THE SUBMARINE REVIEW

NAVAL SUBMARINE LEAGUE

JULY 2003

EDITOR'S COMMENTS

Our July issue is usually heavier with speeches and presentations than the other three editions each year due to scheduling of the various symposiums and major meetings in which the League is highly involved. This year July has more than the usual amount of high-level contribution with over one third of the substantive content devoted to policy issues of interest to the future of American submarining. I include in that listing the very interesting account by LOUISVILLE's skipper, CDR Mike Jalaby, of his ship's action in the recent Iraqi War. It is a *don't miss* piece of history.

These observations of policy, and the implications of policy, like the war patrol of LOUISVILLE, are presented to the members, of course, to keep all of us abreast of the latest in the submarine world so we can spread that word whenever the opportunity may arise. While there is a certain amount of *preaching to the choir* involved in publishing these policy pieces to members of the Naval Submarine League we believe the reader will find information here which is new as well as pertinent.

The first section recounts an American Shipbuilding Association Sea Power Seminar which was conducted in the U.S. Capitol Building earlier this year. The subject is the Navy's Shipbuilding Program, the emphasis is on the submarine and carrier portion of that program, and the point is that we need more ships. These seminars are a regular feature of ASA's efforts and they are sponsored by many members of the Congress. Attendees are mostly congressional staffers, members of the press, naval officers and industry representatives.

The next two sections are also printed versions of presentations at The SubTech Symposium and the Annual Symposium. Here again, the high level from which these observations are made make them very appropriate to the submarine community.

The ARTICLES in this issue offer the usual spread of interest and important thought. Bob Hamilton's reporting from PROVIDENCE provides an up-to-the-minute deckplate observation, and

George Martin's windup of his THRESHER search report gives a critical historical view. There is also plenty to ponder in Joe Buff's piece on a subject of continuing talk among those who don't like to fund submarines. Enjoy your submarine reading!

Jim Hay

FROM THE PRESIDENT

The 2003 Annual Symposium was a resounding success. Your Naval Submarine League set out to put together an agenda that would provide a high level of information exchange from the Submarine Force leadership, recognize the 2003 Fleet Awardees and an outstanding civilian for contributions to the Force, honor the 2003 Distinguished Submariner and have some fun. Admiral "Skip" Bowman, Director of Naval Reactors, set the tone for the information exchange. The pace was maintained by a full agenda including the Force Commanders, Force Master Chiefs and a select group of the submarine force Washington team. The most important message was the need to increase the acquisition rate of the Virginia Class Submarine to at least two per year just to maintain the approved baseline. In this issue of *The Submarine Review* are several articles that we will publish in a separate pamphlet to send to our Members of Congress, DoD, Joint Chiefs, and Navy leadership. You can help us in this regard by making your views known to your elected representatives.

The Fleet Award winners made us all proud–more than half were present to receive their awards but we missed three because they were at sea. The names of the six Fleet and the civilian awardees are listed in this edition of the *Review*. At the banquet we honored Admiral Bill Crowe as our Distinguished Submariner and heard a great address by Admiral Jim Watkins. If you did not have fun, you were not present.

At the Annual Business Meeting I reported the relief of Admiral Frank Kelso as our Chairman by Admiral Bruce DeMars and the election of several new members to your Board of Directors. Also, I reported a very rewarding year where we submitted our first budget with a surplus in five years. Righting the financial ship was a team

effort, with the staff and our corporate benefactors in key roles. We are continuing to expand our use of the Internet to provide information to you. Thanks to the recommendations from many of you, we are putting a Word and PDF file of the updated directory on the website where you can download it if you desire a hard copy. I encourage you to update your e-mail address.

The success of this year's Submarine Technology Symposium (STS) matched that of the Annual Symposium. The dispersion of the 11 keynote speakers throughout the three days allowed everyone to enjoy presentations from Navy and industry leadership on technology issues at every session. Excellent papers on a wide variety of topics were presented. A central theme was the importance of communications at depth. At the completion of this year's signal event Admiral Clemins stepped down as Chairman of the Submarine Technology Symposium. VADM George Emery will lead next year's event.

Admiral Ed Giambastiani addressed both the Submarine Technology and Annual Symposiums this year. His perspective from his new job as Commander, U. S. Joint Forces Command added to the information exchange. The influence that transformation is having on our military preparedness and operations is being heavily influenced by the results of the Giant Shadow operation. This operation demonstrated that SSGN brings a lot more to the table than a large number of cruise missiles and 55 Special Operations Force personnel. This submarine offers the opportunity for "out of the box" thinking. I encourage you to suggest roles and missions that take advantage of the volume provided by SSGN and her 24 very large missile tubes.

Finally, let me wish you a wonderful summer, and ask that you join Jan and me as we pray for the safety of our troops deployed all over the world. I am pleased to represent you as President of your Naval Submarine League. Please recommend membership to your shipmates and friends.

J. Guy Reynolds

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Remarks by Mr. Tom Schievelbein
President, Northrop Grumman Newport News
Sea Power Forum
25 February 2003

Good afternoon. I'm Tom Schievelbein, President of Northrop Grumman Newport News.

It's my pleasure to welcome you to this congressionally sponsored forum on American Sea Power in the 21st Century.

We have three distinguished speakers today.

Before they speak, however, I would like to recognize and thank the U.S. Naval Institute, the Navy League, the National Defense Industrial Association, the Naval Submarine League, the Surface Navy Association, and the Association of Naval Aviation for jointly hosting these forums with the American Shipbuilding Association.

These forums, designed to be informative in nature, give us the opportunity to discuss topics important to the Navy and to shipbuilding.

Today, our topic is the risks posed by a shrinking fleet–and what this means to our national security and economic prosperity.

It's important to bring this kind of information to the attention of our policy and decision makers and to the public.

Because these risks are real.

It's not only our past that reminds us that we are vulnerable–it's our present.

The bombing of the USS COLE, the tragedy that took place on September 11, the color-coded threat levels, the heightened security in this city as well as others around America, are stark reminders that we are vulnerable.

They are also clear reminders that we need to be militarily prepared as a country to defend our lives, and our way of life, at all times.

We must be prepared militarily to deter aggression.

And when deterrence fails–we must be able to respond decisively anywhere in the world.

One of the critical ways we meet this need is through a strong

Navy.

Naval ships are mobile, lethal bases at sea.

They can operate anywhere in the world.

Naval ships do not require permission from a foreign government to engage in military operations far from our shores.

In fact, when foreign governments deny us the use of their land bases, sea power gives the United States the most effective means to defend our freedom.

Yet this all-important means of defense is at risk.

Each year our Naval fleet shrinks.

Yet each year, the number of wars, contingencies, and missions grow.

In 1987, the fleet numbered 594 ships.

Today, it stands at just 301.

Next year, the number drops to 290.

This trend represents a decline to a force level of 200 or fewer ships.

In fact, for the last twelve consecutive years–on average–only six ships per year were bought.

This is the lowest rate of Naval ship production in our nation's history since 1932.

As a shipbuilder, I can tell you that my industry and the Navy are aggressively developing new technologies to transform the operational capability and flexibility of Naval and Marine forces. Yet technology alone will not keep our country safe and secure.

No matter how advanced–a ship cannot be in two places at the same time.

As the Chief of Naval Operations has stated on numerous occasions, and I quote, "Quantity has a quality all its own. Numbers count in ensuring our Navy is prepared and positioned to carry the national security strategy."

A Navy allowed to decline so dramatically cannot rebuild overnight.

It takes years to design and build each Naval ship.

It takes an Industrial base made up of shipyards and thousands of suppliers that make all the components and systems that go into ships.

It takes people, many thousands of them, with skills that are learned and fine-tuned over years, not months.

In the past decade, many in my industry have struggled to keep their companies afloat, and to hold on to skilled people in the face of historically low production rates.

Yet at the same time, we're making major investments in technology, in facilities, in training our people, and in transforming our business and manufacturing processes to try to offset the rising costs associated with low production.

However, it's not enough.

I can assure you that we in the shipbuilding industry are committed to the security of this country–and to working with our Navy partner in rebuilding America's sea power to win the war on terrorism.

And this forum today is designed to help all of us move America closer to this goal.

I will now introduce the first speaker.■

OUR NATIONAL NAVAL FORCE STRUCTURE

Remarks by The Honorable Jo Ann Davis (R-VA)
American Shipbuilding Association Forum
25 February 2003

Introduction by Mr. Schievelbein: Now it's my pleasure to introduce our first speaker. She represents the interests of both my company and my community as the Representative from the First Congressional District of Virginia.

A strong advocate for shipbuilding and a strong defense, she was elected in 2000.

She serves on the House Armed Services Committee, and in particular, the newly formed Subcommittee on Projection Forces.

In her first two years in Congress, she already has developed a reputation in both the industry and in the House of Representatives as a very skilled and effective legislator in working to rebuild the Navy and the shipbuilding industry.

Last year, she led the fight to maintain production for the CVN(X) aircraft carrier–now called CVN 21–and she has introduced in this Congress H.R. 375, the National Naval Force Structure Policy Act.

Please join me in welcoming Congresswoman Jo Ann Davis.

Over the years, the American Seapower Forum has done great work in bringing together the shipbuilding community, bluewater Navy, and congressional members to discuss these important issues. In light of this, I think there is no better forum for addressing the needs of our Navy, and I would like to thank Cindy Brown for this.

In addressing the needs of our Navy, perhaps it is best to examine what has happened to the Navy over the past several years. In short, over the past decade the Navy has been forced to rob Peter to pay Paul, and this has caught up with us. Historically there has been a consistent downward trend in ship procurement and the size of the

Navy. We have come a ***very long way*** from Ronald Reagan's six hundred ship Navy.

Many in the Navy will point to the fact that our ships are no longer as labor intensive, thus requiring less ships. But, let's not kid ourselves. The Navy's budget and growth is determined years in advance, and does not always reflect the true needs of our naval force. Just last year, I received an advance copy of the May Navy Program Objective Memoranda (POM), a document which I am sure was widely perused in these circles. It was a planning document which suggested that, long-term, we reduce the number of ships in our Navy to 291 in 2006 before re-building the Navy to a base of 300 ships by the end of the Future Years Defense Plan.

However, when I was handed a draft copy of DOD's budget submit to OMB, it suggested an immediate reduction of our base force to 291 ships in 2004. This is typical of the budgetary game that we have been forced into playing since the end of the Cold War when it comes to ship procurement and construction. Cut numbers in the current years to free up money for future years procurement . . . When is enough enough? Our Navy, Department of Defense and the Office of Management and Budget must realize that we can no longer put off rebuilding our Navy.

Over time, the Navy has been consistent in arguing that it requires ***more ships***. The QDR cited a need for 310 ships. As recently as three years ago, the Navy was arguing for a force of 360 ships based on 15 Carrier Battle Groups and 14 Amphibious Ready Groups. In more modern times the Navy has always argued for basing its force on Carrier Battle Groups and Amphibious Ready Groups. Earlier last year, the Navy finally publicly suggested that 375 ships was the right number. What's going on here?

It seems pretty clear to me. The Navy is now planning to utilize a reduced combat force relying on Carrier Task Forces and smaller ready groups. Thus, it now needs only 12 carriers, even when ***all*** of the combatant commanders have suggested to me in hearings and other fora that they need at least 15 aircraft carriers to reduce mission gapping.

What does this mean for the Navy? In many respects, it means the Navy has been forced to give in to a budgetary plan that may never supply enough money for it to be a genuine worldwide

presence in terms of combat power and forward deployed air presence. Now, Navy's plan for 375 ships relies more on procurement of LCS's and DDX's, ships for which I have not yet even seen real plans.

This does ***not mean*** that I believe LCS's and DDX's should not be procured. I simply believe they should be an option in the near term to reduce risk, yet we will ultimately be forced to move toward a more robust forward deployed presence.

The ironic thing about all of this is that DOD will not even publicly endorse a budget for the Navy that would allow them to move toward a 375 ship force structure while relying on LCS's and DDX's. Yet, at the same time, it proposes ship swapping crews to save money and increase deployment times of ships. The result would be interesting, if it were not so disturbing, as to what this would do to our industrial base and OPNAV 4700 when it comes to ship maintenance.

What I propose is a simple interim declaration as to the intent of Congress and the policy of the United States. Last year at the end of September, with Congressman Gene Taylor as my partner, we introduced H.R. 5196, the National Naval Force Structure Policy Act. This year, we reintroduced it with 19 of our colleagues.

The intent of this act is simple. This bill declares:

"It is the policy of the United States to rebuild as soon as possible the size of the fleet of the United States Navy to no fewer than 375 vessels in active service, to include 15 aircraft carrier battle groups and 15 amphibious ready groups, in order to ensure peace through strength for the United States throughout the 21st century."

That's it. There's no more to it. I wish there was no need for this legislation. ***However, I believe we have been forced to introduce this measure.*** The budgets for ship procurement have always looked rosy in the out years, but never in the now years. It's time that is changed. While H.R. 375 does not set the force structure, it does set a baseline for us to plan for in the future. To those who would say this is without precedent, I would suggest they review their history and look at what Carl Vinson did with the Two Oceans Navy Legislation in the 1930's. H.R. 375 ***certainly*** allows a level of planning with far more leeway than what Mr. Vinson allowed.

Before I close, I would be remiss if I did not point out some facts which are encouraging. With respect to the Future Aircraft Carrier, CVN 21, DOD did the right thing in planning to integrate more future technology into the carrier with a start date in 2007. We have had, in no consistent way, an ongoing carrier R&D program for future carriers. This is a start. With respect to our ship procurement rate, I'm happy to see the slight increase. However, it needs a radical increase to between 13 and 15 ships a year for long term health.

One thing we should not forget during this time is the fact that our Sailors and Marines might well be going into combat in the near future. They are the strength of our nation, and the best we have to offer. To under fund the Navy is to under fund them. They are the men and women we are concerned about. We support the operators. We should give them the best, and set a new course that steers us to a stronger, safer Navy, and a resurgent America.

Thank you, and may God Bless America.■

108th CONGRESS
1st SESSION

H.R. 375

To declare, under the authority of Congress under Article I, section 8 of the Constitution to "provide and maintain a Navy", a national policy for the naval force structure required in order to "provide for the common defense" of the United States throughout the 21st century.

IN THE HOUSE OF REPRESENTATIVES

January 27, 2003

Mrs. JO ANN DAVIS of Virginia (for herself, Mr. TAYLOR of Mississippi, Mr. FORBES, Mr. McINTYRE, Mr. SMITH of New Jersey, Ms. ROS-LEHTINEN, Mr. ANDREWS, Mr. SCOTT of Virginia, Mr. CUNNINGHAM, Mr. SIMMONS, Mr. LARSEN of Washington, Mr. KENNEDY of Rhode Island, Mr. MILLER of Florida, Mr. PLATTS, Mr. SAXTON, Mr. WILSON of South Carolina, Mr. HASTINGS of Florida, Mr. GOODE, Mr. HOSTETTLER, Mr. LANGEVIN, and Mr. McGOVERN) introduced the following bill; which was referred to the Committee on Armed Services

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A BILL

To declare, under the authority of Congress under Article I, section 8 of the Constitution to "provide and maintain a Navy", a national policy for the naval force structure required in order to "provide for the common defense" of the United States throughout the 21st century.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled.

SECTION 1. SHORT TITLE.

This Act may be cited as the "National Naval Force Structure Policy Act".

SEC. 2. NATIONAL NAVAL FORCE STRUCTURE POLICY.

It is the policy of the United States to rebuild as soon as possible the size of the fleet of the United States Navy to no fewer than 375 vessels in active service, to include 15 aircraft carrier battle groups and 15 amphibious ready groups, in order to ensure peace through strength for the United States throughout the 21st century.

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Remarks by ADM F.L. "Skip" Bowman, USN
Director, Naval Nuclear Propulsion
to the
American Shipbuilding Association
25 February 2003

Introduction by Mr. Schievelbein: Our next speaker knows ships and knows them well.

Admiral "Skip" Bowman was born and raised in Chattanooga, Tennessee. Admiral Bowman is a graduate of Duke University and received his Navy Commission through Duke's NROTC Program. He holds two Masters of Science degrees from the Massachusetts Institute of Technology.

Admiral Bowman has served our Navy for nearly 37 years ashore and in both nuclear-powered attack submarines and ballistic missile submarines. He commanded the attack submarine CITY OF CORPUS CHRISTI from 1983 to 1986 and the submarine tender HOLLAND from 1988 to 1990.

Admiral Bowman's first flag job was as Deputy Director of Operations in the Pentagon's National Military Command Center. He was then assigned as the Joint Staff's Director of Political Military Affairs under General Colin Powell and he served as the Navy's 50th Chief of Naval Personnel.

Admiral Bowman received his fourth star in 1996 upon becoming the third successor to Admiral Hyman G. Rickover as the Director of Naval Reactors. As the Navy's senior submarine officer, he continues to provide the Navy and the nation with strong leadership and vision. I'm glad to have him on our side!!

I'm pleased that Admiral Bowman could join us today.

Ladies and Gentlemen, please welcome Admiral "Skip" Bowman.

I suppose I'd better start off with a couple of caveats myself. First of all, I'd like for the record to show that Congresswoman Jo Ann Davis (R-VA-1st District), the previous speaker, fussed at me several times for not pushing for more ships. That's the first

time that's ever happened.

But there is a caveat that's kind of important. I was told, Cindy [Ms. Cynthia Brown, President, American Shipbuilders Association], that this was to be a forum about nuclear-powered warships, and so my text will depart from my normal ecumenical and joint approach to life and will focus mostly on the nuclear power side of this world.

The nuclear power community is a growing community in the Navy. As a backdrop to what I would like to say about shipbuilding and about nuclear-powered warships, some of you might be surprised to find that our Navy oversees the same number of reactors as the Nuclear Regulatory Commission does in this country. 103 commercial reactor plants in this country, 103 reactors in the United States Navy.

The Chief of Naval Operations, Admiral Vern Clark, considers his nuclear-powered fleet to be 40 percent of his major combatants. Since USS NAUTILUS, our ships have steamed some 126 million miles safely on nuclear power. Today, in addition to the 54 attack submarines, 16 *Trident* strategic missile submarines, and 9 of our 12 aircraft carriers, we're in the various stages of building 5 more attack submarines and 3 carriers, converting two of those former *Trident* submarines to SSGNs, and refueling four LOS ANGELES-class submarines and one NIMITZ- class carrier. A fairly active business.

But in support of our Navy's and our country's global responsibilities and obligations, *Sea Power 21* absolutely demands a forward-deployed, highly mobile Navy. Nuclear power delivers that mobility, delivers the endurance that goes with it, that is necessary in the world today, and as far out as I can see.

Our Navy's warships are needed in more places around the world today than there are warships. Nuclear power helps bridge the gap between what we really need, as Congresswoman Davis said, and what we have today. Nuclear-powered warships can move from hot spot to hot spot faster and arrive on station more fully ready for combat than their conventional counterparts.

That said, even nuclear-powered can only be in one place at a time. We need more.

We've studied the need for nuclear-powered attack submarines

and whether we really need large-deck nuclear powered aircraft carriers ad nauseum, since the Berlin Wall came down in 1989. These studies have unanimously endorsed both the attack submarine and the large-deck nuclear-powered carrier.

Some of you, and some others, have challenged the validity of these studies post-9/11. In point of fact, the Combatant Commanders' demand for these ships has gone up, starting 9/12/2001. Today, right now, 39 of our nuclear-powered warships are at sea, poised to take the fight to the enemy. Our submarines are being asked to operate in places where they've never been. Shallow, contact-thick areas where only the submarine's covert, persistent presence can deliver the goods.

Both the carriers and the submarines were key in routing the Taliban in Afghanistan and in disrupting the planning and operation of Al Qaeda–*the base*–the base of despicability–and both remain key in today's plans.

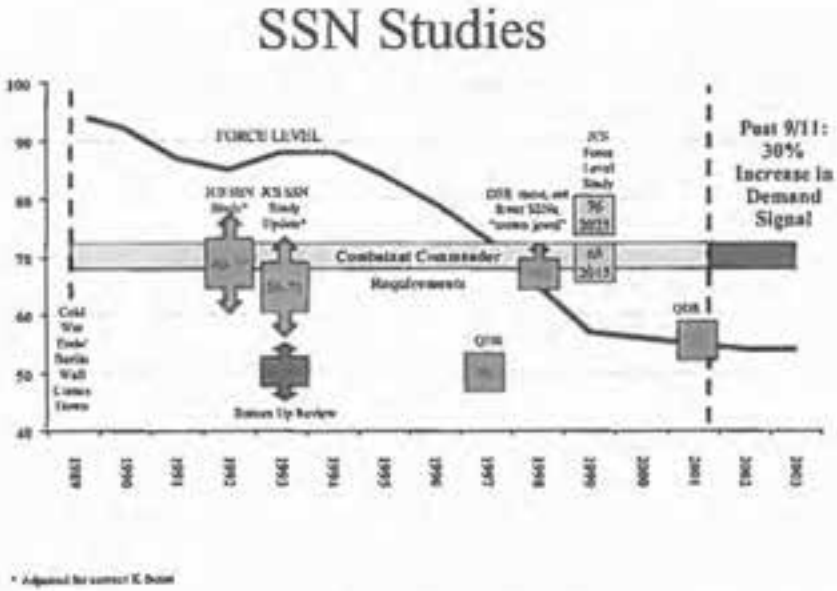
But the future clearly brings imperatives for innovative payloads and sensors launched from these platforms. And that's where we're headed. The recently completed, highly successful ***GIANT SHADOW*** experiment tested concepts in hardware that could double or triple the value of each of these submarines while reducing risk to the crew. And the CVN 21 will triple the electric power available and reduce manning onboard by around 800 billets–all while improving warfighting capability and survivability of these capital ships.

But you know in these days, when you can get a hamburger (without fries) in New York City for $50, we simply have to make these ships less expensive. Less expensive to the taxpayer, and less expensive to the Navy budget. Some are already warning–incorrectly I might add–that the VIRGINIA-class build rate of two per year starting in 2007 will consume some 40 percent of the Navy's budget. We've done a poor job of buying and paying for these ships–these capital assets–smartly. Industry, Navy, OSD, OMB, and Congress simply must come to grips with buying and funding more intelligently. We must mend our ways.

All right, I said I was going to stay parochial and not ecumenical, but let me borrow from a tactic that I learned when I was on the Joint

Staff from my Army counterparts. The Army generals always said that, what you should do when speaking before an audience is tell that audience what you're going to tell them; and then tell them; and then at the end, remind them what you've just told them.

I've told you what I'm going to say, so now let me say it. And I'll do it this time with typical Naval Reactors lecture slides.



This first chart merely shows, over the years (starting with the fall of the Berlin Wall), those studies that I indicated had been conducted, dealing with the need for attack submarines. Study after study, those conducted in the Pentagon and in the Joint Forces, and out in the Combatant Commanders' area of responsibility, have dictated a need for around 65 to 70 submarines. Certainly, one of the bell-ringers was the Defense Science Board's study in 1998 that called the attack submarine "the crown jewel in the Nation's arsenal." At that time, we had 65 attack submarines, and that study said "we need more, not fewer."

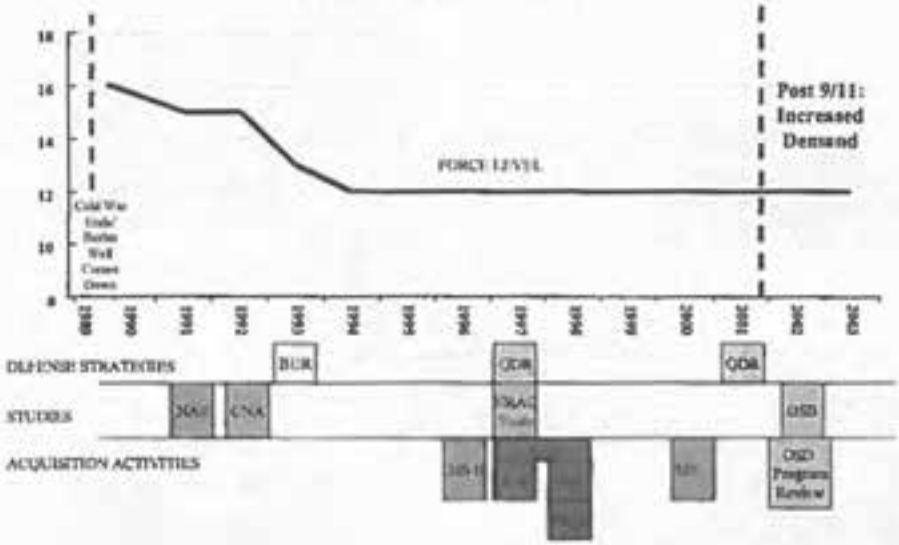
But you might notice, down at the bottom, are three studies that were based, not on warfighting, but on cost. And you might also notice that the black line, which represents today's attack submarine force structure, has merged–not to the Combatant Commanders' needs for warfighting and peacekeeping around the world–but rather to the budgetary demands of those three studies at the bottom.

So I rest my case: We simply must remove cost from these vessels. Post-9/11, as I said earlier, the demand went up for these ships by 30 percent. We are attempting to make do with the numbers that we have (54 attack submarines today) by running these submarines harder. That is to say, our basis for planning has always been that we would move these submarines from point A to point B at 16 knots. Today, to make ends meet, we're moving them from Point A to Point B *to point C*–at 20 knots.

The Navy's planning goals also state that we would be operating while deployed for 65 percent of the underway time (35 percent in port, just port visiting, or doing some needed maintenance). Our attack submarines are pushing 80 percent operational tempo.

We're also seeing a reduction in what the Navy calls the "turnaround ratio" (which means the time that a crew is back in port, divided by the time it was out to sea). So we're trying to make ends meet. Something's gotta give. Something will give. What's going to give at the end of the day is the reactor core endurance, because we are taking neutrons out of this core that are irreplaceable. So the idea that these submarines and the reactor cores in them will last for 33 years, we're seeing drift by us as we continue to operate as we've had to after 9/11.

Aircraft Carrier Studies



The next chart shows the same thing for the carriers. Study after study has looked at alternatives, ranging from the MOB [mobile offshore base] to SWATH [small waterplane area twin-hull] ships to semi-submersibles, to repeat NIMITZ. And each time (and again and again) has determined that the right answer is the large-deck nuclear-powered warship, called a nuclear-powered aircraft carrier of about 100,000 tons.

As Congresswoman Davis said, if you ask the Combatant Commanders, they would call for 15 of these carriers, and we have 12. We are trying to make that work.

Nuclear Powered Vessels in the War on Terrorism

The next slide shows something of what we've been doing post-9/11, and why that demand signal has gone up. In the center, there's a map of that area of the world that includes Pakistan, Afghanistan, and portions of India.

On 9/11, USS ENTERPRISE (CVN 65) was on her way home after completing a deployment to the Arabian Gulf. Upon hearing the news of the attacks, she headed back toward the Arabian Gulf without order from higher authority. Likewise, the aircraft carrier USS CARL VINSON (CVN 70) and the attack submarines USS KEY WEST (SSN 722) and USS PROVIDENCE (SSN 719) proceeded to station off the coast of Pakistan. These four nuclear-powered warships (a total of 12 reactors) responded immediately in this time of crisis–a testament to their endurance, mobility, and

speed. If the President had chosen, he had two carriers and two submarines ready to launch within 48 hours.

I said earlier that nuclear power delivers the mobility and the endurance that's necessary in this crazy world that we're going to be living in, probably for the rest of our lives. I would rest my case with this story.

Also shown on this slide are the various other aspects of the post-9/11 situation that the nuclear-powered warships have been at the heart of: the number of Tomahawk missiles launched against the Taliban in Afghanistan, 30 percent of them from the nuclear-powered warship community; the number of sorties and manned strikes into Afghanistan, 70 percent of them from our carriers.

A new mission: tracking and keeping track of those merchant ships that we know Al Qaeda is involved in. Knowing who's aboard and what their names are. What the names of the ships are. What color they are when they go into port, and what different color they might be when they come out of port. All of this of inestimable value to our Global War on Terrorism.

The next chart covers what I said earlier about *Sea Power 21*. This blueprint for the future is predicated on the notion that the United States is a maritime nation, and of course it is. And *Sea Power 21*, to a lot of people, sounds like more of the same: ***Sea Basing***, ***Sea Strike***, and ***Sea Shield***. But it goes beyond what we've done before. It goes beyond shielding just maritime forces, to shielding those forces ashore. It goes beyond merely striking and moving on, to persistent strike over months if necessary. And it goes beyond merely basing the maritime forces at sea, to providing the joint force commander an option to set up a base when our fickle allies aren't there for us and bases aren't available ashore, to set up those bases at sea.

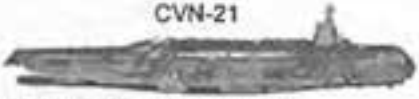
Needless to say, the missions of our attack submarine force and our nuclear-powered carrier force are at the heart of all three of those sub-missions of *Sea Power 21* today.

