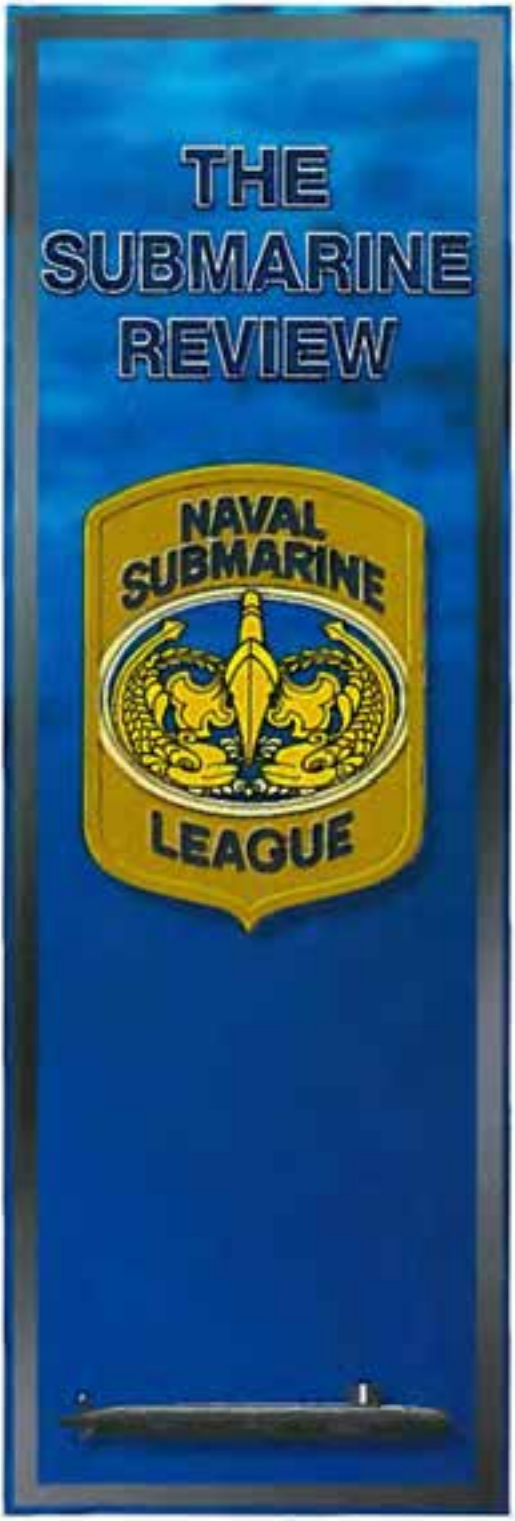

JANUARY 2001

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Another input just starting with this issue is our SUBMARINE COMMUNITY section. We hope to bring you news of the many organizations and activities within our community. The various boat reunion groups, memorial submarines, internet newsletters and specific interest groups like the modelers' SubCommittee and Sharkhunters are all invited to submit their bits and tell the rest of the community just what they are all about and what they have going on.

In the REFLECTIONS section there are three remembrances of folks we have lost who have all contributed, in quite different ways, to our community. Professor Morris is remembered for his work as biographer of John P. Holland, and for his emphasis on the innovative and long lasting nature of Holland's unique inventions

EDITOR'S COMMENTS

As we start a new year **THE SUBMARINE REVIEW** is sporting the cover which will be our new continuing standard. In addition, we are now just a bit thicker in content, having expanded from a total of 144 pages to our new capacity of 160 pages. During this coming year we hope to modernize further with a shift to all digital copy, layout and printing. This will allow us to include more, and clearer, graphics with our articles. Since we frequently publish the text of presentations given at the SubTech Symposium, the Annual Symposium in June and at several other forums during the year, the inclusion of some of the graphics used at those times will be useful in enhancing the points made by the speaker. One of the moves we will **not** be making, however, will be to support those graphics in color. Nor we will be including color photographs in the near future. The reason for not publishing in color, of course, is the significant extra cost entailed in using color internal to the copy of the magazine. The external cover is printed separately, hence the added cost of color is maintained at a minimum.

The FEATURES section of this issue carries the Presidential Proclamation issued on October 12th for the Submarine Centennial. In addition, the Submarine Centennial was both the reason and the means for the recent addition to the grounds of the Naval Academy of a most impressive sculptured memorial to U.S.N. submarines and the entire American submarine community. Admiral Carl Trost was the Master of Ceremonies and Admiral Bob Long was the featured speaker. His words are placed right after those of the President. If you have not already seen the Submarine Memorial, it would be worth a trip to Annapolis. The statue is in front of Dahlgren Hall, right by the road which runs from Tecumseh Court, past the Superintendent's Quarters and out to Captain's Row–a most prestigious site, and one which will ensure the maximum exposure to the most people.

Another *don't miss* FEATURES entry is the speech given at the September *Clambake* by the recently relieving ComSubLant, VADM John Grossenbacher. I believe you will find fresh views

and indications of future directions in that talk which will prove to be of great interest. Some detailed descriptions of that innovation which is going on both at sea and in the pipeline are given by Captains Joe Leidig of SubDevRon 5 and Claude Barron of PMS 401.

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and farsighted conceptual contributions to undersea warfare. Captain Keach, and the early successful efforts in Deep Submergence, are also remembered. The impact of that small part of our larger community has been immense, and it is right that we take a moment to reflect on that and on one who helped bring about those advances. Captain Jim Patton's *Ode to Lum* is also a highly personal remembrance and all who have been down to the sea will recognize the feelings of a shipmate.

There are, of course, many other pieces here which warrant special mention. Jerry Holland's thoughts on a skippers retention efforts are both humorous and thought-provoking. Can we get a comment from a current practicioner of the art? Captain Ted Davis' review of a book about Waldo Lyon should bring back some memories in the older group, but how about hearing from the guys driving boats now about the need to go up under the ice? Commander McIlvaine has also given his thoughts about increasing weapons effectiveness. Is there general agreement out in the fleet about the need for some such concept? Let's hear from the readers; active duty, retired, civilian, industrial or just plain interested. We need the input so we can fill up these extra pages.

Jim Hay

FROM THE PRESIDENT

By the time this **REVIEW** arrives, I hope all of you will have experienced a happy holiday season.

This last NSL year has been an active one. The confluence of events and the work of many people on a single endeavor of love was magnificent. The cooperation of the SubVets WWII, SubVets, Inc., and NSL in the centennial celebration has been most impressive—hopefully setting the tone for future collaborations in the pursuance of Submarine Force excellence. In the last quarter the statue at the Naval Academy has been erected in a site which can be easily observed by many people and midshipmen each day. The window for the Navy Memorial will be installed within the next year. These, with all the events of the year plus many local endeavors in submarine home areas and future books, movies, events and articles have and will serve as fitting memorials to the Submarine Force.

Both symposia were very well attended and the presentations at each were as good as we have ever had. To ensure you are properly advised and can place in your DayTimer, Palm Pilot, or scruffy piece of paper (whichever serves to keep your schedule), these are our two major events next year:

15-17 May	NSL/APL Submarine Classified Symposium
13-14 June	NSL Annual Symposium

Now NSL must concentrate on the future, to ensure our government is not allowed to let priorities be confused to the extent that our defense, our Navy, and the vital roles of submarines are denigrated.

On January 1 I will be (or as you read this-have been) relieved as President, NSL by Vice Admiral J. Guy Reynolds. I know of no one more motivated, knowledgeable, or energetic than he. I am sure he will enjoy the chance to continue to help the Submarine Force as much as I have.

Dan Cooper

THE SUBMARINE REVIEW IS A PUBLICATION
OF THE NAVAL SUBMARINE LEAGUE

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FEATURES

THE WHITE HOUSE
October 12, 2000
100TH ANNIVERSARY OF
THE U.S. NAVY SUBMARINE FORCE, 2000
by The President of the United States of America

A PROCLAMATION

On October 12, 1900, the United States Navy commissioned its first USS HOLLAND. Few people realized that this vessel would be the first in a long line of innovative and technically sophisticated ships that would launch a new era in our national defense. Although early 20th century submarines were small, cramped, and somewhat limited in use, a few visionary American naval leaders recognized their great potential as both offensive and defensive weapons.

By the end of World War I, American submarines were patrolling our Nation's coasts and supporting Allied efforts to keep the sea lanes open along the European coast and around the British Isles. In the 1930s, thanks to the determination of Submarine Force leaders and notable improvements by ship designers and builders, U.S. submarines evolved into a powerful offensive force, equipped with enough fuel, food, and weapons to sustain long-range, independent, open-sea patrols.

In 1941, when Imperial Japanese forces destroyed much of the U.S. battle fleet in the surprise attack on Pearl Harbor, the U.S. Navy Submarine Force stepped into the breach and played a pivotal role in winning the war in the Pacific. With submerged attacks during daylight hours and surface attacks at night, U.S. submarines inflicted a devastating toll on the Japanese Imperial Navy and merchant marine. By war's end, our Submarine Force had sunk 30 percent of the enemy's naval force and 60 percent of their merchant ships.

But this impressive victory came at a heavy price: the Submarine Force suffered the highest casualty rate of any component of the U.S. Armed Services. Of the 16,000 Americans who served in

submarines during the war, more than 3,500 gave their lives.

As the Cold War dawned, the U.S. Submarine Force once again helped to turn the tide of history, this time by deterring war. In 1954, under the leadership of Admiral Hyman G. Rickover, nuclear power was introduced to the fleet on USS NAUTILUS. Together with advances in hull design, silencing techniques, and sonic detection, nuclear power dramatically improved the speed, stealth, and range of U.S. submarines. By the 1960s, when ballistic missiles were successfully launched from submerged submarines, the U.S. Navy Submarine Force helped protect the Free World from Soviet aggression by conducting reconnaissance missions and by ensuring that the United States could retaliate effectively against any nuclear attack from the Soviet Union or its allies.

The end of the Cold War, however, did not bring an end to the challenges facing our Submarine Force, as the outbreak of regional disturbances replaced the threat of all-out nuclear conflict.

Modern submarines, with their ability to remain submerged for long periods of time, excel at gathering timely and accurate information about potential trouble spots around the globe. Should the need arise, our Submarine Force can also exercise powerful offensive capabilities, as it did during Operation Desert Storm in Kuwait and Iraq and Operation Allied Force in Kosovo. Today's submariners continue to build on a proud tradition of service by protecting U.S. interests, defending our freedom and that of our allies, and helping to shape a more peaceful world in the 21st century.

NOW, THEREFORE, I, WILLIAM J. CLINTON, President of the United States of America, by virtue of the authority vested in me by the Constitution and laws of the United States, do hereby proclaim October 12, 2000, as the 100th Anniversary of the U.S. Navy Submarine Force.

I call upon all Americans to observe this centennial celebration with appropriate programs, ceremonies, and activities in honor of those patriots, past and present, who have played a part in the rich history of the U.S. Navy Submarine Force —from ship designers and builders to logisticians and support personnel to submarine crews and their families—and in tribute to those who gave their

lives for our freedom. Because of the vision, dedication, courage, and selflessness of generations of these brave Americans, the United States today has a Submarine Force second to none, whose unprecedented contributions to intelligence, deterrence, and offensive military capability will continue to serve as a strong pillar of our nation's security in the years to come.

IN WITNESS WHEREOF, I have hereunto set my hand this twelfth day of October, in the year of our Lord two thousand, and of the Independence of the United States of America the two hundred and twenty-fifth.

WILLIAM J. CLINTON

REMARKS AT DEDICATION OF SUBMARINE CENTENNIAL MEMORIAL STATUE U.S. NAVAL ACADEMY, OCTOBER 22, 2000

by Admiral R.L.J. Long, USN(Ret.)

Mrs. Rickover, Admiral Watkins, Admiral Trost, Admiral Smith, Admiral McKee, Admiral Larson, Admiral Chiles, Admiral Ryan, Chaplain Abelson, honored guests, Ladies and Gentlemen.

Good Afternoon! First let me say "thank you" to Admiral Trost for that very kind and most thoughtful introduction. One of the joys in being a senior submariner has always been having such bright young men working with you and making you look good.

There are also a number of other "thank you"s to be said today for all that has gone into making this memorial, and indeed the entire Submarine Centennial Celebration, a statement about the United States Submarine Service in which we all can take great pride.

Let me start by saying "thank you"to Admiral Ryan and to the U.S. Naval Academy for giving us this very prestigious locale for our submarine memorial and for hosting us here today.

We also recognize the outstanding support to this effort provided by the several organizations within our submarine community and by that community at large. That American Submarine Community is made up of submariners, both active and former, who know what it is to go down into the sea in these ships. It also includes the industrialists, designers and craftsmen who have put together the pieces, parts, hulls, weapons and engines of these ships and those dedicated experts, both civilian and military, who provide the support necessary to keep these ships on the line.

Perhaps most importantly, we count among our community those very interested, concerned and involved folks in the general public who have always accepted the U.S. Submarine Service as uniquely American and having those traits most valued in American fighting men. I am convinced they respond very positively to seeing our good young men, all volunteers and superbly trained, ready to go into harm's way in a type of ship built in the United States one

hundred years ago. The U.S. Submarine Force was improved seventy years ago so we could fight the fiercest war in history sixty years ago. It was revolutionized with nuclear power and ballistic and cruise missiles forty-five years ago so we could face down a bi-polar competitor for thirty five years. The Force is ready now to face the future, with all its unknowns, in the name of our nation and all it stands for.

Working for that larger submarine community are the organizations which have participated in the events and planning which have led to this day. The Submarine Veterans of World War II are represented by Captain Art Rawson, the United States Submarine Veterans are represented by Senior Chief Jack Ensminger, and the Naval Submarine League is represented here today by Admiral Bill Smith, the Chairman of their Board of Directors. We say "thank you" to these organizations, to their leaders and to their members for all they have done.

The National Submarine Centennial Committee has done magnificently in providing the nation with a year-long very visible reminder of both the outstanding history and high potential of America's Submarine Service. They are deserving of a very special "thank you" and it is a particular pleasure to offer those thanks in person to the Chairman, Admiral Hank Chiles and his Vice Chairman, Captain Dave Cooper, and to Captain Bill Clautice who has been instrumental in siting this statue. Admiral, I would also ask that you pass along these "thanks" of ours today to those corporate sponsors of the Submarine Centennial who have given so generously so this memorial could be crafted and erected both to honor the past and to influence the future.

Another heartfelt "thank you" is offered to the artist who has given us the benefit of his talent and the work of his hands in producing this memorial. Perhaps we can be excused for a special sense of pride since he is one of our own as the son of a man who labored mightily in, and represented a particularly effective part of, the submarine development effort. Ladies and Gentlemen please join me in a round of applause for Mr. Paul Wegner, the sculptor responsible for the Submarine Memorial Statue before you.

And now to the Submarine Memorial itself. It is most fitting that it is near the Battle of Midway Memorial in the Naval Acad-

emy yard. That battle was clearly a decisive battle of World War II. The Battle of Midway represents a discrete point in history; it took place over several days of highly intensive combat within a fairly small part of the vast Central Pacific. The U.S. Navy was outnumbered and outgunned there but outstanding individual courage and better on-the-spot command carried the day. It was, and still is, a high point of U.S. naval history. I'm proud that our Submarine Force contributed to our victory at Midway.

This Submarine Memorial commemorates not one point in history, but one hundred years of innovation and dedication, both in war and peace. It is a monument to the inventors like Holland, to the early operators who saw the potential in the submarine like Nimitz, to the engineers who worked out the problems of production like L.Y.Spear, to the wartime leaders who sent their boats out like Lockwood, to the wartime skippers who brought about great things with diesel boats like Dealy, Fluckey and Cutter. It also memorializes the technical skills and management acumen of Rickover and Levering Smith. The early nuclear legend-making trips of NAUTILUS, TRITON, and the Skate class boats are remembered here. The Cold War building program is a part of this memorial and was itself a monument to *tenacity* with 190 submarines built, tested, manned and operated since NAUTILUS sent her "Underway on Nuclear Power" message. The end of the Cold War is also a part of the first century submarine story, and we can take justifiable pride in the large part played by this Force in bringing about a peaceful end to that contest. The last decade of this first century is also represented here. There was no easy ride for submariners after the Berlin Wall came down and the submarine operations in the world's oceans have shown another full dimension of submarine reach and endurance which is being used to lead the way into the next century.

There is a further element enshrined in this memorial and that is the honor, respect and great debt of this nation to the wives and families of those who have labored so hard and long to bring about the Force for Freedom we know today. Their sacrifice was real and their willingness to pick up that lonely burden has been, and is now, greatly appreciated. We could not have done it without them.

To the wives and families we give our heartfelt "thank you".

I used the word *tenacity* a moment ago in connection with the building program, but perhaps it is more appropriate to apply that word to the entire history of U.S. submarines. It was all done with determination, singleness of purpose, and endurance in the face of big obstacles. *Tenacity* is also a word, a trait, a character strength we can recommend to all those who follow us in this Submarine Community.

Thank you all for attending this event this afternoon.■

ADDRESS TO THE NDIA CLAMBAKE

Sub Base, New London
September 2000

by VADM John J. Grossenbacher, USN
Commander, Submarine Force
U.S. Atlantic Fleet

We've had an absolutely wonderful Centennial Year. The Smithsonian Exhibit, Prestige Stamps, gala events and press exposure have done a great deal of good in helping submariners celebrate an important event. These efforts have also helped remind us of our history and rich heritage; a reminder that I hope is permanent. Moreover, this historical perspective is important to retain and reflect upon as we think about the future.

Centennial Year events have also helped remind many in the nation of what their submarines have done in the past, and continue to do now on behalf of the people of the United States. A fortuitous event, the release of the movie U-571, and a tragic one, the loss of the Russian Submarine KURSK, have raised the public consciousness of submarine related matters.

This year has also been a significant one in terms of public discussion of some truths and non-truths about classified submarine operations. This exposure in the public domain has led some with knowledge of these operations to wrongfully assume that information to which they were privy had been declassified and their pledge to protect its security abrogated. Admiral McKee, a former Director, Naval Nuclear Propulsion, used to describe classified submarine operations as "Putting your head in the tiger's mouth." We all need to remember that revealing specific information on when, where, how, and how well these operations can be conducted simply serves to sharpen today's, or a future, tiger's teeth. It has been necessary to publicly address Cold War submarine intelligence collection, surveillance and reconnaissance capabilities in generic terms. I don't think we need to go further.

Some of you were able to attend the Naval Submarine League's Annual Symposium in June. Among the many fine presentations was Admiral Tom Fargo's (Commander-in-Chief, U.S. Pacific

Fleet) discussion of the current security situation in the Pacific. What I heard Admiral Fargo say in the course of his remarks was that the enemy in his Area Of Responsibility is **instability**, and he gave us good examples of that instability's sources: North Korea's conventional and unconventional military capability and national goals; China's view of the future of Taiwan; ethnic strife in Indonesia; Indian and Pakistani differences that were forged during the birth of those two nations; economic potential in Asia, Southeast Asia, India, and the growth of military muscle and national assertiveness that accompanies realization of that economic potential. These are very real and proximate sources of **instability**. Admiral Fargo's Pacific Fleet is focused on doing what military power can do to influence these and other sources of **instability**. They're also keeping themselves prepared to deal with **instability's** undesirable and sometimes unpredictable manifestations when that influence is incomplete or unobtainable.

The challenges posed by **instability** are not confined to the Pacific. In fact, I suggest that the economic potential of Asia mitigates some of instability's uncertainties in that region. The Central, European and Southern Command Areas Of Responsibility are also well sown with the seeds of **instability**. Competition for resources—oil in the Persian Gulf and Caspian Sea—water in the Middle East, the proliferation of advanced weapons and Weapons of Mass Destruction-related technologies, deep rooted, long standing and violent hatreds anchored in historical relationships and religious differences between ethnic groups in the Middle East, Balkans and Caucasus, absolute economic hopelessness in former Soviet countries and Africa, the inexperience and immaturity of peoples and leaders attempting to make enormous political and economic changes when faced with market economy forces and representative governments for the first time in their history, an AIDS epidemic of terrible proportions in Africa, environmental damage of significant scale in Russia, narco-trafficking in Central and South America, large scale international organized crime and terrorism as a way of war. These sources of **instability** will likely manifest themselves in ways like large refugee flows, like dissatisfaction with the political and economic status quo and will manifest themselves too in peoples' susceptibility to the promises of

demagogues in whatever form or of whatever political persuasion.

This **instability** is the enemy of the peace, economic growth, free trade and continuing development of personal freedom that is our national leaders' vision for the desirable world future. That vision drives American policies, the implementation of which we in the military inherit responsibility for when we become the *Other Means* to be used when diplomacy fails. The collapse of the Soviet Empire both unleashed pre-existing forces of **instability** and created new ones. Many of these forces are difficult at best for America to influence. Difficult even if we skillfully apply all of the tools of our political and economic power with military strength underpinning them in well-coordinated acts of diplomacy. Some of the undesirable and unpredictable manifestations of that **instability** will almost certainly require the use of military force. Dealing with these manifestations and consequences, whatever and wherever they are, must be the focus for our military capability in both the near and longer terms.

For those whose business is in or supporting the military, I think these circumstances tell us two things, neither of which is profound, but both of which are important nonetheless. First and foremost, despite mitigating factors like the recent trend toward the spread of liberal democracy, the growth of global economic interests, and the humanizing impact of worldwide mass communications, the world remains an uncertain and potentially dangerous place. We in the military are likely to be needed. We've yet to reach the end of history. Our nation will want and need military power to deal with the byproducts of **instability**. Second, the precise capabilities and quantity of those capabilities we will need are difficult to know, much more difficult to know than during the days of the Cold War. It is difficult to judge the form that the modern strain of **instability**'s seeds will take when they sprout on tomorrow's battlefield. Kosovo, East Timor, the war on drugs, the World Trade Center bombing—these may or may not be good indicators. Is more capability akin to law enforcement, intrusive intelligence collection, non-lethal weapons, and the ability to strike non-state entities preemptively what we'll need more of? These are not unreasonable questions for us to be pondering.

Additionally, although the opportunities presented by rapidly evolving information technologies are familiar to us all, they are challenging nonetheless. And it seems we will not be permitted the luxury of either concentrating on one particular region of the world or of having an *evil empire* to plan for and measure ourselves against. **Instability** is a more insidious enemy than an evil empire. Flexibility and adaptability anchored in a foundation of capability whose characteristics we think will endure seem to be the order of the day.

For those of us in the submarine business I think this puts a premium on the global reach our submarines provide and the global power of our Navy's stealthiest warships, our submarines. America's SSBNs remain the foundation of National Missile Defense and the cornerstone of a vital new 21st Century deterrence that is still evolving. The stealth, agility, endurance and multi-mission flexibility of our SSNs allows them to deliver access to the vital littorals of the world and also allows them to deliver military capability promptly and by surprise.

