248), which were lost before making a patrol, and listing the Atlantic patrols made by the boats that were later transferred to the Pacific. With the exception of the R-12 and S-26, which also made no patrols, all 52 submarines lost during the war are covered. The boats are grouped

alphabetically within eleven classes, starting with the S-boats and ending with the Tench class. This could make it difficult for a casual reader to locate a particular boat, and even experienced submariners might have trouble remembering a boat's proper class. In fact, the author has made the common error of including the GOLET, GUAVINA, GUITARRO, and HAMMERHEAD (SS 361-364) in the Balao class rather than the Gato class. (The photos of all four show the Gato-type *covered wagon* superstructure.) The name of FLYING FISH(SS 229) should be written in two words.

The main source of general information about each boat including the builder, commissioning date, and disposition, appears to be the eight-volume *Dictionary of American Naval Fighting Ships*[1], in which the entries vary significantly in quality from volume to volume. However, the author has limited his extracts to only a few sentences per boat, and I made no effort to check these entries for accuracy. The photos, although often of interest, are not reproduced clearly enough to distinguish detailed features of the boats. These are minor criticisms and should cause casual readers no real problems.

Unfortunately, the useful features of the book are offset by some serious limitations of particular concern to readers looking for accurate and reliable information. The basic problem is revealed by the bibliography of only eleven entries, of which those that are clearly the main data sources are as much as 50 years out of date. In addition to perpetuating the errors or omissions in these sources, the author has introduced too many mistakes of his own in transcribing or interpreting material from them. This reviewer hates to harp on such errors, but as a general indicator, there are eight misspelled names in the otherwise useful charts reproduced inside the front and back covers, several of which errors are repeated throughout the book. The more serious deficiencies stem from the data sources used by the author.

The data on patrols have been taken from Appendix F of Clay Blair's *Silent Victory*[2] and rearranged by boat. In spot checking, I noted some errors in transcribing dates and place names, and many misspellings of skippers' names. The big problems with the patrol data are that Blair gave only the month when each patrol was begun and showed all of them as starting from the fleet headquarters

location (Pearl, Fremantle, etc.) although many boats underwent upkeep and started patrols at forward bases like Guam, Midway, Subic Bay, and others. Milton has simply repeated the same limited information.

The lists of sinkings appear to have been taken practically verbatim from Roscoe[1] and thus perpetuate many 50-year old errors that have long since been identified by later researchers. Among the more egregious ones are giving NAUTILUS half credit for the carrier SORYU (she made only a dud hit on KAGA, attributing the sinking of U-163 to HERRING (disputed by German sources), identifying the carrier sunk by RASHER as OTAKA (a mistranslation of the correct name, TAIYO); continuing to credit boats with the *Unknown Maru*s never corrected by JANAC[2], and perpetuating that source's characterization of certain ships as *ex-light cruisers* and *ex-gunboats*" (They were merchant ships converted to armed merchant cruisers or gunboats, not former warships.) There are also many misspellings of Japanese ship names, such as identifying the big tanker sunk by PINTADO as the SUSAN MARU #2 instead of TONAN MARU #2. Also taken directly or with minimal modification from Roscoe and Blair are the various appendices ranking boats and skippers according to ships sunk, listing wolf packs, etc. Both sources based their rankings on JANAC data because there was nothing better when those books were written.

A few additional comments are worth noting. On page ix the author states that the S-34 claimed "what *may* have been the first sinking" of the war on December 12, 1941, but a few pages later he identifies the boat correctly as the S-38. The victim has finally been identified as the Norwegian freighter HYDRA II of 1,375 gross tons. The reader may decide what credit should be allowed for this sinking. Milton says CACHALOT and CUTTLEFISH were retired from patrols because they were worn out and broken down. Since they served reliably and effectively as school boats at New London for the rest of the war, the real reason was more likely their inadequate speed and endurance. PLUNGER is pictured on page 50 as toppled over in drydock at Pearl Harbor; she really fell off the marine railway. On page 197 the author describes the Balao class as having a "slightly increased operating depth,"

whereas most submariners viewed the 33 percent depth increase as a major improvement in the boats' ability to withstand Japanese depth charges. LIONFISH and MANTA are stated to have been built at the Cramp Shipbuilding Company, which is true only in part. They were started there but completed by Portsmouth. The photo of LIONFISH on page 262 shows the incomplete boat in the process of being towed away.

In sum, the author of this book had good intentions and did a lot of work pulling material together. With such a mass of data, 95 percent or more of it may be correct, but the reader cannot be sure where the errors are. Regrettably, the use of obsolete data sources and insufficient checking or proofreading make it an unreliable reference work and one that perpetuates rather than corrects ancient errors.■

Notes:

1. Blair, Clay, *Silent Victory*. Philadelphia & New York: J. B. Lippincott Co., 1975.
2. Roscoe, Theodore, *United States Submarine Operations in World War II*. Annapolis, MD: United States Naval Institute, 1949.
3. *Dictionary of American Naval Fighting Ships*. Volumes I-VIII. Washington: Naval Historical Center, Department of the Navy, 1959-91.
4. *Japanese Naval and Merchant Shipping Losses During World War II from All Causes*. Washington: Joint Army-Navy Assessment Committee, U. S. Government Printing Office, 1947.

BIG RED

Three Months on Board a Trident Nuclear Submarine

by Douglas C. Waller
Publication Date: 3/10/01
Harper Collins Publisher
$27.50, 314 pgs., 32 photos
Reviewed by CAPT R.H. Weeks, USN(Ret.)