FUTURE SSNs

SUBTECH

FUTURE CVNs

CVN-21



Revolutionary Propulsion Plant
Zonal Electrical Distribution System
- 3X Increase in Electrical Power

Integrated Warfare System
EMALS
Aviation Enhancements
- Enlarged Flight Deck Footprint
- Advanced Arresting Gear
- 3 Aircraft Elevators
- Pit Stop Fueling/Arming
- Smaller, Redesigned Island
- 2 Hanger Bays
- Increased Sortie Generation Rate

Survivability Enhancements
Redesigned Weapons Stowage/Handling
- Relocated Weapons Elevators
- Automated Handling

800 Billet Reduction

But the future is also very bright. On the next chart, we show examples of what I mentioned earlier. This experiment, ***GIANT SHADOW***, is all about where I think we need to go.

My own submarine community has painted itself into a corner, in a certain respect, by touting the virtues of SSGN as only having to do with *Tomahawk* missiles and *snake-eaters* (special forces). Certainly, it has to do with that. And carrying over 150 Tomahawk missiles, which nearly equals the number of *Tomahawk* missiles in today's carrier strike force, is a very important contribution to tomorrow's warfare. And carrying a platoon of 60 sea-based special forces that can plan their missions in their entirety from onboard the ship is very important. But beyond that we must go.

This experiment that was conducted just a couple of weeks ago off the shores of Florida, in the USS FLORIDA (SSBN 728), demonstrated the capability to move sensors off the submarine and well inland. Unmanned underwater vehicles, unmanned aerial vehicles, to be controlled from the ship (in the case of the underwater vehicle, launched from the ship). The underwater vehicle tracing a safe path for the special forces to go ashore through a minefield that was implanted in the waters there, a simulated minefield. The unmanned aerial vehicle–not launched this time from the submarine, but lent to us–to be controlled from the submarine, downlinking to the forces ashore. This is what we need to do: taking our sailors out of harm's way, extending the reach of the submarine far inland. And this is the future. And this thinking needs to extend to our SSN's.

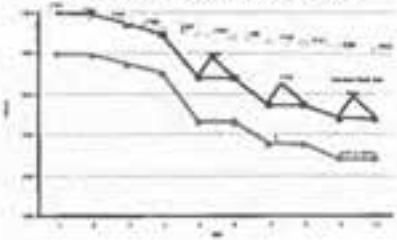
In the bottom left-hand corner is an artist's conception of the advanced sail that could hold some of this payload that doesn't necessarily go *boom*. We have to get out of that mind set, also.

On the right-hand side is the carrier of the future (CVN 21) that Congresswoman Davis spoke about. Indeed, CVN 21 will provide three times the electrical power. Indeed, her design will allow survivability enhancements and opportunities for future additions. There will be an 800-billet reduction, and an operating cost of about $9 billion, over the life-cycle of this ship, less than the NIMITZ-class carrier. CVN 21 is the way of the future, and it was the right thing to do at the end of the last budget cycle to go back to the

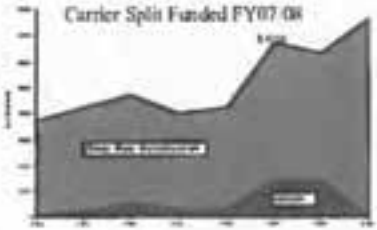
drawing boards and ask ourselves what could be pulled forward from CVNX-II (so-called then) onto CVNX-I, now named CVN 21.

Pending Decisions

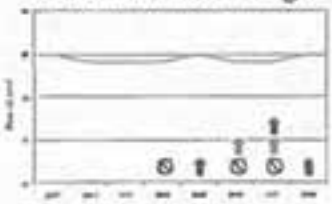
VA Class Cost Reduction



SCN Account



Submarine Refuelings



But now the next chart leads us to the problems, the decisions, the areas that we have to take full account of and come to grips with. On the left-hand side, trace out the top, black line on the top chart: that's what we would achieve if we continued to buy these submarines foolishly, one at a time, one each year, as though we weren't in the game for the long haul. That represents the *learning curve*. It does represent savings, but not very dramatic savings.

The next curve down shows the additional savings achieved by going to two a year. Simply going to two a year, stabilizing the work force, allowing the shipyards to plan, allowing the subcontractors to plan, and equally important, simply adding numbers in the denominator with the numerator staying the same. What I'm talking about

is the overhead at the yards will stay the same (in the numerator), and we're dividing that fixed overhead by a larger number of ships in construction (the denominator) and therefore the unit cost of each of these submarines will come down. So if nothing else, going to two a year, all by itself, achieves unit-cost savings for those reasons.

But the power that's really available to us is in the President's FY04 budget. And it is to couple a multi-year procurement option with economic ordering quantity, which the Navy is footing the bill for and putting up front. So the bottom curve coming down shows the dramatic power of coupling a multi-year procurement contract with economic ordering quantity. (I'm going to talk about this on the next chart, and last chart, just a little bit more.)

In the bottom left-hand corner are the eight remaining LOS ANGELES-class submarines on the table in the years ahead. We have inactivated and decommissioned 10 LOS ANGELES-class submarines. This, I think, is a tragedy. We have refueled, or are in the process of refueling, 13. That leaves 8 of the 31 original 20-year core, LOS ANGELES-class submarines to do something with.

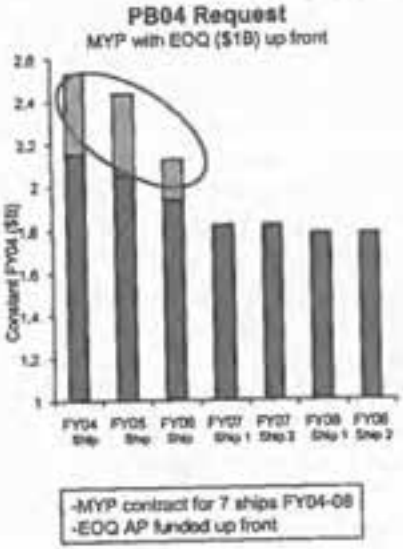
The up arrows show the five LOS ANGELES-class submarines that are in the President's budget for refueling and continuing on for 12 years for a net cost of $200 million. Twelve years of service for a net cost of $200 million. The other marks are those decisions that we could make to include three more LOS ANGELES-class submarines in the refueling batch.

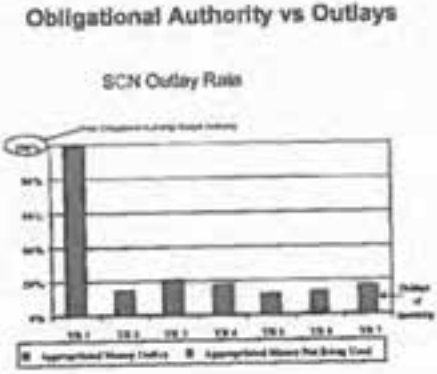
For $200 million apiece, I think we should.

On the right-hand side is the decision that's pending on the Hill to allow split-funding at least over 2 years of this expensive, but very much needed CVN 21. At the bottom is the old way of doing business: fund it all in one year. Now I know everyone in this room who has ever bought a house, buys their house exactly that way, right? Pay for a house in one year. No. Doesn't make sense when buying a house.

Doesn't make sense when buying these capital ships, either At least by split-funding over 2 years, it provides the Navy some head space in the upper chart on the right to buy more ships during those two heavy years of CVN funding. We must take these decisions on this Hill this year.

VIRGINIA Class





Another thought: "EPQ"

Finally, in the last chart, I wanted to talk more about this multi-year procurement with the so-called economic ordering quantity leverage that is available.

On the left-hand side is a profile of what the President's FY04 budget looks like. Circled is a billion dollars of Navy money–in $400 million, $400 million, $200 million increments–to fund primarily the material buys from the shipyards to their subcontractors. Enormous leverage and savings can accrue to this. Giving those subcontractors the opportunity to plan ahead, to stabilize their own workforce, to figure out the most efficient way to deliver this needed material to the shipyards, to level-load and avoid the cost of each year starting up and shutting down, and starting up and shutting down: this is the right thing to do. And the Navy has funded this in this FY04 budget that's now on the Hill.

The right-hand side is out-of-the-box, not-asked-for, purely Bowman-think. It has to do with another angle at this. Given that the Navy put this billion dollars of EOQ money up, if you take a look at the required outlays–that is to say, after budget authority is granted, after money is deposited figuratively on the Treasury books in *YR 1* (year one) for the submarine, and let's say $2 billion for round numbers–in that first year only about 7 percent of that $2 billion is really needed in outlays: in bills that must be paid, in checks that must be drawn against that account.

So let's call it 10 percent so we can do the math in our heads: $200 million against the $2 billion that is written on the Treasury books. So $1.8 billion sits on the Treasury books, doing us no good, earning no interest, no helping. If we could employ that $1.8 billion that's shown at the top of that *YR 1* scale in allowing the ***shipbuilders***, now, to be all ***they*** can be, and utilize that funding in what I'm calling *economic production quantity* (EPQ)–there's more money to be saved.

This may not be the best idea in the world (in fact, it might be a terrible idea), but it's another thought. It's another idea.

And we have shown that we've got to stop doing business the old way, through everything that I've said. We must find a better way. ■

Remarks by Mr. John K. Welch
Senior Vice President-Marine Systems Group
General Dynamics Corporation
American Shipbuilding Association Forum
25 February 2003

Introduction by Mr. Schievelbein: Last but certainly not least, it's my pleasure to introduce someone who is a colleague, competitor, teammate and friend.

From October of 1995 until March of 2002, he was the President of Electric Boat of Connecticut.

In 2002, he was promoted to lead the Marine Systems Group of the General Dynamics Corporation. This Group includes Electric Boat, Bath Iron Works of Maine and National Steel and Shipbuilding Company.

Please join me in welcoming Mr. John Welch, Executive Vice President of General Dynamics.

Thank you, Tom, and good afternoon everyone.

In my remarks today, I intend to review a bit of history about our submarine industrial base, describe where we are today, and suggest some important steps we and the government need to take to continue our progress.

First, let me touch on our history. As the Cold War ended, the Submarine Force demonstrated amazing flexibility, taking on new and expanded missions addressing threats no one foresaw in the 1980's when a lot of boats operated today were authorized. The nuclear submarine industrial base similarly responded to the changed environment with dramatic re-engineering in order to remain flexible, innovative and affordable.

When I first went to work at Electric Boat in 1989, there were 17 submarines in the shipyard in various stages of construction. Employment was over 21,000 and the Navy's attack submarines force level was just six ships short of the 100-ship goal set earlier in that decade.

With the end of the Cold War, the Seawolf submarine program

went from a 29-ship class to three ships. The final two ships had a rough birth, but they were finally authorized and provided our industrial base with a *bridge* of work for transitioning to the VIRGINIA-class.

During the post-Cold War period, only five submarines were authorized over a ten year period. In contrast, during the previous ten year period, an average of 3-1/2 submarines were authorized per year. In parallel with this downsizing of the work load, the shipyards and the suppliers kept a strong focus on the required capability of the submarines and on the affordability of these ships. We learned a lot and we, in fact, made major advances in our design and construction of submarines. For example, the computer aided design tools and the design-build process used for the VIRGINIA-class have reduced lead ship changes by 90 percent compared to the SEAWOLF-class. As another example, a VIRGINIA-class submarine is about 30 percent less costly to construct, compared to SEAWOLF, and the operating costs of a VIRGINIA are similarly about 30 percent less than SEAWOLF.

Another aspect of the re-engineering of the submarine industrial base has been the historic teaming arrangement between Electric Boat and Newport News Shipbuilding. This teaming is producing affordable submarines while maintaining the key elements of the two shipyards–both shipyards being crucial pieces of our nation's industrial base. This teaming is working beyond our most optimistic expectations. Best practices, lessons learned and all management decisions are focused on delivering the best product, at the best price.

Now, well past the Cold War transition period, we are producing great submarines. The VIRGINIA is on track for early delivery in May of next year. Note that this early delivery is pegged to the original schedule, established in 1992. This is the first time since World War II that the lead ship of a class will be delivered ahead of schedule.

Controlling cost growth during lead ship development and construction program has been another VIRGINIA success story. The design is complete and the estimate at complete is within 3 percent of the original target.

The estimate at complete for the first four ships is within 15

percent of the original target. As I stated, the lead ship is scheduled for early delivery and the man-hour estimate for all four ships is very close to original estimates, within 2 percent.

We have experienced greater than expected costs in inflation above the assumed rates mandated by the government in 1997 and actual material escalation. Material escalation has been higher than that experienced in other shipbuilding sectors and I believe this is due to the extremely low rate of production experienced in the later 1990's to now, and the drastically restructured supplier base.

I'll talk about how we can best deal with the supplier base in a moment. But I must take note of the strong leadership that was taken by the Navy and Congress in addressing prior year shipbuilding issues during the FY03 budget cycle.

All of us can be very proud of our performance in building submarines following the end of the Cold War. In spite of necessary massive down-sizing, we kept our focus on submarine capability and affordability.

But as we look to the future, we need to go further. And we need our customer, the Government, to take the necessary steps that will open opportunities for additional savings as we build ships to the required force levels. Specifically, we need two things: We need a multi-year acquisition process and we need to increase the submarine construction rate to two per year.

A multi-year acquisition of submarines with EOQ funding to support multi-ship set material buys will allow major decreases in the cost of submarine construction. The VIRGINIA submarine is now 82 percent complete and the following three ships are on schedule. The VIRGINIA-class is therefore mature enough to give confidence to the Department of defense and the Congress that these ships can be built on time and within funding limitations. A multi-year acquisition process in FY04 is the right next step.

The other key action required from the Government is an increase in submarine construction to two per year to support force level requirements. OMB noted with their release of the FY04 budget that

". . . submarines are being procured in insufficient numbers to maintain a long-term force level of 55 attack submarines. Industrial base, political and budgetary considerations confound the Navy's ability to achieve optimally designed shipbuilding programs."

Two submarines per year will provide the Navy with the needed number of submarines, will strengthen the submarine industrial base, and will significantly lower the cost per ship.

We have a major opportunity in the FY04 budget and its out-year planning. We have been good stewards of the submarine industrial base during the dramatic changes of the last decade. Working closely with our customer, we have built a strong record of producing new submarines with great capability and affordability.

We now need the Government to take the next steps: Multi-year contracting authority and an increased construction rate to two submarines per year will provide the stability and contracting means for significant cost savings.

Thank you.■

Remarks by Admiral James O. Ellis, Jr.
Commander, USSTRATCOM
Submarine Technology Symposium
Laurel, Maryland
14 May 2003

Good evening distinguished guests, colleagues, in uniform or out, and friends, old or new. It is truly my privilege to be with you here tonight and to share this dais and this hall with those in whose wave, or should I say baffles, I have sailed and whose lead and example I have proudly followed for now nearly 34 years. Admiral Kelso, thank you, sir, for that overly generous introduction. As a service and as a nation, we will always be in your debt.

We are all gathered here tonight as supporters of America's vital submarine capabilities. That may sound strange, coming from an aviator and a fighter pilot, but it is true. As has been noted, I am a late-in-life nuke. My first memories of Naval Reactors are that of the interview process in early 1986 and being squired around the maze of the old NAVSEA 08 by someone I now know was really a Second Class Petty Officer and being constantly referred to in the third person as she would knock forcefully on Al Forssell's door and announce, "I have the aviator here." I knew then that if I wanted this to work, and I did, that I would have to work. I needn't have worried. To this day, I freely admit that I would have been a better strike fighter squadron CO if I had been through the Nuclear Power training before rather than after that tour.

But in reality, my fascination with the submarine service and nuclear power had begun decades earlier. You see my Mom is from New London, my uncles all worked at Electric Boat and I had grown up crossing the Thames River Bridge and reciting hull numbers from memory, much to the consternation of my Naval Aviator father. I can, here tonight, admit for the first time that my seventh grade science project was an attempt to build a working model of the George Washington plant. I am embarrassed to admit to Admiral Bowman but I got a "C" when I suffered a loss of coolant casualty and spilled red Kool Aid all over the gymnasium floor.

Having established my expertise, I should now, in all seriousness, congratulate Admiral Archie Clemins and all who had the vision and, yes, courage to put this symposium together. The challenges are as real as the opportunities and newer, high-tech versions of the old solutions simply will not work. It is not enough to be outside the box; we must blow the box up. I firmly believe that the future of our submarine fleet depends on our ability to chart a course over the horizon to a point beyond our current vision. We need to develop a fresh paradigm that perhaps we now can neither see nor fully understand.

Consider for a moment the professionals who design videogames. One of the companies producing those games today is Electronic Arts. The President of that company says it takes 18 to 30 months to make a top-quality game for the PC. When the studio team begins its work, the PC they're creating the game for hasn't even been invented. This company is working right now on theoretical models for games that won't appear in stores until 2007. Ladies and gentlemen, that is for developing a *game*. The stakes for developing and coordinating all systems important to our national security will be much higher and require that level of foresight and much more. Our bottom line is much different from that of industry. We, as a nation, cannot simply declare Chapter 11 and reorganize to forestall our creditors.

Tonight we stand at a pivotal point in history. The fabric, theory and practice of the world security environment have changed dramatically over these past two years. There are a much wider variety of threats today than there were during the Cold War, and a much broader range of capabilities is required to defeat them. Some would argue that a thousand snakes have replaced the dragon that was our Cold War rival.

We are now examining as never before the technological, organizational and operational capabilities that we **have** and that we **need**, fully mindful of the *delta* between the two. We share an interest in keeping the United States on the cutting edge of defense technology. We must ensure we have the systems absolutely essential to our national security well into the future. Many of you are full partners in that effort, but we must accelerate. It reminds me of the immortal words of my first CO, as he would slam his hand on

the podium and bellow, "I want patience and I want it now!"

Things are changing, not just for the Submarine Force and the Navy, but also for all of us, as my assignment to United States Strategic Command attests. As most of you know, the roots of STRATCOM's relationship with the submarine community go back to the early days of the Strategic Air Command. SAC was established in 1946, followed by the US Air Force in 1947. Our strategic forces were very small and consisted exclusively of bomber-delivered weapons. The next decade saw development of Army, Navy and Air Force ballistic missile systems, but submarines were also evolving. A mere 50 years separate the first A-Class harbor defenders from the message sent of 17 January 1955, from Commander Wilkinson in USS NAUTILUS–"underway on nuclear power."

The Cold War provided a compelling incentive to develop new technologies. It was through the initiative and foresight of Admiral Raborn and his project staff that the Navy's ballistic missile development brought parallel development of our nation's first ballistic missile submarine, delivering this capability in an incredible five years; well before others thought possible. Can you imagine the conversation in the Pentagon in the early fifties? "Let me get this straight–you want to launch an intercontinental ballistic missile from a submarine **underneath** the water? **Right!**"

All of the nation's nuclear capabilities were soon integrated in the first strategic deterrent war plan. In 1960, integration continued as a Joint Strategic Target Planning Staff stood up at SAC Headquarters in Omaha. It was the first joint staff of its kind.

Continued advances in submarine technology kept us ahead of our Cold War counterparts. Our SSNs played a key role in strategic deterrence by shadowing our adversaries' SSBNs and collecting intelligence on their deployment patterns and operations. There's no doubt in anyone's mind that our undersea service personnel played a pivotal role in winning the Cold War. In fact, in a recent submarine documentary, an aging commentator opined that Red Raborn should have been awarded the Nobel Peace Prize!

In 1992 SAC and the JSTPS were replaced by the cross-functional, joint-strategic organization we called US Strategic Command. Over the following decade, STRATCOM saw minimal change; but

there has been a whirlwind of change inside the Department of Defense in just the past year. Following a series of high-level studies that included the Rumsfeld Space Commission, the Quadrennial Defense Review, and the Nuclear Posture Review, the President and Secretary of Defense directed the creation of a new unified command. This new command would effectively and efficiently anticipate and counter the diverse and increasingly complex global threats confronting our nation. These threats to our homeland, our allies, and our interests abroad range from conventional military capabilities to the asymmetric and indirect dangers of cyber attack. Threats also include weapons of mass destruction and terrorism. Each one is global in scale and often transcends geographic or regional boundaries.

Last October we began building this new command by combining the missions and strengths of SPACECOM and the old STRATCOM. At the time I saw us simply jacking up the existing command and sliding space and computer network operations underneath. It quickly became evident that this wasn't to be the case. We are truly a new command. We've even gone back to classically defining the word "strategic" as meaning more than a synonym for "nuclear." That being said, I was happy to both preserve tradition and save the Omaha city fathers money by not having to change the local road signs.

The true nature of our new structure was revealed on 10 January 2003, when the President expanded our role by adding four missions previously unassigned to a unified command. These new missions include global strike planning and execution; integration of Department of Defense information operations; global missile defense integration; and what we call "C4ISR." That's oversight of command, control, communications, computers, intelligence, surveillance and reconnaissance in support of strategic and global operations. Today's STRATCOM is less than a year old. We must leverage the wealth of experience from our legacy missions to take America's defense in the direction ordered by the President and Secretary of Defense. Meanwhile, our adversaries will continue seeking to circumvent US strengths and exploit any vulnerability on the ground, in the air, at sea, and in space. We are wrestling now with how to do all of this on a compressed timeline, with minimal

staffing increases even as we reorganize externally and internally. A wise old man once told me that you couldn't have traction without friction. I'm here to tell you that if that is the metric, we really are making progress!

But I was not invited here to speak of my own challenges but rather to address yours. In truth, though, they really are linked and in many ways parallel. Each of us must find a way to build on historic strengths while reshaping what we are for a broader and deeper role. Each of us must reach outside an historic and storied community to integrate ourselves in new organizational constructs and draw insights and expertise from different communities, different services and different agencies. The submarine community has done that in the past; it must now do so again.

Last week I was part of a small group meeting with the NASA Administrator Sean O'Keefe as he wrestles with a post-Columbia path for the agency. He seized on the Polaris Program as an example of a multi-dimensional, technological and operational challenge that yielded incredible success, reshaping strategic deterrence concepts in half a decade. I had to remind him that, of the three individuals most often credited with that success, Arleigh Burke, Red Raborn and Levering Smith, none of them were submariners. Sometimes we can gain a different perspective, if we have the courage to but ask. That reminds me of the discussion I had with my back-seater after a long-ago night carrier landing. It was a bad night weatherwise and, as the pilot, I hadn't made it any easier. The NFO, not a pilot, offered some well-intended technique suggestions, which I countered with the rhetorical question, "How many night landings have you flown?" He responded calmly with the perfect response, "None, but you don't have to be a dog to judge a dog show."

That brings me back to my opening remarks about achieving a vision that extends beyond our current horizon. The Navy has made great strides in joint interoperability and realignment, but there's candidly much more to do–especially in light of the new missions I've just described. This is not foreign to many in this community and this room. Our undersea forces have greatly refined and honed their capabilities since the days of USS NAUTILUS. When it was launched, Admiral Hyman Rickover said, "The nuclear-powered submarine is not just an improved submarine, but a totally different

kind of warship." He was looking over the horizon. Within a decade, President John F. Kennedy watched a Polaris fired from USS GEORGE WASHINGTON. The President said the "efficacy of this weapon system is not debatable." Once again, with "41 for Freedom" we had looked beyond the current horizon and pushed the envelope back.

With Sturgeon-, Los Angeles-, Ohio-, Seawolf- and Virginia-Class submarines, we've built on that tradition, and it's time, once again, to look beyond the horizon. The challenge now is for us to look ahead at the same time we find balance between both operational capability and fiscal resources. Before us there are unprecedented **opportunities** to shape the deliberations on what future capabilities best serve the needs of our nation. But they are only opportunities, and we must have the courage to seize them. We must think integration, not isolation. We must consider **real** consolidation, integrated operational concepts and streamlined, non-traditional chains of command, not just produce more Memorandums of Understanding or senior steering groups. We must populate an undersea force with elements that are cohesively and collaboratively linked to make it both indispensable and effectively indestructible.

Frankly, I think that's our biggest challenge. Submarines won the Cold War staying submerged and undetected. The term "Silent Service" bespoke courageous crews, autonomous ops and triumphant returns with brooms lashed to the masthead. How do we maintain a submarine advantage when light-speed communications have become vital to our warfighting capability, when the term network-centric is so much used as to approach over-use, and where responsive re-tasking in minutes is the emergent standard? Our submerged capabilities have not kept pace with our growing needs–a 512K pipe doesn't satisfy the communications needs of today's warfighter, much less tomorrow's. How do we stay submerged and undetected–**but connected**?

To plan for tomorrow, we must have the best information today. That means Integrated Information Operations that rely on the capabilities of our platforms. We cannot skew all our resources from hot spot to hot spot. We must remind ourselves that, though we may prize flexibility and mobility, going blind in vast areas of the world **invites** challenge and confrontation; it does not **deter** it. Submarines

have always made unique contributions to this area but must have the full sensor suite with robust reachback analysis and connectivity full time to serve our future needs.

More than 54 percent of our nation's nuclear deterrent is submarine-based. We've called our nuclear deterrent America's insurance policy. That said, SSBN's remain the **ultimate** insurance policy **for** our insurance policy. As important as this is, we must not shy from our task to reassess our undersea capability. If we find the assumptions on which Plan A was based are no longer valid, we need to have Plan B. And as deterrent concepts must account for new adversaries and broaden to include advanced conventional forces yet to be created, we need to assess what role N-TACMS and conventional SLBMs might play.

We must consider new tools and techniques in order to expand our capacity to offer our leadership and Combatant Commanders more and better options based on rapidly changing global conditions and events. All the data in the world will not help when the time comes to make decisions unless it can be effectively transformed into timely action. It's said that even a perfect view of a chessboard is of no use if you don't know how to play chess. And, I would add that we must also have the right pieces on the board and the effective interactions of all of these elements will be crucial. As Secretary Rumsfeld noted, "Possibly the single most transforming thing in our force will not be a weapon system, but a set of interconnections and a substantially enhanced capability because of the awareness [it provides]."

We'll need to muster the courage to address this now. We must resist the siren song of interim battle management and unique architectures. We need to avoid the concept of operations and command relationship stovepipes driven by artificial timelines. Perhaps most important–we must pace and critique ourselves to ensure we do it **right** the **first time**. Our nation's defense cannot afford the time, treasure and travail to do it over again.

Submarines give us unique characteristics of stealth, endurance and firepower. That is a good description of what they **are** but not of what they **can be**. To enhance their asymmetric value, we must be looking at payload capability from many perspectives–including efficiency, balance, flexibility and economy. Consider just one

example. To perform specific indications and warning missions, submarines need to take extra personnel and equipment onboard--the highly specialized *spooks* from our service cryptological element. We do not retain an indigenous or reachback capability for this and other functions. If this capability is important enough to drive force levels, then it is important enough to have full-time.

Some efforts to improve the way we operate are already underway. We're looking at designing systems that will require less manpower and less maintenance. Other initiatives such as the forward basing of some of our SSNs in Guam will also improve the operational utility of our undersea forces.

Recently we've conducted exercises and evaluations of new systems and concepts. GIANT SHADOW successfully proved the utility of the SSGN for special operations forces insertion and recovery, use of both unmanned undersea and aerial vehicles, as well as a cruise missile launch platform. It is a great start and shows what can be done even without large dollars and lengthy ACTDs.

We must find new ways to make our investment in nuclear propulsion pay off. That includes a brand new look at how all of our systems integrate so we can modify them to better complement one another.

First and foremost is communications. It's not easy to push modern information from the bottom of the sea through a tiny antenna. We need new technology to give our undersea forces the same bandwidth to communicate as the other pieces on our chessboard. Future submarine missions will require a revolution in communications connectivity and supporting bandwidth. The vision is to allow submarines to communicate without the current restrictions of depth and speed. We want sufficient bandwidth to maximize the effectiveness of data and intelligence collected by the submarine to achieve real-time connectivity and reach-back. What we **want** is ELF-like **connectivity** and fiber-like **bandwidth**. For our contractors or EDs in the audience, next week will be just fine.

We've already started developing Narrowband-based systems that are based on Internet Protocol architecture and a higher data-rate antenna. Ultimately, submerged data exchange and communications will allow us to deploy a new generation of sensors and other payloads--but we need to get there sooner rather than later. We also

must understand that today, every weapon system must earn its way into the inventory and onto the battlefield. Whether you're comparing manned aircraft and UCAV's, heavy armor vs. STRYKER Brigades, or DDX and the Littoral Combat Ship, there is a new dynamic in play in both procurement and operations.

I do not often use business analogies but there is now a market place approach to our future systems and the metrics are harsh and unyielding. For this community, it is no longer enough to just ask whether the submarine is a capable platform or system for a given task. We must demonstrate that it is the **best** asset for that task. These tasks will then come to the Submarine Force, not because it is your right but because it is the right thing to do. Toward that end, we must challenge conventional wisdom with approaches that may at first appear neither conventional nor wise. We must switch to low magnification to achieve a wider field of view and encourage fact-based analysis and consideration of other alternatives such as broadband inserted arrays, unmanned undersea vehicles, and next generation surface and air platforms.

We also need to consider the role of submarines as platforms for missile defense interceptors and other innovative concepts–such as SOF insertion to support Computer Network Attack (CNA) and other information operations, as well as strategic deception. We need to ask ourselves, what can we bring to the broader fight and, in turn, what do we need to support these roles?

Those of us who are interested in the future of undersea forces must deal with a strange dichotomy. We've grown up in an America that thinks of submarines as very special–with their great tradition of courage, independence and initiative. Just consider the popularity of the recent Turner Network film about the submarines CSS HUNLEY, or our memories of USS NAUTILUS traveling beneath the North Pole. We take pride in undersea challenges well and truly met by elite defense and industry teams. We are a part of something very special that has taken us in just a few years from diesel technology to sea-based ballistic missile systems, and Seawolf-class submarines that are the envy of the world.