Strategically I think our Navy's submarine programs and our submarine community are well poised to deal with the uncertainties of a world where instability is the now and foreseeable enemy. To the credit of our community's military, scientific, industrial and engineering leadership, I think we've gotten it right. I'm assuming that most of you have heard the Submarine Force's Strategic Concepts—Gain and sustain battlespace access, Be a keystone in developing dominant knowledge, Strike with surprise from close in and Deter weapons of mass destruction. These concepts have been expressed by Admiral Bowman and others in our leadership, so I won't dwell on them. I believe they align well with the challenges that we are now, and will continue to face. I'm equally convinced that our technical goals are well founded.

Get payload: We must continue to work to get more, new and different types of payload. For example, we need to continue to place emphasis on adjuvant undersea and air vehicles to facilitate a clearer picture of the battlespace, go where we cannot go, and provide us with tactical advantage versus mines and diesel-electric submarines, particularly when we're compelled to engage these adversary capabilities on their terms.

Get Connected: We're leveraging the explosion in information systems technology to collect more, fuse more and convert more information to knowledge, as well as more readily share that information and knowledge with other naval and joint forces. Again, the goal of all this is to develop real-time dominant knowledge at the beginning, during initial action, and as needed throughout an operation or campaign.

Get Modular: Advanced submarine designs incorporating modularity will allow us to increase payload capacity, adapt, improvise and respond to change.

And we're developing **Electric Drive** to achieve important improvements in acoustic stealth while providing the power and flexibility for potentially revolutionary advances in sensors and weapons technology.

Both these strategic concepts and technical goals should, I think, lead us in the right direction, and facilitate the flexibility and adaptability we must have to help us hedge. By hedge I mean to invest enough of our intellectual and other capital in a range of ideas and technologies so we don't foreclose future options in what we put into our submarines and submariners. Hedging will allow us to develop options which may not seem attractive or high priority today but gain importance and become imperatives quickly in the future. Hedging, while protecting the core capabilities and enduring characteristics our experience and collective wisdom tell us will remain important, is a challenge to the discipline and clear headedness of all our choice making processes—particularly those involving resource allocations and most particularly the Subtech process. It is a challenge I think we're being compelled to face.

Given that we've probably got the strategy and technical goals at least reasonably correct, what challenges below the strategic level do we need to take on? At this point it would be easy for me to give you a briefing on how well our Submarine Force is doing today, but I won't. Let me summarize my view succinctly: Our Submarine Force is in great shape. We have enormously talented people supported by staffs, maintenance organizations, engineers, technical experts and a civilian industrial base that have combined their efforts to field the best Submarine Force in the world. Having

said that, we need a healthy diet of introspection, self-criticism and listening to responsible observers and critics to stay the best. So, the following is a laundry list of the issues that most concern me based on my judgment as to where we are now, and the uncertainties of the present and near future as best we can understand them.

People: We are in a war for people! Attracting and retaining quality people is our single biggest challenge. We simply must get this right because it underpins all of our other readiness and capability issues. My sense is we face a similar challenge in our civilian industrial base, but the magnitude and seriousness of that challenge is not as clear to me as it is with our uniformed submariners.

Force structure: We don't have enough submarines. Although we're answering the nation's call, and meeting most of our deployed commitments, our warfighting commanders are becoming accustomed to doing without all the intelligence, surveillance and reconnaissance they think they need. Additionally, we cannot support the Inter-Deployment Training Cycle demand for training services and other important near-home uses of our submarines. Refueling the seven remaining 688 class submarines that can be refueled and converting up to four Tridents to SSGNs would help in the near term, but eventually we will need to build more faster. The Trident SSGN conversion would also give us a new capability whose dimensions have yet to be explored.

Depot maintenance: A significant portion of our Force will soon enter major maintenance availabilities. This will only exacerbate our force structure shortfall. Moreover, the impact on force retention, training, and proficiency of having a significant percentage of our crews in the industrial environment must be assessed and dealt with—perhaps differently than we have done in the past.

Efficiency: Efficiency from a global force employment perspective is much more important than worrying about how submarines are allocated between SUBLANT and SUBPAC. We need to operate our force like the worldwide capability that it is, and maximize the efficiency of its employment in terms of transit times, fuel usage, and minimizing homeport changes for our crews. In doing so we need to be mindful of the necessity to maintain a

reserve capacity for the force. The ability to stretch ourselves beyond our peacetime plans will almost certainly be necessary at some point in the future and we cannot give that flexibility away in our search for efficiency and sharpened pencil planning. Aboard ship we need to vigorously and purposefully attack training and administrative practice inefficiencies. Our crews work hard, very hard. Theirs is a tough, unforgiving business. High standards, high performance and high morale are required. We need to apply all our organizational and technological tools to make the training and administration for our average ship less time consuming than it is today. We need to be smarter in how we are spending our crews' time. Our people need to use the time we'll give them on new, more complex multi-mission skills, while developing the confidence required for flexibility and adaptability. They need more time to think about what they're doing and how they're doing it. They need it for a number of reasons, not the least of which is so that they are able to tell us what we need to do to better support them.

Mines: The presence of mines in the water today translates into a submarine exclusion zone, and that does not assure access! In my view there simply isn't enough adrenaline flowing on this issue. We need to make it a front and center concern for our crews in their training and proficiency now. There is effort and investment on the technology side that promises to help, but our crews need to be actively working the problem with the tools available today to make themselves and all of us smarter and keep us focused on its realities. We need to mainstream the mission of mine warfare in the Submarine Force so we can adapt to what technology does and doesn't deliver. We will also need to adapt to the successes and failures of current Navy-wide plans to develop organic Mine Warfare capability for our battlegroups.

Diesel Electric Submarines: Like mines, diesels threaten our ability to deliver access. The development and deployment of Air Independent Propulsion systems further exacerbates this challenge. Fortunately, Air-Independent Propulsion (AIP) diesels are less immediate a problem than mines. Nevertheless, we must be proficient and confident in fighting this formidable adversary on his

terms, and such proficiency and confidence neither come easily, nor overnight.

Acoustic security: Masking our acoustic signatures is vital to enabling us to train in a realistic fashion against our allies who operate modern diesel submarines. It also enables us to utilize SSBNs to do more of the types of things our SSNs do during the Inter-Deployment Training Cycle. We need the flexibility to do more of both of these. We also need to look hard at the limitations associated with our current approach to acoustic security.

Weapon system reliability: Whether it's Tomahawks or torpedoes, when submarines are shooting because they are delivering surprise or access, they are *Silver Bullet Shooters*. We must rigorously test our weapons and weapons systems so that we will have a very high level of confidence in their performance, confidence in all expected environments, and confidence throughout whatever we expect the length of a War Patrol to be.

Process and human engineering of combat systems: We are to a large extent still applying digital technology to analog processes in our combat systems. I suggest that more process and human engineering is required in our hardware and software development to help submarine Captains integrate information and make the informed value judgments that are fundamental to their warfighting success. This isn't just a matter of convenience. Our submarine Captains only have so much capacity to integrate, sort and prioritize in dynamic conditions. In addition, the combat systems we give our crews must enable them to execute multiple missions at a battle rhythm that is faster than we can currently deal with.

Build-Test-Build: Much of our success in applying technology in the submarine business has been due to the rigorous discipline that comes from a first principles approach—Get the math and science right, do the engineering very well, and test and verify performance. This approach is fundamental to success in the dangerous and demanding business of submarining and shouldn't change. However, the pace of change in information technologies as well as the imperative to adapt, be flexible, and hedge demands that we incorporate the Build-Test-Build approach to technology application where it makes sense to do so.

Stand and fight capability: Fighting in the littorals will, on occasion, necessitate actions that compromise our stealth and may not permit us to retreat behind its protective cloak. We may, for example, have to shoot down incoming torpedoes and develop *defensive* capabilities because we purposely compromise our stealth and make the conscious decision to stand and fight. In my view this is an important area where we must hedge our bets.

Law Enforcement-Like Capability: Our submarines may need the tools required for law enforcement type functions. I don't think we can dismiss the potential for needing non-lethal weapons on our ships.

Undersea Battlespace Picture: Our battlegroups and Joint Task Force Commanders need an easily interpretable undersea battlespace picture that depicts bathymetry, environmental effects on weapon and sonar performance as well as mine and undersea vehicle threats. Once they have a tool that they are as comfortable with as the air and surface pictures they have today then we will have been successful in giving them the undersea battlespace awareness they need.

That's my laundry list. I don't expect everyone to agree with it, nor have I covered all of my concerns. Our future challenges are significant, but if it were easy we wouldn't need all of the talent, intellect and energy present in the Force today—nor would it be much fun! I hope my list stimulates discussion and thought, study, and the work I think we need to continue doing in order to maintain America's preeminence in Undersea Warfare—A preeminence we should be able to demonstrate **Anywhere, Anytime.**■

ARTICLES

SUBMARINE FORCE MULTIPLIERS

by CAPT Charles J. Leidig, USN
Squadron Commander
DevRon 5

The end of the Cold War was a defining moment, a watershed event for the U.S. Submarine Force. Within a few short years of the dissolution of the Soviet Union, the Russians were forced to tie their frontline submarines to the pier and the seas were literally swept clean of true undersea competition. Without firing a single torpedo, the U.S. Submarine Force had achieved a long sought victory over an enemy that had defined a generation of submarine warriors.

Equally astonishing, however, was the ephemeral nature of the victory's euphoria. As Navy white papers, beginning with "...Forward From The Sea", appeared more quickly than new construction submarines sliding down the ways, the Submarine Force found itself confronted with an enemy it had not foreseen—its own success!

With its enemy vanquished, the Navy's budget imperative was to produce a *peace dividend*. Submariners were forced to rightsize, recapitalize, reshape and redefine their role in the new strategic environment. Even before they could articulate and justify their raison d'être, the close-aboard depth charges from Navy leadership and force planners attrited their numbers and with full rudder put the Submarine Force on a course that has led to today's unprecedented and dangerously low numbers of submarines.

Today's Strategic Environment

As today's submariners stand on the bridge and examine the world horizon, they see an era of high operational tempo and a force structure that is woefully inadequate to fulfill the mission requirements of the unified combatant commanders. This is not just hype or Submarine Force propaganda. An independent Joint Staff Attack Submarine Study concluded that there is a valid requirement

for 68 SSNs. Today those numbers stand at 56 and will very soon reach 50. The pain is real!

For the first time, the Submarine Force is saying "No". No, we can't fulfill the attack submarine requirements of theater war plans. No, we can't deploy sufficient attack submarines to conduct today's real world missions. "No". A word that historically, has never been part of the submariner lexicon.

At the same time, the battle to turn those numbers around will not be easy nor will it be won soon. It is now crystal clear that the downsizing of the '90s will take decades to correct.

Force Multipliers

The question that the submariners of this generation must now face is: How can we optimize the effectiveness of our limited number of submarines? How can we ensure that each submarine brings the maximum warfighting capability possible to the littoral battlespace?

The answer is: we must investigate, identify and incorporate *force multipliers* into our submarine tool bag. Force multipliers are capabilities which, when added to and employed by the submarine, significantly increase its combat potential and enhance the probability of successful mission accomplishment. For the Submarine Force these added capabilities must afford a broader range of battlespace influence, reduce the CO's decision cycle time, and allow one submarine to perform and appear as multiple platforms both in time and space.

Already our submarines are referred to as force multipliers in Naval Warfare Publications when added to a Battle Group Commander's tool bag. Similarly, many inherent characteristics of the nuclear submarine can be defined as force multipliers. For example, speed, endurance, and stealth are all intrinsic traits that most assuredly increase a submarine's combat potential. Nonetheless, given these existing innate warfighting capabilities we must now explore other tools that will further increase each submarine's effectiveness.

What Are the Right Tools?

Filling the tool bag requires difficult choices because of today's significant funding constraints. To date, the Submarine Force has taken a more evolutionary approach to upgrading submarine capabilities; for example, the commercial-off-the-shelf (COTS) upgrading of fire control systems and sonar processors. This type of gradualist approach worked well during the Cold War when the threat was known and technology was still progressing at a relatively moderate pace. However, this environment no longer exists. In order to confront head-on the dramatic challenges of the coming century we will have to embrace revolutionary technology and operational concepts. Only then can we truly transform and revolutionize submarine warfare.

Undersea Cooperative Engagement Capability

A revolution in submarine warfare might begin by applying the cooperative engagement capability (CEC) that has been developed for employment in the anti-air warfare mission area. Under this concept, all ships and aircraft in the battle group are interconnected, sharing contact and fire control data in real time. The synergy that is created allows one ship or aircraft to track an incoming cruise missile from an optimum position while simultaneously feeding its fire control solution to another ship or aircraft which is in a better position to engage and launch a defensive weapon. The CEC not only ties together the sensor capabilities of all ships and aircraft on the network but, in addition, it prevents *blind spots* in coverage for individual units and improves decision and execution timelines for all commanders.

Can this concept be applied to submarine warfare? Is real time interconnectivity possible in the undersea environment?

In the long term, the efficacy of an undersea cooperative engagement capability (UCEC) would require a significant effort in systems integration. A *system of systems* that links advanced undersea sensors, processors, and unmanned vehicles would form the backbone of the UCEC architecture. If implemented this capability would become the submarine commander's ultimate force

multiplier.

As I envision it, the capabilities of a UCEC network will be near limitless. Consider for example, a network that integrates multi-mission capable unmanned aerial vehicles (UAV) and unmanned undersea vehicles (UUV) with aircraft, surface ship, and onboard submarine sensors. These adjunct unmanned vehicles could be launched directly from the submarine, other platforms or both, depending on the scenario. Access to the network would give the submarine CO the ability to receive and process data from multiple platforms and ultimately conduct torpedo attacks and anti-ship or anti-air missile strikes without holding direct contact on any onboard sensors. Still not impressed?

Here's the news! *What will make the UCEC truly revolutionary is that the CO will be able to conduct these same operations and missions while submerged.* That's right—while submerged!

Off-hull sensors, at-sea platforms and land-based units, from small tactical forces to major commands, on the UCEC network would be linked real-time via flexible undersea acoustic information exchange systems and robust space systems. This complex network would give the submarine CO direct access to space systems while operating submerged and thus provide the submarine a continuous, real-time battlespace picture.

With a complete tactical picture and continuous two-way communications while operating submerged the CO would be capable of directing the launch of weapons carried on other platforms. In the future, the UCEC will give submarines such supreme connectivity that their current multi-mission capability will be expanded into mission areas that include anti-air warfare and theater ballistic missile defense. Sound unbelievable? It's not!

The Tools Are Already Here

Although the implementation of a UCEC network is still several years away, the near-term outlook is very positive. Within the next decade many of the network's critical elements will be added to the submariner's tool bag. In order to field a far-reaching UCEC network in the shortest time possible, we must begin today the

development of these tools along with their tactical and operational concepts. Participation in Fleet Battle Experiments and Submarine Force developmental exercises, even before the pieces and parts of the network are acquired, will be essential to our long-term success.

To our advantage, some of the pieces are available today and ready for action. UAVs, UUVs, the Advanced Deployable System and Acoustic Communications are continuing to develop rapidly behind the scenes. As I see it, the near term challenge for the Submarine Force is to get these systems off the drawing board and into the fleet for training and conceptual development. Let's not depend on engineers and contractors to develop the systems' concept of operations. If we get these tools out to the fleet operators, they will teach us how to employ them. They will let us know what these force multipliers can do!

Integrating and Employing Force Multipliers

The new tools under development and ready to be added to the tool bag are force multipliers in the truest sense. Many submariners are surprised to learn that the Submarine Force has already deployed UUVs at sea and conducted UAV operations in two separate submarine exercises. The Advanced Deployable System has been tested in a littoral ASW scenario and advanced acoustic communications recently made headlines when a submarine at a 400 foot submergence depth was able to transmit e-mail ashore.

Let's look at how these systems can be employed to enhance our submarines' capabilities and also be integrated into a UCEC.

In the U.S. military, unmanned systems have historically been employed on missions where the risk to operating personnel was considered too great. Similarly, for missions where covertness was an overriding consideration, properly designed unmanned vehicles could provide a higher probability of success. As a result, the design and development of unmanned vehicles has often been mission-unique and highly specialized. Today the continuing trend in warfare toward minimizing personnel risk has created a renewed interest in unmanned systems, however, there is an increased emphasis on practicality, affordability and simplicity.

UAV systems provide an excellent model for examining the

utility of unmanned systems in battlespace dominance and warfare. Historical UAV missions have included intelligence collection, reconnaissance and surveillance, target acquisition and battle damage assessment. UAVs are proven assets in providing this real time data to commanders and increasing situational awareness as observed in recent real world operations.

Today the role of the UAV is expanding even further. Already exercises have demonstrated their exceptional potential as airborne data links, radar jammers, chemical and biological weapon detectors, target designators for precision air attack systems and weapons delivery platforms. Additionally, technology has continued to increase UAV endurance and improve payload capability while simultaneously reducing size and radar cross section. For the Submarine Force, this means that launching UAVs from signal ejectors, vertical launchers or torpedo tubes will be a reality in the very near future and that these new UAV roles will become part of the submarine's multi-mission capability.

The correlation of these various UAV roles and missions to UUV operations is nearly direct. The path to achieving this wide range of capabilities for UUVs is an achievable vision. Already the Submarine Force has operated at sea the torpedo tube launched Near-Term Mine Reconnaissance System (NMRS) UUV that carried a highly capable sonar system for mine detection. Sonar detection data from this UUV was relayed real time back to operators on the submarine via a fiber optic link. After the mission the UUV could be retrieved back into the submarine via the torpedo tube and prepared for additional missions.

Its follow-on, the Long-Term Mine Reconnaissance System (LMRS) UUV, will also have mine detection as its primary role but will be autonomous in operation, no longer requiring a fiber-optic link back to the ship. When it is introduced into the fleet in 2003 its range and endurance will be significantly improved over NMRS. Equally important, its concept of operations is already being evaluated this year by Submarine Force operators in Fleet Battle Experiment Hotel.

In parallel to the LMRS acquisition, fleet operators are testing alternative UUV payloads. These payloads will expand UUV

operations to intelligence, surveillance and reconnaissance missions. Other payloads that would allow the conduct of UAV-like missions are limited only by the imagination. For instance, picture UUVs serving as undersea communication nodes in support of a UCEC network. In a USW role UUVs might serve as sonar jammers and torpedo decoys. Against a slow moving diesel submarine a UUV might prove to be the ideal search and classification platform allowing the controlling submarine to remain well beyond the enemy's weapons range. Additionally, UUVs could be designed to carry torpedoes with the capability of operating in a patrol or loiter mode, ready to attack when directed acoustically. Similarly, UUVs operated at periscope depth could fulfill a variety of roles in anti-shipping, anti-air defense and even theater ballistic missile defense. In support of weapons of mass destruction missions UUVs could be used for atmospheric and water sampling in search of chemical, biological, and nuclear weapon activity. Consider multiple UUVs operating from one submarine fulfilling USW, ISR and weapons delivery roles simultaneously. In the future each submarine will be loaded with multiple UUVs, all of which will be retrievable after completing their mission. One submarine that looks like many? You bet!

To bring these multiple UUV roles to reality the Submarine Force already has plans for the development of a Mission Reconfigurable UUV (MRUUV) that will merge the LMRS UUV platform with the alternative UUV payloads being tested in the fleet today. As a result, by the end of the decade, submariners will have a viable inventory of widely capable UUVs on one common vehicle.

Force Multipliers and Cooperative Engagement

While the multiplying effects of off-hull vehicles are evident, it is the synergy of their integration into a highly interconnected network that is revolutionary. *[Emphasis added by Editor.]* To build an undersea *netted* system will require submerged sensor fields that are capable of providing not only an acoustic surveillance capability but also the communications interface between submerged platforms and space assets.

The Advanced Deployable System (ADS) is one part of this architecture. The ADS is a theater-deliverable acoustic surveillance system that can provide continuous detection of submarines, ships or even minelaying operations over a wide geographic area. Detection information might be processed by nearby shore stations or transmitted directly to satellites via buoys connected to the underwater arrays. The portability and responsiveness of this system will permit deployment worldwide and to regions of high importance during crises. These characteristics are of increasing importance as ISR requirements continue to increase and our naval forces continue to downsize.

Similarly, distributed buoy fields can be laid at sea permitting two-way tactical information to be passed between satellites and theater assets via the radio-frequency spectrum to transceivers on the buoys. The data can then be relayed to acoustic transceivers that are deployed well below the ocean's surface. This will permit submarines and UUVs operating submerged to achieve real-time connectivity without coming to periscope depth. Although these acoustic data rates are slow today they will improve very soon.

The Future of Submarine Warfare

With a limited number of submarines in the Force over the next three decades and no foreseen decrease in mission requirements, the integration of force multipliers and a cooperative engagement capability is absolutely critical for the next generation of submarine warriors.

The submarine CO of the 21st century must be able to take advantage of the military's widely dispersed theater and national sensors both above and below the ocean's surface. The submarine of the new millennium must have a broader range of battlespace influence and a horizon that is unlimited. If provided real-time two-way connectivity from the ocean depths, the submarine's roles will be expanded into previously undreamed of mission areas. With unlimited detection ranges and incredible offensive lethality through cooperative weapons engagement, the submarine itself, will become the *supreme force multiplier*.■

THE OPERATOR IS PART OF THE SYSTEM

by CAPT Claude Barron, USN
PMS 401

Introduction

"The System is unsatisfactory and the ship is not ready to deploy" – Commodore sends.

This was the first sentence of a Navy Record Message concerning Acoustics-Rapid Commercial Off-the-Shelf (COTS) Insertion (A-RCI) Phase I implementation on a submarine from the Squadron Commander to the operational and acquisition world. What could have gone wrong? A-RCI Phase I was operational on another ship without serious problems. Factory training had been conducted with some growing pains and problems, but had not been deemed *unsatisfactory*. Traditional approaches to installing A-RCI and conducting subsequent crew training had been used. What had gone wrong, what was the problem, and what could be done to fix it?

A-RCI had been initiated by a team of organizations led by Team Submarine's Mr. Bill Johnson, Naval Sea Systems Command (NAVSEA, PMS 425), and Mr. Jim Thompson, Program Executive Officer, Undersea Warfare, Advanced Science and Technology Office. Driven by the need to reestablish acoustic advantage, the A-RCI initiative leveraged the breakthroughs in COTS technologies, combined efforts of Fleet operators and engineers to design the displays and operator interfaces, and revolutionized numerous acquisition processes to get the best of the best to the Fleet.