Douglas Waller has written an interesting chronicle of a portion of a USS NEBRASKA (SSBN739) strategic patrol in the Atlantic. Seen primarily through the eyes of its CO, Commander David Volonino, and the Chief of the Boat (COB), MCPO David Weller, it pays close attention to the relationship between the two, and between them and the remainder of the 162 man crew. The author interviewed 106 crewmembers over the course of a month in port and three weeks at sea. The only person not given his proper due is the ship's Executive Officer.

Big Red covers every aspect of a strategic submarine's operations, including the difficult egress from its home port and its return [early SSBN homeports were on the open sea—later ones were "up the river" in the Southeast US].

One of the more interesting threads sewn in the course of the book is the background of many of the crew—how they got from Anytown, USA to USS NEBRASKA.

The author rightfully spends a significant section of Big Red on strategic missile release procedures—from receipt of an exercise presidential release order to the simulated release of the SSBNs Trident missiles. After all, as Mr. Waller points out—when a Trident submarine goes to sea, it becomes the sixth largest "nuclear power" in the world.

This reviewer takes exception to two passages in Big Red. One, "during the cold war, a Trident would never have dared to sail into a confined ocean like the Mediterranean" is anethma to an old Med SSBN hand. We routinely made Polaris/Poseidon patrols in the Med for years. There was seldom much boredom during a Med run.

The other is more personal. To quote "The (boomer) couples

who stayed together...probably shouldn't have been married. Certainly they shouldn't have kids." I find this an affront to my wife and to the thousands of other fine boomer wives who successfully raised many thousands of kids.

Big Red should prove a good read for the general public and the non-submarine military. For old time boomer sailors, it informs them of the changes that have occurred and an answer for the question "Grandpa, what did you do out there?"■

Douglas Waller is the congressional correspondent for Time magazine. Earlier in his career he had worked for Newsweek and been a congressional staffer. He has published two other books on military matters.

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.

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

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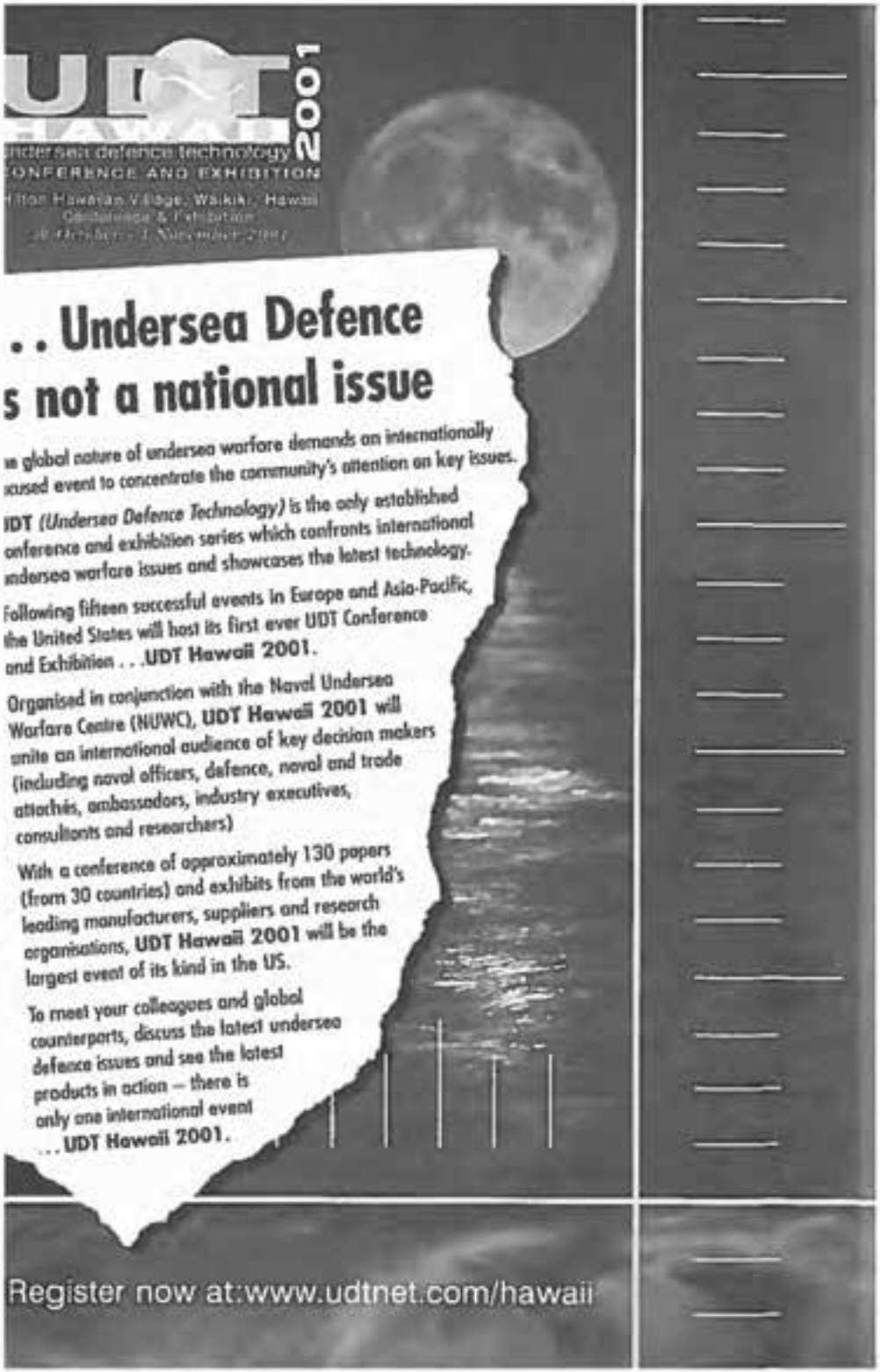
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