However, I must emphasize that the days of the lone-wolf submarine operating in Silent-Service isolation are over. Just as our special operations forces, the *snake eaters*, stepped out of the

shadows to become more integrated with the rest of our forces, and remain an integral part of all operations today, so too must our undersea forces. The future of submarines and their real potential, lie in making them less isolated, less special, not more. Our leadership expects it; warfighters demand it and you must deliver it.

We must consider the best way to build on our success in appropriately integrating all of our capabilities to support everything we do, in or outside DOD. Accomplishing this may make undersea operations a bit less distinctive, but so much more essential. In doing so you will dispel occasional critics by expanding capability, flexibility, sustainability and interoperability so as to more than address their concerns and fully meet the challenge before us. My own experience in joint operations argues that the most effective proponent of what one brings to the nation's defense is often one who wears a different breast insignia or even a different color uniform than your own.

It is also helpful to have integrated into the warfighting concepts, both of the Commanders who will ultimately employ your capabilities and the services that support them. I always liked the scene from the recent movie The Gladiator in which the rag tag group led, afoot, by the hero defeat the chariot-mounted Legion by uniting in a phalanx of mutual support. Not all good concepts are drawn from looking forward. Indeed, someone once told me, "If you want a new idea, read an old book."

We must focus on the technology improvements I've mentioned and on how our submarine fleet can more effectively support all our operations and new missions. Aim for the heart of what we need; don't be satisfied with the periphery. But we must also remember that this is more than technological challenge. It is also operational and, yes, cultural. The wealth of talent in this room and in the organizations you represent, can ensure we break down organizational barriers, rethink the possibilities and re-define the way we will fight in the future. Our goal is a completely integrated network to expedite communication, decision-making and response by forces of startling capability.

This system must translate data to information, information to knowledge, and knowledge to wisdom in the blink of an eye. It must be available everywhere, all the time. We cannot accept mediocrity

or mendacity, ladies and gentlemen, because the game just got much bigger and is simply too important to lose.

As you have listened with more politeness than I deserve tonight, your thoughts may be beginning to wander. Perhaps you are saying to yourself, "OK, wise guy, so how do we do all this?" Perhaps you have uttered about my remarks a version of my Grandfather's old saying, "It's easy to be a clown when you don't have to run the circus." Fair enough. But let me give you a few final thoughts on where we may look for new opportunities. I've spoken of conventional SLBMs that add a stealth weapon to a stealth platform that could bring effective preemptive suppression of enemy defenses and counter mobile targets. What about non-lethal attack concepts that would allow a counter-proliferation blockade of country X? How about an expanded and intrusive ISR capability that captures more of what we need as we move from merely perfect to now exquisite intelligence? What about a mobile space launch capability using aging boosters to provide tactically responsive space lift inside the current Air Tasking Order (ATO) cycle? What contributions can a submarine launch platform make to integrated global missile defense? The list is as long as your imagination and as wide as your opportunities.

If there is only one act you take away from my remarks, it is this--The organization, planning and technical achievements we must strive for are not optional. As former Secretary of State Henry Kissinger said, "The absence of alternatives clears the mind marvelously." America's defense has always depended on our unique partnership of military, industry and academic strengths. I have every confidence we will realize an alternative future. The rewards for success are too high, and the price for failure is far too great. The submarine community has enjoyed a long storied history of overcoming obstacles through ingenuity, bravery, and courage of its crews.

Taking my own advice, in preparing for tonight I dusted off an old book. It was Samuel Elliot Morrison's history of submarine operations in World War Two and in it he described the challenge and change of early combat operations; perhaps a tactical parallel to our own changing future. The emphasis added is my own. "**Excessive caution** was another deterrent to success. This was

partly the fault of **convention** in prewar target practice which imposed severe **penalties** on a submarine that was sighted before firing. **Early** in the war, American submarines stayed **submerged** all day, often waiting for targets to **appear** instead of **seeking them out**, fired from **extreme ranges**, dove deep at the **slightest** sound of countermeasures. **Night attacks on the surface, penetration of enemy harbors, counterattack on escorts** - all normal procedures in years to come - were **daring innovations** in this exploratory year." **Daring innovation** is the operative phrase that must drive our shared future.

We can do it; we must do it. Chief Justice Oliver Wendell Holmes once noted; "Greatness is not in where we stand, but in what direction we are moving. We must sail, sometimes with the wind and sometimes against it–but sail we must, and not drift, not lie at anchor."

Thank you for inviting me to be with you tonight, and thank you for continuing the storied contribution of the submarine force to our nation's defense.■

Speech by ADM James D. Watkins, USN(Ret.)
to the
2003 Naval Submarine League Symposium
12 June 2003

Admiral Kelso, Admiral and Mrs. Crowe, distinguished members and friends of the Submarine Family:

I am indeed honored to have been selected by the Chairman of our Naval Submarine League to be your guest speaker tonight. But I feel especially privileged to be with you to help honor Bill Crowe as this year's "Distinguished Submariner." Bill and I have been friends and known each other for almost forty years. In fact, as a C.O., Bill was my Division Commander when I brought the then *Cadillac* of attack submarines, the Skipjack Class USS SNOOK, to San Diego in the early sixties from her post-shakedown availability at the Mare Island Naval Shipyard. Bill helped me prepare for our first patrol to the Western Pacific outfitted with the latest in high-tech experimental surveillance suits called "Waterboy."

This suit produced so much new and exciting on-the-scene information that our friends in the many affected branches of government were ecstatic. Not long thereafter, "Waterboy" morphed into the sophisticated collection suit installed across the force in those days called the WLR-6.

Well, you can see from this very brief sea story that you're dealing with two very antique ex-operational submariners in Bill and me tonight. In fact, SNOOK was *euthanized* 20 years ago before her expected end-of-life, but fortunately, buried between two great American predecessors, USS GEORGE WASHINGTON, and USS PATRICK HENRY– alas, SNOOK's only claim to historical fame. So, now, Bill and I just sit on the sidelines and view with "shock and awe" the newest generation of sub and sailor. Wow, what a series of transformations–from diesel to nuclear, and to the rapid series of new hull and technological system enhancements in the '70s, '80s and '90s which could never have been predicted forty years ago! What a tribute to those in this room and beyond who have kept the vision and reality alive for this unique contribution to our national

security.

I was fortunate a few weeks ago to have been invited by Admiral Bowman to ride one of our newest Seawolf Class submarines, USS CONNECTICUT, in the Arctic Ocean. We took off on a Sea Otter logistics flight from the *beautiful garden spot* of Dead Horse, Alaska; then landed a few hundred miles north at the ice camp supported at the time by the University of Washington and Penn State's Applied Physics Lab; then flew by helo to CONNECTICUT which was resting a few miles away in the ice at about 74 degrees north. We submerged, spent the night under the ice, shot the latest version of the MK-48 torpedo at ourselves (with a comfortable depth separation I might add) which successfully avoided the confusing ice picture and recorded hits on us. More importantly, we spent long hours talking to their superbly trained and motivated crew; put our hands on the technologies from stem to stern; and listened to the latest briefings on CONNECTICUT's own recently successful missions and those of her counterparts in Iraqi Freedom. I was overwhelmed at the state of today's submarine art and struck by how we had transformed ourselves so successfully from the independent scout and raider role of earlier days, to a recognized Navy battle group member of the Cold War years, to the fully-integrated total force enhancement player today so well exemplified during Iraqi Freedom operations this year. I came away from this voyage with only one serious question on my mind–had I been witness to one of the final days of ice station scientific operations in the Arctic Ocean? With the close of the Cold War, did responsible decision-makers believe that understanding the mysteries of the Arctic were any less valuable to the nation? What about the volumes of vital scientific data that only the ice-capable nuclear submarines can provide? What about the need to understand the Arctic's predominant climate-generation role? Who would otherwise provide much of the necessary ground-truth correlation with satellite observations to help us gain this understanding? Was there no mechanism to transform certain programs from Navy to the other eight non-Defense ocean-related funding agencies to help share cost burdens for continuing this important work so vital to their own missions? Why did these other agencies not stand up in righteous indignation when the

research-equipped submarine USS RICHARD RUSSELL was scheduled for decommissioning long before end of core life? Wherein was the post-Cold War long-range vision vested? . . . certainly this vision should not have been expected to come from the Navy or Department of Defense alone.

So, while the Navy's Submarine Force seems to have transformed beautifully into today's changing world, there doesn't seem to be a counterpart on the non-Defense side of our bureaucracy that benefited from forty years of information flow spinoff, some of which now seems to be in the process of being terminated, maybe legitimately for national security reasons, but certainly not so for the larger national interests. I can say this because of my current and unique vantage point of chairing the U.S. Commission on Ocean Policy for the President and the Congress.

But, tonight I'd like to give you some thoughts on where I see the continuing submarine transformation headed in this new and crazy world in which we find ourselves and where its enlightened leadership may help, as well, move many others who share the ocean environment to join in a more sensible transformation. Let me now wander back a few years to my early days as CNO during the Cold War, shortly after President Reagan called for both a 600-ship Navy and a modernization of our strategic forces. Remember, at that time, we were still very concerned at the degree of deterioration of our defense readiness posture which progressively worsened in the aftermath of Vietnam. A big debate was also raging then on the famous MX missile basing and of our strategic deterrent forces modernization. In late 1982, the President was asked by the Congress to give them an acceptable concept for strategic modernization by spring of 1983. Each Service Chief was tasked to formulate and present their independent positions on this matter. I was aided by a small group of wonderful Navy thinkers, including some submariners who may well be in this room tonight. Further, I called in many outside strategic experts to help me as well. One of these was the famous Dr. Edward Teller since I was studying the efficacy of giving some attention to strategic defense as one aspect of modernization. No sooner had he come into my office than he began a line of questions which went like this: How large is a

ballistic missile submarine? How many different kinds of missiles could it carry? How much electrical power can it generate? How long could it sit on an enemy's land-based intercontinental missile trajectory path? Could it be effective in a boost-phase intercept role? Could the submarine remain stealthy and still continue to be in real time communications with the national command authority? How survivable are the best submarines that we have? Well, I was overwhelmed, albeit pleased, with his intense interest and line of questioning. I only bring this dialogue up tonight to illustrate the vital importance of challenging conventional wisdom and always trying to look at the future possibilities to match anticipated technological advances. We need to find these thinkers, inside and outside of uniform, who can challenge and inspire the next generation of visionaries interested in developing a solid insurance policy against future national security unknowns. The Submarine Force contribution to such an insurance policy has been significant in the past, is significant today, and may be even more so in the future.

In this connection, I was pleased to learn of the decision to convert four of our otherwise retiring Ohio Class ballistic missile submarines to nuclear powered guided missile submarines, SSGNs–in some ways answering in real terms the type of thought-provoking questions posed by Dr. Teller twenty years before. What a mistake it would have been to retire those hulls early before taking advantage of their exciting potential to meet the growing number of uncertainties which will surely challenge our future national security planning.

In this regard, I asked VADM Grossenbacher when he was in town recently to brief me on the concept of operations for a transformed SSBN to SSGN. He gave me a wonderful review of GIANT SHADOW, the so-called limited-objective experiment conducted at sea in consonance with the CNO's Sea Power 21 vision initiatives. What a sensible precursor test to the forthcoming overhaul and conversion of USS FLORIDA to an SSGN at Puget Sound Naval Shipyard. The recent edition of *Undersea Warfare* presented an exciting story of this experiment and posed some *what ifs* which I'll try to answer regarding the questions they raised. "Could these new conversions carry a large arsenal of conventional sensors, delivery

vehicles, and weaponry? Yes. "Could these vessels remain stealthy and invisible to potential enemies so as to preclude any credible counter prior to sensor or weaponry utilization? Yes. "Could these vessels remain stealthy and invisible to potential enemies so as to preclude any credible counter prior to sensor or weaponry utilization? Yes. "Could these SSGNs also house scores of Special Operation Forces to conduct clandestine operations anywhere, anytime?" Yes. "Could these underwater platforms support other naval forces for long periods of time as well? Yes. "Could they carry and launch unmanned aerial and underwater vehicles to provide real-time intelligence information to all war fighting commanders in a region?" Yes. So, in summary, then, isn't this a unique jewel in the crown of America's arsenal for freedom? An unequivocal, yes.

In the anticipated world of the early 21st century, we will be dealing for years with the latter day equivalent of President Reagan's concept of an "evil empire"–but this time, the "empire" is a faceless, nation-less, ruthless, evil band of hoodlums called international terrorists, bent on bringing to heel all who do not conform to their bizarre and godless ideology. Under the resultant and prospective operational environment which this projection portends, the unenlightened might say that submarining has no significant role. The visionary on the other hand, would say: nonsense . . . in fact, this is just the scenario within which submarines can make a powerful and unique contribution to the joint war-fighting community engaged in such a fight–stealth in reaching the battlespace; self-contained capability of conducting the necessary real-time, on the scene intelligence, surveillance, and reconnaissance operations, well inland if required and with both on board human and remote all-source sensor information fully integrated; solid communications interchange capability with the assigned joint operational authority; and flexibility to launch an impressive number of salvos of conventional cruise missiles on a variety of time-critical targets.

Of course, these new conversions are only the tip of the iceberg for future submarining. Our most sophisticated and modernized fleet of improved 688s, Seawolf and Virginia classes of submarines continue as pillars of strength to help answer many classic core

requirements for the 21st century Navy. Demonstration of their superb contributions to recent confrontations with the terrorist would attest to this. Further, our remaining 14 Tridents will continue to provide the nation with the ultimate credibility of our strategic deterrent to any rogue nation that would ever attempt to hold us or our allies hostage to a threat of employment of weapons of mass destructions.

So, I say the future remains bright for our submariners. Your vision is clear, you seem to be on course to realize that vision and you are transforming beautifully to match the radically changing times. We old-timers are proud of your continuing professional leadership in this very important niche in the national security scheme of things. You will be faced with many obstacles to realizing your dreams in this century as we were years before you. Those who carp at you for submarine weapon system costs, for example, will always be around. These people come and go, always boasting of ways to do the same job much better and cheaper. They seldom win. Persistently sound logic; past superb performance; enlightened vision for the future; and sustained professional leadership will beat them every time. So, keep up the good well-thought out fight as is the submariner's hallmark. Thanks again for allowing me to be here tonight to honor Bill and all of you for commitment to our nation's security.■

Remarks by
Admiral F. L. "Skip" Bowman, U.S. Navy
Director, Naval Nuclear Propulsion
to the
Naval Submarine League Symposium
11 June 2003

Admiral Kelso, thank you for inviting me to be a part of this 21st annual meeting of the Naval Submarine League.

I applaud the continued efforts of Submarine League members to promote awareness of the important role submarines play in ensuring our national security. We continue to need you. Thanks for helping to tell the story.

I also applaud your selection of Admiral Crowe as the Naval Submarine League 2003 "Distinguished Submariner." We as a Nation are indebted to Admiral Crowe, a career naval officer, a diplomat, and most importantly to this symposium, a submariner, for his leadership and vision.

I'd like to kick the symposium off today by giving you my perspective on the status of our community and the road ahead.

First, I want to say loud and clear that the Submarine Force answered the call during this past year of war. It was a team effort, and each of you can be proud of all that we have accomplished.

Today, submarines are deployed around the world in support of the Global War on Terrorism. Submarines are quietly going into a lot of areas where other platforms are ineffective in gathering critical intelligence. The inherent stealth and the multimission capability of our submarines are serving the country well in this global struggle.

Our Navy and our boats were certainly visible during Operation ***IRAQI FREEDOM***. During that conflict, submarines fired about a third of the more than 800 TLAMs expended. USS CHEYENNE (SSN 773) was the first to shoot on day one of the war. At one point, we had 10 submarines operating in the Red Sea and 2 in the Arabian Gulf working with 2 British counterparts. The professionalism of our crews, the material condition of our boats, and the skill of our operational staffs ensured that when the President called, the

Submarine Force delivered.

I also want to brag just a little on our great people and our two operational commanders and leaders, John Grossenbacher and John Padgett. Under their leadership:

- Officer retention reached 39 percent this year, up 5 percent from last year.
- On the enlisted side, and based on what I see when I am out riding our submarines, I can say that the *esprit de corps* of our Sailors is at an all-time high. This spirit and our collective attention to people programs are evident in our reenlistment statistics. Listen to these numbers for our submarine sailors:
  - First-term sailors.....69 percent
  - Second-term sailors..... 82 percent
  - Career sailors to 20 years..... 95 percent
- Although our SSBNs have typically led the retention honor roll, we now have fast attacks joining this elite group. For example, USS CHARLOTTE (SSN 766) has an overall reenlistment rate of 95 percent!

Our operational leaders have kept people at the top of their priority list–and it shows.

So we're very much out there–on station–and in very high demand. Our submariners are the finest trained in the world, sailing aboard the finest submarines in the world. We have worked hard for the successes we have enjoyed this year. Still, our accomplishments during Operation ***IRAQI FREEDOM***, our enhanced retention rates, and our peak levels of morale do not guarantee victory tomorrow. Let me say a few words about the road ahead.

Think back to 1982 when the Naval Submarine League was founded. We were fighting a Cold War against the Soviets, and the primary mission of our SSNs was blue-water ASW. If someone had stood before us then and told us that our primary focus would shift dramatically in future conflicts like ***IRAQI FREEDOM***–and that we would operate 12 SSNs in the shallow waters of the Red Sea and Arabian Gulf, maintaining continuous communications with a Joint Task Force Commander while awaiting the order to launch precision strike munitions well inland . . . we might have called for a random drug analysis for that person.

But it's a safe bet that we'll be required to make similar dramatic changes in the way we fight wars in the coming decades. The good news is that as a Submarine Force, historically we have been able to adapt to these challenges and remain relevant because of our inherently transformational culture. The transformation process has been underway in the Submarine Force for more than 100 years.

We led the way in transforming those original, rudimentary submersibles into capable diesel-powered fleet boats. We led the way in bringing sonar to the combat fleet. During World War II we led the way in taking the fight to the enemy in the Pacific. We revolutionized the role of the submarine-which, up to that point, had served as scouts for the Fleet. We also led the way into the nuclear era-first with nuclear propulsion and later with nuclear missiles, providing strategic deterrence. We've moved from ASW and Indications and Warning in the Cold War to add ISR, precision long range strike, and SEAL insertion today.

Here inside the Beltway, the term *transformation* has become a household word. Nonetheless, many are still wrestling with exactly what it means. Recently, General Richard Myers, Chairman of the Joint Chiefs of Staff, partially described *transformation* as "a process and a mindset. Adopting a transformational mindset means applying *current fielded capabilities*–in the *current* environment–to accomplish any assigned mission." Now, this pragmatic approach to transformation reminds me of the first principle of wing-walking: *Don't let go of the first strut until you have a damn good grip on the second strut.*

Just as we did during the Cold War, we must be able to fight wars today while we transform for tomorrow. We must maintain our ability to operate with impunity in all the oceans of the world while we recapitalize and transform our force.

In an October 2002 *Proceedings* article, the CNO noted that the oceans of the world provide a vast maneuver area–in fact, the largest maneuver area–from which to project direct and decisive power around the globe. I couldn't agree with the CNO more. I would merely add that the undersea volume is the largest part, by far, of that maneuver space–by an entire dimension–and we can't afford to relinquish our dominance in projecting power, both from and within this undersea volume.

Our civilian leadership has provided some clear direction on where we in this room should be heading. In February 2002, Deputy Secretary of Defense Paul Wolfowitz noted that America must "think about how to exploit our asymmetric advantages–advantages in precision strike, advantages in intelligence, advantages in operating under the sea." I've commented several times how Dr. Wolfowitz must have been thinking of tomorrow's submarines when he said this. But he's right: America is the preeminent undersea power. Nevertheless, we need to further refine our ability to fight from the undersea battlespace.

Our transformation efforts in this area are well underway. Exercise ***GIANT SHADOW*** provided clear, and present, proof. We showed the world that a stealthy SSGN linked with UAVs and UUVs and delivering critical intelligence to SSGN-delivered SEALs ashore is a thing of the present. We also launched two *Tomahawk* missiles from a modified D5 missile tube.

The *Trident* D5 missile tube modification increases the available payload volume for SSGN to 20 times that of a conventional SSN–and we don't have to use it all for precision strike. New unmanned sensor payloads that can swim, fly, or crawl into tight spots–while allowing the host submarine to maintain a safe standoff distance–are needed to take full advantage of the unique collection and warfighting capabilities of submarines. This is all about transforming our ability to fight from the undersea domain.

In years to come, ***GIANT SHADOW*** will be remembered as a watershed in our tradition of transformation. It brought together real capabilities that exist today-not empty promises of what might be delivered tomorrow-in a truly transformational way . . . and it demonstrates the warfighting value of payload volume on our stealthy submarines.

Although conducted aboard USS FLORIDA (SSGN 728), the exercise tested future attack submarine concepts–not just future SSGN capabilities. This is an important distinction because we need to look for ways to add this capability throughout the SSN force that are not cost-prohibitive.

I'm intrigued by options to increase VIRGINIA class payload volume to allow these SSNs to use the payloads now already tested on SSGN. Some of the options I have seen would quadruple the

payload for a 10 percent increase in cost. Is this a real option? Would it give the country a better return on its investment in undersea preeminence? It sure deserves a hard look.

We must be thinking of new ways to extend the eyes, ears, and noses of our attack submarines offboard and inland. UAVs and UUVs that could deploy today from SSNs need further development. If we're going to have missiles loitering over potential targets inland, why can't they also act as UAV sensors for us?

Throw the box away!

One of our transformation paths, then–projecting power and surprise from under the sea–is well understood and well underway. But this is only half the equation. We also need to be able to ensure dominance while fighting in the undersea domain.

In February of this year, Dr. Wolfowitz directed the Chairman of the Joint Chiefs of Staff to conduct a review of our undersea warfare capability with the goal being to develop a set of recommendations to guide our future investments and further our dominance in this area. The crucial role of submarines in maintaining undersea superiority was acknowledged in his forwarding memo that directed the study:

Submarines are critical contributors to [the] U.S. preeminence [in undersea warfare]. Their technical achievements and operational capabilities pose significant obstacles to potential adversaries who would seek to use the ocean depths to attack our interests.

The precepts of this study clearly articulate the need to dominate the fight in the undersea battlespace because our potential adversaries continue to improve their ability to challenge U.S. supremacy under the sea and in the process, challenge our Navy's *Seapower 21*.

A recent article in the *Far Eastern Economic Review* offers the following insight:

[An] underwater rivalry is intensifying in Asia as regional powers compete for control of strategic waterways. A multibillion dollar undersea arms race is gathering momentum as established powers and smaller nations rush to build or buy potent new submarines.

The threat posed by diesel submarines is real. They are out there-and as the article states, they are improving. It's no secret that today the best kill platform against a located submerged diesel is an

SSN. Given the fact that we have the right training, superior tactics, and a heavyweight, tested torpedo, we can handle the threat. These diesels are not black holes.

To continue to dominate the diesel threat, including the unlocated diesels, will require us to seamlessly integrate data obtained from the battlegroup's organic and offboard sensors (including fixed and distributed systems) in real-time. The submarine must be able to hear and respond to the battlegroup commander instantaneously. We simply don't have time to stop what we're doing, clear baffles, and make a trip to PD. The missing link, then, is real-time, underwater connectivity. Our inability to pull and push this highly perishable information from and into the Common Undersea Picture is the current Achilles' heel of the submarine in the coordinated ASW process.

I am encouraged by some of our developing technology. During several recent real-world exercises, we tested the Acoustic Communications System (ACOMMS). We demonstrated–*in situ*–the ability to conduct two-way, extended-range data transfer at speed and depth. We can't yet be satisfied with the rate or volume of data transferred, but it's a step in the right direction. We've got to keep working on the physics of this tough problem.

To use *Seapower 21* language, we have to better integrate the submarine into FORCEnet, this time the undersea FORCEnet, which in the CNO's words is the "glue–an overarching effort to integrate warriors, sensors, networks, command and control, platforms, and weapons into a fully netted, combat force"–that binds *Sea Strike*, *Sea Shield*, and *Sea Base* into a coherent vision for future naval operations.

If our Navy can't rapidly sanitize the undersea battlespace by destroying enemy diesel submarines, then one key element of *Sea Shield* will be compromised. The Joint Force combatant commander will, rightfully, be reluctant to move high-value units close to the enemy's coastline, limiting our ability to establish a secure *Sea Base*. And the *Sea Base* is crucial–as Admiral Clark has noted, "*Sea Basing* serves as the foundation from which offensive and defensive fires are projected–making *Sea Strike* a reality." And so it follows, then, that if we can't dominate the fight in the undersea battlespace, *Sea Shield* unravels, making *Sea Basing* tenuous, and *Sea Strike*

more challenging: *Seapower 21* simply might not work.

Last month at the annual Submarine Technology Symposium held at Johns Hopkins, I challenged our technical community to step up with some fundamental breakthroughs to solve this challenge of comms at speed and depth. We need transformative innovation not efforts to rewrite the laws of physics. Work at our Naval Postgraduate School on Undersea Communications Docking Stations is an example of working with the laws of physics to help solve this problem. I look forward to the results of their efforts.

On the first page of Secretary of Defense Rumsfeld's *Transformation Planning Guidance* (issued this past April), President Bush states that we need a

. . . future force that is defined less by size and more by mobility and swiftness; one that is easier to deploy and sustain; one that relies more heavily on stealth, precision weaponry, and information technologies . . .

That sure sounds like a submarine to me. But remember what Will Rogers once said:

"It's great to be on the right track, but if you're standing still, you're going to get run over."

The Naval Submarine League will continue to play a crucial role in the transformation of the Submarine Force by providing an invaluable intellectual forum in which our best and brightest can frankly discuss the challenges we face and help develop practical solutions. Keep charging!

Thanks for listening. Let's have a great symposium.■


The sea dominates the Earth.
This dominates the sea.
It runs silent; it runs deep. The Virginia-class attack submarine is the most advanced undersea weapons system in the world. This nuclear-powered submarine comprises an innovative mix of technology, flexibility and combat effectiveness. Designed to meet changing missions and threats, it's at the forefront of the Navy's push to maintain 21st century sea superiority. Northrop Grumman Newport News is proud to be a partner on the Navy's next-generation submarine. It's one reason there will always be something in the water that keeps America strong.
NORTHROP GRUMMAN
DEFINING THE FUTURE
Newport News

Remarks by CDR Michael Jabaley
Commanding Officer, USS LOUISVILLE (SSN 724)
to the
Naval Submarine League Symposium
11 June 2003

Thank you Admiral Reynolds for that introduction. Your earlier comment on Lieutenants remembering Admirals' names sparked a memory - when I was Chemistry and Radiological Controls Assistant on USS DRUM and undergoing my final qualification board for my dolphins, the first question was "Who is COMSUBPAC?" That day, I knew the answer - J. Guy Reynolds. So I'd like to thank you for furthering my Naval career!

Submarine force leadership, submarine force industry, membership of the Naval Submarine League, and ladies and gentlemen - Aloha and Good Morning! Today I will present an overview of USS LOUISVILLE's 2002-2003 deployment and discuss how it was both a classic example of the multi-mission capabilities of today's submarine force, and also a harbinger of the transformation inherent in SSGN.

I was privileged to relieve as Commanding Officer of USS LOUISVILLE in May of 2002. At that point, the ship was already in the pre-deployment cycle, having finished the first Pre-Overseas Movement, or POM, upkeep, and all of the required major examinations of the Inter-Deployment Training Cycle. We still had several tactical development exercises, the second POM upkeep, and of course final certification remaining. The deployment was planned as an independent SEVENTHFLT deployment, that is, one not associated with a carrier strike group but focused on conducting training, exercises, and special operations missions in the Western Pacific. As such, my focus as Commanding Officer was on bringing the crew's performance up to the required standard for operating in the shallow water, high contact density littoral environments that are the hallmark of that region. Using training opportunities in the local Hawaiian opareas, in the attack centers, and using the onboard capabilities of the CCS Mk 2 Block 1C Combat Control System with the ARCI Phase III sonar suite, we were able to rapidly raise our

proficiency in littoral Undersea Warfare and Battlespace Preparation, including Intelligence, Surveillance, and Reconnaissance, leaving us ready for exercises and missions alike. However, as the summer progressed, two issues reminded us that a submarine can never expect to deploy with only one mission in mind, and required a shift in focus.

First, our government began to make the case in the press and in the diplomatic arena for a renewed effort in enforcing the United Nation sanctions against Saddam Hussein's Iraq. Although it seemed only a remote possibility at the time, we knew there was always a chance that military force - and for us in particular, the submarine Tomahawk strike mission - would be called upon. Although strike exercises are a regular part of our training, the interest level is always raised when one knows that the mission may actually be tasked. As we scheduled additional exercises and attack center sessions, the value of the training also increased with the additional interest.