Identifying the Problem

The effectiveness of U.S. submarines in an ASW mission hinges on their ability to maintain an acoustic advantage over their foe. This advantage must be transparent to our adversaries and maximize our ability to make acoustic detections and maintain tactical control of the battle-space. In the 1990s, U.S. submarines experienced an erosion of their acoustic advantage. Modern threat acoustic signatures evolved away from typical narrow-band-only

signatures to more complex signal patterns, making the job of threat detection more challenging. The A-RCI sonar system was designed with improved signal processing capabilities able to exploit these more modern threat signatures. Additionally, A-RCI introduced advanced display concepts that allow operators to more efficiently search the ocean volume for threat platforms. In combination, these elements have allowed U.S. submarines to regain an acoustic advantage. Whereas A-RCI designers did their job well, as in all predecessor systems, the element of signal recognition rests almost exclusively with the operator. Without operators who can *recognize* modern threat signature characteristics, the system is useless. For this reason, the Commodore's message had nothing to do with the A-RCI system itself...It had everything to do with the fact that we had not carefully considered the *Operator as Part of the System.*

System performance is directly linked to operator performance, and in spite of the accomplishments listed above, incorporating the operator as part of the system, just as the hardware and software elements were incorporated, had not been achieved in the initial A-RCI implementation. Treating the operator as a key element of the system meant the Navy had to make sure the operator was trained and proficient in the operation, maintenance, and employment of the system. These goals had not been accomplished and something had to be done to change the training paradigm and make the operator part of the system.

Fortunately,

- a team of *out of the box* thinkers was ready to answer the call;
- the acquisition approach for the system had been nontraditional, allowing unconventional solutions;
- the necessary technology was available; and
- everyone engaged was determined to solve the problem.

Bottom Line Results

The ARCI Phase II installation training process accomplished all of these challenges in less than six months. Results included 200% improvement, or better, in Sonar watchstander proficiency, high

quality training tools that remain on the ship for continuous use, universal praise from Commanding Officers, and an institutionalized process for the long term.

Key lessons relearned included:

- Training must be conducted in an authentic operational environment
- The *Teacher* (vice *instructor*) is critical
- Performance has to be measured against an absolute standard

Outlining the Approach

To solve this problem, the following steps had to be taken:

- The right people had to be engaged and supported.
- The proficiency of the sonarmen had to be quantified to identify their weaknesses, and this quantification had to have irrefutable validity.
- Training tools had to be identified, designed, and incorporated into the existing system.
- Training curriculum and examinations had to be developed.
- A comprehensive training plan had to be developed, sold, supported, and executed.
- Training effectiveness had to be measured and follow-on improvements had to be made.

Implementing The Solution

A. Engaging and Supporting the Right People

Two old naval sayings have been re-proven by the A-RCI installation training process: "It is the crew that makes the ship what it is" and "Go ask the Chief." Key to solving any problem is selecting the right people to address it. Two primary groups were involved in resolving the A-RCI problem.

1. The Concept of Operations and Operator-Machine Interface (OMI) Group (COSG)

The A-RCI/Advanced Program Build (APB) Sonar Development Working Group (SDWG) oversees and manages several working groups, including the COSG. The COSG consists of senior Sonar Chief Petty Officers from the Type Commander's Tactical Readiness Evaluation (TRE) Teams; the Office of Naval Intelligence (ONI); Commander, Submarine Development Squadron Twelve (COMSUBDEVRON TWELVE); and other agencies, as well as a smaller number of civilians representing academic and technology organizations. The COSG was established to engage Fleet operators in the design and development of A-RCI's displays and OMIs. In this capacity, it had exceeded expectations. Nonetheless, when the requirement to address operational training surfaced, the COSG instantly recognized a new challenge and took charge.

In September 1998, the COSG Chairman, Master Chief Terry Stuckart, convened an impromptu meeting with senior sonarmen from throughout the Fleet and representatives of industry to analyze Fleet-wide operator proficiency and training issues. Following that meeting these sonarmen provided the NAVSEA (PMS425) Program Office a set of concerns and recommended solutions, which they volunteered to implement. Master Chief Stuckart (COMSUBDEVRON 12), Master Chief Clinch (ONI), and Chief Rule (ONI) worked with Commanders Submarine Force, U.S. Atlantic and Pacific Fleets (COMSUBLANT and COMSUBPAC) to organize the available personnel assets and justify the need for dedicated in-port and at-sea operator training time.

In addition, they worked with the NAVSEA Program Offices and the Office of the Chief of Naval Operations (OPNAV N879) to ensure the funding and hardware needs were met. At ONI, using in-house assets, Senior Chief Willetts developed a survey to measure operational proficiency against an absolute standard using sonar lofargrams from real-world submarine engagements. Master Chief Shafer and Senior Chief Koshoffer at COMSUBLANT wrote the training curriculum. Senior Chief Leonatti and Senior Chief Behnken at ONI created a library of element-level recordings of

real-world submarine encounters. Master Chief (Retired) Dennis Bailey at the Johns Hopkins University/Applied Physics Laboratory developed ground truth documentation to accompany the training tapes. Mr. Paul Bruhns pursued development of an A-RCI system replica hosted on a Sun Workstation that would be used as the classroom training platform.

2. The *Teachers*

Creating this training program was not, however, the COSG's most significant contribution. Their biggest impact was in their role as *teachers*. In addition to the normal day-to-day duties and responsibilities at their parent commands, the Chiefs of the COSG personally conducted the shipboard training both in port and at sea on a part-time voluntary basis. Defining the attributes of a good teacher is beyond the scope of this article, but the teachers from the COSG provided four elements vital to success:

- Expert operational knowledge and proficiency
- Extensive experience in submarine sonar operations
- Training techniques that emphasized student understanding of core sonar watchstanding principles
- One-on-one mentoring that can only occur on the ship in actual or simulated operational situations using real-world data

With every A-RCI Phase II installation, two-man teams conducted training for two weeks in port and one week at sea. The curriculum, discussed in detail below, was based on two fundamental elements: a) establishing a solid foundation of technical knowledge, and b) applying one-on-one/over-the-shoulder teaching in an operational environment with the operators *on watch*.

The mental fusion of acoustic information gleaned from lofargrams and headphones is a trade skill that has to be taught. Detecting threat contacts often requires rapid recognition and analysis of information, which must then be translated into conclusions and actions. Like an athlete, the sonarman's performance is dependent on his inherent abilities, how much he has practiced, and the quality of his coach. The teachers from the TRE Teams, from ONI, and COMSUBDEVRON TWELVE are the

coaches who made the difference.

Quantifying the Proficiency of the Sonarmen

How do you measure the proficiency of a sonarman against an absolute standard? What is an absolute standard? How can a representative sample of sonarmen in the Atlantic and the Pacific Fleets be effectively surveyed? Who has the skills, time, and resources to create and administer such a survey, grade and assess the results, and then translate those results into corrective actions? The COSG provided the solutions to these challenges, taking charge and skillfully executing its plan.

Historically, the predominant methods of evaluating a sonarman's operational proficiency outside the classroom used relative standards. Sonar Shacks were evaluated against each other with relative grades of Average, Below or Above Average, etc., or they were deemed ready or not ready to deploy. Although effective in certain aspects, relative assessments are frequently subjective and can be as much a matter of opinion as they are a matter of fact. Additionally, it is difficult to use relative standards to determine Fleet-wide operational proficiency, changes in that proficiency, or the effectiveness of training conducted. The challenge then was to put the sonarman in a simulated situation with an assessment tool—a series of lofargrams that had been validated (ground truthed) so that the sonarmen's capacity to recognize and assess what was evident in the lofargram could be compared to known values.

The *survey* was created, disseminated, and graded by Senior Chief Willetts at ONI. It used MACDSP and legacy sonar system lofargrams of 20 sonar contacts of interest taken from recordings of real-world encounters. These lofargrams were printed on paper for serial presentation to the sonarman much as they would be seen on a sonar display during normal sonar search. The contacts in the survey included a large variety of foreign submarines and torpedoes. One hundred lofargrams were shown in the survey, including 20 contacts of interest, as well as 80 lofargrams of merchants and fishing vessels and some containing no contacts at all.

The sonarmen were instructed to page through the paper grams

in a process similar to the normal watch standing routine of paging through towed array beams as they searched for sonar contacts. They were instructed to use a three-pass process. On the first pass, the sonarmen evaluated the grams and flagged those that they recognized as containing contacts of interest. On the second pass, those lofargrams having contacts of interest were to be analyzed to yield as much tactical information as possible, such as target speed, indications of zigs, or opening/closing contact. On the third pass, the targets were to be classified as accurately as possible. The 100 lofargrams were organized into 5 sets of 20 grams each, where each set represented a different ocean area of the world. Operators were given 2.5 hours to complete the survey.

The survey was distributed and administered by Acoustic Intelligence (ACINT) Specialists, TRE Team members, and squadron sonarmen to qualified sonar watch standers aboard submarines, at training commands, and at submarine squadrons and group staffs. Nearly 200 qualified watch standers took the survey. The demographics of those taking the survey are shown in the following chart:

Fleet Operators	
SSN	25%
SSBN	31%
Sonar Instructors	30%
Staff Sonarmen	3.5%
Qualified ACINT Specialists	7%
ACINT Specialist Trainees	3.5%

The results indicated clear weaknesses not only with the Fleet operators but also with the sonar instructors, and at the same time, lent validity to the ONI ACINT Specialist training program. The results among ACINT Specialist trainees should have been predictable based on the screening process used to select ONI trainees, but

post-A-RCI Installation training results reveal that the dominant parameter is not innate ability but rather teaching techniques.

Coincident with the survey, a different inquiry was initiated by COMSUBLANT and conducted at the Naval Undersea Warfare Center (NAVUNSEAWARCEN). This COMSUBLANT-sponsored research is commonly called the *Lost dB Study*. The fundamental purpose of that study was to determine why contact hold times observed in shore-based analysis of tape recordings from at-sea events were much longer than the hold times reported by the recording ships. The study used Fleet sonarmen and ACINT Riders on both legacy sonar systems and the more advanced *black box* systems to determine if the dB detected by the sensors were actually being displayed as *volts* on the operators' screens (CRT). The study clearly indicated that the *volts* were on the screen both on the legacy sonars and the black box systems, for approximately the same amount of time. The *Lost dB Study* complemented the results of the proficiency survey and showed that one of the primary causes of hold time differences was the proficiency and training of the operator.

Most importantly, the survey proved beyond any doubt or subjective opinion that there was a universal problem in our sonarman's ability to recognize and detect contacts of interest on lofargrams. This was a reality that had to be addressed as soon as possible to improve the overall tactical performance of the Submarine Force. The clarity of the results, driven by the rigor of the survey and the *Lost dB Study*, served as a catalyst to bring the different organizations responsible for sonarman training together in the effort to solve the problem. This teamwork between OPNAV (N879), the Fleet staffs, and the NAVSEA Program Office proved to be a vital by-product.

Obviously, the success of new sonar systems featuring lofargram-based search would be dependent on the operator's fundamental ability to read the grams. A lack of recognition proficiency would not be overcome by improvements made to the display formats, no matter how much they had been enhanced. In fact, enhanced displays that are more effective at presenting some of the more arcane sonar signals could serve to exaggerate a signal

recognition problem. Given these realities, it became very clear that we had an opportunity with A-RCI Phase II Installation training to teach system operation on the new system, and at the same time, teach lofargram reading skills. With this as the goal, we developed the right tools and a superb curriculum that has had a tremendous return on investment. In addition to the enhanced processing performance of the A-RCI Phase II system itself, operator contact recognition performance, due solely to improved lofargram reading skills, resulted in major improvements to the overall *system* detection performance. This demonstrated unequivocally the importance of the operator as part of the system.

Identifying, Designing, and Incorporating the Right Training Tools

Fundamental to any project's success is the application of the right tools. Fortunately the tools were already available. The challenge was applying engineering and acquisition solutions to put the right tools in the right place to make the plan work. Critical tools included the following:

- Towed Array Record/Playback Unit (TARPU), an element level tape recorder/reproducer installed in the front end of the Towed Array processing string
- Transportable Sun Workstations running A-RCI and APB tactical software
- Acoustic tape recordings of real-world contacts formatted for playback on TARPU.

The TARPU

The installation of an element-level tape playback capability imbedded in A-RCI Phase II demonstrated the flexibility of COTS-based systems and is a story of overcoming technical and programmatic challenges and contractor and program office courage.

During APB98 sea tests on USS AUGUSTA, an expensive tape player was used to feed recordings of real-world submarine sonar contacts through the A-RCI system to compare the legacy sonar displays against the A-RCI displays and algorithms being tested.

Using the tape playback as a data input to the system accomplished the intended goal, but more importantly, the ship, the testing team, and the COSG recognized that playing real-world data through the system would be an invaluable training tool.

The challenges became:

- finding an affordable tape recorder that would meet the needs of the numerous organizations using recorded acoustic data,
- solving the engineering problem of how and where to install the tape recorder in the A-RCI system, and
- addressing the substantial programmatic and business risks of installing the recorder in a system that was four months from the first shipboard installation.

NAVSEA (PMS 4252) and ONI attacked the tape recorder selection process in a very time-compressed environment. The tape recorder had to be affordable, compatible with current and future analysis equipment formats, small enough to fit in the available space, technically interfaced with the system, and environmentally tested. None of these were easy to accomplish, and only through the technical expertise and determination of the parties involved were these issues resolved within the existing schedule and budget limitations.

The element data output from the tape recordings had to be compatible as an input to the signal conditioner at the front end of the A-RCI System. The signal conditioner used in Phase I, however, had several military-unique cards, and it could not be interfaced with the selected tape recorders. Digital Systems Resources, Inc., (DSR) had designed a COTS-based signal conditioner that could be interfaced with the desired tape recorders, but it was not scheduled for inclusion in A-RCI until later. The first shipboard installation of the system was scheduled in about 16 weeks, and the training plans and curriculum had all been developed with the tape playback capability as a prerequisite. Risk can take many forms and is always present in any acquisition program, but the situation did not seem to have a win-win solution. The inclusion of the TARPU in A-RCI Phase II appeared to pose a

genuine risk to delivering the system on time, but delivering the system without the ability to train the crew seemed even more unacceptable.

To solve this no-win situation, Lockheed Martin in Manassas, as the Prime System Integrator, and DSR, working with NAVSEA (PMS425), united to solve the numerous technical, schedule and programmatic problems to install the COTS signal conditioner in the A-RCI Phase II system and deliver it to the ship on time. This accomplishment reflects the commitment of the people involved to doing the right thing, as well as their technical expertise in solving the engineering and business issues.

Transportable Sun Workstations

To support the sonar division's classroom training while A-RCI Phase II was being installed on the ship, a portable shore-based processor with A-RCI's Phase II tactical software was needed. Running the tactical software on portable COTS hardware demonstrated a hidden advantage of using COTS as the basis for the installed system. Two relatively inexpensive Sun Workstations, one for each coast, were purchased by the NAVSEA Program Office for classroom training. The training systems could be called simulators, but in fact they allowed for authentic presentation of real-world acoustic data using the A-RCI tactical software as processor.

Perhaps the greatest value of the Sun Workstations was their ability to be manipulated in real-time. This allowed the teachers to access system menus and alter system options in the classroom, to demonstrate operational characteristics of A-RCI, and afforded operational hands-on training opportunities for each student. This classroom training workstation was quite flexible and enabled the teachers to tailor training to the individual needs of a submarine crew and run and rerun sections of the curriculum as needed.

Acoustic Tapes of Real-World Contacts

Both the TARPU and the Sun Workstations depended on real-world data provided by the ONI element-level recordings. These

recordings had to be specifically formatted from their original state to one that was compatible with A-RCI system playback. This was a significant and vital effort accomplished by Senior Chief Leonatti and Senior Chief Behnken at ONI. It represented a monumental effort to search the ONI data base, play back data for review, identify suitable acoustic events, and reformat and deliver the necessary 21 tapes in time for training. Supporting documentation had to be prepared for the tapes that listed target signature characteristics and times when the target and own ship maneuvered. Mr. Dennis Bailey produced a series of detailed ground truth reports for the tapes that catalogued and time-stamped target acoustic signature and operating characteristics. These were invaluable guidebooks for the training teams.

One of the most important aspects of these training tapes is that they remain on the ship. This enables the ship to replay the tapes as part of an organic training program. The ship's chain of command now has the ability to use the expertise on board to train new personnel, and more importantly, to practice the trade skills of reading acoustic grams and system operation using real-world data. The training tape series can be refreshed periodically and updated with more up-to-date data, which because of the A-RCI data playback capability, provides the ability for near Op-Immediate intelligence. Ships preparing for deployment can obtain recently recorded TARPU tapes from other A-RCI ships returning from patrols and play them back immediately to prepare for their next assignment.

Developing Training Curriculum and Examinations

The curriculum had three fundamental goals:

1. Operational Proficiency: Train the operators to operate the new system (a traditional installation training goal).
2. Employment Proficiency: Teach the operators, supervisors, and officers how to best employ the system for a given tactical scenario (where system employment is distinctly different from and a higher order task than system opera-

tion).

3. Signal Recognition: Significantly improve sonarmen's proficiency in a) recognizing contacts of interest by improving pattern recognition techniques, and b) using all acoustic clues to exploit the target.

A senior member of the Pacific Fleet TRE Team used to say,

"Michael Jordan did not become a great basketball player sitting in a classroom calculating how to shoot baskets. He became a great basketball player by taking a ball out on the court and SHOOTING baskets."

In other words, practice begets proficiency.

This doesn't imply that classroom training is not required as a vital step towards operational proficiency—it certainly is. But learning acoustic signal recognition and analysis skills is like learning a language. Learning the basics in a classroom is necessary, but real proficiency occurs when the student is placed *in-country* and forced to use the language as part of his daily life. The same is true for the skill of obtaining tactical information from sonar displays. Training has to be accomplished using the ship's tactical sonar system, vice a laboratory signal analyzer, and if at all possible, aboard ship in a simulated or actual at-sea condition. Training on the ship, both at-sea and in port simulating an at-sea watch standing environment, was key to the A-RCI Installation Training philosophy and success.

The Curriculum

The A-RCI classroom curriculum is organized into four modules:

- A-RCI System Overview and Theory of Operation
- A-RCI System Operations
- Acoustic Intelligence and Signal Recognition
- A-RCI System Employment

The classroom training is intended to teach the students how to operate and employ A-RCI and at the same time, strengthen their

understanding of basic signal processing characteristics, to ensure they make correct choices during A-RCI system operation. To fulfill those goals, the curriculum was written to emphasize practical information vice in-depth technical theory. A-RCI System maintenance training had been accomplished during factory training, which will migrate to the schoolhouse or pipeline training. As an addition to the factory and pipeline training, the COSG's A-RCI installation training was focused on system operation, and only information germane to operational proficiency was presented. But, at the same time, it was the unanimous opinion of the COSG that a Theory of Operation module be included to give students an appropriate understanding of rudimentary technical sonar concepts—a level of knowledge throughout the Fleet that had deteriorated as badly as signal recognition.

System Overview and Theory of Operation is presented in one day. Significant topics include towed array characteristics, towed array beamforming, Fast Fourier Transforms and frequency analysis, and A-RCI signal processing techniques that were not elements of the legacy sonar systems. A-RCI system operations is presented in one day, providing students a definition of displays and system options and including demonstrations of all modes of A-RCI on the Sun Workstation. Demonstrations are followed by individual system operation by the sonarmen at the Sun Workstation. An ONI ACINT Specialist devotes one day to signal recognition and acoustic intelligence. He demonstrates not only the appearance of a signal of interest on A-RCI but also emphasizes the appropriate options and display enhancements that will maximize presentation of these signals.

After the operators have become familiar with A-RCI system operation and how to recognize contacts of interest, one day is spent teaching system employment. This module focuses on current tactical doctrine, and in fact, relies on the published A-RCI Operating Guidelines as curriculum. Recommended system lineups and some of the reasons for deviating from default system settings are discussed. The last day of the classroom curriculum is spent reviewing salient elements of the week's training, performing testing, and making presentations to the ships' officers.

One of the overwhelming challenges in creating the A-RCI classroom curriculum was to document information held as head knowledge by many people, which in most cases was not available in a format readily understood by the average sonar operator. For example, although the ACINT Specialists are experts at signal recognition, this is largely due to their years of accumulated experience in detecting and operating with foreign ships and submarines throughout the world. Senior Chief Willetts and Chief DelCambre at ONI had to make a significant leap of imagination to articulate the process of signal recognition—a task that often seems to be more art than science. Nonetheless, the training results repeatedly reveal that even the most junior operators now clearly understand the distinction between signals of interest and those radiating from benign merchant ships and trawlers—indications of Willetts' and DelCambre's success.

But perhaps the greatest challenge facing curriculum writers was turning the explanations of the engineers and scientists about A-RCI signal processing characteristics into practical information that the average high school graduate could digest. To overcome this challenge, a three-day seminar was convened at NAVOCEANO, Stennis Space Center, MS, where an eclectic mix of sonar engineers and system developers from NAVUNSEAWARCEN, DSR, Lockheed Martin, and the University of Texas presented a series of lectures to the COSG. These presentations explained the technical facets of A-RCI, from basic towed array theory and beamforming to more arcane topics such as spatial vernier, adaptive beamforming, and Fast Fourier Transforms. Master Chief Shafer and Senior Chief Koshoffer from COMSUBLANT then took on the challenging task of translating these lectures spoken in the language of *Planet Algorithm* into a series of low-level lectures that virtually all sonarmen could understand. This module took no less than 4 months to write, reflecting the enormous difficulty of the job, and required significant technical acumen.

Developing, Selling, Supporting, and Executing a Comprehensive Training Plan

Dynamic is perhaps the most accurate word to describe the

Training Plan. Developing and implementing the comprehensive effort was not done in a top-down process, with every detail worked out in advance and then followed like a script. The Training Plan consisted of an overall strategy with key parts as described above. One critical plan element was the support from and the schedule coordination with the Type Commanders to connect the teachers with the ship at the right time for maximum training effectiveness.

At the heart of the plan were the people. All understood the reasons for the effort and the relative priority. Micro-management by the Program Office was unnecessary. Master Chief Stuckart at COMSUBDEVRON 12 and Master Chief Clinch at ONI and their teams used the COSG as the focal point of organization and took care of the curriculum, the tapes, and scheduling requirements. Mr. Victor Gavin, as the A-RCI Chief Engineer, supervised and coordinated development of the tools for the TARPU and the Sun Workstation.

Significant credit is due the COMSUBLANT and COMSUBPAC Staffs. In today's operational environment, the tasks assigned to both the ships and the TYCOM staff personnel frequently exceed the available assets. Carving out and coordinating the at-sea operational time and dedicating personnel to conduct the training was as substantial a challenge as it was significant to the success and quality of the training.