Second, after our pre-deployment certification was completed and all that remained was final loadout, the issue of mine warfare arose. Due to changes in deployment schedules and capabilities, a several week gap in SEVENTH FLEET mining coverage resulted. Although this could normally be covered by the ready SSN in Hawaii, this gap unfortunately fell during the annual exercise of the defense of the Republic of Korea. As such, it was decided that we would need to be certified for mining prior to deployment. Once again, the presence of mining in our training plan had laid the groundwork, and with a short focused period we were able to complete the Mine Readiness Certification Inspection and deploy immediately after. So having thoroughly stressed each of the classic submarine missions of Undersea Warfare, Surface Warfare, Strike Warfare, Mine Warfare, and Battlespace Preparation, we deployed on 10 September 2002. As a point of interest, as we left the pier in Pearl Harbor, it was just 12 hours shy of one year since the terrorist attacks of 11 September 2001.

Despite the multi-mission focus of our deployment preparations, the first four months of the actual deployment went pretty much as planned. We participated in bilateral exercises with a Republic of Korea Submarine, attended the celebration of the tenth anniversary

of their Submarine Flotilla, and participated in ANNUALEX, a fleet exercise with the Japanese Maritime Self Defense Force. The exercises against the newest Korean and Japanese diesel submarines were tremendously worthwhile. Without discussing in too much detail, I will say that after conducting operations with many different diesel submarines, as Admiral Bowman said, they are not black holes. We also completed two highly valuable independent operations of significant interest to national security.

The second of those two missions ran from early December until the middle of January. As that mission progressed, we paid more and more attention to the scant news items loaded on the broadcast and tried to read the tea leaves showing where the world community was headed with Iraq. As it became clear that diplomacy would not result in Hussein's adherence to the UN sanctions, the next question was of course, how would this affect us? We quickly found out as we transited off station in mid January. Instead of a much anticipated liberty port visit in Perth, Australia, we were diverted to Guam and directed to shift focus. We offloaded eleven torpedoes and onloaded eleven Tomahawk missiles. We would have taken more missiles, but there were none left in Guam. We opened and inspected every seawater heat exchanger in the engine room in anticipation of extended operations at periscope depth in warm water. We fixed everything that was broken and reloaded all supply parts, consumables, and food for ninety days at sea. Although we had not been officially extended or even ordered to FIFTH FLEET, the writing on the wall was crystal clear - as the diplomatic process proceeded, the pace of military preparations rapidly quickened. As we left Guam on the 28th of January, we had a subnote heading west but still no official orders. The details were filled in as we transited to the US CENTRAL COMMAND AOR.

It was during this phase of our deployment that LOUISVILLE, along with every other submarine that was called upon, demonstrated the hallmarks of the submarine force that will be so valuable when in place on the SSGN platform. Mobility, Stealth, Endurance, and Firepower are the classic assets and were instrumental in the submarine force's contributions to OPERATION IRAQI FREEDOM.

As the CENTRAL COMMAND requests for forces started

coming in, deployed and deployable submarine assets were literally spread across the globe. Using our case as an example, in a short ten-day stop in Guam we were able to repair, replenish, and reconfigure the weapons loadout to make LOUISVILLE fully ready to support combat operations. The value of the forward deployed submarine tender, USS FRANK CABLE, COMSUBRON FIFTEEN, and the submarine infrastructure present on Guam was not lost on us. And then upon underway, a direct 8000-mile transit to CENTCOM was rapidly executed using the unparalleled advantages of nuclear power. We chopped to FIFTHFLEET on 11 February and four days later were on station in our launch basket. The mobility of the SSN made such a rapid response possible, and once again the Navy was the first to have all forces in place and ready to fight. The SSGN program will further enhance this mobility advantage by using the proven OHIO-class platform to give the force four assets fully ready to rapidly position wherever they are needed.

The stealth feature of the submarine is of course well known, particularly to this audience. And although the operating environment during OPERATION IRAQI FREEDOM proved to be for the most part benign, the frightening reality is that our information suggests that there are still terrorist cells actively planning waterborne assaults on naval vessels. An undeniable advantage of the submarine is its much lower vulnerability to such an attack when on station. The force protection concerns during a port visit are still critical, of course, but were not an issue during our FIFTHFLEET operations, as we simply never had the need to conduct a pit stop in theater. But although the threat to our Naval forces from the Iraqi military was low, we cannot be assured of that in future conflicts. The ability of a submarine to remain undetected on station, anywhere the depth of water will permit, combines the real physical force with the force multiplier of the unknown. The preeminent acoustic advantage of the OHIO class platform will make for an even more impressive stealth package, with four SSGNs capable of being undetected on station anywhere throughout the world's oceans, within striking distance of most of the world's militarily significant targets.

After leaving Guam, LOUISVILLE operated continuously at sea for 83 days. While this is by no means a record, it is yet another

testament to the at-sea endurance of the nuclear powered submarine. Remember now that upon leaving Guam, LOUISVILLE was in the fifth month of deployment and over six months out of our last upkeep. To embark on a three month underway at this point is certainly a challenging proposal. However, the design and maintenance program of the 688 class submarine is again a proven success, and our case was no exception. The at sea repair capability and redundancy in design made our endurance on station simple. In fact, our only concern was food; although we had enough to subsist comfortably for ninety days, we certainly welcomed the replenishments at sea that were scheduled for us as they made the menu much more varied. Our first replenishment was conducted in seas too rough to open the main deck hatches. We loaded only essential stores by hauling them up to the fairwater planes from the small boat. Chief of the Boat, Master Chief Tom Vatter, stood on the starboard fairwater plane hauling up a 25 gallon can of hydraulic oil, proving that fairwater planes are an undeniable advantage of the non-"improved" 688s. Subsequent replenishments were in more suitable weather.

With scheduled replenishments easily possible in a benign environment, a submarine could remain onstation literally for an indefinite period. In a high threat environment, a rotation of forces pulling back to a replenishment area would be required. In either case, the SSGN, with its larger stores capability, would have even longer periods between replenishments and therefore an increased endurance.

And finally, firepower. The Strike Mission was of course the heart of our participation in OPERATION IRAQI FREEDOM. Let me describe some of the more interesting aspects. As soon as we left Guam, we started participating in strike exercises. C5F and C6F ran a combined exercise, BABYLON EXPRESS, once a week. With forces in the Mediterranean Sea, the Red Sea, and the Arabian Gulf, the exercises were complex and robust. During our transit to station, planning the exercises took on an added dimension as we were in a greater than 25-knot moving haven. As the exercises progressed, we learned more and more about fitting into the striking force.

Let me give you an example - one of the first issues to be raised was the backhauling of empty capsules after firing torpedo tube

launched, or TTL, missiles. The standard for TTL salvos is to be able to fire the follow-on salvo of four missiles within two hours of completing the first salvo. There was much discussion on the pros and cons of jettisoning the empty capsules, which is allowed, instead of backhauling them into the torpedo room prior to loading the next salvo. The tradeoff is one of speed, in not having to backhaul, versus not being able to perform the inspection shown here to ensure all pieces of the capsule diaphragm are accounted for.

The discussion eventually arrived at the conclusion that the crews should be able to backhaul and reload four tubes and still meet the two hour standard. This is a challenge, but it can be met with thorough planning, extensive practice, and choreographed teamwork. Once we chopped into FIFTHFLEET, we backhauled the torpedoes out of the tubes, loaded four Tomahawk missiles, and then conducted regular training of the dual reload parties, using actual Tomahawk missiles. By the time we arrived on station, we were fully ready to execute multiple salvos meeting the two hour standard.

At this point, let me explain what I found to be our biggest frustration during deployment. You have heard much discussion about the wonderful communications suites on the submarine of today. Unfortunately, LOUISVILLE is one of the few SSNs left in the fleet that is not EHF capable. We exist on the classic VERDIN broadcast and SSIXS communications during normal operations. While almost all of my peers have access to SIPRNET at sea, and in some cases high data rate access even to the Global Broadcast System, our non-record traffic communications is limited to the BGIXS system, which in addition to being our primary circuit for delivery of Tomahawk Mission Data Updates, or MDUs, also passes unclassified email. As you can see by the data rates, while everyone else is using cable modems, we dream of dialup access. Now this is still much better than having nothing at all, but the limitations of the system are such that it is usable only for basic communications with friends and families, and has little use for non-record traffic with the chain of command or peers. For instance, I did not catch wind of the missile capsule discussion until halfway through, and then only when my Commodore drafted a message summarizing the salient points and sent it to me via record traffic. The conversation had

been conducted solely by SIPRNET email. I found that the best connectivity I had for frank discussions with my chain of command was using our Iridium satellite telephone.

Once we got onto station, we found that our best operational connectivity was through the UHF Command Net, with an HF net as a backup. After about a week on station, multiple problems with the satellite and net control stations caused significant UHF degradations. This resulted in the loss of BGIXS delivery of Tomahawk MDUs as well as the UHF Command Nets. Our only voice comms were on HF nets and we were using TADIXS for MDU delivery. It was agonizingly slow, but reliable. After a week and a half of this, satellite channel reallocation allowed restoration of UHF circuits. Recognize that these issues were transparent to most of the other forces as their primary communications were all EHF. It was only our British brethren in the Arabian Gulf, HMS TURBULENT and HMS SPLENDID, who were in the same boat. Due to the vagaries of HF communications, we found ourselves in the Red Sea acting as a comms relay between the Brits and the Carrier Strike Group Commander, all of whom were in the Arabian Gulf. HF comms were very reliable, however, and we had a tasked relay platform to allow us some entry into the chat rooms and SIPRNET connectivity.

For most of our time, that relay was USS PITTSBURGH. Jeff Currer and his team were a big help throughout; on one occasion while troubleshooting a problem with one of our Torpedo Tube Control Panels, we passed information to PITTSBURGH via HF, who then entered into the SIPRNET chat room with Type Commander staff and Naval Undersea Warfare Center technicians stateside, who then passed troubleshooting guidance for relay back to us. In six hours we had a multiple failure casualty solved that would have taken days of drafting and trading messages. Even for a platform that was relying on HF voice comms, the SIPRNET was a huge help. Our ability to integrate deeply into the striking force despite our communications limitations was a classic example of innovation and adaptation on the part of the force commander, the fleet commander, and all platforms involved.

One advantage we did have was the tremendous utility of the Advanced Tomahawk Weapons Control System, or ATWCS. The

ease of maintaining the mission library with this system is phenomenal. There is no more disk space limitation of the Data Transport Devices, or DTDs, and ATWCS gives a full search and analysis utility that is invaluable. As we were analyzing planned launch positions, the achievability of the different missions from the various positions became an issue. With ATWCS, my Weapons Officer, LCDR Shawn Nisbett, was able to quickly pull all of the missions for our area, build a composite launch basket, and in less than 10 minutes give a percent mission achievability for each of the proposed planned launch positions. This is a task that would have been nearly impossible using legacy fire control systems.

And finally, the strike itself. After being on station for over a month, the diplomatic deadlines passed and military action became imminent. Due to the inability to gain overflight permission for missile flight paths through Turkey, the Mediterranean forces came through the Suez Canal and joined us in the Red Sea. At the height of the force concentration, there were 14 submarines in theater - 10 in the Red Sea and 4 in the Arabian Gulf. Add to that the numerous surface ship Tomahawk shooters and you can see that missile flight path planning became very complex. As H-hour approached, we were once again in the dark. You may remember the stories of the opening days of Operation Enduring Freedom, our strike against the Taliban in Afghanistan, with CDR Scott Bawden on USS PROVIDENCE monitoring an Army Chat Room, recognizing the imminent need for Tomahawk tasking, spinning up missiles on his own initiative and being ready when the call for fire came out - great stuff. Here's how it happened on LOUISVILLE. There was another Tomahawk exercise in progress. It was Wednesday, the 19th of March. We were in comms on the UHF net, talking to the Launch Area Coordinator, or LAC, as we went through the planning phases. We had received the exercise Launch Sequence Plan, but not an Indigo, or Execution Order. As the time for the first salvo approached (in which we were not tasked), we started to notice a decrease in voice traffic. The first salvo time came and went with no execute order. Although most other forces were communicating on EHF as a routine, there was usually someone who shifted to UHF due to a casualty or for training. And there was always the Brits. So it was clearly unusual to have no traffic on the net. We called the

LAC and asked for a status of transmitting exercise Indigos, and received a curt "Negative Indigo. FINEX exercise." Clearly something was up. We realized that actual strike planning was in progress, that it didn't involve us, and we quietly took our seat on the sidelines. Although we did not know it at the time, the FIFTHFLEET staff was deep into the rapid planning that resulted in USS CHEYENNE launching the first strike of the war, in the bunker assault that attempted the decapitation of Saddam Hussein's regime. At this point, I would like to borrow a line that CDR Chas Doty, Commanding Officer of USS CHEYENNE used during his deployment brief in Pearl earlier this week.

"47 hours and 59 minutes after President Bush issued his 48 hour deadline, CHEYENNE shot the first missile of Operation Iraqi Freedom.

You are allowed to launch a Tomahawk one minute early."

Over the next thirty-six hours, we watched as several salvos of a few missiles each were launched. USS KEY WEST and USS SAN JACINTO, both within twenty miles to the west of us, launched salvos on Thursday night, presenting us with a great visual show. Finally, Friday night the heavily anticipated *shock and awe* strike was tasked. We were tasked with a maximum capacity salvo and successfully shot all tasked missiles. We shot two more salvos, one on Saturday night and the final salvo on Sunday morning. The Sunday morning salvo was a great example of Rapid Plan and Shoot. The mission was already resident in ATWCS, and for us that made it simple. We had already accomplished standard mission planning for each of the first pre-planned waypoints in the library, so when we were tasked by voice with firing a missile in less than an hour, it was easy. The long leg, missile alignment, finished about five minutes before the launch window opened.

It is interesting to compare LOUISVILLE's experiences in OPERATION IRAQI FREEDOM to those of the ship in OPERATION DESERT STORM, when USS LOUISVILLE became the first to fire a Tomahawk in conflict in 1991. In the communications area, at least - now watch closely - the more things change, the more they

stay the same. The only change on LOUISVILLE is that we no longer need two WSC-3s for comms, but now use mini-DAMA. The rest of the force has made a large jump, though. One of the great tools to come out of the workup to the war is the White Board, which is simply a multi-user spreadsheet. Each firing unit updates its status on items such as missile alignment, launch position, time of first launch, etc. The status is immediately visible to all other firing units - that have EHF - and the Launch Area Coordinator. This tool removes the need for voice communications for all routine reports and frees the voice nets for casualty reports. Combined with strike chat rooms, the call-for-fire concept of Tomahawk strike is here. So with the advent of EHF, medium data rate, and high data rate communication systems, the limitation is no longer the equipment on board the submarine - it is now bandwidth. Oh, and one other legacy from DESERT STORM - just as Jeff Currer and I shared experiences in the Red Sea this spring, twelve years ago it was Frank Stewart on LOUISVILLE and then CDR Chip Griffiths on PITTSBURGH, striking the initial blows in DESERT STORM.

You will be happy to hear that we did finally make it to Perth, with a seven day stop on the way home. Now, I have been trying to get to Australia for my entire naval career. Of course, at this station in life, the experience was different from what it might have been twenty years ago. Perhaps it is because my wife sent our two oldest children - or as Admiral Padgett would call them, the upper third - down under for the week to act as my chaperones. But from playing golf with kangaroos on the course, to Australian Rules Football, to spending ANZAC day in the pub with the Australian Sub Vets, it was without a doubt the port visit highlight of a memorable deployment, for the entire crew.

One final point I would like to make. When all was said and done, LOUISVILLE returned home on the 13th of May, after a deployment of 246 days, over eight months. To put it another way, that's all of baseball playoffs, the entire NFL and college football seasons, the entire college basketball season, and all but the playoffs of the NBA. Which, actually, is a good thing in the case of the NBA. While the extended time away presented its own challenges, I am proud to tell you that the crew and the ship performed magnificently throughout the entire deployment. The statistic of which I am

the most proud is that during the entire 246 day deployment, not once did LOUISVILLE need to pull in for a problem - no HUMEVACs, no MEDEVACs, no material casualties requiring a return to port during the entire run. During the period of the extension of unknown length, it was an easy task to explain to the crew the importance and necessity of what we were doing, and they really understood the significance. And, of course, it was a once in a lifetime experience for all of us. Having just passed the one year point of my command tour, you might think I would be wondering what I could find to compare to this over the next two years; I take great satisfaction, however, in the fact that next month I will take the ship into SRA and strike LOUISVILLE from the ranks of non-EHF capable submarines, as we receive a communications upgrade and the installation of the BYG-1 Combat Control System, the latest and greatest in warfighting technology.

In closing, I hope that I have given you a glimpse into the missions and roles that today's submarine force fulfills. With the advent of SSGN, we gain a platform that will be even more ready to demonstrate the Stealth, Mobility, Endurance, and Firepower that makes the submarine force so valuable to our Navy and to our Nation.

Thank you and Mahalo!■

ARTICLES

Aboard USS PROVIDENCE During the Iraqi War

by Mr. Robert A. Hamilton

Bob Hamilton is a reporter for The New London Day covering defense issues.

There was no hesitation or confusion as the order came over the IMC, "Man battle stations, Strike." For months, the crew had practiced the procedures, so everyone knew where they were supposed to be and what they were supposed to do.

"One minute to launch," declared the officer watching the countdown. "Ship ready," said the navigator. "Mission ready," the executive officer pronounced. A short time later, the captain gave the order, "Launch." There is a rumble that you can feel through your shoes, a hissing and then a slight overpressure in your ears, as the weapons system vents, and the ship rocks slightly back and forth as more than two tons of missile exits a torpedo tube and speeds towards Iraq.

The navigator keeps the periscope trained on the Tomahawk that is racing away. "Booster separation," he said as the first stage capsule dropped away and plummeted to the sea. Then, "transition to cruise." The first missile was followed in quick succession by another, and then two from the vertical launch system, which rock the boat up and down as they are pushed into the air to begin their journey.

"Way to go, men," CDR Jonathan H. Kan says softly over the whispers in the control center. Minutes later, he gets on the ship's communications network: "Well done to get us to this point. The missiles transitioned to cruise, so they're on their way." The ship returns to its normal routine; less than an hour later, the wardroom sits down to dinner, to an AC/DC song, "Dirty Deeds," playing on the wardroom audio system. Talk turns to how long the war might last.

Down in the torpedo room, the weapons handling crew has

managed to come up with procedures that allow them to reload weapons in half the time of the fleet standards. The young men, volunteers drawn from several different divisions on the boat, came up with a suggestion for a cruise T-shirt: a picture of a shark labeled "Providence" shaking a Tomahawk missile in his fist over the Baghdad skyline, and the caption, "We deliver on time the next one's free."

"We've worked very hard to be a part of this operation," Kan said later in his stateroom, as he waited to see if there would be any more strike orders that night. He described how the PROVIDENCE crewmen had to cut short their training to deploy 10 days early so the boat could be in place in time. The typical "last weekend" family plans all had to be abandoned, but there has been no grumbling.

"They have a lot to be proud of, and you can be sure we will keep reminding them of that, because the achievement today was not trivial," Kan said.

Over the next four days PROVIDENCE would launch all its Tomahawk cruise missiles into Iraq, in several waves. Each time a countdown began, more than two dozen people crammed into a control room that would be crowded with half that number. Anyone not assigned a duty during battle stations crowded into the crew's mess, where they watched the launches on the Perivis system that feeds live video from the periscope.

With that deployment, PROVIDENCE entered the history books as the first submarine to fire land-attack missiles on consecutive deployments, the first submarine to go "Winchester" (the term for firing all of its ordnance) in the Red Sea during the war, and the first U.S. nuclear submarine ever to bring a journalist into combat.

As a staff reporter for the New London Day in Connecticut, I have been covering submarines for the better part of a decade, and have gotten underway numerous times, occasionally for several days, so I have some understanding of the boats and their crews. But I also know that the submarine force guards its secrets carefully, and when the Pentagon announced during the buildup to the war that it would embed reporters with the troops, I never expected that would include putting a reporter on a submarine.

But in late February 2003, I got a call from CDR Bob Ross, then the public affairs officer for the Sixth Fleet. After an exchange of

small talk he got to the reason for his call: if he could arrange it, would I fly to the Mediterranean Sea to deploy aboard a Groton-based submarine that was going into combat? "Yes" does not begin to describe my response, but I also figured that as he ran it up the chain of command, someone somewhere would nix the idea. But Ross fell back on his favorite expression–if you don't ask, the answer is automatically no–we both got busy on our respective ends.

The original plan was for me and a photographer, Tim Cook, to go to Crete and hook up with USS TOLEDO some time in mid-March. Instead, I got a frantic call from Ross the morning of 10 March, informing me that I had to be on a flight out of Boston that afternoon to Cyprus.

Cook and I made a mad dash for the airport, and after a transatlantic flight and a few hours in a Cypriot hotel, we were boarding a Seahawk helicopter for a hop out to USS WINSTON S. CHURCHILL, an Arleigh Burke-class destroyer, and then a small-boat transfer to PROVIDENCE.

I would learn later that when Turkey decided not to support the war, the Navy choreographed a massive movement of naval forces out of the Mediterranean, and into the Red Sea. We had to rush because once the ships entered the Suez Canal, the door would slam shut on our opportunity to join them. I was still under the impression that we would be operating in the Med, though, until I had been aboard about five minutes, and the captain announced that we were heading for "the Ditch."

On 11 September 2001, PROVIDENCE was on its way home from the Persian Gulf when terrorists attacked the World Trade Center and the Pentagon. Without waiting for orders the captain, then CDR Scott Bawden, turned the ship around and headed back to its station. It fired the opening shots in the war against the Taliban in Afghanistan. But many of the men who led it into combat two years ago were gone when it headed for the Red Sea this year.

"Since our last deployment probably 30 percent of the crew has turned over," Kan said. "Look at our chiefs–none in engineering were on the last deployment, none in weapons, and in navigation only one of them made the trip. Three chiefs out of 16 on board made the last deployment. And in the wardroom, only five of the 15 made it. That's the challenge–you get all these new guys in and not

much time at sea until you deploy, so how do you get them ready."

Not that he was worried about their capability. Kan, the squadron staff, the Commander, Naval Submarine Forces have all put the ship through a series of rigorous pre-deployment inspections and exercises to make sure it is ready to go into harm's way.

"The certification process is about a billion times harder than the actual deployment," Kan said. "If you can get through the certification, you can get through the deployment."

On the way across the Atlantic the crew trained continuously in strike operations, a series of 36-hour exercises in which they simulated combat, with a special emphasis on reloading the torpedo tubes. The crew realized that combat assignments are parceled out based on who is ready to fire, and they didn't want to miss a single opportunity. For more than 80 hours the reload team members man their posts, grabbing a few minutes of sleep on the hard, cold, polished steel weapons racks when there is a lull–walking back to their racks would waste precious minutes that could be spent sleeping.

But there are also drills to handle problems with the propulsion plant, or to fight fires and flooding. The ship must be prepared for strike operations, but it must also be prepared for a myriad of problems that can arise during combat. There is no margin for error on an operational submarine.

The men in the torpedo room are convinced theirs is the most important part of the ship. Everything else is just to get the weapons to the launch basket on time. But everyone holds the same point of view–engineering crewmen say the ship wouldn't move without them, navigation team members say the ship would get lost if they don't do their job, and so on. Each of the young men describes the importance of his job with fierce pride, and considerable expertise.

"The American public is getting their money's worth out of these sailors," Kan said. Most operate four hours on, eight off watch section, but even when they are not on watch they are cleaning, repairing equipment, studying for their next qualification or advancement examination or taking care of personal chores such as laundry. The captain said it's important that officers and senior enlisted people keep a close watch on the crew.

"You may be setting a guy up not to get any sleep for a day and

a half, and they won't say anything to you, they'll just try to work through it," Kan said. "So it becomes a big obligation on our part to make sure we're looking out for them."

But the reality is that submariners often get by with too little sleep. When a ship has sufficient notice of a strike, the captain and executive officer try to carve a little time out of the schedule to allow the men to grab a few extra hours sleep.

But PROVIDENCE gets only a few hours notice for its first strike, so there is only time to remove the temporary berths from the torpedo room and ready it for combat. Mattresses, sea bags and metal bed trays are moved half the ship's length and up one deck, bucket brigade style. There are a few skinned knuckles as a result of the haste, but the process goes even quicker than the 45-minute goal the captain had set.

LTJG Will Wiley had worked a 24-hour day on the Wednesday before the strike because of the vagaries of the watch schedule, some extra duty and some training that took place during what was supposed to have been his off time.

When the Captain asked him if he had managed to sneak away to his bunk, Wiley replied with a grin that he had managed to squeak in five hours of sleep earlier, and he was ready for anything. Before the day was out he would put that to the test.

On the night of the first strike, the mood in the control room was muted. A few enlisted men sat with their hands folded. Officers who were not taking part in the countdown stood unmoving and unspeaking. The men standing watch did not take their eyes from their computer screens.

The Perivis shows the first missile away, a vertical launch, the white glare of its rocket motor lighting the Red Sea like a small sun, and the drops of ocean water on the periscope sparkle like diamonds with the sudden illumination, then the missile bursts though the launch cloud, and within five seconds is a mere pinprick of light. The second follows, and then the two torpedo tube launches. Their rocket motors light off under the water, so the first visible sign of the launch is a bright green glow, right before the missile bursts through the surface and zooms away. Several of the men remark on the irony that a weapon launch should be so beautiful.

"You get that rush of adrenaline when you see them break the

surface, and then kind of stand there transfixed as they fade off into the distance," said Electronics Technician 2nd Class Peter J. Koester. "I've seen videos, but it doesn't really capture what we saw and felt tonight. There's something different about being here live."

On the first night of combat operations, the captain is moving with practiced ease from station to station, offering a word of encouragement here, a hand on the shoulder there.

"The adrenalin was high," Kan said later. "The hardest thing to do was to keep everybody calm, and following the game plan. They were very prepared, and able to handle the job, but I sensed the adrenaline and wanted to take the time to talk to them, to calm them down."

It is a mantra among sailors that you train as you fight, and fight as you train. That philosophy pays big dividends in the opening hours of the war, as the procedures were carried out flawlessly.

Chief Hospital Corpsman Michael "Doc" Shoulberg noted that the long-distance combat of this war was easier than his first experience, going into Iraq with a Marine division in Desert Storm in 1991.

"Last time was from 25 yards, and they were shooting back," Shoulberg said.

The following night, a Friday, PROVIDENCE fired three waves of missiles, as it combined with other submarines, destroyers and cruisers for a major offensive. The captain was moving around control a lot less, monitoring more of the activity from a distance.

But Kan cannot relax completely. There are other warships nearby–a Tomahawk going up from a destroyer 30 miles away looks like a Roman candle rising into the sky. And there are merchants to worry about as well. One container ship is several miles away as PROVIDENCE launches, but it turns quickly and the master of the vessel gets on the radio to remind PROVIDENCE in a rather frantic voice that he is nearby. Within a few minutes the ship has resumed its course and speed.

In between strikes, the captain ordered "battle rats," sausage, shredded pork and cheese, with some hefty rolls to make a sandwich, the kind of food that you can wolf down when you have a few minutes away from your job.

The officers were in the wardroom discussing how long it might

take to reload the tubes that had been fired, when the weapons officer, LT Eric Svensson, stuck his head in the door, a big grin on his face.

"Permission to spin up tubes?" Svensson asked.

"No way," the captain responded, an exaggerated look of disbelief on his face, after giving the clock on the wall a quick glance. "That's got to be a record."

The strikes continue Saturday, and into Sunday morning. At one point the captain realized the executive officer, LCDR Thad E. Nisbett, has been too long without sleep, and he encourages him to hit the rack. Before Nisbett can make it to his stateroom, however, the captain gets word that another launch has been ordered.

"That's the key, send the XO to his rack, and we get a tasking," Kan said with a chuckle. He picks up the sound powered phone next to his seat at the head of the table, and speaks into it. "This is the captain. Battle stations, strike."

Sunday morning, as the number of unfired missiles continues to dwindle, some of the officers wonder what they will do when the magazines are empty.

"Let's go deep and sleep," suggests LT Josh Powers with a grin.

"How about some engineering drills?" counters the engineer, LCDR Matt Mulcahy.

"Yeah, that's what I meant," Powers responds, grinning even wider.■

LASTING LEGACIES OF THRESHER

by CAPT George W. Martin, USN(Ret.)

Captain Martin was a pilot of the Bathyscaph TRIESTE during the search for THRESHER and holds Deep Submergence Operator Certificate #4. He was in the submersible ALVIN when they found the missing H-Bomb in the Mediterranean Sea. After leaving active duty, he settled down to civilian life and initially worked for the Lockheed Aircraft Corporation during the development of the Deep Submergence Rescue Vehicle. The crew of the Bathyscaph TRIESTE was awarded the Navy Unit Commendation for their efforts in the THRESHER search. Don Keach, Captain USN(Ret.), the officer-in-charge, died in 1999.

Part II

Foreword

Part I related the history of THRESHER and the search for the sunken submarine. Part II provides excerpts from the Court of Inquiry Report and the transition to the SUBSAFE and Submarine Rescue Program of today.

Introduction

Picture a submarine program that involved five new designs, eleven navy yards constructing and repairing submarines, and one yard with five submarines in work. Submarines had new missions: to launch ballistic and cruise missiles. They also had new requirements for operating depth and quietness, new technologies, nuclear power, and new materials, HY-80 steel. The expanding industrial base was developing new manufacturing techniques, tools and standards, and training personnel. The nuclear submarine pipeline was qualifying crew and officers for these submarines. The Cold War Soviets were increasing the numbers of nuclear and diesel submarines, surface ships and aircraft. Such was the dynamic world of the early nuclear submarine era which produced THRESHER.

Fortunately there was a Congress who understood the necessity of a strong defense, as well as the costs of that defense. Congress was confident of its Navy and its role in peaceful uses of atomic energy. The population was proud of their Navy. They also knew the terrors of atom bombs. It was a huge shock, then, when one of our own atom powered submarines sank in our front yard, off Cape Cod. This was near major east coast population centers. People felt threatened by the loss of the submarine and men, and the word *atom* powered used by the media.

The extent of the shock galvanized the Navy into immediate actions: (1) they reassured the public that there was no substantive threat from nuclear radiation from the submarine's reactor, (2) they constrained the operating submarines from a similar accident scenario, and (3) they took steps to find out what happened, and formulated an action plan to prevent a reoccurrence.

The Navy provided news organizations with information about the safety of the reactor in 8,400 feet of sea water. Within days the Navy had water sample and core samples taken from the vicinity of the submarine. These showed no radiation above normal background levels. Soviet ships were on scene almost immediately and generated propaganda about radioactive fallout. The Navy had samples taken throughout the summer from both surface ships and TRIESTE, and all samples were within normal levels. The Navy sent pilots in the Bathyscaph directly to the site implying that the radiation hazards were minimal. The Navy continued monitoring radiation levels in 1965, 1977, 1983, 1985, and 1993 with similar benign results.[1]

The Navy took immediate action to restrict the operating depth of all submarines until more was learned about the causes of the loss of THRESHER on 10 April 1963. That night the Commander-in-Chief, US Atlantic Fleet, ordered a Court of Inquiry to look into the causes of the loss. In the following days, Congress scheduled hearings before the Joint Committee on Atomic Energy for late June to receive the results of the Court's Report. The Navy also established the THRESHER Design Review Board, the Submarine Safety Program and formed the Deep Submergence System Review Group. The results of these activities are summarized here along with a brief look at where we are today.

Court of Inquiry Findings of Fact and Opinion

Two unclassified summaries of the Court of Inquiry report were released in June 1963. The first, "THRESHER Court of Inquiry Reports," was issued 20 June 1963.[2]. The three pages briefly told the findings of fact and opinion describing the final two days and minutes of THRESHER's operations. The opening paragraphs of the three page summary contain the Court of Inquiry's opinion as to the cause of the loss:

"A flooding casualty in the engine room is believed to be the 'most probable' cause of the sinking of the nuclear submarine USS THRESHER, lost 10 April 1963, 220 miles east of Cape Cod with 129 persons aboard.

"The Navy believes it is most likely that a piping system failure had occurred in one of THRESHER's salt water systems, probably in the engine room. The enormous pressure of seawater surrounding the submarine subjected her interior to a violent spray of water and progressive flooding. In all probability, water affected electrical circuits and caused loss of power. THRESHER slowed and began to sink.

"Within moments she had exceeded her collapse depth and totally flooded.

"She came to rest on the ocean floor, 8,400 feet beneath the surface."

VADM Bernard Austin, USN(Ret.), was named president of the Court of Inquiry. The court heard from many witnesses and had certain tests conducted before closing on 5 June 1963.[3]. The complete classified text, The Report of the Court of Inquiry Findings of Fact, Opinion and Recommendation, listed 166 findings of fact, 54 opinions, and 20 recommendations. The Court of Inquiry's findings of fact reconstructed THRESHER's history from building through her final moments. The Court's opinions were conclusions drawn from the facts and the special tests and analyses conducted at the Court's request. The Court's recommendations were of three kinds: specific to the THRESHER class, general to all submarines (particularly the deep diving hulls), plus direction to the Bureau of Ships.

Excerpts from the Court's report follow, between which are

comments by the author containing information gleaned from the findings of fact and the Hearings of the Joint Committee on Atomic Energy. The Court's Findings are in quotation marks. Comments are in plain text.

"Finding of Fact 47. That the increasing operating depths of submarines has compressed the time available in which to take effective damage control action with respect to flooding. The shortness of time available to control flooding is not well recognized."

Comment: The Court had analyses made of what it would take to sink THRESHER in the six minutes from the reactor shutdown time to the time it passed through crush depth, as recorded by SOSUS.

"Opinion 1. That the loss of the USS THRESHER was in all probability due to:

a. An initial flooding casualty from an orifice between 2" and 5" in size in the engine room, which continued compounded by
b. Loss of reactor power due to an electrically induced automatic shutdown,
c. Inadequate operating procedures with respect to minimizing the effects of a flooding casualty and the loss of reactor power, and
d. A deficient air system, susceptible to freeze-up, with low capacity and low blow rate."

"Opinion 45. Had the main turbines remained on propulsion much longer that 0912.5R with the main coolant pumps (classified . . .), THRESHER could have surfaced with a flooding casualty due to any pipe rupture in the ship except (classified . . .)"

Comment: (a) There was a well publicized history of sil-braze joint failure in the 1959-1963 time frame in both nuclear and diesel hulls going to deeper depths. Sil-braze was the best technology available when THRESHER was built. There were an estimated 3,000 sil-braze joints in an S-5-W plant and another 5,000 in other critical systems.

(b) The Court test released a stream of water at test depth

pressure to one atmosphere against a piece of electronic equipment. The result was a stream of tremendous force, spray, fog and noise. The conclusion was that the switchboard shorted and the reactor went into shutdown mode.

(c) The operating procedures for emergencies such as flooding were revised within weeks of the THRESHER loss to allow some valves to remain open to use the energy already in the plant for propulsion.

(d) The Court required a test of the high pressure air system on a sister ship, TINOSA, while on the surface. The strainers in the reducing valves froze up in 30 seconds, stopping air flow.

"Opinion 2. That there is a danger that, in melding together fact and conjecture, conjecture may be stretched too far and become accepted as fact, thus narrowing the field of search for possible causes of the casualty."

Comment: This was an attempt to stop a rush to judgment that there was one particular cause for the sinking when there were "in all probability" several, and some may never be known.

"Opinion 5. That a flooding casualty to THRESHER could have resulted from:

a. A faulty sil-braze joint.
b. Undiscovered shock damage.
c. A flexible hose failure.
d. A casting or piping failure.
e. A minor hull failure.
f. Unknowns, including component failure."

Comment: (a) Sil-braze joints were banished from submarines and replaced over time by all welded joints, manufactured in clean rooms, tested by radiography, and certified by Quality Assurance, a new dimension to the manufacturing process. VADM Rickover required welded joints in the reactor compartment in THRESHER.

(b) Damage from the shock tests was continuously uncovered and repaired during subsequent operations and the Post Shakedown Availability.

(c) Flexible hose failures were common until after December 1963, when new design hose and couplings, and installation procedures were issued.

(d) New procedures for radiographing castings led to a large number of rejections and eventually more reliable products.

(e) Minor cracks were common in welded sections of HY-80 and considered fixable by BUSHIPS. VADM Rickover preferred a more shallow test depth which allowed the use of High Tensile Strength steel.

The Court's Opinions conclude with numbers 54 and 55, and a poignant final sentence:

"Opinion 54: That the lessons learned from the inquiry into the loss of THRESHER are of such moment as to require wide dissemination within the Navy.

"Opinion 55: That the findings and opinions of this court point out numerous practices, conditions, and standards which were short of those required to insure the thorough overhaul and safe operation of the USS THRESHER . . . Vigorous steps should be taken to correct them.

"These shortcomings have developed incident to the rapid changes in materials, workmanship and operating conditions of submarines during the last decade and to the accelerated pace of the submarine program. They can be blamed on no individual or individuals, and many would not have come to notice had THRESHER not been lost."

Court of Inquiry Recommendations

The first recommendation was to protect the at-sea submarines:

"1. That the interim depth restrictions now imposed upon all submarines should remain effective until careful consideration, for each individual submarine, is given to the probable factors contributing to the loss of THRESHER, as listed in Opinion 1."

Most of the other recommendations can be summarized as, the Navy should conduct:

" . . . careful review of the design, construction, and inspection of vital submarine systems, such as sea water and air systems, and

a review of operating procedures to improve damage control capability under casualty conditions such as flooding."

The final recommendation was that consideration be given to establishing an organization responsible for the analysis of events and developments related to submarine safety and promulgating information to the fleet. That recommendation was quickly acted on and became the Submarine Safety Center which is now the Submarine Safety Division of the Navy Safety Center in Norfolk, Virginia.

Navy Judge Advocate General Report

The second unclassified report, "Summary of Events Concerning Loss at Sea of USS THRESHER" was released by the Navy Judge Advocate General, 25 June 1963. This contains the Court's Findings of Fact, Opinion and Recommendations regarding THRESHER's construction, post commissioning operations, and post shakedown availability.[4]

Hearings Before the Joint Committee on Atomic Energy

The Joint Committee on Atomic Energy conducted hearings in late June and July 1963 to review the Court's findings and records and a year later, July 1964, to learn what progress the Navy had made. A staff representative was present from the Senate Armed Services Preparedness Subcommittee. The fact that the Atomic Energy Committee took precedence over the Armed Services Committee indicates that concern about radiation from the nuclear submarine was greater than the concern of being attacked by the Soviets. The hearings were held in executive session so that classified information could be presented. The classified report was reviewed and an unclassified transcript was prepared.[5]

Secretary of the Navy Korth opened his remarks in the hearing by noting that the Bathyscaph TRIESTE was going to surface shortly and he had not yet heard of the dive's results. He had some expectation that TRIESTE would find something of value to the Navy and to the Congress.

Secretary Korth introduced the admirals accompanying him. Korth began with VADM Rickover, who had issued a new instruc-

tion on operating procedures for nuclear reactors, VADM Austin had completed the Court of Inquiry into the loss of THRESHER, RADM Stephan, head of the Deep Submergence Systems Review Group, was investigating search and recovery in the deep ocean, RADM Maurer, OPNAV head of submarine warfare, was looking into submarine operating practices, RADM Brockett, head of the Bureau of Ships, had set up a Submarine Safety Task Group, and RADM McKee was reviewing the design of THRESHER.

The hearings contain a classic example of the way Congress used its powers of oversight to investigate the serious accident of a nuclear powered submarine with major loss of life. There were many issues with the way THRESHER was designed, constructed and operated and the Joint Committee went into all of them, in detail. A pertinent comment made by RADM Brockett was that in submarine design, we moved too fast and too far in offensive and defensive capabilities, and submarine safety did not keep pace.[6]

THRESHER Design Appraisal Board

The THRESHER Design Appraisal Board, headed by RADM McKee, submitted their report on 15 July 1963. The report recommended improvements in design, fabrication and testing for greater submarine safety. Those recommendations were incorporated into the submarine safety program, which became SUBSAFE.

SUBSAFE

The Submarine Safety Task Group was established by the Bureau of Ships to carry out the recommendations of the Court of Inquiry and the THRESHER Design Appraisal Board. The original group considered sixteen broad categories including sea water systems, fabrication methods, machinery components, mandatory use of class plans, high pressure air systems, submarine readiness for builders and sea trials and certification, protection of electrical systems, pressure hull penetrators, improved damage control information in ship's information book, diving trainer improvements, and submarine shock test procedures. The immediate actions were revising operating and casualty control procedures, implementing mainte-

nance and material control requirements and installing emergency ballast blow recovery systems.

Today SUBSAFE is carried out by the NAVSEA Submarine Safety and Quality Assurance Division. Their mission is "to promote maximum reasonable assurance that seawater is kept out of the submarine and that the submarine and crew can recover if there is a seawater casualty." The technical and administrative requirements for SUBSAFE are contained in the Submarine Safety Requirements Manual.[7]

Deep Submergence Systems Project

The Deep Submergence Systems Review Group was formed in April 1963 to review current plans for location, identification, rescue, and recovery of large objects from the deep ocean floor. The Chairman was RADM Stephan, former Oceanographer of the Navy. They examined many scenarios. Three that generated much concern were: (1) a submarine sunk at a depth deeper than the McCann chamber capability but less than the collapse depth of the submarine, (2) recovery of small objects (missile nose cones) from the deep ocean, (3) a SSBN with its nuclear missiles sunk in international waters. The group presented innovative plans in their final report one year later. The CNO gave management of the report's recommendations to the Director of Special Projects, who later established the Deep Submergence Systems Project to implement the recommendations.

The project was initially responsible for development of a Deep Submergence Rescue Vehicle (DSRV), a Deep Submergence Search Vehicle (DSSV), and a Large Object Recovery System of something as large as a POLARIS submarine. Later SEALAB, the underwater habitat, and NR-1 were added. The project's most urgent task was to develop the DSRV that could rescue submariners to a nominal depth of 2,000 feet. The DSRV-1 and DSRV-2 were launched in 1970 and 1971 respectively. Eight mother submarines were modified to transport the DSRV submerged to the downed submarine, avoiding wave and weather. DSRV-1 and DSRV-2 performed successfully in exercises and, fortunately, never had to be deployed in a submarine emergency. The DSRV's have conducted exercises

with US submarines and those of foreign navies. The DSRV-1 was taken out of service in 2000, and the DSRV-2 is in service until about 2005, depending on the phase-in of the follow-on escape and rescue systems.[8]

The DSSV project, originally a manned 20,000 foot submersible, was terminated in favor of a classified project. Man-in-the-Sea, weeks long experiments in saturated diving, developed applications usable in submarine rescue. The Large Object Recovery project was overtaken by the CIA Project Jennifer. The Glomar Explorer's audacious raising of the Soviet Golf II missile submarine, K-129, are well publicized.[9]

Deep submergence search, diving, and salvage systems have performed important missions for the US. Three examples we know about are:

- found and retrieved the Air Force's H-Bomb in 2,800 feet of water in the Mediterranean, 1966;
- found and inspected SCORPION in 10,000 feet in the Atlantic, 1968-69;
- found and retrieved parts of the Space Shuttle CHALLENGER in 1986.

Submarine Survival, Escape and Rescue

Key issues in submarine escape and rescue are: where is the submarine, how soon can a rescue system arrive on site, what will the condition of the crew be by the time it arrives, and what will be the sea and weather conditions. A submarine rescue system is costly to design, build, and operate, and seldom, if ever, needed for a genuine emergency. The Law of Large Numbers tells us that *seldom* does not preclude it from happening today. The system seems expensive until you look at the opportunity cost of not having it. What would it cost if a US submarine sank in *rescuable* waters and the Navy did not have the capability to perform the mission? Ask the Russians.[10]

Submarine missions have expanded since the DSRV concept of operation was conceived in the 1960s. US submarines now operate in the littoral areas of the ocean as well as the classic deep oceans. The DSRV concept of operations included a fly-away rescue system,

predeployed ASRs with Submarine Rescue Chambers on board, and mother submarine SSNs. Now there is one DSRV, no ASRs, and the mother submarines are diminishing in number. The primary escape system now being phased into service is the Submarine Escape and Immersion Suit. This will enable submariners to escape from a nominal 600 foot depth.[11]

In development is the Submarine Rescue Diving and Recompression System with a 2,000 foot depth capability. This will be air deployable, then loaded onto a *vessel of opportunity* for transportation to the site of the downed submarine. The system has several elements: the Pressurized Rescue Module, the Submarine Decompression System and control equipment, and generator vans. The Rescue Module is tethered and surface controlled to locate the submarine and then maneuvered onto the hatch. The attendant can monitor the environment in the submarine, and when safe, open the submarine's hatch. The module can take on board up to sixteen evacuees. The module is then hoisted onboard the *vessel of opportunity* and mated with the decompression chamber element of the system. In addition to development, the system must undergo a certification process for safety and habitability up to five atmospheres of pressure.[12]

Summary

The loss of THRESHER and its crew created the demand for new and improved ways of designing, constructing and operating submarines. Today the Submarine Safety Division of the Navy Safety Center and the SUBSAFE program of NAVSEA have responsibility for continuing these efforts. The loss of the men of THRESHER brought about the DSRVs and the follow-on developmental escape and rescue, diving and salvage systems. We owe a lot to the men of THRESHER.■

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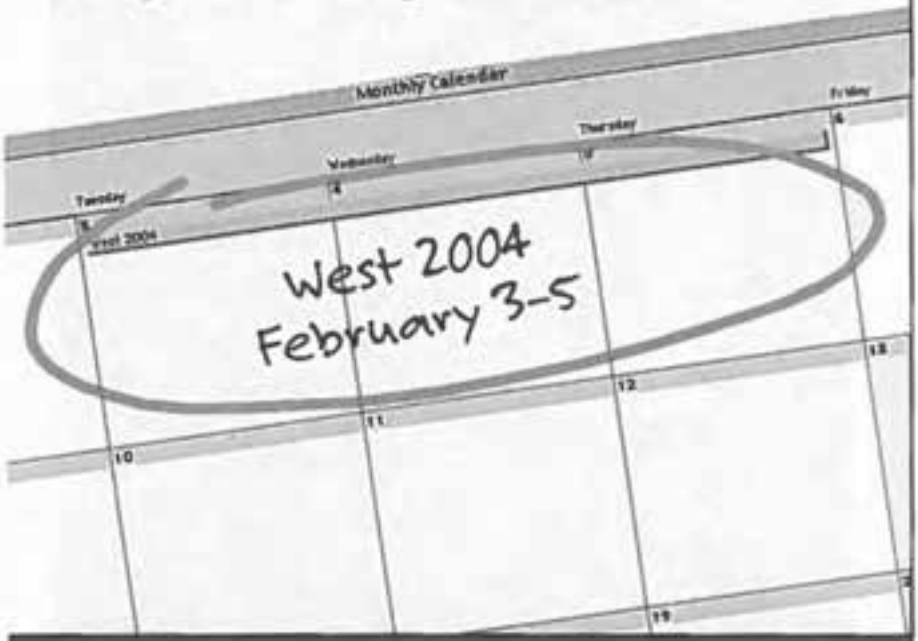

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SO WHAT IF THE SEAS WERE TRANSPARENT?
Part I

by Mr. Joe Buff

Joe Buff is a novelist with several submarine-related books to his credit. He is a frequent contributor to these pages. His first article in ***THE SUBMARINE REVIEW*** *was a look at submarine warfare in the foreseeable future using a novelist's method of forecasting from unclassified sources.*

In the last few years pundits have occasionally posed a negative thesis regarding the future of America's submarine fleet: If some new detection technology emerges that can see for a great distance right through the turbid oceans of the world, submarines would be useless as warfighting platforms.

The present two-part article will address this thesis and largely refute it, by drawing on already ongoing U.S. Navy development programs in Undersea Warfare tactics and offensive and defensive weaponry. We will assess the subject objectively from first principles, guided always by the following premise: Any new technology that would supposedly be able to locate every submarine from long range, regardless of even the best acoustic and non-acoustic stealth, would still have to obey the laws of physics and of information theory, *just as every other weapon system does*. This premise will give us a handle on an open-ended subject, to organize this exposition into logical stages.

Let us label this hypothetical all-seeing new detection technology MAGIC, to express its conjectural nature, and yet by adopting a project codename from World War II also remind readers that breakthroughs (e.g., ASDIC, MAD, SOSUS) have repeatedly occurred in the past. Part I of this article will address the technical limitations which would inevitably apply, and develop (mostly passive) defenses and countermeasures suggested by those limitations. Part II will consider more active defenses, and attacks, against an enemy force equipped with hypothetical MAGIC.

Possible Technology Parameters

First, to demystify MAGIC, we note that it must have one or more of several attributes, in each of several parameters which would appear to apply to all naval target detection and tracking systems:

1. *Emplacement* of MAGIC: MAGIC might be based on the seafloor, looking around and upward; or based in the atmosphere and/or outer space, looking downward; or based on the ocean's surface, operating from a surface ship; or based within the water column itself, on a submarine and/or a dipping or towed variable-depth platform (supported from on or above the surface); or based at least in part on land (either by choice or by necessity). The option might exist to base MAGIC in more than one of these ways.
2. Physical extent and portability of a MAGIC emplacement: MAGIC might employ a single-point, small, mobile platform sufficient for making valuable observations; or might need multi-point observation nodes linked by a network to produce even minimally useful data; or might require a large fixed installation set up over a broad area to constitute just one indivisible observation point/platform/node (as in SOSUS or an ELF transmitter antenna).
3. *Counter-detectability* of MAGIC while in operation: Active, in the sense that the device itself makes emissions that could be observed via various counter-detectors; or passive, in that the device itself need not make observable emissions to perform its function. (Note the latter does not preclude the platform on which MAGIC is installed–aircraft or surface ship for instance–from itself being detectable.)
4. *Symmetry/asymmetry* of MAGIC: Can MAGIC be used by both the hunter platform *and* the hunted submarine, to see each other with equal clarity? Or is it unilateral, in that MAGIC can be used by the hunter platform but *not* by the hunted, for technical reasons? Symmetry also applies to whether one or *both* sides in a conflict possess the technology, and whether if only one side possesses it, the technology

remains secret, i.e., its existence is not known by the other side.

The actual threat to submarines, and the specific impact on undersea warfare, would depend on exactly what MAGIC's attributes were in each such parameter. However, whatever the details, *certain limitations would apply implicit in these attributes*, as discussed next. And as will be overviewed later, such limitations–consistent with prior naval history–*always suggest tactics and technologies for self-defense, countermeasures, and spoiling attacks.*

Limitations of All Detection-and-Tracking Systems

Because the basic rules of practical science apply to all devices that utilize any combination of matters and energy to perform useful work, MAGIC would have limitations in the following regards:

1. *Attenuation rate:* Emissions and signatures, of search devices and targets, spread out with distance according to physical laws. (Even focused laser beams do spread.) This leads to weakening, or attenuation. For instance, when the spherical spreading model applies, the signal strength of an SSN's broadband and tonals declines inversely with the square of range. The signal strength of an active sonar echo off that SSN's hull, as picked up by the platform emitting the ping, declines inversely with fourth power of range.
2. *Image resolution*: Every search system has a limit, as to the angular separation between two distinct objects, below which the system cannot tell the two objects apart. Similarly, every system has a limit as to the angular size of an object, below which that object cannot be recognized by the system as existing at all, The greater the distance between an object of a given size and the search system, the smaller the angle subtended and the more likely the object is to fall below the resolution limit. Wear-and-tear on equipment, and creeping miscalibration or deferred maintenance and battle damage, can worsen resolution far below the nominal or theoretically ideal. If the bearing to the detector is known, a vessel can

also maneuver to present its smallest aspect toward that bearing.

3. *Environmental noise and clutter:* Whatever combination of matter and energy are utilized by a search system to do searches, the environment in which the system exists (including its internal equipment, electronic circuitry, and power supply), and the environment in which potential targets exist, will both contain other matter and energy which baffle the system's automated algorithms and also confuse its human operators. This unwanted, misleading, or distorting naturally occurring matter and energy is noise. Noise causes false positive detections, whose prosecution waste time, effort, and ammunition, and can lead to increasing operator fatigue, apathy, and carelessness. Noise can cause false negatives, in which real targets fail to be noticed. The latter, to the hunter, is a highly undesirable outcome.
4. Aggregate area search rate per unit time: The surface area of all the world's oceans is several trillion square miles. Even when the zone relevant to a given operation is greatly narrowed, a search system requires an allowance of adequate time to carry out complete surveillance with minimal positive and negative false alarms: *The area search rate*–and also, the *total field of view* and the *mobility* of a single MAGIC installation–would determine how many separate installations would be needed to cover a given theater of battle rapidly. The achievable aggregate search rate might be protracted compared to the period during which crucial command decisions must be made.
5. *Data integration lag, and processing delay or failure*: Some forms of search technology must observe each individual small unit of area or volume for a non-trivial period to be able to gather meaningful and reliable data. Some types of raw data are not useful for target detection and command decision-making until after computational processing which may require non-trivial intervals of computer time. During savage battle, computer time might be available only in competition with other critical tactical and strategic requirements, and then only in the face of *aggressive opposition-*

force information warfare attacks (eavesdropping, virus and worm hacking against communication links and switching equipment, plus degradation of computer hardware, operating systems, data storage, and applications software).

6. *Cost, lead-time, and security of system specifications*: New technologies and weapon systems are expensive; no nation's defense budget can ever expand to infinity. From initial proposal of concept, to solving of practical implementation problems, to prototyping, testing, mass production, and field deployment and operator training, can take years. Delays and budget caps may limit the actual utility of MAGIC. Espionage and counter-espionage might also prove decisive to the effectiveness of MAGIC-knowledge by the opposition of operating details and performance specs which enables devising optimal counter-techniques, as will be elaborated below.

These six broad limitations, piling up in chaotic real-world combat conditions, place maximums on:

1. The area over which MAGIC could be employed, and
2. The reliability of MAGIC inside that area.

Actions by the defender to erode this area size and reliability will be treated in the following section.

But first, note that even if the hunted submarine were acquired by MAGIC, all is not lost. Detected does not necessarily mean damaged or destroyed. The target can fight back: against the detection system itself, against prosecution platforms dispatched because of the detection system, and against weapons launched from the prosecution platforms.

When network-centric warfare is running full tilt, this fighting back can employ many friendly assets working in concert with the threatened submarine or submarines. The present concept of Joint Suppression of Enemy Air Defenses (JSEAD) would extend to a Joint Suppression of Enemy Anti-Submarine Defenses (JSEASD?), in which total water superiority is achieved by a hypermodern combined-arms blitzkrieg extending even into cyberspace. This will be the main theme of Part II.

Countermeasures and (Mostly Passive) Defensive Tactics

Were MAGIC to indeed emerge–whatever form it took–the value of naval submarines would by no means disappear. If the future of military technology trends/counter-trends is at all consistent with present and past–and even allowing for discontinuities such as the transistor or laser–then means would be found to help submarines disappear from MAGIC's radar scope. These means could derive from the following versatile toolkit:

1. *Physical barriers to line of sight and signal*: The atmosphere, the ocean, and outer space are subject to obstructions to line of sight, which may obscure completely, or garble/distort, or weaken detection signals. These obstructions can be permanent or transient, fixed or mobile. One example is the blend of dry-land geography and jutting seafloor terrain. An island, or towering underwater seamount, may completely block the ability to detect a submarine if the line of sight from the detector intersects this solid terrain. Over long enough ranges, and depending on the altitude of the detector platform, the earth's horizon or the entire bulk of the planet interferes. In addition, both the atmosphere and the ocean are subject to weather phenomena. Clouds, massive waves in major storms as well, can degrade detection technologies as well as impair the operation of their host platforms (e.g., aircraft or surface ships). Other sources of obscuration, or concealment from MAGIC, might be man-made or artificial, such as oil slicks or plankton blooms. Note that even the gravimetric gradiometer, which relies on gravity fields to see through solid rock, is reportedly unable to detect a *moving* object–including the mass concentration of a nuclear submarine's very dense reactor shielding and core.
2. *Jamming and spoofing*: When the specific characteristics of a detection system are known, such as the form of electromagnetic energy or other energy it emits or relies upon, it is possible to mislead or overwhelm the detection system. Just as with radar, where knowing frequency and pulse rate and pulse shape can be used to create false targets or disguise real

ones, MAGIC–whatever form such a new technology might take–could similarly be vulnerable to a combination of intelligence on its detailed workings and engineering know-how to devise ways to delude it.

3. *Decoys and diversions*: Unlike toying with the fields–electromagnetic, gravimetric, magnetic, acoustic, etc.,–that MAGIC might utilize, the threatened target sub might deploy physical objects (decoys) to confuse the detection system or its operators. In addition, a well planned operation can include many forms of maneuvers, attacks, and distractions which would serve as diversions to defeat the effectiveness of MAGIC itself, and/or to confound the opposition-force human leadership relying on MAGIC data.
4. *Low observable materials and equipment*: As with items 2 and 3 above, intelligence as to the technical specifications of a MAGIC device can be used to engineer around it. A smart and ingenious team of scientists, naval architects, oceanographers, and submariners can aim to swiftly invent materials and/or hull shapes which either absorb or deflect active MAGIC detection emissions, or repress submarine signatures on which a passive MAGIC might rely. If, for instance, it is learned that the behavior of certain types of moving parts within the submarine, such as heavy equipment which rotates rapidly, somehow can be located via action at a distance, by MAGIC, steps can be taken to redesign that equipment, or to surround it by shielding that blocks whatever it is MAGIC is trying to find and localize and track.
5. Maneuvering to avoid: If the location of MAGIC platforms can be identified by friendly battle formations or recon or intelligence sources, then submarines can seek to avoid detection by planning their routes and operations so as to maneuver away from MAGIC. Similarly, if the range, resolution, field of view, and search/scanning patterns-rates of MAGIC detectors are known, this information can be used to plan successful undersea warfare campaigns that stay outside MAGIC's effective detection zones.