Had training become the number one priority in the A-RCI Phase II installation process? The truth is, no. Production and installation was always the number one priority. Can it be said that the *operator had become part of the system* from the perspective of the acquisition process? The answer is a resounding yes.

More importantly, the Training Plan and its execution represented the cooperative and mutually supportive team efforts of numerous organizations that in the past had frequently looked at operational training like a track and field relay race instead of a cross-country meet. Historically, the individual organizations (the Program Office, industry, OPNAV (N879), Type Commanders, shore training commands, etc.) addressed their leg of the training relay and after handing the baton to their team mates running subsequent legs, they stepped off the track and out of the picture.

In A-RCI Phase II Installation Training, the efforts were cooperative and mutually supportive from start to finish. At every point, all teammates knew they were running together in the same race, and the more closely they finished together, the better the team score was going to be.

Measuring Training Effectiveness and Making Follow-on Improvements

The A-RCI Phase II installation training process accomplished all of these challenges in less than six months. Results included 200 percent improvement, or better, in sonar watchstander proficiency, high-quality training tools that remain on the ship for continuous use, universal praise from Commanding Officers, and an institutionalized process for the long term.

The Results, Lessons Learned, and Institutional Changes

To say the results exceeded expectations is an understatement. Many of the improvements have already been addressed. The most striking and illustrative results include

- Improved statistical post-training examination results
- Positive reaction of the Commanding Officers
- Lessons Learned
- Institutional changes made to sustain and transition the installation training to recurring proficiency refresher training.

Lessons Learned

- System technical changes
- Curriculum & training changes
- The young and less experienced operators gained proficiency with the new displays faster than the more senior and experienced operators.

Institutional Changes

One of the most significant results of these events has been the OPNAV (N879) determination to maximize the training value to the Fleet by expanding the effort and making the process and the right people a permanent part of the training infrastructure. Today, representatives from the Type Commander's staff and ONI, along with a civilian contractor (retired ACINT Riders hired for their operational and technical expertise), serve as the core team that sustains and conducts the A-RCI Phases II, III, and IV Installation Training. In addition, preparations are being made to use this team to support the instructors in the schoolhouse and pipeline training program and to accomplish periodic refresher training on ships as deemed necessary by the Type Commanders. Using a core set of experienced and proficient experts fully dedicated to the training effort (whose numbers can be adjusted quickly without changing Navy billet structures) will be an invaluable key to future acoustic proficiency training. This is especially critical in an environment where the APB process will be adding operational and technical capability upgrades to the ships on an annual basis.

Summary

The bottom line is simple. Today, the A-RCI operator is recognized and treated as a vital component of the system and we have relearned three very important lessons:

1. Training must be accomplished in the operator's environment, using the right tools.
2. The teacher (vice instructor) is critical.
3. Performance has to be measured against an absolute standard.

The challenge now is to expand the A-RCI lessons learned to improve acquisition processes and the Fleet's operational proficiency in all of our warfare systems.■

WORLD WAR II: JAPAN'S DISINTEREST IN MERCHANT SHIP CONVOYING

by John Merrill

Preface

Why did Japan wait until late 1943 to implement a central broad Antisubmarine Warfare (ASW) strategy for convoying merchant shipping with escort ships and where feasible, air cover? The Japanese Navy knew from 1939 the U-boat success with guerre de course especially against merchant ships sailing independently, yet did not act.

The Setting

Japan's aggressive and successful early actions of December 1941 created within a few weeks greatly lengthened merchant ship trade routes covering distances up to 3000 miles from the homeland.

Within eight days of Pearl Harbor, the West Coast of Malaysia thousands of miles from Japan, was a destination for cargo ships supporting the Japanese invasion army. The next month Singapore fell, followed later by the Philippines. Other remote invasion points all required at-sea transport over long distances. In addition to significant activity south of the home islands, the long ongoing intrusion and exploitation in northern China and Manchuria also required continuous sea transport although the distances were shorter.

On December 7, 1941, the Japanese merchant fleet stood at more than six million tons. At war, the burden of this fleet would include both the Japanese Army and Navy. Further, the fleet addressed Japan's extensive import requirements for her population as well as the huge demand for raw materials to meet extensive armament production and other industrial needs. A 20th century island, Japan survived on imports.

Size of the Japanese Merchant Fleet	
12/7/41	6,384,000 tons
8/14/45	1,465,900 tons

Accounting for the huge loss in Japanese shipping, foremost was the increasing effectiveness and skill of the United States submarine fleet growing and improving during each year of the war. The number of United States submarines in the Pacific Theater went from 47 in 1941 to 104 in February 1943 and 169 at the end of the war in 1945. United States ships, planes and submarines had the advantage of newly-developed sonar and radar systems. Japan's military technology development and fleet implementation lagged that of the United States by four years.

Further consideration of the demise of the Japanese merchant fleet brings out other factors. The Japanese cult of the naval offensive made merchant ship convoying appear as a defensive role not in keeping with a Samurai's view of fighting on the sea. Among some naval officers, ASW study and research fell into the category of only *common sense*.

It is not clear, why the 20th century Japanese Navy with its strong ties to British naval tradition, practices and strategy was not observant of Britain's success with merchant ship convoying during the last years of WWI. There is no strong evidence that convoying was an important consideration in Japan's inter-war years of naval planning.

Examination of the ASW state of readiness of Japan in late 1941 indicates ignorance of or disinterest in the heavy loss of merchant ships by Britain and others due to the improved U-boats during the first several years of WWII. Moreover, appreciation that air and sea convoy escorting of merchant ships at least moderated the losses seems to have gone unnoticed. Japan did not mount a significant focused merchant ship convoy effort until October 1943.

Before December 1941

The origins of modern Japanese naval heritage are from the successful Sino-Japanese War of 1894-5 and the Russo-Japanese War 1904-05. In both wars, success at sea came from the two Mahanian like clashes of fleet-versus-fleet with the Battle of the Yalu in the former and the Battle of Tsushima in the latter. At that time, the industrial needs of Japan were primarily agricultural and did not demand extensive seaborne support. Japan was not unique in its naval tradition of at sea-encounters with enemy battle fleets and the consequent large budgets for battleships and supporting craft.

After the Russo-Japanese War, the Army and the Navy began to diverge gradually in their perception of national objectives. The Army opted for a continental direction to the west of Japan on mainland Asia for expansion while the Navy inclined southward in the direction of oil and rubber resources. In the years ahead, this division took a toll in national preparedness, reduced inter-service cooperation, effective expenditure of resources, and, ultimately, in a rivalry for fiscal support.

Japan sided with England in WWI in accordance with an existing treaty and declared war against Germany 23 August 1914. Japan's role involved occupation of the Marshall and Caroline archipelagos and capture of Germany's Chinese port of Tsingtao in November 1914. By 1918, Japan's destroyers were part of the extensive allied armada of support vessels in European waters in the successful convoy opposition to the U-boats.

As the fires of World War I abated in the late fall of 1918 with the armistice, attention turned to peace making and keeping. The new and hard won skills of ASW and the successful protection of merchant shipping by convoying with sea and air escorts were put aside and to some extent forgotten by the primary maritime nations. Awareness of the infrequent use of highly touted battleships by both sides during the almost five years of WWI dominated by the U-boat was forgotten. The concept of control of the sea with final decision based on the clash of great battle fleets again assumed its pre-World War I prominence among the primary powers of England, United States, France, Italy, and Japan. The battleship with its attendant

high cost, long-term building requirements, manpower demands and support requirements was the weapon of choice.

In the 1920s and during the international depression period of the 1930s, economics began to play a more significant role in the restrained defense budgets of the primary maritime powers. In Japan, the actual ruling government power divided among the Army, Navy, and the premier's cabinet with the Army in the dominant position. Further, the potential enemies were Russia, China, and United States. The Army with a strong position and military needs directed toward China and Russia in Asia met its funding needs at the expense of Navy support. With limited fiscal means and the United States as its anticipated enemy, naval strategy focused on battle groups and the decisive at sea battles. This strategy obscured development of adequate wartime sea and air escort capabilities for shipping protection during armed conflict.

Smaller allocations insured continuing competition between navy and army priorities, and additional increasing attention to air power provided another factor in dividing the limited defense budgets.

Early in the 1930s, Japanese naval planning included ample recommendations for ships, boats, subchasers, air cover and wartime backup. Considerations were directed towards the need for better ASW and conversion of merchant escorts in time of war. There were other Navy voices that held opposing opinions which, when considering the U.S. as an enemy, held to the belief that enemy submarines like their own would not adopt the tactic of guerre de course. Budgetary restraints and lack of support prevented implementation of ASW-related developments.

In September 1940, Japan impressed by the Axis victories in Western Europe including the fall of France joined the Axis powers. Germany's early 1941 success in the invasion of Soviet Russia triggered Japan's excursions in southern Asia. On July 26, Japan occupied all of French Indochina with ensuing events leading to December 7's strike at Pearl Harbor.

Major Y. Horie, former member of the Imperial Japanese Army, provides some perspective regarding a Japanese view of convoying merchant ships. Horie spent most of the war years (World War II) with the Japanese Navy primarily concerned with

the transportation of troops and materiel in his assignment with the Convoy Escort Fleet from its beginnings to its final days. Horie noted, "I found that Japanese high authority had done virtually nothing on convoy escort operation since the end of World War I."[1]

December 1941 - November 1943

The rule developed by the Allies in the battle with the U-boats based on analysis of the statistics of convoyed merchant ship losses revealed the following:

Number of escorts = (Number of merchant ships/10) + 3, if with air escort
Number of escorts x 2, if no air escort.

The importance of escorts is seen in the numbers of escorts required per convoy. Before 1940, transatlantic convoys had 2 escorts; and in 1943, the number was 7. In peacetime, no Japanese ASW escort craft were built. "The war began without a single ship designed for commerce protection on the high seas."[2]

As the war opened, the Naval General Staff placed the responsibility for shipping protection in its Operations Division with a one-officer billet. Regulations for masters of merchant ships in time of war varied, depending on the geographical locations of the ships. The navy commanders in the various locations issued separate regulations, which created confusion. In the fall of 1942, standardized regulations appeared.

In the early part of the war, Japanese convoys of 10 to 20 merchant ships included merely one warship as escort. Further, the merchant ships went to sea unarmed. It was not until April 10, 1942 that the Japanese Navy assigned units to duty escorting merchant vessels. A shortage of adequate officer personnel to assist in this effort created difficulties. Total Japanese escort support for the 2500-mile link from Japan to Singapore consisted of 10 overage destroyers, 2 torpedo boats, and 5 merchant ships converted to gunboats. The escort for the 2000-mile passage from Yokusuka to Truk was composed of four old destroyers, one torpedo boat, and two converted gunboats.

This disarray and escort shortage created additional problems. Inadequate escort capability and independent tanker and freighter sailings did not assure the arrival in Japan of the now available and much needed resources, particularly, oil from the recently conquered areas in Southeast Asia.

In 1940, the Japanese Navy approved construction of four frigates for coastal defense. Later this class of ship provided the basic design for the much-needed and belated merchant ship convoy escorts. Initially these frigates were equipped with 12 depth charges. The reluctance to embark on an extensive escort building program did not start until mid-November 1943 when the disastrous loss of merchant ships signaled the need to provide escorts was finally realized by Japan.

Negligent in building frigates until June 1942, the navy approved 40 frigates with a request for 360.[3]

Perspective regarding the risks of Japanese merchant shipping in July-August 1942 comes from an anecdote concerning the third war patrol of the USS Narwhal (SS167). This older submarine commissioned in 1930 survived the bombing at Pearl Harbor and was then the first submarine to patrol the area between Honshu and Hokkaido. On patrol, the commanding officer Lieutenant Commander W. C. Wilkins observed the Japanese merchant ships and commented that the coastal traffic looked like "a street car line: fat targets chugging up and down the coast with no escorts. We could take our pick." However, Japanese ASW was not to be overlooked. Three United States submarines were lost in 1941 and 15 the following year.

By late August 1943, the Japanese Navy became alarmed because of greatly increased merchant ship losses. The numbers of submarine attacks increased. Greater numbers of U.S. submarines equipped with communications, sonar, air and surface radar, and improved torpedoes resulted in further sinkings. Growing danger to merchant ships from American bombing planes caused additional dismay to the Japanese Navy.

Postwar accounts by Army Major Y. Horie and Navy Captain Atsushi Oi in the US Naval Institute Proceedings addressed the basis of the inability of the Japanese Navy to cope. Oi suggests

failure in ASW largely because the Navy disregarded the importance of the problem. Horie found the Navy indifferent to the problem of escort protection for merchant ships.

It became essential to confront these extreme shipping losses. On November 15, 1943, the Japanese navy established the Grand Escort Command Headquarters with centralized responsibility over all matters of shipping protection. Frequently throughout the war years, the Navy took various steps to improve the protection of merchant ships but always without a cohesive centralized plan, adequate manpower, and material support.

En route from Fremantle, Australia (one of seven trips), to deliver cargo and commandos to the Philippines in November, 1943, the above-mentioned USS NARWHAL encountered what appeared to be a lone Japanese oil tanker. However, three destroyers escorted the tanker. Packed with tons of supplies and armed only with the torpedoes in its tubes, the submarine attacked the tanker but missed. Evading the destroyer escorts, NARWHAL went on to fulfill its mission, delivering the supplies and personnel and rescuing thirty-two.[4]

Frigates previously mentioned and called "Kaibo-kan" (coast defense), initially not intended for escort duty began to be used as merchant ship escorts. The characteristics of these 220-foot frigates of 800-1000 tons included Diesel or steam engines with deck guns and 60 depth charges. Later versions carried 120 depth charges. Ranges of the order of 6000 miles were typical. Speed of 16-20 knots and adequate sonar made them almost exclusively an oceangoing convoy escort. Construction of these frigates was initiated in October 1943. By May 1944, 145 were completed. Now two years into the war, Kaibo-kans began to operate effectively in the southwest Pacific. In contrast, Britain built and had 100 convoy escorts available before the start of WWII.

Regular convoying started in mid-November 1943 but only on the Singapore run. By this time, damage to the merchant fleet was beyond repair and new construction limited. Wooden 250-ton cargo carrying sampans became numerous along the coasts as the number of merchant ships sharply decreased. Somewhat improved convoy methods were still forthcoming the following year, 1944. Late in that year after the battle of Leyte Gulf, the Japanese Navy became

a minor factor. However, it was during that fall when the U.S. lost eight submarines in six weeks, the highest rate of the war, possibly due in part to the almost after-the-fact convoy escorting of merchant ships.

According to Pacific submarine war naval historian Theodore Roscoe, "Throughout the Pacific War the behavior of the Japanese escort was completely unpredictable."[3] The escort's lack of adequate communications equipment, only at this late date being equipped with primitive radar detection devices, could be one of the reasons for Roscoe's comment. In addition to the deficiency of adequate strategy and tactics for convoying, escort ships, planes, and trained personnel were in short supply.

The Technology Gap

At the start of the war, no Japanese ship was equipped with radar. It was many months before a limited number were supplied. Another year would be required to install radar on the combatant ships. The United States Navy entered the war with radar available and improvements forthcoming.

The delay in the introduction of advanced technology reveals some of Japan's lag. In other systems as well, the United States continued to excel and increase Japan's technological lag even further.

Japanese Technology Introduction

1942 Shipboard radar detector
Aircraft warning radar
1943 Battleship, medium bomber
10cm radar
1944 Air convoy escort radar
Escort ship radar detector (in Dec.)

Summary

Data from Parillo[4] display the final tonnage of the sinkings of Japanese merchant ships during the nearly four years of engagement primarily with U.S. Naval forces over a wide area of the Pacific. During the years 1942-44, U.S. submarines accounted for more than 2/3 of the sinkings of Japanese merchant shipping for each of the years. At the end of 1944, remaining Japanese merchant tonnage was close to or below the 2,000,000 tons required to meet the food supply needs of the country.

Failure to consider and plan for protection of merchant shipping, particularly in view of the industrial power of the United States and the neglect of historical evidence in support of convoying, contributed greatly to the collapse of Japan. This negligence and the presence of more than 150 U.S. submarines in the Pacific by 1945 hastened Japan's defeat.■

ENDNOTES

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REUNIONS

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A NEW KIND OF TARGET MOTION ANALYSIS

The Short-Range Encounter Problem

by LT Jon Walsh, USN
Prospective Engineer
USS MAINE (SSBN741)(Blue)

"Sonar, Conn, report the DIMUS trace bearing 030."

"Conn, Sonar, DIMUS trace now bearing 033 designated S-24, possible submerged contact. Initial bearing rate right 7 degrees per minute."

"Conn, Sonar, S-24 now bears 085, drawing right 15 degrees per minute."

"Right 15 degrees rudder, steady course 060. Sonar, Conn, coming right to keep S-24 out of our baffles."

"Conn, Sonar, S-24 faded, last bearing 118."

A short-range encounter like this one is a confused affair, and often we walk away from one with no clear idea of what really happened. For a contact suddenly gained and lost, we can only estimate a rough solution. If this encounter had taken place in wartime, the Approach Officer would have had to choose from a poor list of options:

1. Shoot first at an extremely close target with a rough solution.
2. Shoot first at a very close target with a fair solution.
3. Shoot first at a close, faded target with a poor generated solution.
4. Shoot a snapshot down the bearing of an incoming weapon.

During the Cold War, our Submarine Force typically detected enemy submarines at long range, with plenty of time to get a good solution and drive to the preferred firing position. Now, many of our potential adversaries are so quiet that we can only hold them at short range for a short time. If our target is a quiet, capable SSN, there is a high probability of counter-detection. There may soon be a contact zig (which we may or may not detect) and torpedoes in the water (which may or may not kill us).

Instead of holding our breath and waiting for data, we could

break the ice with a snapshot, but this is not always a good choice. If we hadn't been counter-detected before, the enemy is most certainly alerted to our presence now, and there will be good counter-fire. If the range is too far, both shots will miss. If the range is too short, both submarines could end up on the bottom. There is no advantage for us in a wild exchange of weapons.

We could attempt to enter a rough solution to improve our aim, but our current methods and equipment aren't very good at high bearing rate solutions through a very close CPA. It is easy to match bearing and bearing rate at any given moment during the encounter. On the other hand, it is hard to get a solution that matches bearing and bearing rate for more than a few seconds before it tracks off (an indication that the solution wasn't very good in the first place).

We could try to maneuver for TMA to get a better solution. If we maneuver outside of sonar range, we get no data. If we maneuver close to the enemy, we prolong the encounter, and the time we spend on TMA gives the enemy a good chance to shoot first and evade.

If we expect to aim a torpedo and hit the target, we need a solution that is:

1. **Timely**. We want a firing solution right now, not during post-watch reconstruction.
2. **Accurate**. We want the firing solution to be close enough for an ADCAP.
3. **Dependable**. We want to know **when** the solution is close enough for that ADCAP, and more importantly, when it is not.

The Old Way to do Business: Stacking Dots

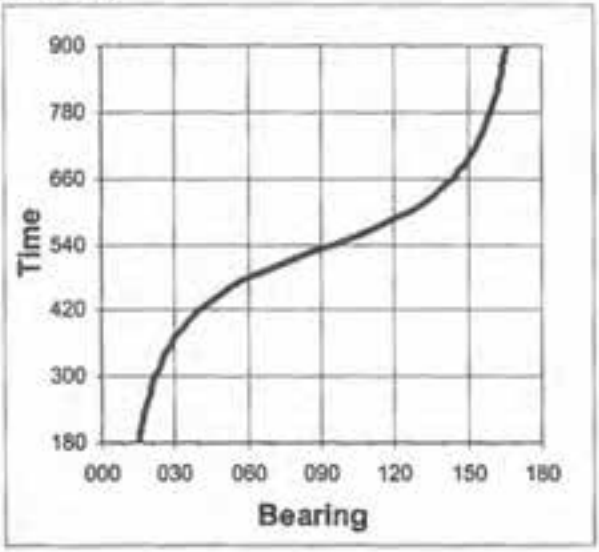
Our problem with short-range encounters arises in our combat system's Cold War approach to TMA. When we stack dots, we are matching one Line Of Bearing after another, and we try to get a best fit for all the data. This works well for moderate and long ranges, where the bearing rates are small. The dots move into a nice vertical line, and we maneuver for another leg. The dots track off, and we tweak them back into line for a good solution.

When the bearing rate grows too fast, as in a short-range encounter, the dot stack falls apart. The bearing difference scale is either too small to contain all the data, or too big to detect and remove course, speed, and range errors from the solution. It doesn't matter anyway, because the solution is changing so rapidly that small errors quickly grow into big errors again. This problem is one of **dependability**. It's hard to tell when a short-range solution is good enough to put a weapon in the water, because a good dot stack and a bad dot stack look about the same in a short-range encounter.

As the Seawolf and Virginia class boats enter service, our Submarine Force will start to regain the acoustic advantage. The new ARCI sonar systems currently being installed in the fleet will detect targets at longer ranges, reducing the likelihood of a short-range encounter. However, for the next several years, most of our submarines will still need to deal with the short-range problem.

A Whole New Way to Look at Bearing Rates

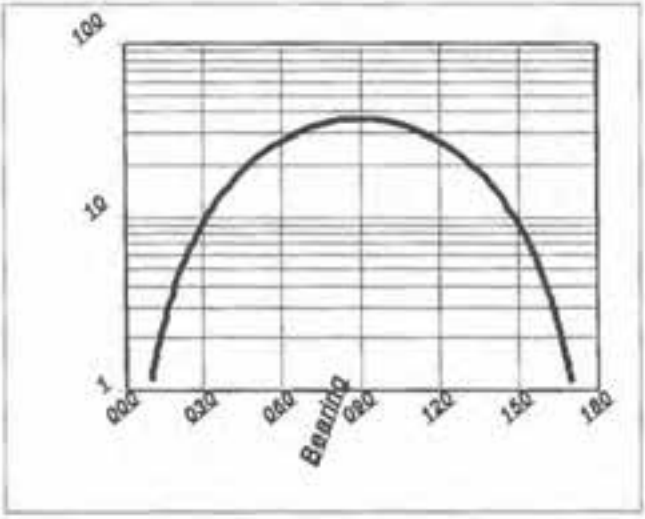
Every submariner is familiar with the **Time vs. Bearing** curve. It looks like this.



On the boat, when both own ship and a contact are steady on course and speed, we see some part of this curve. It may be stretched out on the time axis, and the bearing scale may be shifted right or left, but it is always the same kind of curve.

We can describe the entire Time-Bearing curve by the time, bearing, and bearing rate of CPA. If we know the CPA, we can calculate the bearing and bearing rate for any time before or after CPA. We submariners can measure bearing rate pretty well, and we know a short-range CPA when we see one, but we can't tell the exact bearing of CPA any closer than about $\pm 10°$ in a high bearing rate situation.