Conclusion of Part I

Unconventional detection and tracking devices can also be countered by unconventional high-tech and low-tech subterfuges. These include:

1. *Shell games in port*: While MAGIC might allow tracking of submarines at sea, and possibly even identification of individual vessels, the situation in port could be different. While it is obviously impossible to install physical anti-MAGIC shielding over a large area of the ocean, to do so in a sheltered harbor or submarine base might become feasible and cost-effective if the need ever really arose. This would permit the shuffling around or different submarines of the same class under an impenetrable awning, to help confuse the enemy, at least for a while.
2. *GLOMAR EXPLORER II*: The vessel constructed in the 1960s to recover a sunken Soviet Golf class SSB with nuclear missiles from the ocean floor points the way to an important question: When is a submarine not a submarine? Answer: When it's concealed inside a surface ship that serves as a covert transporter. If a stricken Golf could be swallowed whole by a ship built in the 1960s, why might a perfectly functional SSN not be swallowed whole by a ship built in the 2020s? Perhaps one way to fool MAGIC would be to covertly build several such SSN-transporter ships, and use them to play shell games at sea in the face of the enemy. These ships might prove useful in any case, such as to carry a submarine through a canal or nautical choke point unnoticed.
3. *Boomer or SSGN?*: Since four of the Ohio class SSBNs are being converted to SSGNs, and they will from any distance still appear virtually identical, another form of shell game or bait-and-switch might be used to confuse an enemy possessing MAGIC. Boomers could behave on deployment like SSGNs, at least part of the time and vice versa. This can enhance the security of both the SSBNs and the SSGNs. An enemy not sure which was which might very well hesitate to

attack either, given the potentially catastrophic strategic implications of threatening an opponent's SSGN fleet: thermonuclear retaliation.

4. *Underway/undersea replenishment*: The GLOMAR EXPLORER II concept alluded to above, combined with the need for the largest possible submarine weapons loadout in a future conflict scenario involving MAGIC, together suggest another technique worth investigation and possible development–underway undersea replenishment of submarine magazines. Entry into a clandestine SSN-transporter vessel from below, while local countermeasures to MAGIC are taken, might permit an SSN or SSGN to replenish torpedoes and missiles while at sea, near the forward battle area. This would maximize on-station time, and therefore increase the overall utility of each friendly submarine hull. This in turn might compensate–or more than compensate–for any disadvantage caused by MAGIC in enemy hands.

Part II will attempt to show that in a future world which seems quite believable based upon informed projection from now, submarines do not require total stealth in today's sense to remain an indispensable type of war-winning capital ship.■

Depth Charge: An Early Antisubmarine Warfare Weapon*
Part I
World War I

by Mr. John Merrill

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Opening Days

As World War I began, the German U-boat, initially encumbered with existing rules concerning visits and searches of intended targets, was assumed to be an inefficient war weapon. Rules of engagement for the U-boats were limited by the difficult Prize Regulations governing submarine actions against nonmilitary vessels established by eight nations in the 1909 London Declaration. The Regulations were designed to protect neutral nations' maritime rights and international seaborne commerce in the event of War.**

During these early months of the War, the 1909 agreement significantly hindered effective submarine aggression. "The alternative to sink noncombatant-vessels without warning struck prewar sensibilities as so barbarous that in January 1914 Britain's

*The monograph is primarily about the depth charge, its beginnings and the years of World War I. Post War years saw little development of the weapon. The paper concludes with a brief comment regarding the depth charge at the beginning of World War II and the direction of depth charge developments during the War years.

**Many of the Declaration's submarine inhibiting operational restrictions regarding the sinking of merchant ships were echoed later in the London Prize Ordnance protocol agreement just prior to World War II in November 1936. Germany and England were signatories.[4] The restricted/unrestricted warfare role for the submarine was again in play during the early part of WW II.

First Lord of the Admiralty, Winston Churchill, scorned the idea that a civilized power would ever adopt such a policy."[1] Germany was challenged for the next several years with following the Prize Regulations or departing from their use and adopting unrestricted submarine warfare. By early 1917, three years later, it was the latter. These years of indecision resulted in fewer U-boats and little technological advance in their submarines.[2] During these early years of the War, the United States negative view of unrestricted submarine warfare was a significant factor in curtailing Germany's use of submarines. According to E. B. Potter, throughout the first U-boat campaign from February 22, 1915 to September 20, 1915, the U-boats held back because of the possibility of United States entry into the war.[3]

At first, the small number and size of German submarines also reduced assessment of the potential threat. Some of the German submarines were less than 100 feet long with a crew of 14. Germany's naval intentions in the early stages of the War were directed toward Britain's Grand Fleet. The German U-boats were relegated to the role of reconnaissance and torpedo support for the German High Sea Fleet in dealing with the Grand Fleet.[4] The torpedo as a submarine weapon, although available in small numbers early in the war, was not in general use until March 1917. Prior to that time most sinkings by U-boats were by gunfire.

At first, both sides overestimated the military capabilities of their enemies. Consideration of enemy submarines as potential targets was not in the purview of the designers of the existing destroyers and torpedo boats and their weapons. As submarine warfare developed, it became a close and comparatively intimate encounter of a few hundred yards between enemies while the standard range of engagement for the grand fleets took place at 20,000 yards. A new type of warfare required new tactics and weapons. It turned out that all through the War, the U-boat sea keeping and endurance did exceed expectations.

First Sinkings by U-boats

With few exceptions such as First Sea Lord Sir John Fisher, the menace of the submarine was initially disregarded. On 5 September 1914, a month and a day from the start of the War, U-21 sank the

Royal Navy light cruiser PATHFINDER with one torpedo. A blockade was quickly established with more than eighteen cruisers. On 22 September, the German U-9 torpedoed and sunk blockade patrol British heavy cruisers ABOUKIR, HOGUE, and CRESSY. Six weeks into the war, a war zone was in operation with an Admiralty heavy cruiser blockade of the entire North Sea and the waters between Iceland and the Norwegian coast.

These events and later on the increasing and extraordinary loss of merchant shipping from the unrestricted sinkings coming from adoption of a *guerre de course* strategy by German U-boats pushed the Allies to accelerate development and implementation of antisubmarine weapons to attack and sink the German submarines. As observed by Admiral John Jellicoe of the Admiralty in 1920, British antisubmarine measures were almost nonexistent at the beginning of the war.

Throughout the War antisubmarine weapons improvements followed but the development by scientists and engineers of effective ways to detect submerged submarines did not begin to emerge until the latter part of the War and then only in rudimentary form. The primary Allies' tactic against the U-boat during the first several years of the War was an offensive approach to search, find and destroy. In large oceans with no practical way to locate the enemy submarine, the success rate was low.

World War I U-boat Classes

Class	Range / Speed miles /knots	Max Depth (feet)	Length (feet)	Crew
U Long range cruiser	11220/8 surfaced 56/5 submerged	164	230	39
UB I Coastal torpedo attack	1650/5 45/4	164	92	14
UB III	9040/6 55/4	246	180	34
UC Coastal mine layer	750/5 55/4	164	110	14

Not long into the War the Royal Navy met with success in blockading the German High Sea Fleet. Lacking capital warships to confront the British but with U-boats prevailing against merchant shipping, the German and Central powers confined their naval effort almost completely to submarines. It was not until mid-1917 that the Allies initiated broad merchant ship convoying essentially defeating the *guerre de course* efforts by German submarines. The Allied Antisubmarine Warfare forces (air and sea) included the depth charge in their armament.

Available Weapons

Initially the tools at hand for countering submarines were drift and stationary nets, mines, deck guns and ramming. Mines were widely used but it has been pointed out that as of January 1917, the British did not possess a mine that was satisfactory against submarines [5] However, a new mine based on a German design developed by the Admiralty was in place and effective against the U-boats by November 1917. A surfaced submarine could be rammed. During the War nineteen U-boats were sunk in this way. Merchant ships also rammed and sunk five U-boats. "As time went on, all the later destroyers were fitted with steel rams at the bottom of the stem, and very efficacious they were as tin-openers"[6]

Damaging or sinking U-boats by shelling was not effective because it was difficult to hit such a small target with normal low freeboard before it dived. In addition, with intensive submarine crew training the number of seconds required to dive gradually decreased, thereby giving surface ship gun crews less time to hit the target. With regard to diving times during World War I, times ranged from 20 seconds to one minute.[7] In 1917, the latter part of the war, U-boat dive times were of the order of 40-45 seconds and by 1918, 30 seconds.[8]

When submarines first started firing torpedoes, ships attempted to use a high-speed zigzagging strategy to avoid being hit. As the speed of submarines improved, ships resorted to other methods. Light steel nets were hung around warships beneath the water line to deflect incoming torpedoes. These nets were ineffective and were soon removed from warships.

Improved skill with the periscope and better submarine construction over time allowed the submarine to be first in becoming aware of its surface enemy and to frequently escape or take aggressive action. A target must be visible for gunfire to be effective. The submarine's stealth improved. The Royal Navy invoked submarine versus submarine, and eighteen U-boats were torpedoed and destroyed.

Towed explosive sweep was also examined to determine if it would be an effective antisubmarine tool. After testing, the method was found to be inadequate for reasons that included the safety of the pursuing vessel's equipment handling crew. Another antisubmarine weapon--the lance bomb--a hand thrown 7-pound charge contact weapon--proved to be ineffectual even though used in great numbers (20,000) by 1917.[9]

Early antisubmarine efforts by mid September 1914 included the deployment of 250 trawlers and drifters (a boat fitted for drift-net fishing) to support Royal Navy U-boat hunting in spite of the lack of adequate weaponry if armed. Their role included sweeping mines, antisubmarine patrols and watch for German mine layers. Eventually, auxiliary antisubmarine support vessels included whalers, trawlers, motor launches, motorboats, tugs, yachts, minesweepers, and paddle wheel boats.

British Auxiliary Patrol Vessels [10]

January 1915	827
January 1916	2595
January 1918	3301

Antisubmarine Weapons

The U-boat losses cited in the tables below are at some variance. However, the overall effectiveness of the antisubmarine arsenal through the World War I years is demonstrated.

U-boat Losses [11]

	1914-16	1917	1918	Total
Depth charge	**2**	**6**	**22**	**30**
Gunfire	10	6	4	20
Mines (inc. German)	13	26	19	58
Ramming	3	10	6	19
Sweep	2	0	1	3
Torpedo (inc. German)	6	7	7	20

Against the U-Boat 1914-November 1918 [12]

Weapon	Class of Ship	Destroyed	Damage Serious	Damage Slight
Depth Charge	Man-of-War	-	6	3
Depth Charge	Destroyers and Patrols	35	85	182

In March 1915, the depth and lance bombs were considered in the experimental stage but by August large orders were placed for depth charges. Slow production created limited availability in 1916. However, damage to the U-boats began with direct or indirect U-boat sinkings from depth charges.

By the end of World War I, the antisubmarine warfare tools included the hydrophone for detection of submerged submarines, the 300 pound TNT-or Amatol- filled depth charge, and mines. These weapons plus the mid-1917 implementation of merchant ship convoying met with success against the U-boats.[13] Placing mines at various depths along busy sea-routes also dealt with the U-boats. Estimates as high as 75 U-Boats destroyed have been made. Minefields also blockaded hostile submarine bases. The depth charge, a primitive concept, was eventually adopted by most of the Allies and enemies. "The depth charge was the original dedicated ASW weapon."[14] Airplanes and blimps with depth charges were also added to the enemy submarine hunters.

Antisubmarine weapons and tactics brought to fruition during 1914-1917 included the depth charge that improved the performance of Naval ships and other support vessels and aircraft in their increased and effective escort role for the merchant ship convoys that began in the spring of 1917. The depth charge was prevalent among supporting naval vessels. Requirement for large numbers of depth charges is seen in the number of ships involved in a typical convoy. A convoy of 10-50 merchant ships escort consisted of 1 cruiser, 6 destroyers, 11-armed trawlers, and 2 torpedo boats each with an aerial balloon.[15] Depth charges were important weapons for the supporting ships as well as the merchant ships.

Regarding aircraft, dirigible airships and airplanes had important ASW roles. During 1917, airplanes sighted 185 U-boats and attacked 85. Airships located 26 U-boats and attacked 15. Even the then embryonic underwater detection systems to locate enemy submarines provided a modicum of advantage for the user. As 1917 ended, U-boats turned to conducting attacks in the night, whereas during the earlier years daytime attack was the modus operandi.[16]

John Terraine in *The U-Boat Wars: 1916-1945* places the depth charge in its historical context "... the weapon that would shortly dominate anti-submarine warfare, and become primary in World War II: the depth charge." In 1980, J. R. Hill in *Antisubmarine Warfare* echoes Terraine with "While neither as accurate nor as lethal as expected, the depth charge was still the main killing weapon of World War 2."[17]

Attacking underwater

Underwater bomb explosions to damage enemy shipping received significant attention as a weapon soon after the opening days of World War I. The submarine, as a technological advance, required new counter measures. In the case of the underwater bomb, the above mentioned success of the U-boats in sinking naval vessels as well as merchant shipping created an instant need for some method of countering the German submarines.

The depth charge (underwater bomb) quickly evolved in Great Britain, Germany, France, and Italy at about the same time and the weapon and its implementation gradually improved. The concept

was to provide a way to damage the enemy submarine that did not require contact with the target. The depth charge and the compressive forces of the water in the vicinity of the underwater explosion could damage at a distance from the target. For the next thirty years, the device continued as one of the important tools for antisubmarine warfare (ASW).

Use of exploding powder charges underwater to damage enemy naval vessels and shipping saw increased activity during most of the 19th century. In 1843, American revolver-inventor Samuel Colt and others in Europe independently proposed an electrically command-detonating of explosives under water. Colt's concept of a submarine battery did not receive government support to proceed. In the early years of the Civil War, Confederate Navy Commander Matthew Fontaine Maury (formerly USN and an outstanding nautical scientist of the 19th century) with others successfully initiated electrical triggering underwater explosives to destroy Union naval and merchant shipping underwater. This technique was successful and has been credited more than any other weapon for damaging or sinking Union naval vessels during the entire Civil War. Whitehead's 1860s epic invention, the modern torpedo, became the major undersea weapon by the end of WW II. After successful use of the depth charge during the War the status of the depth charge changed, "The US abandoned depth charges after World War II, preferring torpedos and ahead-thrown proximity contact weapons."[18]

Addressing a Need

In Great Britain, the original idea of a *dropping mine* or depth bomb dates to 1911. How to combat the new naval warfare weapons submarines and aircraft slowly emerged. In a 2002 historical paper, "Anglo-American Naval Inventors 1890-1914", speaking to the invention of the depth charge, the author said "The history of the depth charge is still mysterious." Admiral Jellicoe referring to the origins of the depth charge regarding the real inventor said "No man in particular, ...It came into existence almost spontaneously, in response to a pressing need."[19]

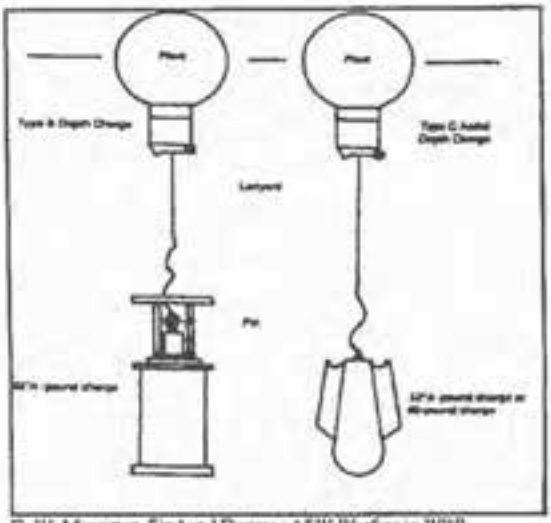
However, several Royal Navy Officers at about the same time during 1914 perceived that a depth bomb type weapon could be used

to counter the submarine. Officers cited are Admiral Percy Scott, Admiral Sir Charles Madden, and Captain P. H. Colomb. Further, Royal Navy Commander in Chief, Sir George Callaghan in October 1914 asked for a depth charge.Development started in November [20]

Early Depth Charges (Surface and Air)

Admiral Percy Scott a long time Royal Navy technical innovator of improved naval gunnery director and range finding systems recognized the impact that submarines and aircraft would have on naval warfare prior to the start of WWI. Late in the fall of 1914, he was appointed head of the Anti-Submarine Department of the Admiralty. Scott designed a bomb that could be dropped by ships on a submarine if it was on or near the surface. He suggested that aircraft could also drop charges. Scott's advocacy also included the opinion that depth charges could be thrown from ships.

At first, depth charges were triggered using a float and a lanyard of fixed length sometimes, referred to as float and line. These English and German depth charges used the float and line for detonation in the early designs. Failure to explode was frequent.



D. W. Mossmer, Find and Destroy: ASW Warfare in WWI, Naval Institute, Annapolis, MD 2001.

Float and Lanyard Depth Charge

Initial United States Navy Bureau of Ordinance depth charge designs immediately prior to entry World War I in April 1917 also used the float and line technique. In October 1914, Captain P. H., Colomb and Admiral Sir Charles Madden independently developed a depth bomb actuated by a hydrostatic valve adjusted to explode at a preset depth. It has been noted that Colomb's and Madden's schemes were sent to Scott but were somehow delayed.

British Depth Charge Status

Depth charge work started December 1914 with four primitive models including an aerial model. The following December, eight depth charge configurations were issued or under development in England.[21] As the depth charge was essentially a proximity weapon and the location of the enemy submarine underwater was imprecise, many depth charges were required for success. Having a sufficient number of depth charges at hand was an unending problem for the remainder of World War I. Early charges used gun cotton as the explosive. Gradually, later models used TNT or Amatol as the explosive of choice, with Amatol used primarily by the British to conserve TNT. Quantities of these explosives varied from 32 to 35 pounds in the early models up to 250 and 300 pound charges later. Typical firing depth settings were in the 40 to 80 foot range. As mentioned previously, the hydrostatic valve for triggering the explosive eventually replaced the mechanical triggering devices of the earlier charges.

A 1915 British designed and developed depth charge designated Type D met with success. However, production only gradually increased. The canister (18 inches in diameter and 28 inches long, similar to a fifty-five gallon oil drum) contained either 120 or 300 pounds of TNT with a dropping rate in water of 6 feet per second. Because of its shape and size, the depth charges took on the name *ash cans*.

The hydrostatic pistol or detonator was inside a hollow chamber in the middle of the depth charge and fired when the chamber filled with water. The inlet for the seawater to the chamber could be switched with a tool to six holes of different size, smaller holes causing firing at greater depths (100 to 600 feet). This was an

improvement over the float and lanyard technique but with limitations. It should be noted that later in 1917 soon after the United States joined the Allies, an engineer of the United States Bureau of Ordnance after examining the British design invented and patented an improved detonating mechanism. Further comments regarding this are discussed below.

The Type D became a prototype for other improvements and adaptations. Twenty-eight years later in 1943 in World War II, it was still standing the test of time as an important weapon. In the ten months from August 1942 to May 1943, of 150 U-boat sinking, 120 resulted from the depth charge (about 85 percent). [22]

Depth charges typically kept in racks on the stern of the vessel could be released from the bridge and rolled overboard. A weapon in the water behind the ship presented a problem. If the ship's speed was too slow and the depth charge set for a shallow depth the danger of an early explosion was significant.

The nature of this uncomplicated way of introducing the weapon into the water behind the ship presented a problem. Upon locating an enemy submarine, the usual practice was to drop a series of depth charges at intervals of 10 or 15 seconds depending upon the destroyer's speed.[23] The attacking ship's speed required that it not be in harm's way when the explosion took place. Fast ships used the Type D with a 300-pound charge; slower vessels D* with a 120-pound charge. Depth charges with adjustable depth setting and greater depth capability allowed either fast or slow vessels to use the 300-pound charges.

Some Royal Navy antisubmarine vessels were equipped with as few as two depth charges in early 1916 and four charges by the end of the year. The allotment for some old destroyers was one depth charge. Depth charges also became included as part of the armament of the Allies merchant ships along with deck guns. Production numbers for the last half of 1917 show a depth charge production of 140/week in July, 500/week in October and 7800/week in December. By early 1918, a destroyer's allotment increased to 30 to 40. Success with depth charges comes about with a saturation approach therefore large numbers are required.[24] One weapon source during the period 1914-18, the Standard Ironworks located in Colchester, England, manufactured 20,000 depth charges.

Depth Charge Throwers

Early experience with the depth charge developed a new requirement. An enemy submarine, by turning perpendicular to the pursuing vessel's track and increasing speed, might evade and escape. This created a need to be capable of *throwing* a depth charge along a perpendicular to the centerline of the ship to widen the attack pattern by providing a type of barrage. Coupled with the stern dropped charges the throwers completed a semicircular pattern. During the War, two throwers evolved the British K-gun and the American Y-gun. In parallel with the introduction of the K-gun in July 1917 and its 75yard range, the Howitzer (a direct hit-projecting weapon with a range of 1200 to 2600 yards) became available at that time. The depth charges are a proximity weapon. These weapons introduced late in the war and in small quantity proved effective and were the vanguard of highly effective World War II depth charge throwing or projecting systems (throwing ahead) such as Hedgehog, Squid, and Mousetrap.

British K-gun

The thrower or projector, a type of mortar, was at sea by mid-1917 but, like the basic depth charge, was in short supply. The above mentioned Standard Ironworks manufactured 264 depth charge throwers (projectors) capable of handling 300 and 400 pound loads, between September and the end of November in 1917. In mid-1917, roughly 300 depth charge throwers were delivered to the Royal Navy.

The basic design of the K-gun was the Thornycroft single barrel design fitted with an arbor or stem. A standard British depth charge was secured to the stem's outer end by lashings or adjustable clips. Throwers were mounted in pairs with one set on each side of the ship, and firing was either manual by percussion or electrically by remote control from the bridge. Initially, the total weight of the depth charge and the firing stem to which it was attached was large and overall awkward to handle restricting the K-gun rate of fire. Later improvements in weapon handling and delivery to the gun overcame this limitation. By 1918, a destroyer equipped with four K-guns and

stern racks could drop a pattern of depth charges to bracket the presumed position of a U-boat.

National Ordnance Activities, p 98

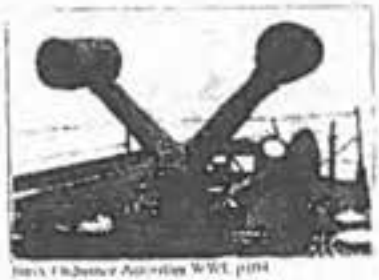
Thornycroft K-gun Destroyer Quarter Deck
Depth Charges on Rack aft

Y-gun

In 1917, the United States Navy Bureau of Ordnance was provided with photographs and designs of the Thornycroft depth-charge thrower. Considerations included the design of a gun that would reduce the impact of recoil on smaller vessels and easier to produce than the K-gun. Suitability for destroyer installation was an additional criterion. The General Ordnance Company of Groton, Connecticut made the calculations needed for the working design and undertook the production and test of the first gun. The order was placed with the New London Ship & Engine Company a manufacturer of submarine engines located in Groton.

A gun was devised to simultaneously throw two depth charges, one to port and one to starboard. The Y-gun with its simultaneous delivery of depth charges resolved the recoil problem of the single thrower. The gun shaped like a Y consisted of two barrels at an angle of 45° from the vertical capable of throwing two 300-pound depth charges. Ranges of 50, 66, and 80 yards made it possible to have a

wide pattern barrage. Interestingly, on destroyers and submarine chasers the Y-gun required a limited commodity-a centerline location competing with deck guns for coveted space.



US Navy Y-Gun

General Ordnance Company received a contract for the Y-gun 8 December 1917 and because of preliminary work in November, deliveries were made 10 December 1917. As a result of this contract, 947 Y-guns were installed on destroyers and submarine chasers.■

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[21] Jellicoe, *op. cit.*, p. 76.
[22] V.E. Tarrant, *The U-Boat Offensive 1914-1945*, Naval Institute Press, Annapolis, MD, 1989, p. 117-119 (interpretation).
[23] US Navy, *Navy Ordnance Activities: World War 1917-1918*, p. 106.
[24] Jellicoe, *op. cit.*, p. 51, 60.

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MMCM(SS) Anthony J. Augustyn, USN
USS ASHEVILLE (SSN 758)

SMALL NAVIES, BIG BOATS

by Dr. Ir. Carel A. Prins and
Commandeur RNLN (Ret.) Hans M. Ort

Carel Prins was general manager for design and engineering at RDM Submarines in Rotterdam until 2000, when he retired from the company. He holds a masters in mechanical engineering and a Ph.D. in nuclear power engineering. He is vice-chairman of the Kursk Foundation.

Hans Ort served in the RNLN until 1982. Twenty years were spent in and with the submarine service, with two seagoing commands as a highlight, followed by supervising the building of the Zwaardvis-class submarines. Before making flag rank, there were commands of a frigate and a supplier, both sailing for a 6-month period in SNFL. After leaving the navy he spent ten years in industry, dealing with submarine building.

Network-centric warfare at sea is an important force multiplier, linking the capabilities of surface, underwater and airborne units. Even as these new integrated operations are developed it is worthwhile to take a closer look at some excellent submarines that have the capability to operate independently as well as in an integrated network. And these need not necessarily be nuclear submarines. There is a family of submarine designs that found its origin in the experimental ALBACORE and, for instance in the Netherlands, evolved as a line of ocean going diesel electric submarines. The Royal Netherlands Navy has operated submarines since the beginning of the 20th century. The development of new submarines for the RNLN has always been based on a strong relationship between the Navy and industry. This has created a number of centers of excellence, complimentary to the navies' own technical capabilities, collaborating in the design of boats to mission requirements for operations in the waters of the North Sea and the Atlantic, but also for the tropical environments in the Far East.

Today the RNLN operates four Walrus class diesel submarines. These ocean going submarines that were delivered to the RNLN between 1988 and 1994 started their development at a time when the Cold War was still dictating their requirements. For patrols in the Northern Atlantic long range, high autonomy and deep diving rated high, as did the need for an advanced combat system and potent weapons. The Walrus combat system is one of the first fully integrated sensor and weapons control systems. The weapons selected for the boats were the Mark 48 torpedo and the Sub-Harpoon missile. With a total capacity for 22 heavy weapons that compares well with some nuclear submarines.

The Walrus Heritage

When the RNLN made their plans for the submarines to follow the first post WW II Dutch designed triple hull Dolfijn class in the fifties, the staff requirement called for nuclear boats. So the focus was on submarine development in the US. The experimental ALBACORE was as much the revolutionary turning point for the RNLN as it was for the US Navy. The design of the operational Barbel class was adopted to lay out new submarines for the Netherlands. These became the Zwaardvis class and were initially intended to be built as a stepping stone towards nuclear submarines. But eventually it became clear that the price tag was more than anticipated and when the US denied the Netherlands the submarine reactor technology it was decided to abandon the original staff requirements for nuclear submarines. Future development was thereby limited to diesel electric submarines, designed as SSK's.

The similarity between the Barbel and the Zwaardvis classes is evident. Both have the partly double hull construction with a single hull parallel mid-body, both sporting a L/D ratio of about 7.7. The 2640 ton boat has three diesel generators to ensure a low indiscretion ratio. The six torpedo launching tubes are of Dutch design and incorporate a pneumatic-mechanical positive ejection system. The weapons are Mark 37 Mod C torpedoes. The Zwaardvis class, therefore, is capable of handling Otto fueled torpedoes. Two watertight bulkheads divide the boat into three compartments. The torpedo room takes up the forward compartment with a storage

capacity of 20 weapons including the weapons in the tubes. Propulsion and auxiliary equipment are located in the aft compartment. A double armature main electric motor gives the boat a 20 knot submerged speed. The 8.4 meter diameter midsection is dedicated to the accommodation distributed over two decks with the battery compartment below. The central control room is located directly below the sail. The steering position for steering both course and depth faces forward and has two redundant positions. Diving controls are on the port side of the central control room, leaving starboard for the sensor- and weapons control. Diesel generators and propulsion are controlled from a separate control room located in the engine room aft.

The sensor suite includes a medium frequency circular array sonar in the bow, a passive ranging sonar, active sonar and an HF intercept sonar. The boats received a Signaal digital target tracking and fire control console during mid life modernization.

The double hull contains the weight compensation tank and fuel tanks. With the spacious design of the boat, ample vertical stability is a bonus. Furthermore, the submarine has high quality habitability with a large galley, two messes, a wardroom and a bunk for each member of the crew of 76 officers and ratings. Such quality living conditions are important for ocean going patrols of long duration. The construction yard was the Rotterdam Dockyard Company (RDM). The lead boat of a class of four, Zwaardvis was commissioned in 1972 and the last decommissioned in 1995.

At the end of the 70's a contract for the supply of submarines for Taiwan was concluded. The 4 boat contract, which ran in parallel with the development work for the new generation RNLN submarines, was given to the Wilton Feijenoord yard, a sister yard of RDM. The submarines, the Sea Dragon class, were to be a copy of the Zwaardvis class regarding the platform design. This made a speedy delivery possible because no time consuming new pressure hull design was necessary. Within this pre-defined hull a more advanced sensor and weapons control system–supplied by Signaal–was projected, as well as modern control and monitoring systems for platform machinery. Two boats were built and delivered in 1988; political pressure prevented the construction of the next two.

When plans for the new generation RNLN boats, the Walrus class, were developed, a number of specific goals were set. The diving depth should be substantially increased, provisions made for a mix of advanced weapons, the sensor suite should be extended and accompanied by multifunctional operating consoles. Furthermore, the platform systems would have to be fully automated. Although the general arrangement is comparable to the Zwaardvis, these requirements resulted in a step change of the well-proven design.

For the much increased diving depth a new steel was developed, comparable to HY 100, with improved toughness to withstand high shock loads. After full-size testing of a segment of the pressure hull the extensive stress analysis software was validated giving the new design a high level of confidence. The integration of the US designed torpedo tubes–the Mark 56 tubes instead of a Dutch design, a consequence of the greater launching depth and the choice of new weapons, the Mark 48 torpedo and Sub-Harpoon–posed an interesting challenge to the designers to reconcile the allowable pressure loads on the tubes with the construction of the water transfer tank and spherical front bulkhead of the pressure hull. The advanced weapons allowed going from six to only four tubes in conjunction with two Mark 19 air turbine ejection pumps.

The sonar sensors consist of a medium frequency circular array sonar, a passive ranger, a flank array, an HF intercept, an active array and a low frequency towed array. The last is of the clip-on type. Thin line arrays were not available at the time and the winch of a standard RTAS proved too bulky to be fitted. For the Gipsy sensor and weapons control system, Signaal (now a Thales company) developed one of the first multifunction operating consoles–Walrus has seven–that allow many sonar, navigation or fire control operations to be performed in parallel, using all and any of the consoles. These consoles are arranged on the starboard side of the central control room.

The communication system covers a wide range of frequencies and includes antennae on hoistable masts as well as a floating antenna. An ESM mast, radar mast, snort mast and two periscopes complete the mast arrangement.

The periscopes are positioned above a raised central platform in the middle of the control room. This elevated position gives the

commanding officer an overview of all activities. He supervises combat system operations on his right, while he can see the single steering position on his left–looking forward on the front bulkhead–and further aft to his left he sees two stations for platform control.

The helmsman can steer the boat manually, but also has an autopilot to his disposition. He can feed instructions into the system to perform maneuvers in a certain sequence, which will then be executed automatically. The rudders of Walrus, as opposed to the cruciform rudders of Zwaardvis, are arranged in X-form. Besides giving a high maneuverability to the boat the arrangement has built-in redundancy: only two of the rudders are needed to steer course and depth. The rudders can also be steered manually using push buttons as a further redundancy.

The engine room, distribution switchboards and main electric motor room are found in the aft section of the submarine. The Integrated Monitoring and Control System (IMCS), supplied by Imtech in the Netherlands, includes full automation of all propulsion and auxiliary equipment. The IMCS has three layers of independent redundant control, including hardwire direct control of emergency functions. This makes for unmanned machinery spaces, which was a first in submarine design. The result is a reduction of the crew from 76 to 50. Platform control and monitoring requires only two operating consoles in the central control room. There is one video display for monitoring and control of the submarine propulsion and one for diving control. The video displays show mimics of all systems on board and individual motors an valves can be started, respectively opened, by tracker ball control. An NBCD panel is located above the video displays. Including the helmsman, the platform is in the hands of three operators. One important task of the IMCS is the automatic starting and stopping procedure for snorting operations. With a single instruction on the control panel, the preparation for snorting and the starting of the three diesel generators, placed abreast in the engine room delivering 2850 kW, is effected. This cuts down substantially on the time to change from electric sailing at periscope depth to actual charging of the battery. IMCS takes less than a minute, thus substantially reducing the time when the submarine is indiscrete.

Because of the great diving depth, and inter-cool system provides the cooling of all equipment. The fresh water circuit itself is cooled in a sea water heat exchanger. Employing an inter-cool system reduces the number of pressure hull penetrations for added safety. At the same time the system effectively reduces corrosion problems, especially important in tropical waters.

The increased performance has made the boat a bit longer than the Zwaardvis class. Habitability of the Walrus class has been kept at a high level. The displacement is 2800 ton, maintaining the Zwaardvis hull diameter but adding a few frames. Furthermore Walrus has a good growth margin for future upgrades.

Submarine Missions

The Cold War dictated the naval staff target for the Zwaardvis and Walrus class boats. Nowadays the question is often asked whether the reduced threat downgrades the functional requirements for a new submarine with corresponding lower investment costs. Frequently this notion then dictates the navy budget, reflecting the desire to reap the *peace dividends*. The mission of the RNLN was ASW in collaboration with other NATO forces in the Northern Atlantic. The surface fleet, the patrol aircraft and the submarines each had their role. In the meantime the specifications of new frigates are much more oriented towards air defense, although they have maintained a multipurpose capability. The Walrus class boats still have a long life and it is not anywhere near the time of making decisions on replacements. The RNLN obviously has to be regarded as an element of NATO collaboration or at least as operating in conjunction with its allies and Walrus, being a versatile, relatively low cost weapon, is very effective in playing in multiple roles.

In a conference[1] organized by MIT, "Antisubmarine Warfare after the Cold War," in '97 it was concluded, from the US Navy point of view, that the new threat is more from the proliferation of modern non-nuclear submarines. "No other individual platform

[1]MIT Security Studies Conference Series, 11-12 June 1997, Lexington, Mass.

compares to a modern submarine, whether nuclear or non-nuclear, in its ability to combine a potent offensive punch with the ability to evade counterattack by opposing forces." The conference proceedings also mention that only a small effort is needed to run an effective submarine service, like the 400 officers and enlisted men who run the RNLN submarine service consisting of 4 Walrus class boats, a S/M tender and the submarine school.

Whether considering the submarine as part of a post Cold War ASW task force, or as the challenger to it, the modern submarine with a well trained crew has a high *return on investment*. As a case in point, Walrus has shown on many occasions during NATO exercises to be able to break through the protective screen of a carrier group without being detected. For both purposes, it is worthwhile to have modern submarines with advanced sensor and weapon capabilities, that are difficult to detect.

The present day role of diesel submarines can be illustrated by looking at three *small* navies and their submarine mission characteristics.

1. For the Netherlands, joined operations in a NATO context are basic to their existence, as it has been since WW II. This is particularly true for submarines. For that reason there is a role for a submarine, suited for a variety of missions: defense as well as attack, ocean as well as inshore. NATO missions take RNLN submarines to operating areas as far away from base as the Mediterranean or the Gulf. This way they provide their contribution to the defense umbrella of NATO of which the Netherlands is an integral part. It follows that bilateral collaboration with one or more of the members of NATO is as effective. In this sense the navies of the UK and the US are frequent partners. The submarines may also be sent across the Atlantic to patrol the Caribbean waters. The ocean going capability of the Walrus class, so needed for their previous Cold War patrols in the Northern Atlantic, stands them in good stead. In short, the present day missions of the RNLN submarines are as follows.

Peace enforcing and peace keeping missions. In support of US efforts during the Balkan wars Walrus class boats patrolled the Adriatic and recently operated in the Gulf as part of *Enduring Freedom.* Counter drugs operations consisted of surveillance of radio and radar emissions, reporting on ship movements. In peacetime the deployment of the submarines to train surface units and the submarines themselves remain at a high level of preparedness. Increasingly important become their deployment in brown water operations, not so much close to the Dutch shores on the continental shelf, but in covert operations in hostile waters. All this without forgetting their war time operations against surface units and other submarines. Quite a versatile mission, for which the Walrus class is very well suited.

2. Taiwan has two Sea Dragon class submarines, the modernized Zwaardvis design of the 80's. Taiwan's submarine mission to defend itself has to consider the shallow waters of the Strait of Taiwan as well as the deeper waters at its entrances and to the east of the island. Submarines can deny the use of the Strait. The Sea Dragons perform well for the ROC Navy. A requirement for more boats has existed for some time and submarines similar to the Sea Dragon or Walrus class would be desirable. These would add greatly to the capabilities of the ROC Navy. The close proximity to mainland airbases necessitates the submarines have a high autonomy, staying out at sea and hiding from enemy units while at the same time presenting a formidable threat to these units. Low signatures and deep diving capabilities are important.

   Surveillance of movements of enemy shipping requires a quiet platform that has the size to carry an extensive sensor suite. Denying the use of the Strait mandates a substantial weapon load of mixed composition. These should consist of torpedoes, missiles and mines, giving the submarines a high hit capability, while staying undetected.

At the same time the submarines' stealth will tie down a great number of enemy units and because of their long range the threat area can be substantially extended.

3. South Korea has been building up their Submarine Force for quite some time. The first batches of type 209 are followed now by a series of AIP capable type 214 boats. It is expected that the next step will be the acquisition of ocean going submarines. Also the ROK Navy has to consider patrols in both shallow and deep water. Historical fear of occupation and the independence the ROK has now enjoyed for decades has resulted in long term planning to establish the means for a strong defense. Their staged submarine acquisition plan has been laid out for a long time and has been executed with some stops and starts as dictated by the economy, but without deviating from their plans. And the requirement for ocean going boats was already made clear long ago.

   The submarines of the upcoming KSS III program shall be capable of performing in a forward defense strategy and be the equal of any submarine threat in the area. They provide a platform for advanced weapons, maybe including land attack missiles. Furthermore, littoral operations in hostile waters will be included in the mission profile. The deep water areas should be a place to hide a submarine from air attacks. The boats have to be deep diving and AIP capable.

Submarine deployment is different for the three navies: operating as part of an alliance in the Dutch case versus the fulfillment of an independent national defense strategy for the others. The functional requirements, however, come very close. And the relatively small navies of the three countries have the same need for boats that can be called *big*, as diesel submarines go.

AIP Option and Operational Aspects

Extended submerged endurance is a performance multiplier of any diesel submarine. The various submarine designers have followed

more than one way to provide AIP. In Germany, operations in the Baltic have set the functional requirements for AIP. Much effort has been put in the development of Fuel Cell technology, and the type 212 boats, now becoming available for the German Navy, have been fitted with a system delivering 300 kW. The system runs on pure hydrogen stored in canisters containing a metal hydride to which the hydrogen is adsorbed. In Sweden, 75 kW Stirling engines burning sulfur free diesel have been in use on RSN submarines for some time including the present A-19 class. The French version is a high pressure boiler burning methanol and supplying steam to a fully enclosed high r.p.m. steam turbine cycle called the MESMA system.

The system pursued by RDM in the Netherlands is the Closed Cycle Diesel (CCD). The original idea stems from the 40's when the German Navy already experimented with it. Removing exhaust gas–primarily CO_2–at greater depths has become possible through the use of a compact rotating absorber, developed in the UK in the late 70's. Based on this technology, RDM started to engineer a submarine CCD system in the mid-80's. The AIP development was part of an RDM program for a new submarine design, the Moray. The very flexible design concept–in the 1600 to 2200 ton range–offered great adaptability to a variety of platform and combat system requirements, for ocean and inshore missions. One of these requirements is to be AIP capable. Detailed integration studies and designs were made for the Moray submarine and a 400 kW CCD test facility was constructed. In 1993 a prototype was tested in a collaboration of the German Thyssen Nord See Werke and RDM, on the ex-U-1 submarine of the German Navy. This boat had been previously used to test a Fuel Cell system and was now converted for CCD. Trials demonstrated the viability of the CCD as a submarine system during sea trials of one month in the Baltic. Most importantly, the noise attenuation measures taken proved that the radiated noise as registered on the noise range was no more than that of the Fuel Cell AIP. With so many AIP options, what was the reason for RDM to choose the CCD? There are a number of aspects to consider.

Safety. The Fuel Cell operates on hydrogen and oxygen as fuel and oxidant. Storage of both on a submarine requires very sophisticated handling and control systems. The German submarines have that at a high cost. Methanol, as used in the MESMA system, is a

toxic fuel. Both the Stirling engine and the CCD use common diesel fuel. Where the Stirling requires absolutely sulfur free fuel, the CCD has the logistic advantage of standard diesel fuel.

Noise. The Fuel Cell itself has no moving parts and is per se noiseless. Even with its auxiliary equipment, the Fuel Cell system is very silent. The Stirling engine and the MESMA system have reciprocating and rotating equipment and are noisier than the Fuel Cell. The diesel engine in the CCD system constitutes an important equipment noise source, but attenuation of structure borne noise (triple flexible mounts) and airborne noise (acoustic enclosure) have proven that the radiated noise is at the level of the Fuel Cell system. As proven on the ex-U-1, the radiated noise signature is a neutral discriminator.

Efficiency. Because the efficiency of a Fuel Cell system is higher than that of a diesel or Stirling engine and the energy content of hydrogen is much greater than that of diesel fuel, the required weight of fuel and oxidizer is lowest for the Fuel Cell by a large margin. The problem, however, is that the safest way to store hydrogen is to adsorb it to a metal hydride. Hydride can only contain hydrogen to a maximum of two percent of the hydride weight. (Reformers of diesel fuel to produce hydrogen are not yet commercially available. Besides, they are bulky and lower the system efficiency.) An AIP plant is usually placed in a closed compartment or *plug*. To keep such a plug neutrally buoyant, the Fuel Cell plug has to be much larger than required for the plant volume alone. So, for example,[2] for a 3000 ton submarine, the Fuel Cell plug would be 44 percent longer to compensate for the extra weight in comparison with a plug for a CCD AIP system. In this case both plugs contain all consumables, weight compensation tanks and the plant. To put it differently, given the same size plug containing either a CCD AIP or a Fuel Cell AIP, the first would give the submarine in the example a 20 day submerged endurance at 4 kn., whereas the Fuel Cell AIP provides for 15 days.

Operational. Diesel engines for any desired output are easily

[2] Presentation "Selection of AIP Systems," J.B. Pearson, BAE Systems (VSEL).

obtainable. Stirling engines suffer in efficiency when engines are scaled up well over 75 kW. The CCD system lends itself very well for up scaling. Fuel Cell systems are modular by nature and higher power ratings should be possible to achieve. Why is more power needed than for supplying the hotel load and a speed of 4 knots? A speed of 4 knots is good for surveillance patrols, in a confined area. In a submerged intercept maneuver, however, own speed and that of the contact should not differ too much. Otherwise the intended intercept cannot be achieved. For a submarine with a maximum AIP speed of 4 knots, the chance to intercept an oncoming target sailing at, say 15 knots, is only nine percent of that of a submarine with a 10 knots AIP speed.

Price. The CCD is by far the cheapest system. In cost of plant as well as overall submarine integration costs. It should be pointed out that the maintenance and training costs because of commonality with the conventional submarine plant are modest as well.

Considering these criteria, RDM decided to develop a CCD system. While the cost involved–development cost and price to a customer–had much weight, the operational aspects were paramount. RDM's decision was not only based on export considerations. The parent navy has to count its pennies too.

Future Development

The Walrus platform is a good base for future development. The growth margin and ample vertical stability allow for introduction of new technology.

The partly double hull construction provides space to accommodate canisters or pods for advanced decoys or UUV launchers, for instance such encapsulating techniques as the Broaching Universal Buoyant Launcher (BUBL). Even if the outer envelope of the boat is to be increased, locally or overall, the pressure hull can stay untouched which would be a great cost saver, both as a refit or for new construction boats.

The platform could be fitted with the communication systems and antennae to become a link in network-centric operations, especially when a UUV launching capability is added.

The Walrus class could be fitted with an AIP plug. To give the

boat the endurance of the example above, i.e., 20 days at 4 knots, the plug would be about 9 meters long.

Conclusion

The Walrus is a *big boat* in comparison with many other diesel submarines. Small navies are relatively *poor navies*, but sometimes are better off with such a *substantial* versatile submarine, either when they are to be serious players in an alliance or solitary operators facing the threat of larger navies. In this context Small Navies need Big Boats, getting a Lot at Modest Expense.■

THE LACONIA AFFAIR: A COALESCENCE OF TRAGEDIES

by Mr. Richard Boyle

Dick Boyle is a former submarine officer with extensive post-service experience with the Arctic Submarine Lab. He is currently engaged in writing a thorough history of submarines.

On the evening of 12 September 1942, *U-156* (Hartenstein) sank the armed British liner LACONIA (19,695 tons) about 250 nm NE of Ascension Island in the South Atlantic. Repercussions would continue right on through the postwar Nürnberg Tribunal proceedings.

LACONIA, en route from Suez to UK, carried 2,732 souls: 1,800 Italian prisoners of war (with 103 Polish guards), a crew of 463, 286 members of the British Armed Forces, and 80 civilians, including women and children dependents.

When Hartenstein realized that survivors included Italians, he commenced rescue operations and told Commander-in-Chief, U-Boats (BdU) what he was doing. At 0400Z (GMT) on the 13th, he transmitted the following message in English on two international distress frequencies:

"If any ship will assist the ship-wrecked LACONIA crew, I will not attack her, provided I am not attacked by ship or air force. I picked up 193 men. 4-52S 11-26W. German submarine."[1]

Hartenstein insisted on a trim dive to be sure he could go deep to avoid danger. The dive was a success.

Meanwhile BdU Admiral Dönitz ordered *U-506* (Würdemann) and *U-507* (Schacht) to rendezvous with *U-156* and assist. Arrangements were also made for the Italian submarine CAPPELLINI (Revedin) to proceed to the scene. A parallel request went to Vichy France, and the colonial sloops DUMONT-D'URVILLE (1,969

[1]Microfilm Publication T-1022 (Roll 2936), RG 242, NARA: KTB, *U-156*, 13 Sept 42, p. 14.

tons) and ANNAMITE (647 tons) were dispatched from Dakar. Later (14 September), the cruiser GLOIRE (7,600 tons) also headed for the LACONIA sinking site. The Vichy ships were expected to be on station by the morning of 17 September.

During the day of 13 September, Hartenstein lightened his load by transferring 31 survivors to lifeboats. He also pulled about 100 others from the water and distributed them among lifeboats that had available space.[2]

On the morning of 15 September *U-156* was shepherding a fleet of about a dozen lifeboats. Women, children and infirm men were taken aboard the U-Boat, and able-bodied men were put back into the boats. By noon Hartenstein had 263 survivors on board his submarine. At about this time, Würdemann showed up with *U-506*, and he took 132 Italians. Both submarines then checked lifeboats for people in need of medical attention, all the while re-settling others in boats that had space. A couple of damaged lifeboats were temporarily emptied and repaired.

That afternoon, *U-507* came upon a group of lifeboats and began to embark survivors, taking boats in tow as well. With 152 survivors on board, Schacht cast off the boats temporarily and made a successful trim dive.

The real event came on the morning of 16 September. *U-156*, with 110 survivors on board was collecting lifeboats at 0925Z, when an American B-24 Liberator began circling the U-Boat and its tow of four lifeboats. Hartenstein wrote in his War Journal:

"As proof of our peaceful intentions displayed large Red Cross flag four meters square on bridge facing line of aircraft's flight . . .[3]

The commander of the B-24 reported back to his base on Ascension Island by radio and requested instructions.

Hartenstein ordered the following messages sent in English by flashing light to the aircraft:

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[2]Leonce Peillard, *L'Affaire du Laconia*, Paris: Laffont, 1988, p. 136.

[3]Quoted in Dan van der Vat, The Atlantic Campaign, New York: Harper & Row, 1988 , p. 293.

[*U-156* Crew Member]: "This is German submarine with English survivors. Is there a rescue ship in sight?"[4]

[RAF Survivor]: "This is RAF officer aboard German submarine. There are LACONIA survivors, soldiers, civilians, women, children."[5]

Apparently, nobody on board the B-24 could handle Morse Code well enough to read the messages. Neither got through.

Meanwhile, back at Ascension, a young officer who was in radio contact with the B-24 commander conferred with a superior and then issued the order: "Sink Sub."[6]

The B-24 made three bombing runs at low altitude (about 250 feet). After the first attack, the lifeboats were cut free. A bomb from the second attack hit one of the lifeboats and capsized another. Some occupants were killed. The final attack delivered a delayed action bomb that exploded under the Control Room of *U-156*. There were still Italians and British women and children below decks. Some panicked.

U-156 was damaged, and Hartenstein knew that he had to dive soon. Moving close to the remaining lifeboats, he ordered all survivors to leave his submarine. They came topside through opened deck hatches and jumped overboard.

The U-boat was sufficiently repaired to make a trim dive by 1145Z. Hartenstein left the area heading west.

The fate of most of the LACONIA survivors was decided within the next few days when those picked up by rescue submarines *U-506*, *U-507* and CAPPELLINI were transferred to the Vichy French ships. The saga didn't end until late October, however, when the last occupied lifeboat was sighted by a convoy. Only four of the original 31 occupants survived that ordeal. In all, 1,111 LACONIA survivors

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[4]Peillard, 1988, *op.cit.*, p. 173.

[5]*Ibid.*, p. 174.

[6]Quoted in Maurer Maurer and Lawrence J. Paszek, "Origin of the Laconia Order," *Air University Review*, Vol. XV, No. 3, March-April 1964, p. 33.

made port, but several died shortly after debarkation.

The "LACONIA Order," issued by Dönitz on 17 September, would haunt him at Nürnberg:

"1. All attempts at rescuing members of ships that have been sunk, including attempts to pick up persons swimming, or to place them in lifeboats, or attempts to upright capsized boats, or to supply provisions or water are to cease. The rescue of survivors contradicts the elementary necessity of war for the destruction of enemy ships and crews.

2. The order for the seizure of commanding officers and chief engineers remains in force.

3. Survivors are only to be picked up in cases when their interrogation would be of value to the U-Boat.

4. Be severe. Remember that in his bombing attacks on German cities the enemy has no regard for women and children.

F.O. U-Boats"[7]

Some found it difficult to be severe. Shortly after the "LACONIA Order" was issued, *U-506* (Würdemann) sank a British steamer and gave sustenance to survivors in a lifeboat. Würdemann further swore his radioman to secrecy and had him transmit the location of the lifeboat on the international distress frequency.[8]■

[7]Quoted in Günter Hessler, *The U-Boat War in the Atlantic 1939-1945*, London: HMSO, 1989, Vol. II, p. 43.

[8]Personal communication, Wilhelm Grap.

THE U-157 AND INFANTA ISABEL
THE CROC AND THE CROCODILE

by Mr. Jamie Bisher

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Secret Affairs between Predator and Prey

Like the crocodile bird (*Pluvianus aegyptius*) who earns immunity from its namesake's jaws by performing a valuable service, at least one neutral passenger ship seems to have bought its own safety by serving as a courier for German naval intelligence during the First World War. It was no benign tradeoff, however, because the peddled information helped German U-boats target other merchant ships for destruction. This strange relationship between hunter and prey fostered a bizarre event, no less startling than that of a bird alighting in a crocodile's mouth.

By spring 1918, the German strategy of unrestricted submarine warfare had been in play for a full year, and not until June 1918 would the hemorrhage of Allied shipping losses be checked when American shipyards could churn out enough new vessels to match the tonnage sunk by the U-boats. In the meantime, German naval intelligence worked feverishly to harvest information about shipping schedules, routes and cargoes, then feed it to operations planners for targeting. A network of intelligence officers, agents, couriers and a nefarious supporting cast of shadowy mercenaries and sympathizers spanned the globe, commanded by major maritime intelligence-gathering centers in New York, Barcelona and Buenos Aires. Their harvests of operationally lucrative tidbits were bountiful, but the short shelf-life of the information meant that it had to be moved to the German Fleet quickly to be useful. Diplomatic pouches and

coded telegrams of sympathetic neutral embassies handled much of this information, but a variety of other channels were cultivated to penetrate the Allied blockade.

Two Spanish ships dominated the transatlantic travel of Germany's couriers in South America: S.S. REINA VICTORIA EUGENIA and S.S. INFANTA ISABEL DE BORBON. American surveillance observed a typical courier transaction on the Buenos Aires waterfront in mid-1918: "On the arrival of the Spanish S.S. REINA VICTORIA EUGENIA, a Spaniard employed by the Banco Aleman or some other German bank went on board and received from the Steward a bundle of letters and books." U.S. intelligence suspected that every white-collared crew member from the captain to the stewards was on the German payroll. As the hunting season on Allied shipping extended into spring 1918, U-boats were said to be rendezvousing with their neutral courier ships at sea, performing a nautical rendition of land-based espionage's brush pass.

INFANTA ISABEL was no tramp steamer and was an unlikely candidate to be meeting on the high seas with combatants. She was a new passenger liner of 10,300 gross tons and six decks filled with 250 crewmen and up to 2,000 travelers on each transatlantic leg between Barcelona and Buenos Aires once a month. Like REINA VICTORIA EUGENIA, she sailed under the flags of neutral Spain and Barcelona's Compañía Trasatlántica Española, which allegedly enjoyed a special, secret relationship with the German Admiralty.

This venerable firm had been operating transatlantic service for nearly half a century, and any unholy association with the Kaiser's navy probably resulted from the strong presence (if not prevalence) of respected German expatriates in the ocean-going commerce industry in Argentina. They were found in every niche–as shipping agents, mariners, merchants, chandlers, bankers and other key positions in management, operations, finance and logistics. The company ran a lucrative passenger trade between Europe and New York, yet it was a thoroughly Spanish institution, and an anti-American grudge may have persisted among some old timers who remembered the Spanish-American War.

Counterintelligence operations of the U.S. War Department's Military Intelligence Division (M.I.D.) discovered that photographs of "all Allied vessels which arrive at Buenos Aires" were "forwarded

by means of Spanish vessels..., especially the INFANTA ISABEL. This steamer is reported to be stopped regularly by German submarines." As if this treachery was not horrendous enough, M.I.D. reported, "Spanish vessels are also suspected of sending wireless information to the Germans concerning shipping."

The Boarding of INFANTA ISABEL

The INFANTA ISABEL DE BORBON steamed out of Las Palmas in the Canary Islands about noon on 17 March 1918 and bore northeast toward Spain on her last leg of this transatlantic crossing. About 9 a.m. the next morning, an artillery shell screeched through the air and blasted a plume of water near the liner when she was about 360 miles out from Cadiz. The ship came to a stop, yet the phantom sniper did not come into view for another 45 minutes. Finally a large German submarine–213 feet (65 meters) long–approached, and the captain of INFANTA ISABEL sent over a small boat with his first officer, purser and six sailors as *hostages*. The purser soon returned with a German boarding party of three officers and twelve men.

The boarding party rendered the liner's wireless radio inoperative and placed the comms shack under guard. "The Germans examined all the first and second class passengers," reported the captain after the cruise, checking passports and interviewing travelers with possible ties to the Allied war effort. Passenger George Robertson was brought before two officers for a brief interview. "One was about 50 [years of age], rather stout, height about 5 feet 8 inches with [a] dark beard. The other was about 30, dark, short thin face." They both spoke "perfect English" and "stated that they were really out for propaganda and to show the Spaniards that they could do what they like with them."

"On board the INFANTA ISABEL the Germans made themselves quite at home and some of them ordered baths to be prepared for them," reported witnesses. "They were quite leisurely in their work and when the lunch hour arrived they partook of this meal." Presumably a German agent (or agents) among the passengers unobtrusively contacted the boarding party during their eight-hour sojourn.

Death Threats, Champagne and the Uruguayan Military Commission

Amongst the passengers the boarding party discovered five officers of the Uruguayan Military Commission to the Allies, led by one General Doufrechou. They were taken aboard U-157 where the commander, "a man of about 37 [he was, in fact, 35], tall and fair," according to Doufrechou, informed the Uruguayans that "he considered that a state of war existed between Uruguay and Germany."

General Doufrechou denied that a state of war existed, although Uruguayan President Feliciano Viera had revoked his country's neutrality soon after the U.S. declaration of war in the name of inter-American solidarity, then formally severed diplomatic relations with Germany on 7 October 1917, and seized eight German merchant ships in Montevideo harbor. Uruguay feared German mischief on her soil intended to distract the United States from the European conflagration. On 15 February, President Viera had publicly expressed concern that German colonists in southern Brazil were preparing to invade, a possibility genuine enough that Argentina's stubbornly neutral president, Hipólito Yrigoyen, offered his support.

The submarine commander presented General Doufrechou with "a German Admiralty list showing Peru, Bolivia, Columbia and Uruguay as enemies." He then gave the Uruguayan officers a choice: to be shot there aboard U-157, or to sign a guarantee that they would remain in Spain and "not go to any Allied country." They chose the latter, and when they returned to INFANTA ISABEL struck a "discordant note" with fellow passengers by chivalrously sending over a case of champagne to U-157.

In contrast, the six hostages from the INFANTA ISABEL received a relatively warm welcome, and U-157's crew even proudly showed them the ultra-modern features of their submarine. "The [INFANTA ISABEL's] first officer had dinner on board the submarine, champagne and Rhine wines flowing freely," noted the Spanish captain with a touch of envy. The submarine's captain showed the first officer "his numerous medals gained for his submarine exploits," and claimed to have sunk more than 300,000

tons of shipping. A relaxed atmosphere prevailed aboard U-157, which circled shark-like round and round the ship, "coming at times as close as 12 meters."

Max Valentiner

The tall commander who presented himself to U-157's reluctant visitors was none other than *Kapitänleutnant* (Lieutenant Commander) Max Ahlmann Valentiner, an illustrious U-boat ace to the German public, a notorious war criminal to the British, Americans and Italians. He was born in the Danish town of Tondern, North Schleswig, then under Prussian occupation, and grew up within earshot of the ocean's roar after his father, a German, moved the family to the Island of Als in 1890. He had taken the helm of U-38 on 5 December 1914 and was soon preying successfully upon small colliers and Liverpool merchantmen off the Welsh coast. It was a brutal business, shelling unarmed freighters while they futilely raced for their lives until the bloodshed and devastating blasts left them dead in the water, then leaving the frightened survivors to their fate in lifeboats riddled with shrapnel or hanging onto wreckage, if not mercilessly liquidating them to label the kill *spurlos versenkt*–"sunk without a trace."