Now examine the graph of **Bearing Rate vs. Bearing on a semi-logarithmic scale.**



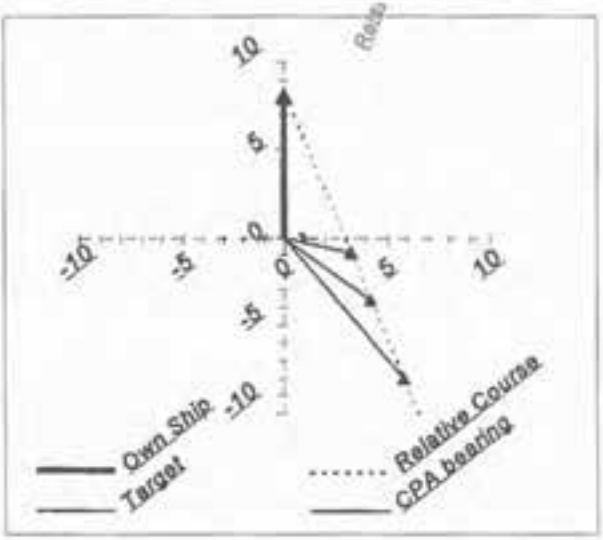
The entire curve can be described mathematically by the bearing and bearing rate of the highest point. That is the point of maximum bearing rate, or the Closest Point of Approach. The bearing rate at any point on the curve is equal to the CPA bearing rate times the square of the cosine of the angular distance from CPA.

This graph looks very simple. The curve is concave down, and it is symmetric. It has no inflection points. If we were to choose any two points on this curve, we could determine the angular difference between the two, and the ratio of the two bearing rates. These two values together are **unique** for any pair of points on the curve. We can use a pair of bearings and bearing rates to calculate an **accurate** bearing and bearing rate of CPA. We can likewise calculate the time of CPA from the time of either data point.

This is the key to solving the short-range TMA problem. The bearing and bearing rate at any two points on a single leg can give us the exact time, bearing, and bearing rate of the CPA or any other point on that leg.

Using the Relative Motion Triangle

When looking at a maneuvering board plot, we can see that the bearing of CPA is always perpendicular to the relative course (DMhr) *(Editor's Note: Other fire control terms defined in the attached Mathematical Basis.)* by definition. Suppose that own ship is traveling north at eight knots, and that the bearing of CPA has been calculated as 070. The relative motion plot then looks like this.



The vectors in the lower right quadrant represent just three out of an infinite number of possible target solutions.

To derive an accurate single-leg solution using this method, it is necessary to provide some input besides the time, bearing, and bearing rate at two points. For example, we can usually estimate a contact's speed based on classification, intelligence, or sonar data. If we can guess the target speed within two knots, we can determine target course within about 10°, with a range error of 15percent or less. An exact speed input will give a near-perfect solution.

If we have no idea what speed our contact is making, we can still get important information about his behavior. For instance, we can obtain the target's minimum speed by setting his course equal or reciprocal to the CPA bearing. This also means that the minimum speed equals the target speed in the line of sight (yDMht) at CPA, whatever the target's actual course and speed may be.

The relative speed DMhr is unique for every possible solution, which means the CPA range (proportional to DMhr/DBy at CPA) is also unique for each solution, as is the range at any other point in time. This means that sonar Range of the Day can be used to narrow the choice of possible target solutions, as can any other ranging information at any point in time. If we maneuver own ship for TMA, we can backfit any new data to the first leg to refine the solution.

Even better, if we can obtain another pair of bearings and bearing rates on the second leg, we can obtain a near perfect solution without any other supporting data. Here is how:

Draw a relative motion plot with own ship's first leg course/speed vector and the relative course line. On the same plot, draw our second leg course/speed vector and the new relative course line. The intersection of the relative course lines marks the precise contact solution.

Zig Detection

Sometimes it is hard to call a short-range zig by looking at the Time-Bearing plot. We can make a new procedure to detect a target zig very easily. This TMA method assumes that own ship

and the target are steady on course and speed in the interval between measurements, thus we have constant relative motion. The bearing and bearing rate at two points will mathematically define the expected time interval from one point to the other, because there is only one way to change the bearing by a given amount and change the bearing rate by a certain factor. What if the target zigs? If our actual (measured) time interval between two points does not equal the expected time interval, that means a possible target zig and counter-detection.

If the contact were to zig during own ship's maneuver between legs, the zig may become apparent when the relative course lines fail to intersect, or if they indicate some unrealistic target speed. It is also possible to fuse the two legs of data using our advance and transfer to see if the bearings and ranges match before and after our maneuver. If they do, we have a good solution. If they don't, there has been a zig.

Practical Uses

This TMA method is excellent for a quick solution on a high bearing rate contact. Under ideal conditions, the solution will be accurate enough to support a covert launch of a quiet weapon from the preferred firing position. To obtain the best results, follow these guidelines:

1. Get a sonar tracker on the contact and send the data to the fire control system as soon as possible.
2. If the sonar tracker tracks off, adjust track and buzz the sonar bearings manually. Remember, garbage in equals garbage out.
3. Allow at least ten degrees of bearing change to get a precise CPA calculation.
4. Measure the bearing rates as accurately as possible using the fire control system.
5. Use a spreadsheet program to handle the calculations quickly.
6. Practice this TMA method on surface contacts. A coopera-

tive merchant will allow own ship to drive several legs for training, and can be easily tracked by more traditional methods to compare solutions.

Future Developments

In time, this new TMA method could be fully automated to give real-time solution updates and zig detections. The necessary elements would be:

1. Data filters to reject bad bearings from a wandering tracker. Right now, the best filter is a trained operator looking at the Time-Bearing plot and the sonar display simultaneously.
2. Direct measurement and input of time, bearing, and bearing rate at intervals as short as twenty seconds.
3. Own ship course and speed input, and automatic advance and transfer adjustments between legs.
4. Logic instructions to detect zigs and adjust the solution accordingly.
5. Interfaces with other automated TMA methods to combine the data for the best overall solution.
6. A decision aid that optimizes weapon tactics, updates ballistics, and recommends the best launch time.

This new TMA method is just one example of how computers can make us better submariners. Over the next ten years, commercial off-the-shelf processors and software will vastly improve our ability to analyze and interpret the thousands of signals our sensors collect every second at sea. Our submarines will become much more powerful and effective combat ships.

Mathematical Basis

1. Submariner Inputs

Co Own ship's course in degrees true

DMho Own ship's speed in knots

DMht Target speed in knots (assumed)

T_1 Time of first data point

By_1 Target bearing at first data point, in degrees true

DBy_1 Target bearing rate at first data point, in degrees/minute

T_2 Time of second data point

By_2 Target bearing at second data point

DBy_2 Target bearing rate at second data point

2. Simplifications

$\Delta T_{min} = T_2 - T_1$
In minutes

$\delta = By_2 - By_1$ For this example, assume $\delta > 0$ (right bearing drift)

$R = Dby_1 / DBy_2$
Assume $R < 1$ (increasing bearing rate, such that the CPA is to the right of By_1, but not necessarily By_2)

$u = 2 (1 - R \cos^2 \delta)$

$v = \sqrt{R^2 \sin^2 2\delta - 4R^2 \cos^2 \delta + 4R + 4R^2 \cos^4 \delta - 4R \cos^2 \delta}$

$w = R \sin 2\delta$

$\beta_1 = \tan^{-1} [u / (v + w]$
in degrees

$\beta_2 = \beta_1 - \delta$
in degrees

3. Outputs

$By_{cpa} = By_1 + \beta_1$
Target bearing at CPA, in degrees true

$Dby_{cpa} = Dby_1 / \cos^2 \beta_1$
Target bearing rate at CPA, in degrees/minute

$\Delta T_{pmt} = (180 / \Pi\, DBy_{CPA})$ *

$\sqrt{(1/\cos^2 \beta_1) + (1/\cos^2 \beta_2) - (2 \cos \delta) / (\cos \beta_1 \cos \beta_2)}$
In minutes. To be compared to ΔT_{act} to detect a zig.

$Cr = By_{cpa} + 90^0$
Relative course in degrees true

To determine target course for an assumed target speed, use the trigonometric identities in combination with the Law of Cosines, which states: $c^2 = a^2 + b^2 - 2ab \cos \theta$, where a, b, and c are the sides of a triangle and θ is the angle between sides a and b.

For our purposes, we can consider the triangle parts to be defined as follows:

Side a = DMho, side b = DMht, and side c = DMhr (relative speed)

$\theta = Ct - Co$

It is helpful to define another angle $\phi = Co + 180° - Cr$ to solve the problem. By rearranging formulas, we can calculate Ct and DMhr for an assumed target speed DMht. We can also solve for Ct and DMhr graphically on a maneuvering board plot.

Moving on,

$$Rh_{cpa} = K\ Dmhr / DBy_{cpa}$$

CPA range in yards; K = 1934 °yd-hr/NM-radian

$Rh_1 = Rh_{cpa} / \cos \beta_1$
Range at time 1 in yards

$Rh^2 = Rh_{cpa} / \cos \beta_2$
Range at time 2 in yards

We now have time, bearing, range, course, and speed for data points 1 and 2, and the CPA. The solution is complete.■

A LITTLE DOLPHIN HISTORY

by CAPT Pat Taylor, USN(Ret.)

The following comes from a personal note found in my father-in-law's Class of 1926 (USNA) Fifty Years After Book wherein fellow classmates were invited to forward an anecdote and boast of grandchildren. This story is told by William C. (Bill/*Crawf*) Eddy, who among other things, had been the featured cartoonist of the Log and a heavy oarsman on the crew at the Naval Academy. Here's his story.

William C. (Bill or *Crawf*) Eddy, cartoonist par excellence, inventory, and electronics wizard, was one of the few who qualified in submarines without attending Submarine School. He achieved this distinction while serving in S-35 on the China Station where, as some people claim, "Anything can happen." Regarding his submarine service, *Crawf* stated, "As you know, I had a hearing loss at the Academy which in its early stages I was able to cover up by reading lips. This worked fine until I went to China and transferred to S-35 where, with typical Navy logic, I was assigned as Sound Officer on a boat which had the old binaural SC tubes which required perfect hearing in both ears to locate and track the target. As a result, S-35 hung up a dismal record in submerged attacks, but our failure gave me an idea of generating the sound into visual readings which would not require perfectly balanced hearing by the sound operator. With the idea in mind, I rotated to New London in the fall of '29 and was given space and some petty cash to develop the so-called *Eddy Amplifier*. With my few dollars and even fewer capabilities in the field of electronics, I bought some cheap tubes, transformers, and parts from Kresge's and built the Mk 1 Mod 1 which unaccountably worked on our first approach. Subsequent attempts with improved models proved equally effective which in time brought the development to the attention of Red Ruble, head of Electronics, BuEng. Subsequently, the experts discovered that the bargain basement parts that I had been using were effective to the point where the $E_y I_x$ curve was distorted sufficiently to make the unit work. Knowing this, they *designed in* the necessary distortion, and the units went into production at the Washington Navy Yard for fleet distribution. I was later granted

a patent through the Navy for this gadget."

While still at New London, *Crawf* and Simon Lake collaborated to build a 156 mc transmitter using a single modified 201A tube in a tin can atop a periscope for short range inter-submarine communication. About this time, the medicos caught up with his deafness, which had become more acute, and he had to retire as a Lieutenant (junior grade). (My note: Eddy was later recalled to active duty and retired as a Captain, USN.)

The following is quoted from a June 1977 letter from *Crawf* regarding a matter of interest to all submariners: "Back in 1922, I was on the Class Crest Committee and, using a *bows on* photo of the (submarine) O-2 and adding two dolphins rampant, I came up with a design of the '26 class crest. About two years later, George Meale of Bailey, Banks and Biddle, mentioned that the submarine service was looking for a design for *Submarine Wings* to denote qualification in submarines. Using my original sketches of the '26 crest, and flattening out the dolphins, we came up with the present submarine insignia which was adopted by the Navy. George gave me what purported to be the first *dolphins* struck from the dies, which I gave to my mother. I was very proud to reclaim this original *dolphins* after qualifying in O-35. The class might be interested in the tie-in between the '26 crest, the O-2, and the present dolphins".■

Author's Footnote: While I never had reason to study the Naval Academy's 1926 class crest before reading Eddy's letter to his classmates in the 50 Year After book, the similarity is amazing—the bow on sub with bow planes rigged out and flanking dolphins—not yet straightened out as in our proud insignia...

CLASS OF 1926

UNITED STATES NAVAL ACADEMY

AN HISTORIC BLUNDER:
Further Downsizing the RDT&E Infrastructure

by Dr. Richard Thompson

Recently, a study was released under the aegis of the Undersecretary of Defense for Acquisition and Technology ("A Plan to Streamline DoD's Science and Technology, Engineering, and Test and Evaluation Infrastructure") which proposed further cuts in the already beleaguered RDT&E (Research, Development, Test and Evaluation) infrastructure of the armed services; the Navy is slated for $73 million in personnel cost reductions, and another $278 million in *management efficiencies* through fiscal year 2005. The study is fundamentally flawed, consequently, the plans it embodies (for the Navy at least) are a prescription for disaster in conflicts in the next century. While it is useful to address the flaws of this study, it also is important to emphasize why a sustainable, organic Navy RDT&E enterprise is essential.

Importance of a Robust Naval RDT&E Infrastructure

The importance of a robust Navy RDT&E enterprise should be axiomatic, particularly to the submarine community. In naval warfare and in undersea warfare especially, technically advanced platforms, weapons, sensors, and data processing have proven important, or even decisive in many conflicts. The recent victories in Iraq and the Cold War, together with the defeat of Japan, were in large measure due to the technical superiority of our forces. Much of that technical superiority was developed in Navy facilities, and would not have been developed in the marketplace otherwise. Regarding submarine development, Vice Admiral J. Guy Reynolds, USN(Ret.) recently pointed out that a certain degree of capability can be purchased virtually off the shelf, but that if you wish to be dominant and prevail, you must develop submarine technology yourself. Moreover, if you wish to be dominant, you must invest for the long term, developing technologies from infancy to maturity. Radar is a good example. Radar was discovered at the Naval

Research Lab in Washington in 1930 (as well as other places), where by the summer of 1940 it had been developed to the stage where it could be deployed (as the experimental XRF) on six ships (Norman Friedman, *Naval Radar*, Conway Maritime Press, 1981). Even though the advantages of radar in naval warfare were evident at the time (accurate ranging, detection at night, etc.) and an overt threat existed (Japan) such that radar development was declared a top priority, it still took a decade to develop radar to even a usable state. This effort was expanded enormously during the war and resulted in Allied dominance. Japanese efforts were significantly smaller than Germany's, and with the coming of war were completely outclassed by Allied efforts. By starting early and investing heavily as war approached, we achieved a dominant position in a technology that was vital to our success. It is worth mentioning that warfare is like poker, in that if you have the second-best hand it is still costly to stay in the game, but you lose.

Flaws in the Study

An overarching error in the study is the rationale: that the Armed Forces have been reduced approximately 40 percent since the end of the Cold War, and therefore the RDT&E infrastructure should be reduced the same amount. *[Emphasis added by Editor.]* Why should the RDT&E effort be linearly related to the force level? Clearly, with the Revolution in Military Affairs doctrine the emphasis now is on small, lethal forces embodying advanced technology, especially information technology: essentially, the focus is on the quality of our forces and their technology, not quantity. Shouldn't the research effort be proportional to **quality** rather than quantity? The report acknowledges this in citing a greater need for RDT&E facilities than ever before. The proportion of the budget devoted to RDT&E is about half what it was when Jimmy Carter was President, and only 40 percent of that during the Reagan Administration. This would argue that the proportion devoted to RDT&E should be growing, not shrinking. Nevertheless, the guidance from the USD(A&T) is to plan for a 25 percent cut, with no justification whatever for this figure.

A sizable proportion of our RDT&E infrastructure is devoted to

test facilities. These facilities enable us to test new technologies as well as prototype and preproduction devices. Most readers of **THE SUBMARINE REVIEW** are familiar with the Atlantic Undersea Test and Evaluation Center (AUTEC) in the Bahamas, as well as gunnery ranges and missile ranges. These facilities are essential to the development of new systems, and often are unique. Moreover, they may be inconvenient or impossible to reestablish once closed, due to land use and other legal considerations.

An Example of a Specialized Test Facility

Suppose you wish to test a device, something like an expendable bathythermograph (XBT), which is deployed from a three inch signal ejector on a submarine. In particular, you (or the sponsoring activity) might wish to know how it performs in the *real world*, at sea, on a submarine. Before it can go to sea, the device and the procedure for testing it must be approved by the engineers at Naval Sea Systems Command. They are charged with assuring that the device and the test itself not endanger the submarine, its crew, or the stealth and warfighting capabilities of the ship, or interfere with other equipment. Some years ago, for a modest sum you could have tested your prototype in a specialized test tank at the Naval Surface Warfare Center, White Oak, Maryland. If you wanted, you could film the ejection of the device, and recover it easily for inspection to see if ejection damaged it. If you wanted to, you could test the device 50 times in a day to increase your confidence in its reliability. If it jammed in the tube or prevented the valve on the signal ejector from closing, the guy who ran the facility wouldn't be too happy and might charge you a few bucks to drain the tank and fix the valve, but nobody would get hurt, the delay would be modest, and you would quickly identify the problem. Without that facility (or a similar one) you have to test it on a real submarine. The people at NAVSEA basically would have to take your word for it that the device wouldn't endanger the submarine. With the drawdown in submarine numbers and increase in requirements, there may not be a submarine available for testing at this level for a long time, or at all. If it fails once you eject it, you have

no way of finding out what went wrong, or recovering it. If it jams the valve, it puts the ship at risk and there will be many unhappy people wishing to speak with you when the ship returns to port. One of the reasons for test facilities is they enable the scientists to make many trials cheaply and with low risk. The tank costs half a million dollars to build and $50K a year to operate; the submarines costs a lot more. Fundamentally, progress is quicker if you can make lots of mistakes fast. As these facilities close or become less accessible, the progress of development is slowed, and the ability to even conduct R&D becomes questionable.

Privatization of Navy RDT&E

A *leitmotif* of the report is that much RDT&E activity can be carried out by contractors, in contractor facilities, thereby saving money. It remains unclear how costs will be reduced if technically trained people are employed in a project and paid at (higher) industry levels and additionally enable the contractor to make a profit. It may be that the goal is to avoid maintaining those expensive, trained people on government payrolls, and instead use contractors who (presumably) can rapidly hire bodies, then lay them off when the contract is finished. In view of the intermittent use of specialized testing facilities, it seems unlikely that a for-profit enterprise would maintain a facility and the skilled people needed to run it once a project was completed. A facility like the test tank described above might be in use 20 days a year on the average. Would industry hire people to maintain and operate the facility with that modest degree of usage?

Suppose you want to implement a technology, like building Otto-fueled torpedoes. If you want to transfer (or maintain) technology, the preferred mode is a person. With some difficulty you can work from reports or patents to implement the technology, but in all cases it's better to have a person expert already in building that kind of torpedo. For many technologies there are other applications, but for some the only customer is DoD. This concern is very familiar to the submarine community, as many technologies are nuclear- or submarine-specific, and consequently were threatened by proposed gaps in submarine construction. If you've laid off your skilled

people because the contract is over, you may not be able to hire them back and must train new ones. This results in overtly higher costs, especially in production. One of the essential things development of a new technology provides is a nucleus of people who understand it, which is essential if you want to put it into production. If the technology is developed elsewhere, to implement it you have to create that nucleus of people from scratch, even if the learning curve is steep.

Recently, concern has grown abut the difficulty of attracting top-drawer scientific and engineering talent to defense R&D in the government (D. Mulholland, "U.S. Military Struggles to Attract Top Researchers," *Defense News*, September 13, 1999). This concern has led to a Congressionally-mandated report due for release shortly. Among the reasons cited in the report and by other experts are the low pay of government service and the exciting and lucrative opportunities in the private sector. I would suggest that the shrinkage and instability of DoD RDT&E funding also encourages technical staff to leave the government. In the R&D communities the need for a continuity and a *corporate memory* are very acute, since good (and bad) ideas often recur and it is useful to know which ideas were rejected in the past, and why. Often a *bad* idea becomes a good idea when new technology makes it possible or expands its capabilities. An example is the cruise missile, obsolescent in the form of Hound Dog and Regulus in the '60s, but now a premier weapon due to terrain contour mapping and GPS guidance. At some level, scientists and engineers are creative people who need to be free to focus on the problem at hand. If they are obliged to spend up to 50 percent of their time seeking funding to support programs instead of working the problem, this is a source of immense frustration. Indeed, the only thing keeping many scientists in the DoD is the uncertainty of funding of the research enterprise in all sectors—public, private, and academia. The other side of this coin is that stable funding and the opportunity to work on cutting edge projects might attract very good people for modest additional cost.

Conclusion

By cutting defense R&D now, we are running the enormous risk that somebody, somewhere will come up with a better mousetrap before we do. Sometimes, an evolutionary improvement changes the balance dramatically: how much better does an acoustic signal to noise ratio need to be to unmask our submarines? How fast and stealthy does a sea-skimming missile need to be before it can't be stopped? One thing we do know is that the dominant military technologies of today (including atomic energy, rocket propulsion, radar, and digital computers) were pioneered on a small scale, in the laboratory, usually as an outgrowth of scientific inquiry into the laws of nature. Fortunately, there were farsighted military people present at the creations of these technologies who were able to support their development. In some cases, it was a close run thing. If we don't create the new technologies first ourselves (or hear about them soon) we run the risk of nasty surprises, like ballistic missiles and jet aircraft, which the Germans brought to fruition before the Allies. As many have pointed out, if Hitler had managed the development of these and other technologies better, the war in Europe might have turned out rather differently.

Yet the savings created by cutting defense R&D are modest, by any measure. The proposed reductions in the plan would not even pay for a warship (and barely pay for a new C-17 transport plane, for that matter). The entirety of what the Navy pays for basic research (the origin of the breakthrough military technologies cited above) is less than half a billion dollars. The country is in the midst of unprecedented prosperity; can we really not afford this? Is it worth running the risk of having another nation militarily dominant over the United States? It cost hundreds of billions of dollars and many lives to defeat the Soviet Union, fortunately without a nuclear showdown. By spending a modest amount now, while we can readily afford it, we can maybe avoid that enormous expense of competing with a peer in the future. Put another way, running large risks to achieve small gains (or savings) is not the path of wisdom.■

FIRST DISASTER

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

The history of submarine disasters reaches back more than two centuries—to 1774 when John Day, an English carpenter, first took a vessel to the depths and, sadly, stayed there.

A clue to Day's mentality emerges from the journal of Mr Peter Oliver (1713-1791), former Chief Justice of Massachusetts, who in 1776 retired (perhaps prudently) to England. He includes an anecdote, gathered during a visit to Derbyshire on 18 August of that year, referring to Day's exploring the flooded Peak Cavern three years earlier:

> "...after being gone for some Time and the By Standers supposing he was drowned, they heard a Voice, and then a plunging: upon which R. Daykin, our Guide, ventured as far as he dared... & ...caught hold of Mr. Day's arms, & a Man behind Daykin...saved the drowning Man [who] was speechless for some Time: but no sooner had his Senses returned, but he said, he would take another Plunge: but those present, finding him disorder'd, prevented him.
>
> This Mr. Day was a Projector [inventor], & perhaps not of the soundest Mind; for, some Time after, he undertook to sink a Vessel at Plimouth, to sink himself with it & to live under Water for some Time; he made the Attempt; the Vessel was sunk with him, but neither however rose again."

Day's submersible career commenced with converting a small market boat into a diving machine by adding a watertight chamber into which he shut himself on a Suffolk Broad. It was claimed that he went down to 30 feet and surfaced unharmed 24 hours later; but it is much more likely (in light of 13.5 pounds pressure at 30 feet on every square inch of a wooden hutch) that he simply allowed the tide to rise and fall over his beached contrivance.

Whatever; the experiment initiated a major money-making venture. English gentry had a passion for gambling under the Hanoverian kings; and Day was sure that huge wagers would be

laid on the probability (or otherwise) of sending a full-size ship to the bottom—a depth of 100 yards was mentioned—and bringing it up again with the crewman still alive.

In November 1773 Day approached a Mr. Christopher Blake to fund the project:

> "Sir,
>
> I found out an affair by which many thousands may be won; it is a very paradoxical nature that can be performed with ease; therefore, sir, if you chuse to be informed of it, and give me one hundred pounds out of every thousand you shall win by it, I will very readily wait upon you and inform you of it. I am myself but a poor mechanic and not able to make anything by it without your assistance.
>
> Yours etc.,
>
> J. Day"

Mr. Blake was hooked although, having viewed a model of the proposed diving vessel, he made discreet enquiries in London where he doubtless learned (unlike Day himself, it seems) about the huge force that would be exerted on a container 300 feet below the surface. He told Day "at any expense to fortify the chamber", in which he was to subsist, "against the weight of such a body of water" and insisted that the depth should be no more than 20 fathoms (120 feet) while reducing the total time of immersion from 24 to 12 hours.

With finance assured Day purchased the sloop MARIA, "of 50 tons burthen", for £340 (say $75,000 today). She had a 31 foot keel and a 16 foot beam.

A box-like wooden air chamber, 8 feet deep, 12 feet long and 9 feet broad "containing 75 hogsheads of air", was built into the hold. It was reinforced by strong timbers on the inside and entered by a square opening at the top sealed by a thick bevelled hatch suspended from a hinged pole, like a sea-saw, with a counterweight at the other end so that lifting or lowering it was no great effort. A chain pulled the hatch down, from inside, to settle it into position, while the angled edges were coated with flannel so that sea pressure would effect a seal as the ship descended.

Three differently coloured signal buoys were fixed above the chamber with catches, releasable internally, to signify that the solitary occupant was "very well" (white) "indifferent" (red) or ' "very ill" (black) when they floated up to the surface.

MARIA was ballasted sufficiently for her to submerge when the hull was flooded by hauling on lines to pull out sluice plugs in the bilge. Twenty tons of boulders in nets were suspended beneath the keel: they were held by 4 iron rods, passing through supposedly watertight tubes into the air chamber, which Day could turn to release this external ballast (on which the MARIA would sit at the bottom) when he wanted to surface.

At 2 o'clock in the afternoon of 20 June 1774 MARIA was towed out from the Pool of Plymouth (Sutton Harbour) to a spot equidistant between the north foreshore of Drake's Island and Firestone Bay, some 300 yards from either beach. Navigational cross-bearings were:

St Nicholas Sd due South;
Fire Stone Bay N 1 ° W.

The depth was later found to be 22 fathoms (132 feet) although this was, of course, charted at Mean Low Water Springs. Therefore pressure at the bottom would be at least 60 pounds p.s.i on the flat surfaces of the "pressure hull".

Contemporary accounts tell of the intrepid adventurer appearing "more than ordinarily cheerful" and "confident that his enterprize would be crowned with success and universal acclamation". He took with him "a hammock, a watch, a small wax taper, a bottle of water, and a couple of biscuits" and "watched the hour with the greatest impatience" while Mr. Blake observed proceedings from a barge nearby. The frigate HMS ORPHEUS, whose captain had been ordered to render assistance if required, was also anchored in the vicinity; and it just happened that Lord Sandwich, First Lord of the Admiralty, was in Plymouth at the time. John Montague, 4th Earl of Sandwich (1728-1792) was an inveterate gambler: it was he who refused to leave the gaming table for a meal, ordering the waiter to bring some slivers of meat between two slices of bread. There is little doubt that he took more than a passing interest in the dive.

When all was ready Day walked to the forecastle and withdrew the bilge-plugs. Then, as the vessel appeared to be on the point of going under, he stripped off his coat and waistcoat, saying he believed he should "have a hot birth of it". Bidding well-wishers goodbye he climbed down into the chamber "with the greatest composure" and shut the hatch: "presently the *Maria* sank gradually down with her stern somewhat foremost".

A local newspaper informed readers that "His [Day's] patron beheld the spot from whence he vanished with a pensiveness that seemed to forebode to his mind an evil omen, and a solemn silence seized all the witnesses of the extraordinary and aw[e]ful sight."

A quarter of an hour after MARIA had vanished "the surface was suddenly agitated, as if boiling". For sure the air chamber had collapsed under pressure. None of the three buoys came to the surface, and nor did John Day. But large sums of money were literally at stake and Lord Sandwich was every bit as anxious as Mr. Blake to find John Day still alive. Accordingly, the First Lord ordered Plymouth Dockyard experts to raise MARIA. Some 200 workers toiled non-stop with lighters and lifting cables for three days, but to no avail.

All hope was abandoned save by a Doctor N.D. Falck, MD of London who believed that the wreck could indeed be lifted and that Day could yet be resuscitated. There was, he wrote, "A philosophical probability of restoring life to a man whose death I presumed not to be real, but a mere cessation of the animal functions, and whose congealed mass of blood would remain a considerable time, in so cold a region, before a chance of putrefaction could take place; add to this that he was secure from becoming food for the fish, and having been fortunate enough to restore to life persons that had been drowned (the method of which I have fully stated in my Seaman's Medical Instructor) I own that my sanguine expectations were flattered, not withstanding the length of time he had remained in this suspense, since we have had instances of some extraordinary recoveries, with circumstances less favourable than here."

Dr. Falck was referred to Blake who wrote to him on 17 July 1774:

"SIR,

In consequence of a letter you wrote...offering your service to get up the ship, I hereby inform you, that if you have a mind to try to effect it, and that it proves successful, you shall have her for your reward, after I have examined the work and the cause of the failure of the experiment."

Dr. Falck then solicited further Admiralty assistance to salvage MARIA, but Lord Sandwich declined on 20 July:

" SIR,

I must beg to be excused from concerning myself in any shape about the vessel that was sunk at Plymouth; while there were any hopes of saving the life of the unfortunate man who sunk in her, I was ready to lend any assistance in my power, but as soon as that became desperate [despaired of?] my interference ended."

Undeterred, Dr. Falck left the capital on the morning of 25 July and arrived at Plymouth on the afternoon of the 28th. He was introduced to naval and dockyard officials but, with an eye to the First Lord, they politely refused official help.

The doctor's determination was undimmed: perhaps a wealthy punter was behind him. He established MARIA's position on Saturday 30 July, and on Monday 1 August two 40 ton barges were moored over the wreck.

The plan for salvage was ingenious and sophisticated, involving barbed spikes to be remotely pile-driven into MARIA's timbers, and heavy block-and-tackle lifting gear aided by buoyant casks attached to thick hawsers passed under her bow and stern.

Unfortunately, a gale intervened; but, when the storm abated, the hawsers were hove taut at low water so that the next rising tide would lift the wreck a few feet, allowing it to be towed into shallower water where the operation would be repeated as many

times as necessary until MARIA emerged high and dry.* On Thursday 11 August the wreck rose far enough with the tide for Dr. Falck to order mainsails to be hoisted on the barges: the wind, northerly and brisk, thereupon carried the wreck some 100 yards towards Drake's Island. Nonetheless the Doctor "...saw too many difficulties remaining to receive it [the first lift] as decisive." He was right.

During the night one of the hawsers parted and MARIA slipped from the salvage team's grasp. On the morning of Sunday 14 August an additional 50 men manned sheerlegs rigged on each barge and, briefly, the wreck was lifted off the bottom again—only for the main hawser to slide out from under the hull.

Several more attempts at salvage were made between periods of foul weather but all gear was becoming worn, costs were mounting alarmingly, and Dr Falck's practice demanded his return to London. Regretfully, (for "I must have succeeded at last") he left the scene in early October and "various circumstances" prevented his return.

There have been spasmodic but unsuccessful attempts in recent years to rediscover MARIA. Tidal streams in Plymouth Sound are strong and the remains are probably silted over; but searchers, who have painstakingly trawled the position of the dive, may not have realised that the little vessel had been shifted half a cable to the south.

In any event, poor John Day became the first of 65,000 submariners who still lie on the deep seabed: may they ever rest in peace.■

Editor's Note: Richard Compton-Hall tells the full story of The Submarine Pioneers in his recent book of that name reviewed in the October 1999 issue of ***THE SUBMARINE REVIEW.***

*As in salvaging the Royal Navy's first submarine HOLLAND I Plymouth in 1982.

NAVINT NEWS

In the interest of providing Submarine League members with information on submarine happenings outside the United States, arrangements have been made to extract appropriate news items periodically from a major international naval newspaper. It is the intent here to highlight those items of foreign submarine news which fall between hard news available in the American general and trade press, and the background pieces more usually found in these pages. Accordingly, the following is reprinted with permission from NAVINT, which is published twice monthly by Tileprint Ltd. Of 13 Crondace Road, London SW6 4BB.

From NAVINT issue 1 August 2000.

New Russian Fleet Plan

The Russian Navy's headquarters believes that 12 strategic nuclear submarines (SSBNs), 20 general purpose nuclear submarines (SSNs), 35 diesel electric submarines (SSKs), and around 70 surface warships would be sufficient to ensure the country's security in the 21st century, according to reports published by the Bellona Foundation in Norway.

According to the Bellona reports, a confidential presidential decree outlining the goals of the Russian Navy was issued on 4 March. The decree stipulates the main features of the state policy towards the Navy from now to 2010. Admiral Viktor Kravchenko, Chief of the Russian Navy General Headquarters, said that Russia should possess a powerful naval potential in the new century in order to provide defence and security. The priorities of the Navy's development should be SSBNs and general purpose submarines as well as *unified vessels*.

Admiral Kravchenko emphasised that the naval budget must get 25 percent of the total defence budget in order to achieve these goals. The current naval share of the budget is around 10-12 percent. The Russian Navy currently operates 26 SSBNs, 50 SSNs and SSGNs, 80 SSKs, and about 100 surface ships. No fewer than

183 nuclear powered submarines are currently being taken out of service in the Northern and Pacific fleets.

The Brazilian SSN

The Brazilian Navy is to invest R$750 million aiming to conclude development of its first nuclear attack submarine (SSN). The announcement was made by Sr Marcus Vinicius de Oliveira Santos, the Director of Centrol Tecnologico da Marinha. The project began in 1980, and has already cost R$1.3 billion. The SSN is to be delivered in 2010.

Canadian Upholders

Cammel Laird of Birkenhead, UK has secured a subcontract from BAE Systems to reactivate the former Royal Navy diesel electric submarine UNSEEN, originally built at Birkenhead over a decade ago. Launched in 1989, UNSEEN has been bought by the Canadian Navy as HMCS VICTORIA. BAE Systems was awarded the contract to reactivate, refurbish, and modernise all four Upholder class for the Canadians.

India's Kilo

India's Chief of Naval Staff, Admiral Sushil Kumar, will visit Russia later this month for the commissioning of the Navy's first missile equipped submarine, official sources said on 4 July. INS SINDHUSHASTRA, a Project 877 Kilo type fitted with the Klub-S missile system, will be commissioned at the Baltiisky yard in St. Petersburg on 16 July.

UK's SSN Force Status

In an official statement on 11 July the UK Ministry of Defence confirmed that six of the Royal Navy's 12 nuclear attack submarines (SSNs) are operational: SOVEREIGN, SPLENDID, SUPERB, TRAFALGAR, TRIUMPH and TURBULENT. SCEPTRE and SPARTAN are refitting at Rosyth; TALENT, TORBAY and

TRENCHANT are at Devonport; and TIRELESS is at Gibraltar. The last named is undergoing a *standard repair* following a leak of coolant water in her reactor compartment, and will remain there until the autumn. SPLENDID, TRAFALGAR, and TRIUMPH are now armed with Tomahawk land attack missiles (TLAMs).

From NAVINT issue of 1 October 2000.

British SSNs Undergo Powerplant Checks

Two UK Royal Navy nuclear powered attack submarines (SSNs) based at Faslane on the Clyde were "temporarily withdrawn from operational service" earlier last month because of a flaw in the propulsion system of a sister vessel, the Ministry of Defence (MoD) said. The Swiftsure class submarines HMS SOVEREIGN and HMS SUPERB "are currently out of service and will return to service depending on the safety cases" made for them, an MoD spokesman said. These safety cases will be decided by the naval nuclear regulatory authorities. But these SSN's operational status is good enough to meet their planned operational commitments in the future, the MoD claimed, describing reports of the problems as inaccurate.

In the first case of problems hitting these SSNs, the defect in HMS SCEPTRE's powerplant was discovered in 1998 at the beginning of a two and a half year refit. HMS SCEPTRE is still in refit, as is HMS SPARTAN, while HMS SPLENDID has been declared safe to operate until next February, when her future is to be reviewed. The way individual reactor plants are built has a bearing on acceptable safety margins, the MoD admits. An acceptable safety margin for one submarine may not necessarily apply to others of the same class.

The latest SSN problems have added to recent difficulties with some newer Trafalgar class submarines which have meant that only four of the Navy's 12 SSNs were thought to be immediately available earlier last month. Of the Trafalgar class SSNs out of service, HMS TIRELESS is in dock at Gibraltar with a cooling system problem.

From NAVINT issue of 15 October 2000.

Two More Australian Submarines Upgraded

The Australian Minister for Defence, John Moore, and the Minister for Industry, Science and Resources, Senator Nick Minchin, announced on 14 September the decision to modify two more Collins class submarines and to approve other submarine related work, at a total cost of A$72 million. Two submarines, HMAS FARNCOMB, and the yet-to-be launched sixth submarine, RANKIN, will be upgraded with the same modifications that were approved for HMRS DECHAINEUX and HMS SHEEAN in December last year. Changes to the submarines include modified propellers, modified casing sections, improved hydraulic system components, and improvements to diesel engine reliability. "HMAS FARNCOMB will enter refit later this year, and the sixth submarine, RANKIN, is due to be completed next year," Moore said. "As these proven modifications can only be incorporated during build or during scheduled refits, the government has approved their incorporation now in FARNCOMB and RANKIN to resolve known deficiencies and reliability shortcomings," said Moore. He said the decision to proceed with the upgrade of an additional two submarines reiterated the government's commitment to the Collins class, in advance of broader issues which will be canvassed in the upcoming Defence White Paper.

"The government is committed to bringing all six Collins submarines to full operational capability. A final decision on recommended options to achieve this capability will be considered in the context of the strategic outcomes of the White Paper," Moore said.

Iran Inaugurates Submarine Ammunition Line

Iran has inaugurated a plant in Tehran for the production of what a local television report described as *submarine ammunition*. The Project 877 submarines operated by the Navy are armed with short range missiles in the fin as a defence against helicopters, which may be the *ammunition* referred to, but it might conceivably apply to torpedoes or tube launched mines, although Iran's defence industry

is more likely to be involved at a support level.

A separate plant was commissioned for the production of electro-optical tracking equipment. The report quoted Defence Ministry Vice Admiral Shamkhani as saying that this will "remove one of the main weaknesses in anti-radar warfare in the country's air defence system". This presumably reference to defeating the U.S. forces' ability to jam fire control radars, a major factor in the destruction of Iraq's air defence system during the War in 1991.

The two plants were amongst eight military factories inaugurated to mark Government Week. Shamkhani said, "Unfortunately we live in a region which has become, against its will, heavily armed and there is no option but to strengthen our military capabilities".

From NAVINT issue of 1 November 2000.

Egypt Chooses Dutch SSK Design

The Egyptian Navy is to buy two Moray 1400 type diesel electric submarines (SSKs) from Rotterdamse Droogdok Maatschappij (RDM), following a long campaign by various European builders to supply replacements for ageing Project 033 Chinese-built Romeo type SSKs.

The sale is to be funded by Foreign Military Sales (FMS), with hulls constructed by Litton's Ingalls Shipbuilding yard at Pascagoula, Mississippi, according to the official announcement made three weeks ago (the deal was actually approved on 15 September). Sceptics think that we may see a re-run of the farce over the construction of three Dolphin class SSKs under FMS funding. For a long time the fiction of building the three boats at Pascagoula was maintained, but finally construction took place at Kiel by Howaldtswerke Deutsch Werft (HDW) to avoid a very steep *learning curve*.

The Moray 1400 is the smallest of a family of designs prepared over ten years ago by RDM. The Egyptian boats will have an air-independent propulsion (AIP) system, but no details have been released. It seems unlikely that the French MESMA system will be chosen as it has not yet gone to sea, nor is a fuel cell installation likely (HDW fought very hard to win the Egyptian contract, and

might be unwilling to release the technology to a competitor). The Swedish Stirling plant is well proven, but there is an outside runner in the race. RDM cooperated with Thyssen Nordseewerke and Cosworth to fund the closed-cycle diesel (CCD) known to RDM as SPECTRE. The system was installed in U.1 following her sea trials with the prototype fuel-cell installation for the Type 212 submarines.

Weapons and Electronics are also unannounced, but Kollmorgen periscopes can be taken as read, and ArgoSystems AR-700 electronic support measures (ESM), to maintain a reasonable level of U.S. industry participation. For similar reasons A Boeing combat system is likely to be selected, but it seems unlikely that the U.S. Navy will release Mk 48 ADCAP, and Seahunter is a possible alternative. Sub Harpoon anti-ship missiles may be made available.

Contracts for two more boats can be expected in the future, to replace the second pair of Romeos. We can look forward to some very lively *knocking* of the Moray design from one or two disappointed suitors.■

From NAVINT of 15 November 2000.

Five RN Nuclear Submarines Clear of Defects

Geoff Hoon, UK Secretary of State of Defence, told the House of Commons on 1 November that the initial phase of the inspection programme of UK Royal Navy (RN) attack submarines (SSNs) showed that five boats had no defects. All 12 SSNs were under investigation because of the flaw in one submarine's primary cooling circuit, the Trafalger class attack submarine HMS TIRELESS discovered last May.

However, seven boats, including TIRELESS, were not clear of the problem, Hoon said, proof of the difficulty which had obliged the Navy to recall or investigate all 12 Swiftsure and Trafalgar class SSNs. This prompted many doomladen headlines in the British media and some extraordinarily ignorant comments by those who should know better, suggesting that the whole RN submarine force was either doomed or useless. The presence of a Germany Navy submarine at Plymouth for a Flag Office Sea Training (FOST)

workup led to banner headlines proclaiming that a "U-boat had been borrowed to defend UK coastal waters".

What Hoon said was, "The inspections have shown that there is no evidence of this problem in five submarines. Although four of these were already alongside undergoing repair, maintenance or refit, this means that HMS TRIUMPH, which has the capability to launch Tomahawk missiles, will return to operational duties shortly. Analysis of more detailed inspections will allow a recovery programme to be set in place for those submarines which are affected. We aim to have this established by the end of November. In the short term, HMS TRIUMPH's availability means that we are much better placed to conduct operations, including those in support of the deterrent."

The Ministry of Defence (MoD) confirmed the current status of the SSN fleet as follows:

HMS SOVEREIGN	Faslane for maintenance - clear of flaw
HMS SCEPTRE	Refit in Rosyth - clear of flaw
HMS SPARTAN	Refit in Rosyth - clear of flaw
HMS TRENCHANT	Refit in Devonport - clear of flaw
HMS TRIUMPH	Devonport - clear of flaw
HMS SUPERB	Faslane for maintenance - signs of flaw
HMS SPLENDID	Faslane - signs of flaw
HMS TRAFALGAR	Devonport - signs of flaw
HMS TURBULENT	Devonport - signs of flaw
HMS TORBAY	Refit in Devonport - signs of flaw
HMS TALENT	Devonport for maintenance - signs of flaw
HMS TIRELESS	Gibralter - original defect under repair

The MoD would not indicate what had caused the problems in the cooling circuit of the PWR-1 reactors of the two classes, but went out of its way to emphasise that the problem does not affect the PWR-2 reactors of the four Vanguard class ballistic missiles submarines (SSBNs). It was observed that the flaw could relate to a metallurgical or other weakness, but this was before Hoon had made his statement.■

IMPROVING SUBMARINE WARFIGHTING ENDURANCE

by CDR Brian McIlvaine, USN

Commander McIlvaine is a submarine officer assigned to U.S. Joint Forces Command. He enters the PCO pipeline for USS OHIO (GOLD) SSBN 726 this January.

A common refrain among professionals, be it sports or warfare, is that execution of fundamentals is the key to success. The Submarine Force can better answer the needs of the warfighting CINCs by the application of this concept to the arena of sea control, and specifically sea denial, through the development of a half stow length torpedo.

Sea control has been recognized since the time of Mahan as a critical warfare capability. Given the amount of goods that are delivered over the oceans, and more importantly from a warfighting perspective, the importance to logistics delivery that the seas represent, sea control is critical. Conversely, sea denial is a critical warfare capability. We should not assume that we can control the sea near an enemy's shores, nor should we assume that we would be able to control the airspace over the enemy sea lanes. There exist means for an enemy to limit our ability to operate close in, particularly if we are dealing with a country with a large number of ports and a large coastline. If we truly need to stop the enemy's ability to move warfighting material over the oceans, the ability to execute the sea denial mission becomes critical. Given that this is a critical warfighting capability, the ability of our Submarine Force to operate for extended times in areas fills this need.

Submarine warfighting endurance is a function of several items in the submarine mission profile. These include length of transit, time on station, and the number of weapons that a submarine torpedo room holds. Many discussions as to the right number of submarines have taken place over the last several years. These include the QDR, the Joint Staff study, and by the leadership of the submarine community. Over the long term, the only way the CINC's requirements will be met is to increase the build rate of attack submarines. In the mean time, can the current force of submarines improve the level of support provided to the warfighting

CINCs?