In early November 1915, Valentiner was ordered to a new patrol area in the Adriatic to begin operations out of Cattaro (present-day Kotor, Montenegro) under the Austro-Hungarian flag. While making its way through the Mediterranean, U-38 encountered the Italian passenger ship ANCONA off Cape Carbonara, Sardinia, and torpedoed and shelled the New York-bound passenger liner, even though Germany was not yet at war with Italy. Some three hundred lives were lost, mostly immigrant women and children bound to join their menfolk in America. Valentiner's cruelty dominated front pages of the *New York Times* for a few days, and stirred outrage in the United States, but Austria-Hungary took the blame. Soon after, Valentiner was reviled in the world press for torpedoing the British P & O passenger ship S.S. PERSIA on 30 December near Crete, killing 334 passengers, among them "four English nuns bound for Karachi" and Eleanour V. Thornton, "a paragon of beauty on whom was modeled the mascot of the Rolls Royce car radiator." Off Malta

on New Year's Day 1916, he destroyed the pride of the Glen Line Fleet, killing 10 of GLENGYLE's crew in the process, three days later blasted the freighter COQUET, killing 17 seaman, and so forth.

Through 1916 and 1917, U-38 faced the growing threat of *Q-ships*, British submarine hunters disguised as the kind of creaking freighters that the Germans usually found to be easy targets. On 11 March 1917, the British S.S. SPRINGWELL was saved from U-38 by Q-ship WONGANELLA. However, Valentiner proved that he was as capable in combat as he was in piracy by sinking Q-ship REMEMBRANCE in the Aegean on 14 August, then armed steamer ZAIDA in the Gulf of Alexandretta three days later. In mid-September 1917, U-38 returned to service under the German flag just before Valentiner turned over his command to Wilhelm Canaris. Valentiner then took the helm of one of the German war machine's most advanced weapons, *unterseekreuzer* U-157.

Rare Glimpse of an *Unterseekreuzer*

As soon as the INFANTA ISABEL DE BORBON pulled into Cadiz, word of her stopping spread through the port to the ears of James Sanderson, the U.S. Consular Agent. American maritime and intelligence professionals were as thrilled as they were shocked by the stopping of INFANTA ISABEL. The incident provided a rare glimpse of Germany's new class of ocean-going predator, the *unterseekreuzer– undersea cruiser*. These boats had evolved from the unarmed submarine freighter DEUTSCHLAND–now the well-armed U-151–which had called in Baltimore and New London amid much fanfare during summer 1916. Early in the afternoon of 20 March, Sanderson promptly telephoned Seville to advise American consul Wilbur Gracey. Sanderson hustled to assemble a summary of the incident and even rounded up a photograph of the submarine, which he forwarded in a report to Gracey later the same day.

Just as quickly, naval intelligence *Agent S.7* interviewed a variety of crew members and passengers to put together a report for the American naval attaché in Madrid. The captain of the INFANTA ISABEL seemed reluctant to give *Agent S.7* any information, but did relate that Valentiner claimed to have been at sea in U-157 for seven

months, and numerous other tidbits. One Uruguayan officer told the American agent that he had counted six to eight torpedoes and had seen two inoperable quick-firers [naval guns] in the interior of the submarine, but General Doufrechou provided the richest description:

> Painted white, but worn and patches of rust showing...Guns, two fifteen-centimeter Krupps, 1917 model...Large telescope mounted on a raised platform near the conning tower. Wireless gear from conning tower to stern...The crew consisted of eight officers, including the first engineer and a doctor and 72 men...The second officer wore short side whiskers and spoke English fluently. A first lieutenant had two wound scars...They were very leisurely in everything they did in the submarine, and seemed to keep nothing secret.

The INFANTA ISABEL's first officer was even allowed to peer through "a new telescopic apparatus... which is of immense power," and was amazed at the magnification, which allowed the viewer to distinguish the flag of a ship on the horizon. "Further, that they had a new apparatus for sighting the guns which was most precise, and... an arrangement of Frahm tanks [an advanced mechanism for reducing roll motion] which gave a very steady gun platform." Even U-157's sleeping arrangements caused comment: "Everything on board is worked electrically, even the beds, which, on pressing a button, disappear into the wall."

Via the Marconi Inspector at Cadiz, *Agent S.7* learned from the INFANTA ISABEL's talkative wireless operator of U-157's impressive modern communications station. "The submarine worked on 2-kilowatt power, and they said that they were able by air pressure, to raise their wireless masts to a height of 35 meters and had direct communication with Nauen [the German Fleet communications center]."

Soon after INFANTA ISABEL left U-157, the ship's radio room picked up a message from the wireless station on the Canary Islands warning that another Spanish ship had been torpedoed nearby. Indeed, Valentiner told the hostages that "there were 8 submarines

operating in the vicinity." The flotilla included U-152, U-153 and U-154, among others.

James Sanderson and *Agent S.7* were busy again on 21 March when the Spanish S.S. MONTEVIDEO unexpectedly returned to Cadiz after having left for New York three days prior. The MONTEVIDEO had been stopped by U-157 soon after Valentiner released the INFANTA ISABEL. "After examining the MONTEVIDEO's manifest, [Valentiner] declared that more than 1,200 tons of the cargo on board, or say about 80 percent, was contraband of war, and that the vessel should by rights be sunk," noted Sanderson's report of the incident. Valentiner then proposed putting a 15-man prize crew on board and sending her to Germany, but was allegedly talked out of it by MONTEVIDEO's captain. "As justification of the Captain's action in coming back to port, the submarine commander wrote out and gave to the Captain... a document setting forth the circumstances...," Sanderson continued. Valentiner's permission slip for MONTEVIDEO was strange behavior indeed for a pirate with such a ruthless reputation.

Epilogue

A few weeks after Valentiner's rendezvous with INFANTA ISABEL, U-151 left Kiel on 14 April 1918, for a return voyage to America under the command of Heinrich von Nostitz und Jänckendorff. He terrorized the East Coast of the United States for several weeks, laying mines off Baltimore harbor and across Delaware Bay in late May, seizing schooners by night for extra provisions, cutting overseas telegraph lines on the sea bottom, and sank 23 ships (61,000 tons) in total. U-151 was replaced by U-156 in July, then U-140, U-117 and U-155 took turns stalking the western Atlantic into October, destroying scores of unwary American ships.

Valentiner had made a prophetic statement to an officer of the INFANTA ISABEL back in March: "The Commander of the submarine manifested to the Spanish officer left on board as hostage that before the end of the year, peace would be signed with France." Unfortunately for Valentiner and company, his prophecy turned out to be true. He had turned over command of U-157 four months before the Armistice occurred on 11 November. U-157 was interned

at Trondheim, Norway, until its formal surrender to the French on 8 February 1919. She was broken up at Brest in July 1921.

Ironically, INFANTA ISABEL DE BORBON was renamed URUGUAY in 1931, despite her treachery to that country's military mission during the Great War. Likewise, her sister ship, the REINA VICTORIA, was renamed ARGENTINA in 1931. Both were bombed and sunk during the Spanish Civil War, refloated in 1939, and scrapped in 1940 and 1945, respectively.

Max Valentiner returned to his family home in Sønderborg after World War II, died of heart disease in the local hospital on 19 June 1949, and was buried in the cemetery of St. Marie Church there.■

IN MEMORIAM

CAPT Tracy Monroe Kosoff, USN(Ret.)
CAPT Stephen Logue, USN(Ret.)
CAPT Bruce L. Bullough, USN(Ret.)
RADM Thomas M. Hopkins, USN(Ret.)
CAPT William F. Ramsey, USN(Ret.)
CAPT Jack Sabol, USN(Ret.)
CAPT Clarence "C.C." Brock, Jr., USN(Ret.)
CAPT Gary Bethke, USNR(Ret.)

RUSSIA EYES THE US NAVY AND SEES ITSELF: *INCIDENT AT MAP GRID 36-80* AS A CULTURAL MIRROR

by Dr. William C. Green
Department of Political Science
CSU San Bernardino

A nuclear submarine in the North Atlantic has a reactor incident and is compelled to surface. The naval command of its erstwhile adversary offers assistance, which is rejected because of misplaced national pride and a fear of revealing secrets. The stricken submarine's crew is unable to control the situation, and the submarine sinks, threatening the lives of all aboard and sparking an international crisis.

This scenario reads like a composite of the series of Soviet and Russian submarine disasters that culminated in the loss of KURSK in August 2000. In fact, it comes from a 1982 Soviet film, *Incident at Map Grid 36-80*, and the luckless submarine is American. The film is one of a dozen or so thrillers directed by Mikhail Tumanishvili. While it predates the much better known *Hunt for Red October* by eight years, this work cannot compare with its US counterpart in either suspense or production values. Yet all the same it is worth watching, even two decades after its release. It gives us lengthy scenes of the Soviet Navy in action, and more importantly, it provides invaluable insights into a mindset that still drives the Russian Navy.

Incident at Map Grid 36-80 is a not-very-distinguished example of that typical late Cold War genre, the geopolitical thriller. Its plot is straightforward–the Soviet North Sea Fleet is conducting Fall exercises, and of course is being shadowed by air, surface, and subsurface units of the US Navy. Operating immediately outside the Soviet exercise area is a nuclear attack submarine USS BARRACUDA, partnered with a P-3C Orion. To give his team real-life training, the submarine's weapons officer sets up a cruise missile strike profile on seven Soviet surface ships, including the exercise flagship, VTOL carrier KIEV. He assures a nervous subordinate that

the missiles cannot be launched accidentally, as the firing computer is locked and the only override controls are in the commanding officer's stateroom.

In the middle of the exercise BARRACUDA suffers a reactor accident. Ordinarily it would surface to survey the extent of the casualty and make repairs. In order to maintain secrecy, the commanding officer, Captain Turner, orders a technician to enter the contaminated compartment and conduct the survey while the submarine is still submerged. While the rising level of radiation forces the submarine to surface, the technician, Allen, has already been exposed to a lethal dose. In his bitterness he breaks into Turner's stateroom, triggers all computer overrides, and then breaks into the communication compartment and broadcasts an SOS. Finally, Allen leaps into a life raft and paddles away into the astonishingly calm October waters off North Cape, shouting for those crew members in earshot to save themselves and let him die.

The Soviet exercise commander, Admiral Spirin, is alerted to this incident when one of his reconnaissance aircraft spots the crippled submarine and reports abnormally high radiation levels. He immediately contacts his US counterpart, Admiral Rink, and offers assistance. Rink assures him that the submarine is in control of the situation and no assistance is needed. Minutes later Spirin receives BARRACUDA's SOS. He immediately orders a rescue team sent out.

The rescuers will ride to Map Grid 36-80 in a specially designed enclosed boat strapped to the belly of a modified Tu-16 BADGER. Over the submarine the boat will detach, parachuting down with rescuers aboard. There is one hitch--the rescue aircraft does not have the range to reach the US submarine without refueling. While a tanker is available and in the air, it does not have enough fuel aboard to refuel the rescue aircraft and itself return to base. Without hesitation Spirin orders the tanker to drain itself dry, fly back as far as possible, and ditch when the last drop of fuel is gone. He will have a second rescue team on hand to pick up any survivors.

The humiliation of being offered assistance from the Soviets unnerves Admiral Rink. He orders Turner not to allow the Soviet rescuers to board his submarine or off-load its crew. The obedient Turner fires a nasty-looking Colt .45 over the heads of his would-be

rescuers, while another American follows up with a burst of semiautomatic fire. Rink also orders the P-3C to prevent the rescue attempt by interfering with the air-to-air refueling. When this fails, Rink cashiers the hapless pilot on the spot.

Meanwhile, below decks on BARRACUDA, things are going from bad to worse. Not only is the reactor out of control–no longer locked, the firing computer has ordered cruise missiles fired at the two nearest Soviet ships, including KIEV. Fortunately the Soviets are able to shoot down the two incoming using SA-N-3 surface-to-air missiles and YAK-36 fighters. But Admiral Spirin's patience is at an end. He gives the Americans ten minutes to scuttle their submarine; otherwise he will sink it himself. A heartbroken Turner is the last to leave for the safety of the Soviet rescue boat. He watches sadly as his submarine sinks slowly beneath the waves. In a thrilling climax to the movie, the tanker pilot saves his crew by disobeying orders and crash-landing at a deserted World War II German airfield right on the coast.

An interesting facet of the film is its portrayal of the US Navy. Tumanishvili was out to create an impression of *American-ness* rather than portray American naval personnel with strict accuracy. The results can be jarring or amusing to US audiences, although it must be conceded that the effect is more true to life than Sean Connery's performance as Captain Ramius in *Hunt for Red October*. Tumanishvili cast Balts–actors from Latvia, Lithuania, and Estonia–to play most of the American roles, presumably because they appeared more Western to his Soviet audience than Russians would have. All the film's *Americans* have fairly pronounced foreign accents, and they do not differentiate between American and British English usage. In an attempt to portray the multiethnic nature of the US military, an African actor portrays a P-3C crew member–at other points in the film, African-Americans are portrayed by actors in blackface.

This lack of concern for strict accuracy extends to uniforms, insignia, ranks, nomenclature, behavior, and dialogue. One example is that US naval aviators–like their Soviet counterparts–are given army-style ranks. Thus, the pilot of the P-3C is Major Armstrong. On several occasions, US mission commanders acknowledge a transmission in the Russian manner. For instance, Captain Turner

says,"I am BARRACUDA" rather than "This is BARRACUDA." [1] It might be noted at this point that the subtitles are incomplete and occasionally misleading, and complicate the viewer's problem in identifying and tracking the various characters.

One of the big attractions of the film is its portrayal of then state-of-the-art Soviet military equipment and platforms in actual operation. Not surprisingly, both the Americans and the Soviets use Soviet systems in this film. For example, the P-3C is actually an Il-38 MAY, US surface ships are played by KRESTA-class cruisers with American-style hull numbers painted on, and a VICTOR I plays USS BARRACUDA. All the interior scenes are filmed either in an actual Soviet submarine or in sets modeled on Soviet submarines. When BARRACUDA fires cruise missiles at KIEV, we see SHADDOCKs blasting off. We see YAK-36 flight operations from KIEV, AA-3-N missiles shooting down the ASMs, and–most spectacular of all, a complete wing-tip to wing-tip aerial refueling operation between two BADGERs. We are reminded of the *throw away* nature of Soviet military equipment when we learn that as an eight-year-old aircraft, Volk's BADGER tanker is viewed as worn out and ready for the scrap heap. Because of US emphasis on repair and preventive maintenance, aircraft often are kept flying for twenty years or longer.

From the opening scenes, when his collie brings him his slippers at sunrise, it is clear that Major Gennadi Volk is the film's hero. Volk, pilot of the Tu-16 tanker, is highly regarded by subordinates and superiors alike, but at thirty he is at a career dead end unless he upgrades to a more advanced aircraft. This he refuses to do, for reasons he has not shared with his wife, and the old timers in his squadron will not disclose to newcomers. Toward the end of the film we learn the secret–Volk and his navigator, Captain Sergei Skiba, have flown together for the past eight years, since Skiba pulled him from the wreckage of a plane crash. Skiba is 47, past the

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[1]In 1960, the US press reported that German Titov, the second Soviet cosmonaut, had arrogantly screamed, "I am an eagle!" once in orbit. In fact, he was merely acknowledging a transmission with "This is *Eagle*."

mandatory retirement age for his grade. However, a regulation allows him to continue in the service so long as he is part of a functioning crew. Volk is ruining his own career so that his friend can keep flying.

The issue is pointed enough that Admiral Spirin himself expresses his frustration that he cannot promote Volk. The North Fleet naval air commander, Major General Pavlov, decides to resolve the situation by flying with the tanker during the exercise. The stirring events of the day allow Pavlov to observe Volk at his best and most daring. That evening the tanker crew, including Pavlov, meet for a dinner party at Volk's apartment. Skiba pulls the general aside and gives him his letter requesting retirement. Pavlov shakes his hand and tells him he's done the right thing. At the end of the film we see Lieutenant Colonel Volk flying off in his brand-new Tu-95 BEAR D reconnaissance aircraft.

A running theme in the film is the demands military service places on marriages. Volk's wife is highly discontented with the role she is expected to play, a patient Penelope eternally waiting for her husband's return. When preparing for the dinner party, she vents her feelings on Nadezhda Pavlova, the general's wife. Pavlova essentially tells her to *suck it up*. The nature of her own marriage is reinforced at dinner. Pavlov was hit by flying glass in the crash landing, but he does not worry his wife with his near escape. Instead, he tells her that his face is bandaged because he was scratched by a kitten. At other points in the film we see a crusty old warrant officer chewing out a conscript for marrying a seventeen-year-old girl, and hear Skiba bemoaning the choices that have left him a middle-aged bachelor. One contrast Tumanishvili draws between American and Russian life is family size; Volk's pregnant wife avers that the uncertainty in her life means she will only have one child, while Armstrong has relentlessly sired a string of girls (he tells Volkov his fourth has just been born, and he insists he won't stop until he gets a son).

These subthemes allow us many insights–into the domestic life of Russian naval officers, many details of their service life, Russian perception of Americans, and, through Tumanishvili's portrayal of American servicemen, unconscious attitudes really held by Russian military professionals.

The film portrays the US *main adversary* in an unexpectedly human and sympathetic manner. The Americans we see really are nice guys. Friendly relations spring up automatically between US and Soviet military personnel, until the rigid, authoritarian US military system gets in the way. When Spirin receives BARRACUDA's SOS he curses Rink for deceiving him, until a staff officer makes excuses for the American. The P-3C and Volk's tanker have encountered each other in the Arctic skies many times, and the two have established a friendly relationship. Armstrong jokingly calls Volk *the Wolf* (*volk* means *wolf* in Russian), he and Volk know each other's family life in considerable detail, and Armstrong is able to see immediately that his usual co-pilot, Captain Gremyatchkin, is not in the cockpit and asks after him in some concern. Yet when Admiral Rink orders him to buzz Volk's tanker in the midst of refueling operations–threatening the lives of everyone aboard both Soviet aircraft–he hushes the objections of a subordinate by saying that orders must always be obeyed. Even Turner is shown as a competent commander who is trapped into destructive behavior by the need to save face and the orders of his superiors.

With the perspective of hindsight, we can see that the scenario in this film foreshadows the real-life tragedy that unfolded two decades later, when the Russian Northern Fleet commander refused British and US offers of assistance following the sinking of the submarine KURSK. The attitudes and actions attributed to Americans in this film also appeared in real-life Soviet behavior when the YANKEE-Class submarine K-219 sank in 1986 and the MIKE-Class submarine LENINSKIY KOMSOMOLETS sank in 1989. It is this feature of *Incident at Map Grid 36-80* that makes an otherwise mediocre action picture still worth watching, its subconscious projection of Soviet and Russian attitudes onto the American adversary.■

Incident at Map Grid 36-80 (sluchai v kvadrate 36-80), 1982
Soviet Union, Color
Mosfilm Production
Russian, Subtitles in English
VHS copies may be ordered for $59.85 from Facets Multi-Media at (800) 331-6197.

THE SUBMARINE COMMUNITY

THE DOLPHIN SCHOLARSHIP FOUNDATION

by Kathy Grossenbacher
DSF President

When the Dolphin Scholarship Foundation (DSF) was established in 1961, COMSUBLANT's spouse became the first DSF President. On 7 July 2000, I became the 16th President of this wonderful foundation when my husband, John, became the Commander Submarine Force, U.S. Atlantic Fleet (COMSUBLANT).

As John and I prepare for our upcoming move and retirement from active duty, I would like to share my thoughts, genuine affection, and respect for everyone who has been a special part of DSF.

There are many reasons DSF has grown from one modest $350 scholarship to over $5 million for 839 scholars. The vision and determination of a few officers' spouses to help provide financial assistance for our submarine sons and daughters were the catalyst and spark that captured the attention of the entire Submarine Force 43 years ago. Sound advice and smart investment decisions created the solid long lasting Trust Fund DSF has been built on. This foundation is not, and has never been, endorsed or financially supported by the Navy or Submarine Force. DSF is a *not for profit* organization under Internal Revenue Code 501(c)(3). The $5 million DSF has granted since its inception has been raised by the Submarine Force family members, both officers and enlisted, by corporate donations, individual gifts, and countless fundraising activities. Without the thousands of talented, dedicated, generous donors and volunteers, DSF would not exist! The Dolphin Scholarship Foundation is the largest and oldest scholarship for military college-bound children in our entire Navy. With the Submarine Force continually being downsized, we continue to raise over $100,000 every year from our own submarine community. Every dollar of this money goes directly to the scholars. This is truly a legacy to be proud of. DSF is the model that all other Navy community scholarships want to emulate.

The Foundation currently has a staff of five part-time paid employees, a 10 member Board of Directors comprised of the President, two retired Admirals, a retired Force Master Chief, several retired Captains and four outstanding Hampton Roads community leaders. DSF also has a 15 member Distinguished Advisory Board whose members do not vote but are available to provide advice to the Board of Directors. The Advisory Board consists of men and women who are *distinguished* military and civilian leaders. With the combined efforts of our Board, Advisors, staff, and the submarine communities in Bangor, Washington; Groton, Connecticut; Honolulu, Hawaii; Kings Bay, Georgia; Norfolk, Virginia; and San Diego, California, we will ensure continued success of DSF well into the future.

Why do we work so hard and care so much about this foundation? SIMPLE! The sons and daughters of our submarine family deserve the opportunity to find financial assistance to help support their educational goals and future aspirations. These young people are the future of this great country.

During the past three years, I have been a member of DSF's selection committee. As a mother and teacher, I can honestly say DSF's selection process is fair, difficult and encouraging. Fair because of DSF's high standards and excellent requirements for application, difficult because we had 317 applicants in 2003 with only 33 openings, encouraging because the applicants are all wonderful, smart, creative, and awe-inspiring young men and women. I am continually amazed at the tough academic programs, extra-curricular activities, and personal challenges these young people seem to be able to balance. EVERY SINGLE APPLICANT IS A WINNER! Every member of every selection board wishes we could award a scholarship to each applicant.

To all our DSF scholars–I congratulate and commend you! The entire Submarine Force is very proud of you. To the applicants who were not selected this year, DO NOT GIVE UP! Apply again. You may be selected next year.

I leave DSF with total respect and gratitude for the many, many people who have given me valuable advice and support since July 2000. DSF will always hold a special place in my heart. Thank you everyone!■

2003 DOLPHIN SCHOLARS

This year the Dolphin Scholar Foundation will fund 133 Scholarships, including 33 new recipients. Each grant will be $3,000, totaling $399,000 in scholarship monies.

Scholar	Sponsor	Home State
Michael F. Baker	EMCS(SS) Mark K. Baker	NY
Mark-Anthony Blackmon	MSC(SS) Bryron Blackmon	HI
Robert F. Bode	MMCM(SS) Michal Bode	WA
Kami A. Bosworth	MTI(SS) Norman Bosworth	GA
John A. Camara, II	LCDR John A. Camara	VA
Megan R. Christopher	STSC(SS) Jodie Christopher	CA
Ellen M. Cole	MM1(SS) Scott B. Reeves	TX
Amber N. Disotell	MT1(SS) Lonnie D. Disotell	GA
Kimberly A. Elkin	LCDR Herbert R. Elkin	MD
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Kathleen M. Goodson	CDR Scott W. Goodson	TN
Margaret M. Gullick	LT Jerry W. Gullick	NY
Brandon L. Henneke	CWO2 Mark E. Singer	FL
Katherine M. Johnson	CAPT Kevin R. Johnson	HI
Daniel M. R. Kohlbeck	ETCS(SS) Daniel G. Kohlbeck	WA
Kristen M. Leary	CAPT David A. Leary	VA
Brandy E. Lipps	CWO2 Jeffery T. Lipps	GA
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Lauren R. Maurer	CAPT Douglas E. Fremont	VA
John D. McAneny	CAPT Douglas J. McAneny	CA
Jacqueline M. McCoy	CAPT Kevin M. McCoy	NH
Seth D. Osenkarski	MS1(SS) Raymond Osenkarski	HI
Bryan D. Pooler	HMCS(SS) Bryan D. Pooler	WI
Thomas C. Powden	SKCM(SS) Thomas A. Powden	CT
Sonja M. Rosnik	EMCS(SS) John C. Rosnik	VA
Carla J. Ryall	MM1(SS) Kenneth W. Ryall	CT
Daniel J. Sagendorf	FC1(SS) Mark S. Sagendorf	FL
Karl Q. Sault	CDR Kenneth R. Sault	HI
Charlotte M. Toolan	LTJG David Jimenez	RI
Paul A. Victoriano*	CAPT Edwin A. Victoriano	GA

*Declined scholarship due to appointment to U.S. Air Force Academy

BOOK REVIEW

FINAL BEARING
by George Wallace and Don Keith
A Forge Book, Published by Tom Doherty Associates, Inc.
(ISBN 0-765-30415, 512 pages)

Reviewed by VADM George W. Emery, USN(Ret.)

The Naval Submarine League rarely includes reviews of fictional literature in this journal, but their willingness to include this review of Final Bearing required little stretch from their emphasis on non-fiction.

George Wallace with the capable aid of Don Keith has created a novel that is all too close to reality. The American demand for illegal and addictive drugs, the formidable and persistent South American drug industry, the imaginative distribution schemes to deliver those drugs to an all too ready-to-receive market, and the Joint military and government agency effort to intercept and squelch this traffic are well known to the American public.

A cast-off DEA agent and a crusty retirement-eligible Seattle policeman respond to the drug overdose death of a young woman in an affluent Seattle neighborhood. Other similar deaths accumulate at an alarming rate. Dark street rumors abound of a costly and unusually potent strain of cocaine, but its origin is unclear. The trail eventually leads to a Colombian drug lord, determined to rescue his people from poverty through a revolution financed by a drug that will yield millions of dollars to his cause.

Enter the San Diego based element of the Joint Drug Interdiction Agency led by a SEAL Special Forces commander and supported by Commander John Ward, Commanding Officer of the gallant but aging submarine, USS SPADEFISH. Together they turn a routine Submarine Force counter-drug operation into a full-scale offense within the verdant and nearly impenetrable jungle of an ancient Incan Empire and at sea in pursuit of a mini-sub manned by discontented Europeans and a tramp steamer funded by a surprising Chinese source.

If you can still feel the roll of a submarine at periscope depth and the anxiety produced by a sudden alarm from the Reactor Plant Control Panel, if you still enjoy action-packed adventure and the surprises a good piece of fiction can bring to your easy chair, you'll love this first saga by George Wallace.

And if you like this one, you're sure to enjoy his next. I've already read the galley and it's even better. ■

THE SUBMARINE REVIEW

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

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

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

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

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

NAVAL SUBMARINE LEAGUE
Audited
COMPARATIVE STATEMENT OF FINANCIAL POSITION

	31-Mar-03	31-Mar-02
ASSETS		
CURRENT ASSETS		
Cash	$ 22,349	$ 9,191
Cash Equivalents	13,576	9,576
Restricted Cash	4,411	5,489
Investments at Market	274,159	300,579
Prepaid Expenses	11,013	13,606
Accounts Receivable	1,448	568
Total Current Assets	$ 326,956	$ 339,009
FIXED ASSETS		
Furniture & Computer Equipment	27,879	27,879
Office Condominium	251,021	251,021
	278,900	278,900
Less Accumulated Depreciation	(114,123)	(106,587)
Total Fixed Assets	164,777	172,313
Total Assets	$ 491,733	$ 511,321
LIABILITIES		
CURRENT LIABILITIES		
Accounts Payable	$ 1,089	$ 1,026
Deferred Income	79,985	76,390
Deferred Membership Dues	76,318	40,622
Rental Deposit	675	675
Total Current Liabilities	$ 157,067	$ 117,712
LONG-TERM LIABILITIES		
Deferred Membership Dues	144,898	130,795
Total Liabilities	$ 301,965	$ 248,507
NET ASSETS		
UNRESTRICTED		
Undesignated	$ 21,381	$ 85,294
Board Designated for Equipment	21,150	21,150
RESTRICTED	147,237	156,370
Total Net Assets	$ 189,768	$ 262,814
Total Liabilities and Net Assets	$ 491,733	$ 511,321

NAVAL SUBMARINE LEAGUE
Audited
For The Year Ended:

	Permanently Restricted	Unrestricted	31-Mar-03 Total
REVENUES			
Contributions	$0	$131,467	$131,467
Dues		61,178	61,178
Annual Symposium		101,166	101,166
Subtech Symposium		201,331	201,331
Submarine Centennial	1,790		1,790
Bank Interest		119	119
Dividends	3,621	4,364	7,985
Advertisements		23,725	23,725
Rent		8,100	8,100
Realized Gain (Loss)			
Unrealized Market Gain (Loss) On Investment	(12,962)	(17,870)	(30,832)
Other		3,282	3,282
Total Revenue	($7,551)	$516,862	$509,311
EXPENDITURES			
Awards and Grant	$0	$11,113	$11,113
Publishing		69,606	69,606
Promotion		33,759	33,759
Annual Symposium		114,835	114,835
SUBTECH Symposium		153,059	153,059
Submarine Centennial	1,582		1,582
Chapter Support		13,279	13,279
Special			
Total	$1,582	$396,651	$397,233
SUPPORTING SERVICES		185,124	185,124
Total Expenditures	$1,582	$580,775	$582,357
INCREASE (DECREASE) IN NET ASSETS	($9,133)	($63,913)	($73,046)
NET ASSETS, BEGINNING OF YEAR	$156,370	$106,444	$262,814
NET ASSETS, END OF YEAR	$147,237	$42,531	$189,768

NAVAL SUBMARINE LEAGUE HONOR ROLL

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