It is clear that in a sea denial role, the limiting component for the Submarine Force is going to be magazine size. For the U.S. Submarine Force, ship fuel endurance is obviously not an issue, and with the ability of the ships to support themselves with food stores for over 60 days, it becomes clear that limiting component in a wartime environment will be ordnance endurance. By improving the ordnance endurance of our current submarines, wartime submarine requirement shortfalls can be addressed.

The Submarine Force can provide more bang per platform by developing a torpedo that is one half the length of the current Mk 48 torpedo, allowing two torpedoes per stow. The design criteria of the Sturgeon class submarine torpedo room was to be able to fit two Mk 37 torpedoes in each stow. The Seawolf class submarines basically identified torpedo room size as the requirement, and the rest of the ship was built around it. The Submarine Force can effectively double the torpedo weapons loadout of Los Angeles and Virginia class ships through the development of a half length torpedo.

Would it make tactical sense to build a modern half length torpedo in order to provide more weapons for submarine skippers? This can be resolved through analysis of the targets submarines are expected to counter and the tactical environment in which those weapons would be employed.

The Mk 48 torpedo was initially designed to go against a submarine threat that could be detected, tracked, and classified at significant ranges. Our ability to successfully classify targets as submarines allowed us to target without requiring a visual identification—which obviously is challenging against a submerged submarine! Additionally, the titanium double hulled submarines of Russia which were the design target required a large warhead (650 pounds) to ensure a platform kill. An analysis of targets in the sea denial role allows you to design a weapon with granted much reduced capabilities, but still providing enough capability to give the submarine CO the flexibility in ordnance to greatly increase the effectiveness of his torpedo room.

Targeting is a process that has identifiable steps—a common

mantra in the Submarine Force is detect, track, and classify—these each being components of the process of targeting another platform. It is wasteful in terms of ordnance volume to have a weapon whose range is much longer than you can target. Conversely, it clearly increases risk to have a weapon that requires the submarine to approach more closely than is necessary to identify the target. It should be noted, however, that this is precisely the situation that American submarines fought under in World War II. Is it realistic to assume that U.S. submarines will be give carte blanche to attack surface targets without identification?

This will depend on whether or not we can positively classify the target without visual identification. If so, then shooting a torpedo at a target you can't see is acceptable, and range at launch is not driven by a rules of engagement requirement. There still is some benefit to be gained by a half length torpedo, though, since the submarine skipper can make employment choices in order to improve his torpedo room utilization.

A far more likely scenario is that submarine skippers will need to perform an identification of the target. This is particularly true for non-warship surface targets. Submarines by their nature and our methods of water space management are likely to be able to be identified as enemy based on the fact that we detect them. If rules of engagement require a visual identification for surface targets, as is likely the case, then the limiting component of the submarine skippers attack profile is not weapon endurance but rather range and height of eye concerns to support an acceptable visual identification. The skipper does not have to be able to identify necessarily what it is, but should be able to say what it is not. Simple height of eye calculations for submarines and masthead height implies that even large merchants will require range closure to 20,000 yards as a minimum. Based on real world experience, this is probably conservative. Even if a visual identification is required, we need to be sure that submarines are not placed at risk by closing range too far.

Again—we must return to the threat. As a counter to submarine based sea denial, the enemy with ASW assets is likely to resort to convoys in order to concentrate those assets. This improves his probability of detection, but conversely allows the submarine CO

to probably forego visual identification, since the act of convoying can be reasonably assumed to reflect a warfighting basis. The use of a longer range weapon to target the enemy's ships in this instance is warranted.

So if we go back to first principles and ask what it is we try to target, in the sea denial role it is clear that a half length torpedo would give submarine skippers the advantage of increased warfighting endurance by simply having more weapons, but only if the weapon capabilities match the target set. What would be the minimum required capabilities of this torpedo? To answer that effectively, determine what specific targets the weapon will attack. Since weapons load out will become the limiting item for the submarine CO, the CO will not want to employ a larger weapon than required, if he has a choice.

Target: Merchant Vessels

This is not the limiting target set by any means. Merchants probably can't detect the incoming weapon. They essentially alert on explosion. Typical merchants have a top speed of about 20 knots, and typical cruising speeds of 17 knots. Depending on the size of the ship, sinking may take more than one shot. Given the limited ability of merchants to perform basic damage control, this is unlikely. The worst case scenario for this target set would be a stern aspect target at high speed. A more likely scenario is a beam target at high speed. This assumes that the submarine will be able to detect, track, and classify the target prior to it driving to a stern aspect. Even if this is not the case, the speed and endurance capabilities of U.S. submarines will let the CO control range and aspect.

Target: Diesel submarines

This is a more limiting target. To be conservative, we must assume diesel submarines probably will detect the incoming weapon. Worst case assumption in this case is an alert on launch. If diesel is at speed, it is probably detectable, trackable, and U.S.

skipper can work to control aspect or simply use a Mk 48. The diesel submarine as a target warrants it. The worst case scenario for diesel submarines is driven not by target geometry, but by ability to detect the target submarine. The worst case assumption in that situation is a dead in the water target. The appropriate assumption then is that the target has a dead astern aspect, and will start opening range immediately. Open source data for Kilo Class submarines gives their top speed as 17 knots, and the Type 212/214 submarines a top speed of 20 knots.

Target: Warships

This is also a limiting target, and it should be realized that while a half length torpedo might not be a *one shot kill*, the ability to have more weapons is advantageous. As the Russians say about nuclear weapons "Quantity has its own quality." That said, if presented with the opportunity for a one shot kill against a threat warship, most CO's would probably use the Mk 48, so exclude these from analysis. Even so, it is safe to say from recent real world examples that the 300 pound warhead of a half length torpedo would still provide at least a mission kill against most warships.

Given the above targets sets of merchants and diesel submarines, what are acceptable minimum performance parameters needed? The characteristics that are critical are speed, warhead, endurance, and brains.

To provide adequate range closure and provide *room for growth* in top end diesel submarine speed, a 30 knot torpedo should be sufficient. If we reduced the available power by one half, we do not get a fifty percent reduction in speed. Basic fluid dynamics would estimate a loss of thirty percent of top end speed. Reducing the engine size and power output may also allow you to reduce the level of noise generated by the torpedo, reducing chances for target alertment. It may be that the power plant volume cannot be reduced by one half. While this area is clearly the one where the experts need to weigh in, it is worth exploring.

Warhead size can be reduced by approximately one half. Open source information puts the Mk 48 torpedo warhead at 650 pounds. Based on pictures of the effects of a Mk 48 torpedo

(http:www.navy.gov.au/3_photo/sinkexvid.htm) and recent real world experiences, three hundred pounds detonated beneath the keel should be enough for at least a mission kill. One hundred pounds, as in the Mk 46 and the cancelled Mk 50 torpedoes, is probably not enough. Six hundred and fifty pounds is overkill for most of the targets that this weapon would be targeted against. Three hundred pounds should be more than enough for a mission kill even against warships. It would likely result in a hull kill against any merchant or diesel submarine. Reducing warhead size lets you reduce torpedo length proportionately.

Required endurance for the weapon is tied directly to top end speed. A faster torpedo will not have to run as far. If the top speed of the torpedo is less then the top speed of the target, unless the target alerts too late, no amount of endurance will result in a hit. The following statements are just time / speed math based derivations. 20,000 yard endurance was selected in order to allow the submarine CO to ensure that he can see the length of run of his torpedo. The following assumptions are then needed:

1. A target takes about three minutes to reach top speed.
2. The torpedo reaches top speed in thirty seconds.
3. Weapon impacts on first intercept (no reattack required)

Given those assumptions:

- A 30 knot torpedo can chase down a stern aspect 20 knot diesel submarine from DIW in under 20,000 yards, assuming the target alerts on launch with a launch range of 7,000 yards.
- A 30 knot torpedo can chase down a stern aspect 25 knot diesel submarine from DIW in under 20,000 yards assuming the target alerts on launch, though the range at launch is prohibitive at 3,900 yards.
- A 30 knot torpedo with 20,000 yard endurance can intercept a 17 knot beam aspect merchant with a range at launch of 16,000 yards.
- A 30 knot torpedo with 20,000 yard endurance can intercept

a 17 knot stern aspect merchant with a range at launch of 8,500 yards.

In each of these cases, if the CO can safely launch from a closer range or better control aspect of the target at launch, the weapon has more fuel left at intercept and will have more fuel remaining for reattack.

Keep in mind that detection range may be very limited for DIW diesel submarines. In this case the benefit of the half length torpedo is that much clearer, since limited endurance becomes less limiting, and having more weapons becomes more attractive. This is reinforced by the experience of the British Royal Navy in the Falklands war, when they experienced high ASW weapon usage rates. The half length torpedo is probably not an effective weapon against another country's nuclear submarines, since the torpedo has little if any speed advantage. It could be effectively used as a *break contact* counter fire weapon, however.

As far as the *brains* of the weapon are concerned, there may or may not be much to be gained here. Some finite amount of volume will be required for the sensors, and while Moore's law may reduce the volume of the brains behind the sensors, unless that volume is large to start with it does not result in much gain.

Can it be done? Should it be done?

The answer to the first question is probably best left to torpedo designers and engineers, although the above analysis indicates it is possible. Should it be done is a much harder question to answer. Torpedo shooters surely desire the added number of weapons that a half length torpedo allows, provided they can be tactically effective. Most attack submarines on deployment today carry far more Tomahawks than torpedoes, because that is what they shoot. In a major theater war, torpedoes will become more important. Given the large usage rate of ASW employment experienced by the British Navy in the Falkland's war, the advantages of the half length torpedo become even more clear. The development of this weapon would compete with other programs within the Navy and the Department of Defense, each of which is seen as vitally

important to somebody. It may be that this simply does not make the cut. Finally, this could be used as basic platform for modular UUV development. A careful consideration of utility will have to be done if UUV's start to take away from precious weapons stows, particularly when we are called on to fight. If we cannot stow two UUV's per stow, they will quickly limit our ability to carry weapons of war to the fight. Even the limited number of torpedoes currently carried could be doubled by a half length torpedo.

The engineering challenges are not mind boggling—the scaling of the power plant and the sensors and brains of the weapon are probably the most difficult issues. This is an effective way to improve the warfighting endurance of American submarines.■

THE SUBMARINE COMMUNITY

THE DOLPHIN SCHOLARSHIP FOUNDATION

by RADM Al Kelln, USN(Ret.)
Chairman, DSF Board of Directors

The Dolphin Scholarship Foundation is a non-profit corporation in Virginia which exists to assist the children of submariners and submarine support personnel to obtain a college education. There are currently 127 of those young people working toward their Bachelor's degree who are receiving $3000 a year as Dolphin Scholars. That means each recipient may get a total of $12,000 for up to four years of undergraduate education. These scholars reflect the entire spectrum of the submarine community, representing all parts and ports. They are selected solely on the basis of scholastic proficiency, non-scholastic activities and financial need.

The most recent group of scholars selected numbered 43 and 42 of them came from nineteen states while the family of one is stationed in Japan. The sponsors of that year 2000 group are divided almost evenly between 23 enlisted and 20 officers (including 6 LDOs and 2 CWOs). Of those sponsors 21 are on active duty, 16 are retired and 6 left the service prior to retirement. Among the students themselves there are 14 boys and 29 girls. Most of those (32) were in high school at the time of their selection but 11 were already in college. There were 215 eligible and complete applications received for that selection and, not surprisingly, the majority were from the major submarine concentration areas. Virginia led the applicant list with 38, while Connecticut had 25 and Washington submitted 21. Hawaii, Florida, Georgia and South Carolina each were in the teens and California had 8 applicants.

The history of the Dolphin Scholarship Foundation has been marked by steady evolution, incremental progress and a lot of hard work by a great number of dedicated people. It was founded in 1961 by the Submarine Officers' Wives' Clubs from the various submarine home port areas. In 1961 the Foundation awarded one scholarship in the amount of $350. In 1962 the program was

extended to include the children of all active duty submariners, enlisted and officers. Five grants were awarded that year. By 1963 the grants were increased to $500 per year and eligibility was extended to include dependents of active duty support personnel who had served at least six years at a submarine base, in a submarine tender, or in a submarine rescue vessel. In 1965 the charter was broadened to include the children of former members of the U.S. Navy who had served at least five years in submarines or six years in submarine support activities. In 1967 and 1969 the scholarship grants were again increased, first to $700, and then to $800 per student per year.

1967 also saw the consolidation of the funds in a trust account administered by what is now the Bank of America. In 1969 the charter was also amended to provide for the management of the SCORPION Memorial Fund, with the first of the 101 SCORPION dependents entering college in September of 1970. By 1978 fifty Dolphin scholarships were being funded at $1000 per year, and since that time both the amount of the scholarship and the number of students supported has continued to grow to the current levels. In 1987 the DSF took over management of the THRESHER Scholarship Fund and funded the remaining 20 THRESHER scholarships. Beginning with the 1999 selection, the eligibility requirements were changed to eight years of sponsor's service for qualified submariners and ten years for submarine support personnel.

In 1990 the legal structure of the Foundation was thoroughly reviewed. As a result, the Dolphin Scholarship Foundation was incorporated on November 9, 1990 in the Commonwealth of Virginia as a non-stock corporation. By incorporating, the Foundation was established as its own legal entity. Incorporation also created an elected Board of Directors with clearly defined responsibilities for governance, administration of the program, and investment of the Foundation's assets. In 1999 Dolphin Scholarship Foundation established a Distinguished Advisory Board, consisting of prominent retired submariners and civilian friends of the Submarine Force. The purpose of this Board is to develop a closer relationship between the operator and corporate communities.

The endowment which underwrites those scholarships has grown to $4 million through the efforts of the entire submarine community, their friends and neighbors. Over the time since 1961 the Foundation has awarded in excess of $4 million to over 700 deserving and dedicated students attending colleges and universities throughout the United States. For the near future, the Foundation is striving to increase even further both the number of scholars and the amount which they receive. It is their hope that the ratio of applicants to selectees also can be reduced from about 5 to 1 at present down to about 3 to 1. That will be done, of course, only by increasing the endowment and thus raising the amount of money available for tuition assistance.

The sources of the required funding have also grown in both level of effort of the original sponsors with consequent higher results and an increase in the number of types of major contributions. At first the funds were raised largely through the tireless efforts of Submarine Officer's Wives Organizations throughout the United States. Those groups, in Bangor, Kings Bay, New London, Norfolk, Pearl Harbor and San Diego are still major contributors to the Dolphin Scholarship Foundation. Their Dolphin Stores, with all the submarine-related jewelry and artifacts, have generated profits which have gone to benefit the children of the submarine community through Dolphin Scholarships. The tremendous amount of hours devoted by the wives groups to that effort has paid off most handsomely in the best possible way.

In addition to the input from the well known Dolphin Stores, the Dolphin Scholarship Foundation enjoys many private and corporate philanthropic and memorial contributions each year. The Foundation recognizes those contributions by naming *Special Scholarships*. Each $25,000 donation is recognized as a *Perpetual Scholarship* and each $1,000 donation is recognized as a one-year *Memorial* or *Honorary Scholarship*. There are currently 16 of the *Perpetual Scholarships* and they are named as follows:

Aloha (SOWC Pearl Harbor)
Bangor Officers Spouse Association
RADM Jack Darby
Foxwoods Resort (2)

VADM & Mrs. Elton Grenfell
Richard & Carol Hayward (3)
Kings Bay Gold & Silver
RADM Jack & Marcia Lee (3)
Mashantucket-Pequot Tribal Nation
Kathleen O'Beirne (SOSA New London
Rolla Parsons

Currently there are also 17 *Honorary/Memorial Scholarships:*
Mrs. Dot Arthur
CAPT Robert W. Bulmer
VADM & Mrs George W. Emery
Mr. Edward F. Hulina
VADM Vincent Lascara
Mrs. Pat Lewis
CAPT Eugene E. Lindsey, Jr.
Mr. Edward A. Morse
Navy League
Pfizer/Petro
CAPT Albert L. Prosser
Raytheon (2)
Shellback Cruises
John Michael Stepaniak
Submarine Centennial
ADM James D. Watkins

Another source of support for the DSF endowment which funds the scholarships is the sales effort of the Foundation itself.. The sale of Dolphin Calendars, a yearly event since 1963, generates approximately $5,000. Diving into Dolphin History, A Culinary Celebration of the Submarine Force Centennial was produced by the foundation in honor of the Submarine Force's 100th anniversary. This book includes recipes from each submarine in commission at the time of publication, as well as *the best of the best* recipes from a variety of cookbooks published throughout the submarine community since 1946. Both the calender and the cookbook are for sale through the Dolphin Scholarship Foundation office (address

and phone number are at the end of this article).

Naturally, the process by which students are selected for scholarships is of paramount interest and it is most important that the integrity of that process be above reproach. As noted in the opening paragraph, final selection of scholarships is determined by giving equal consideration in three areas. These aspects of qualification are scholastic proficiency, financial need and commitment and excellence in school and community affairs. These judgements are based **solely** on the information provided by the student in the completed application, the school transcript, letters of recommendation, and a brief statement by the student regarding career objectives. The basis of consideration in each of those three areas are straightforward and easily explained.

Scholastic proficiency is evaluated using a computer program to rank all applicants from highest to lowest scholastic standing. High School applicants are ranked according to a score derived from a student's highest SAT or ACT scores and high school class rank, as documented by the high school counselor or in the transcript. College students' scores are derived from the student's college Grade Point Average, the number of college terms completed, and a comparative ranking of the college attended. Each student's transcript is reviewed by each member of the Selection Committee.

Financial need is based on the information presented in the application. Need is considered with regard to income, number of family members who will be in college at the same time, area cost of living, cost of selected college and family financial resources and obligations.

Character and all-around ability, or non-academic performance, is based on information in the application regarding extra-curricular school and community activities. In addition three letters of recommendation are required, one of which must be from a non-academic source, and these are part of the consideration. The student must also submit a statement of career objectives which completes the input for this area of evaluation.

The Selection Committee consists of the Dolphin Scholarship Foundation President, a submarine officer's wife, a submarine senior enlisted member's wife, the SUBLANT Flag Secretary and two educators (usually one at the high school level and one at the

college level).

Prior to review by the Selection Committee, as much identifying information as possible is blanked out on the applications, and an alphabetical code is assigned. Each application is reviewed independently by each committee member, who assigns a maximum of 10 points per category. The three areas are weighted equally. With six reviewers and three categories, each applicant can receive a maximum of 180 points. The applicants with the most points are selected. The students are then identified and letters of acceptance and regret are sent. Students having the next highest scores in each category (high school and college) are chosen as alternates.

The President of the Dolphin Scholarship Foundation is always the wife of the current COMSUBLANT., and is now Mrs. Kathy Grossenbacher. She is ably assisted by four staffers. Mrs. Dianne Moore is the Office Manager, Mrs. Tomi Roeske is the Scholarship Administrator, Mrs. Ann Maliniak is the Public Affairs Administrator and Mrs. Laurey Perez works in Philanthropic Development.

The Foundation has moved its offices from the quarters of Commander, Submarine Force, Atlantic Fleet at the Naval Base in Norfolk to a larger, more capable space in Virginia Beach. The new address is:

5040 Virginia Beach Boulevard
Suite 104-A
Virginia Beach, VA 23462

The telephone number is 757-671-3200 and the FAX number is 757-671-3330. Any of the staff persons named above will be able to provide information regarding the scholarships and making application for consideration.■

USS RASHER (SS/SSR/AGSS 269) ASSOCIATION

by Mr. Dick Traser

The USS Rasher Association consists of a union of former crew members who served in USS RASHER (SS/SSR/-AGSS 269); the surviving family members of crew who have departed on Eternal Patrol, and those persons interested in RASHER and submarining.

Our creed is to perpetuate the memory of those submarines and boats lost through the years; to sustain the legacy of USS RASHER; to further the cause of submarining; to associate in good fellowship to enjoy the camaraderie of fellow submarine sailors, and in particular, those who had the pleasure to serve aboard RASHER, the *First Among Equals*; and to speak no ill of any of our mates.

Initiated by those who served aboard RASHER (SS 269) in WWII, the association has expanded to include the crews of the subsequent SSR and AGSS boats. Contact is maintained within the group via the contribution dependent quarterly newsletter, Through the Scope, and boat reunions.

Reunions have been held on an irregular basis since the first one in Chicago in 1968, which drew 45 former WWII crew members. These attendees represented the 255 men who served in RASHER from her commissioning to the end of WWII. The 10th reunion held in 1985, in Hampton, Virginia, drew 20 attendees, and it was decided at this reunion, because of declining membership, to invite the post WWII crews to be part of the group.

The 12th reunion, held in Manitowoc, Wisconsin in 1993, drew 28 total former crew, 19 of whom were WWII Rashermen, while the remaining 9 were from the SSR boat. The reunion held in October 1998 in Branson, Missouri, the first hosted by a non-WWII crewman, drew 15 WWII crew, 15 post WWII crew, and 28 wives, relatives, and friends of RASHER.

Projects ongoing within the organization to fulfill the tenants of our creed include:

- Increasing membership by identifying, locating and contacting former crew, surviving members of departed crew, and those persons having an interest in RASHER;
- Identifying, locating, and securing RASHER artifacts and

memorabilia for eventual placement in a museum setting for preservation and the enjoyment and education of all;

- Maintaining contact with preserved RASHER artifacts including her periscopes, sail and conning tower; her battle flag, and her bell;
- Spreading the world of RASHER and her exploits that others may likewise be aware of the contribution she has made.

If these ideals are in line with your feelings about RASHER and submarining, then we would very much appreciate your association with us. Hopefully you will also encourage others who fall within our membership description to join us.

Please contact Dick Traser, 913 N. Sierra View Street, Ridgecrest, California 93555-3013; (760) 446-4659; e-mail: ussrasher-269@usa.navy.org; html: http://www.ridgenet.net/ ~ straser/thruscope001.htm.■

IN MEMORIAM

CAPT James W. *Doc* Blanchard, Jr., USN(Ret.)
EMCM(SS) Christopher F. Guckert, Jr., USN(Ret.)
Mr. Ted N. Swain
CDR Herbert Tibbetts, USN(Ret.)

NAVAL SUBMARINE LEAGUE AWARDS PROGRAM REVIEWED

by CDR Rick Dau, USN(Ret.)

The League's awards program recently underwent a thorough review at the direction of the Board of Directors. The review team recognized from the outset that the NSL awards program was far more comprehensive than is generally understood. The League presents more than 100 performance based awards to members of the submarine community each year!

While this topic was covered in a July 1998 article it is apparent, as noted above, that not everyone is aware of the full scope and magnitude of the program. This combined with the review team's one consistent finding—"The program can benefit from greater publicity"—makes it appropriate to provide the membership with a detailed discussion of the program and the findings of the review.

The awards program is one highlight of the support the League provides to the Submarine Force. Awards recognizing excellence instill pride in the individual, reinforce the important role of the Submarine Force, and showcase the excellence that marks the performance of every submariner. The Fleet Awards and Literary Awards are presented at the League's annual symposium in June.

The Naval Submarine League Awards Program is comprised of six distinct elements. These are a Fleet Awards program, Submarine School awards, Special Category Awards, Literary awards, Accession awards, and a Photo Contest. The individual program elements are discussed in the following sections.

Fleet Awards

A national Fleet Awards program is administered in accordance with OPNAVINST 1650.22C. This is the best known segment of the Submarine league awards. The current four performance awards, with the planned addition of a COB award, provide recognition opportunities for officers and enlisted personnel as well as government civilians. The breakdown includes two awards designated for officers, three for enlisted, one for either officer or enlisted, and one for officer, enlisted or government civilian. The

instruction also calls for annual recognition of the officer and enlisted submariner longest qualified in submarines and currently serving onboard a submarine. The recently completed review concluded there is an equitable distribution of awards. Table 1 summarizes the performance awards.

Table 1
Fleet Awards (7 Performance Plus Two Longest Qualified)

Award	Recognizing	Recipients
Warder	Outstanding Achievement	Military/Civilian-LCDR or junior
Lockwood (3 Awards)	Professional Excellence	Officer/CPO/E-6 or junior (one each)
Levering Smith	Support Excellence	Officer or Enlisted O4 or junior
Jack N. Darby	Inspirational Leadership and Excellence in Command	Submarine Commanding Officer
TBD	Excellence in Leadership	Chief of the Boat

The current annual performance awards are named in honor of four distinguished submariners.

The **Frederick B. Warder Award for Outstanding Achievement** recognizes a specific action, contribution or continuing performance which most positively influenced the reputation, readiness or future well being of the Submarine Force. Government employees, civilian or military (Lieutenant Commander or junior) are eligible for this award.

The **Charles A. Lockwood Award** for submarine professional excellence recognizes individuals for achievement, contribution, specific action or consistent performance, which best exemplifies the traditional spirit embodied in the Submarine Force. Three

awards—one each to an officer, a chief petty officer and an E6 or below enlisted submariner are presented.

The **Levering Smith Award for Submarine Support Achievement** recognizes specific or continuing submarine support actions that have most contributed to the furtherance of the spirit or fighting mettle of the Submarine Force. One award is presented annually to a Navy service member (officer or enlisted) lieutenant commander or junior.

The **Jack N. Darby Award for Inspirational Leadership and Excellence of Command** recognizes a submarine officer who has displayed exceptional leadership in command. One award is presented each year.

In November, the Board of Directors approved an additional performance award, to be awarded on annual basis, to the outstanding Chief of the Boat. The League staff is currently working with the two Submarine Force Command Master Chiefs to select an appropriate name for this award and establish the eligibility and selection criteria. A change to the OPNAV instruction will be prepared and the first award will be made in 2001.

Separate from the national Fleet Awards, the Naval Submarine League Aloha Chapter worked with Commander, Submarine Force Pacific to establish a Pacific Fleet awards program. This program is administered in accordance with COMSUBPAC INST 5060.1. Four winners are selected from Pearl Harbor based submarine crews and include one commanding officer, one junior officer, one chief petty officer, and one enlisted submariner (E1-E6). Selection is based on overall outstanding performance of duty, individual achievement, and excellence in leadership with emphasis placed on warfighting skills and the individual's contribution to his submarine's warfighting readiness.

Submarine School Awards

The Submarine School Awards program recognizes the outstanding performance of one member of each graduating class in three programs—Basic Enlisted, Basic Officer, and Advanced Officer training. Sixty-five awards (15 Officer/50 Enlisted) are given each year. The Naval Submarine League Nautilus Chapter provides area

support. These awards are summarized in Table 2.

Table 2
Submarine School Awards

School	Award	Recognizing	Number & Type
Basic Enlisted	William H. Purdum	Most Improved Graduate	50 per year/plaque
Basic Officer	Fire Control Excellence	Fire Control Performance	8 per year/clock & certificate
Advanced Officer	Literary	Best Essay	7 per year/$100 (+$200 if published

The participants in these courses form the backbone of the Submarine Force and early recognition by all members of the class that superior performance is recognized and rewarded is an important element of their career development.

Special Category Awards

Distinguished Civilian

The Distinguished Civilian award is an independent award with the selection process managed by NSL. This award recognizes the personal contributions of government and industry individuals, which have been of extraordinary value to the success of the United States Navy submarine programs. No more than two awards are to be given in any one year. The most recent award winner was Mr. Carl Schmitt, retired Deputy Director of Naval Nuclear Propulsion.

Naval War College Award

Each year the Naval Submarine League presents a $1000 award to the Naval War College student who excels in a submarine related

project or essay. The detailed criteria and selection of the winner are within the province of the War College.

Accession Awards

Each year the Naval Submarine League presents the Frederick B. Warder Outstanding Achievement Award to more than thirty graduating NROTC seniors selected for submarine duty. The administration of the Warder award is in accordance with CNET P1533. The award recognizes midshipmen with proven academic and leadership skills. These awards are presented by NSL members whenever possible.

Literary Awards

The literary awards program encourages critical thinking and innovative approaches to addressing important Submarine Force issues. The Editor of the Submarine Review manages the literary awards program with assistance of the NSL Editorial Review Committee. The participation of the U.S. Naval Institute in this program adds prestige to this program. The addition of an award for the best article by an enlisted submariner is under consideration.

Table 3
Literary Awards

Category	Prize	Eligible	Donor
Best Article on Submarines or ASW	$500	Open to All	USNI
Best Article by Active Duty Author	$250	Open to All	NSL
NSL Literary Prize	1st - $400 2nd - $250 3rd - $150	Open to All	NSL

NROTC Essay Contest	1st - $300 2nd - $200 3rd - $100	NROTC Students	NSL

NSL Photo Contest

An annual photo contest is run in cooperation with Undersea Warfare Magazine. Four cash prizes ($400/250/200/50) are awarded. Each entry must be related to the activities of the Undersea Warfare community and should reflect the drama, excitement, and beauty of the undersea world. The second annual contest is currently in progress.

Assessment Summary

The Board directed review looked at all aspects of the NSL awards programs and determined that the program is comprehensive, healthy, and on target. The major review findings are presented here.

- The Fleet Awards Program is strong and is proper in scope and balance.
- The COB award is an excellent addition to the program and no further additions are recommended.
- The Submarine School Program is sound and continued support is recommended.
- The Literary and Photo Awards program is sound.
- The scope of the Accession Awards requires further review.
- All aspects of the program can benefit from increased publicity.■

DISCUSSION

MORE ABOUT HITLER'S U-BOATS

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

In the continuing debate between Norman Polmar and Captain Enos/Clay Blair over the effectiveness of Hitler's U-Boats (July 2000 **THE SUBMARINE REVIEW**, p. 142-43), Polmar has by far the better of it historically. Although Clay Blair did a masterful job of gathering documents and data—for which current and future historians will be eternally grateful—his conclusion that the U-boat peril in the Atlantic in World War II has been "vastly overblown" and that the epic struggle was "somewhat misleadingly called the 'Battle of the Atlantic' " is not historically supported by the events *as they occurred* and the perceptions of the individuals involved *at the time*.

It is apparent that such a conclusion depends too heavily upon hindsight: the undeniable fact that the peril was defeated. However, a more accurate historical perspective can be gained by studying events in the context of conditions at the times they transpired and the estimates of the situation—arguably perceptions, but right or wrong—through the eyes of individuals at those times who faced the threat on a day-to-day basis and made decisions accordingly that directly affected the outcome of the war or at least its duration.

For example, let us travel back to July 1940. Hitler's war machine had subjugated Norway, Denmark, Holland, Belgium, most of France with a subservient Vichy government in the south, and had driven the remnants of the Allied ground forces, primarily British, at Dunkirk to a stirring but inglorious withdrawal from the continent. Britain stood alone, defiant but ill prepared on land, in the air and on the sea for the inevitable next blow. And it was on the sea, Britannica's self-proclaimed realm, that it fell, not unexpected by Churchill who was imploring Roosevelt to provide destroyers to protect shipping that was still sailing independently or in convoys with too few or no escorts at all because of a lack of British escorts.[1]

Against this largely unprotected British merchant shipping in

the western approaches to the British Isles, Doenitz struck. With the Norwegian campaign over—in which U-boats were extensively used over Doenitz's strong dissent—and torpedo problems resolved (Yes, they had them too), Doenitz launched an all out "tonnage war" from recently acquired Atlantic bases in France. By July 1940 it was in full-swing. Thus began what the U-boat men referred to as the *[First] Happy Time*. And by early fall it was at a crescendo. On the night of 21-22 September 1940, five U-boats sank eleven merchantmen and damaged another out of a convoy of fifteen fully laden vessels. And on the night of 18-19 October, six U-boats out of a wolf-pack of eight sank seventeen merchantmen from one convoy and on the following night of 19-20, five of the same eight sank fourteen from one convoy and seven from another. Thus, in less than three days and two nights, eight U-boats, operating in different combinations and attacking almost exclusively on the surface at night in wolf-packs—Doenitz's *Die Rudeltaktik*—had destroyed 38 merchant vessels from three different convoys. No U-boats were lost.[2] Without question, under the circumstances at the time, Churchill was absolutely justified for being "really frightened". As we should have been—but weren't.

Fast forward to 12 December 1941. On that date, Doenitz initially deployed five U-boats, with more to follow—*Operijan Paukenschlag* or "Operation Drumbeat"—to the east coast of America and Canada. America was completely unprepared for the *merry massacre* that followed despite the fact that the British Admiralty had provided the American Navy virtually all of its knowledge and experience, accumulated in over two years of war, regarding the U-boat peril and how to best counter it. The first blow fell on 14 January 1942 when Kapitäleutnant Richard Hardegen, *U-123*, sank the Norwegian (Panamanian registry) tanker NORNESS, 9,577 tons, 40 miles west of Nantucket Lightship. Thus began what U-boat men referred to as the *Second Happy Time*. Between then and April 1942, U-boats sank 198 merchantmen, more than half tankers, for 1,200,00 tons, off the east coast of the United States. During which time there were never more than 10-12 U-boats deployed along the entire east coast.[3]

S.E. Morison, the unofficial historian for the history of the

Navy in World War II, concluded:

> "...the United States Navy was woefully unprepared, materially and mentally, for the U-boat blitz on the Atlantic Coast that began in January 1942 ...this unpreparedness was largely the Navy's own fault. Blame cannot be imputed to Congress ... or to President Roosevelt."[4]

By mid-June the situation had deteriorated to such an extent that General George C. Marshall, Chief of Staff of the Army, and senior military advisor to the President—essentially equivalent to the Chairman, Joint Chiefs of Staff today—addressed a letter of concern on 19 June to Admiral Enest J. King, Commander in Chief United States Navy (Cominch 12/20/41) and Chief of Naval Operations (CNO 3/26/42), as follows:

> "The losses by submarines off our Atlantic seaboard and in the Caribbean **now threaten our entire war effort** [emphasis added] ...**I am fearful** [emphasis added] that another month or two of this will so cripple our means of transportation that we will be unable to bring sufficient men and planes to bear against the enemy in critical theaters to exercise a determining influence on the war."[5]

It is difficult to envision a man of General Marshall's stature—senior military advisor to Presidents Roosevelt and Truman during all of World War II and later Secretary of State who oversaw the reconstruction of a war ravaged Europe—being **"fearful"** of anything without justifiable cause.

King responded on 21 June in a secret memorandum that agreed with Marshall's assessment:

> "I have long been aware ... of the implications of the submarine situation... It is obvious that the German effort is expanding more rapidly than our defenses, and **if we are to avoid disaster** [emphasis added] not only the Navy but also all other agencies concerned must continue to intensify

the anti-submarine effort."[5]

Similarly, it is difficult to envision King—characterized as "adamant" by Churchill—as ever contemplating much less predicting **"disaster"** without justifiable cause.

King also outlined plans for the convoying of all shipping along the east coast, the Gulf of Mexico and the Caribbean. By August 1942 those plans bore fruition with the introduction of the Atlantic Interlocking Convoy System. As a result, there was an immediate sharp drop in shipping losses and a rise in U-boat losses. Considering the meager results not worth the U-boat losses, Doenitz essentially abandoned the once lucrative theater and redeployed his boats once again along the North Atlantic shipping lanes where U-boat transit times were shorter and therefore time-on-station greater. Thus ended the U-boat *Second Happy Time* by the adoption in the theater of an universal convoy system in general and the effectiveness of escorts in particular, not only as deterrents to attack but also as very effective U-boat killers in the counter-attack mode—the latter result being somewhat disconcerting to the *Search, Sight, Sink* advocates of only *offensive* ASW measures as opposed to allegedly *defensive* convoying.[6]

By October 1942 Churchill had become a convert to convoying and sent a personal telegram to FDR stressing the dire need of the RN for escorts to meet the U-boat menace and reiterating that "...the problem of the U-boat menace, still without doubt the outstanding problem of the war."[7] His assessment was officially confirmed on 19 January 1943 at the Casablanca Conference when the Combined [Allied] Chiefs of Staff, together with President Roosevelt and Prime Minister Churchill, agreed that the "defeat of the U-boat must remain a first charge on the resources of the United Nations." That policy was affirmed at the Atlantic Convoy Conference, 1-12 March 1943, in Washington and personally endorsed by Admiral King.[8] But as with many such policy declarations in the earlier years of the war, the U-boat offensive was way out ahead.

By February 1943 Doenitz had redeployed about 100 U-boats to the North Atlantic, of which 37 were concentrated in the *Black*

Pit area south of Greenland, not as yet covered by any air protection. In the face of this renewed blitz, allied merchantmen losses that month increased sharply to sixty-three vessels, fully laden with war supplies. But the worst was yet to come. March 1943 saw the Battle of the Atlantic rage to a pitch of intensity and delicacy of balance which came as close to disrupting communications between America and her European Allies as had the U-boat campaign in April 1917. In the first twenty days of March the Allies lost 97 ships, more than a total of 500,000 tons. Two convoys, HX.229 consisting of forty and SC.122 sixty ships, were opposed by 40 U-boats and were particularly badly mauled. They lost a combined total of twenty-one ships. Such shipping losses and—equally or more importantly—their cargoes of critical war materials could not be sustained indefinitely even by the combined industrial might of America and her allies. Only one U-boat, U-384, was sunk.[9]

This toll from escorted convoys caused the British Admiralty to seriously consider some strong arguments for discarding the convoy system in favor of allegedly more effective offensive schemes. But cooler heads prevailed and the Allies clung to their convoy strategy through the crisis. Their faith was rewarded when long-range plans to bolster and modernize convoy defenses began to materialize. By the end of March 1943 five surface support groups, with their prosecute-to-kill capability, and escort carriers, with their continuous air umbrellas, together with additional very long range (VLR) land-based aircraft, to close the *Black Pit* gap, all made their appearance. Unknowingly at the time, the corner had been turned.[10]

This increased support for the convoy system resulted in a sharp decrease in merchantmen losses and a dramatic increase in U-boat losses. During April and May 1943, fifty-six U-boats were lost in all areas; forty-one in the North Atlantic in May, thirty-three of which were sunk in the first twenty-three days of that month.[11] Such appalling losses, even for the bitter no-quarter battle being waged in the frigid, stormy wastes of the North Atlantic, could not be sustained for long without destroying the U-boat arm as a viable fighting force. Accordingly, Doenitz made the agonizing decision to withdraw—temporarily—his U-boats from the North Atlantic convoy lanes. In his memoirs he stated:

> "Wolf-pack operations against convoys in the North Atlantic ... were no longer possible ... I withdrew the boats from the North Atlantic on May 24 ... We had lost the **Battle of the Atlantic** [emphasis added]."[12]

But that was not the end of the U-boat threat. Doenitz continued to send U-boats to sea to prey on merchantmen and warships alike right up to the cessation of hostilities when going to sea in a U-boat was virtually embarking on a suicide mission. His rational, after admitting defeat in the Battle of the Atlantic, was that as long as U-boats presented a viable threat to the Allies, their presence would require the Allies to maintain a formidable ASW organization of ships, aircraft, personnel and industrial resources to contain the threat and prevent its resurrection which, at least, would prolong the war. His reasoning was sound. For their continued depredations forced the Allies to maintain such an ASW force—progressively increasing in size and technology—the resources of which otherwise could have militarily and materially contributed to an earlier defeat of both Germany and Japan.

That continued attack and its earlier crippling successes lead Churchill to conclude that, "The U-boat attack was our worst evil. It would have been wise for the Germans to stake all upon it."[13] The historical record supports his opinion. After the 1938-1939 winter war games, then Captain Karl Doenitz, C-in-C of the resurrected U-boat service, concluded and so recommended to Admiral Erich Raeder, C-in-C , German Navy, that a total force of 300 U-boats would be required to be decisive if Britain again adopted a convoy system. No action was taken until 28 September 1939—after the war began—when Hitler visited U-boat headquarters at Wilhelmshaven. Doenitz again recommended a force of 300 U-boats and convinced Hitler to approve an increased priority for U-boat construction to achieve that goal. However, full implementation of Doenitz's recommendation was impeded by Raeder's insistence on continuing construction of 2 battleships, 2 cruisers, an aircraft carrier, plus destroyers and miscellaneous coast defense craft in accordance with the original Z-Plan. In addition, Field Marshall Herman Goering and the Chief of Staff, Armed Forces

both opposed the increased priority on national resources to rapidly expand the U-boat arm. Hitler refused to intervene to overrule Goring and the Chief of Staff. As a result of this lack of priority in U-boat construction, Germany began the war with only 57 U-boats, of which only 39 were ready for action. And of those, only 22 were Type VIIs or Type IXs , the only types suitable for Atlantic operations from German bases. Not until 1943 did Hitler realize that the U-boat arm offered the best chance of victory and personally assigned top industrial priority for a vast expansion of the U-boat fleet.[14] But it was too late, for America by then had had the time to marshal its industrial strength not only to produce the necessary massive quantities of war munitions, but also to organize an effective convoy system and an ASW organization capable of defeating any U-boat fleet that Germany was then capable of producing.

Was it a "Battle"? There can be no doubt but that it fulfills the accepted definition of "a prolonged general conflict pursued to a definite decision." It certainly was a prolonged general conflict that lasted, at minimum, for over 44 months from the first day of the war on 3 September 1939 with the sinking of the British liner ATHENIA by Kapitänleutnant Fritz-Julius Lemp, U-30, to Doenitz's withdrawal of U-boats from the North Atlantic convoy lanes on 24 May 1943. The definite decision was provided in Doenitz's own words: "We had lost the Battle of the Atlantic." Naval historian Stephen Roskill spoke for the participants and an overwhelming majority of historians since when he classified it as a decisive battle:

> "Because convoy battles are marked only by latitude and longitude, and have no names that ring in memory like Matapan [or Midway], the victory of May, 1943, is scarcely remembered. Yet it was in its own way as decisive as the Battle of Britain in the summer of 1940."[15]

The foregoing are but clippings from a vast historical record replete with similar documentation attesting to the gravity of the U-boat threat to Allied victory in World War II and the validity of the assessments made by Allied leaders such as Churchill, Roosevelt,

General Marshall and Admiral King that all could be lost unless it was met and defeated. The historical lesson to be learned is not whether the U-boats lost the *tonnage war*, but rather how close they came for the second time in the 20th century to severing the sea lanes of communication between America and its European Allies. Which leads to the sobering conclusion that contrary to Mahan that a war on shipping—*guerre de course*—is "secondary" and "inconclusive" by nature", it can be a primary and potentially decisive method of naval warfare in a modern, industrial, logistics-dependent world. A lesson that all nations, particularly those dependent upon sea lanes of communication for industrial viability or projection of power, should take seriously to heart; and be prepared to meet the threat before the outset of hostilities.

In our particular case, with naval and sea borne logistics commitments worldwide in several crisis areas, there should be no need for a logistics support vessel or warship flaming datum reminder—torpedoed by "a young diesel submarine commanding officer with one eye on his periscope and other on visions of The Order of the Crescent or the Red Star for Gallantry."[16] ■

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REFLECTIONS

RICHARD KNOWLES MORRIS

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

Dr R.K. Morris, scholar, author, poet, astronomer, sailor and good friend to submariners everywhere, died aged 84 in Connecticut on 5 October 2000. He was the biographer of J.P. Holland.

It is fair to suppose that, without Dick Morris, submariners would not appreciate the extent of the debt we owe to John Philip Holland.

There were many hundreds of inventors, over two centuries and more, who endeavoured but failed to design a submarine that functioned as it should. Only a quizzical little Irish immigrant, quondam monk and schoolmaster, got it right - and Morris told us why.

"John P. Holland (1841 - 1914), Inventor of the Modern Submarine" was published by the US Naval Institute in 1966 (with a new edition surfacing for the centennial) and was quickly recognised as a classical, definitive and very readable work.

Inspired initially by diaries and papers of his grandfather, Charles A Morris, Superintending Engineer of the John P Holland Torpedo Boat Company, Dick Morris researched deeply and internationally, establishing a close relationship with submarine communities. The abiding respect that resulted was mutual.

Morris explained how Holland overcame the dramatic problem of longitudinal instability that plagued other submarine torpedo boats; how he rejected safer-seeming submergence on a level keel and insisted on changing depth with down or up angles applied by properly positioned diving rudders; how he propelled HOLLAND VI, which became USS HOLLAND (SS1) on 12 October 1900, by the (then) best combination of internal combustion engine and electric motor-cum-generator; how he adopted a streamlined shape that was close to being ideally proportioned for submerged performance; and how he fought continually, albeit not in the end successfully, to preserve a fishlike uncluttered hull against what he saw as the desire of officers for "a deck to strut upon".

Some 40 years after Holland's death we found his beliefs about hull-form vindicated and revived, first in USS ALBACORE and then SKIPJACK.

If history is indeed equivalent to risk-free experience, Dick Morris made this freely available to us by recording John Holland's struggle—in the face of pride, prejudice, politics and bureaucracy—to produce what was rightly called the world's first really successful submarine. We may be grateful to Holland's biographer.■

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..

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CAPTAIN DONALD L. KEACH, USN(RET.)
1929-1999

by CAPT R. Norris Keeler, USNR(Ret.)

Captain Donald L. Keach, USN(Ret.) died in Homosassa, Florida in August 1999 following a lengthy illness. Keach had a long and productive career in the submarine service, deep submergence community, and various private sector and international ocean science and technology programs and projects.

Keach was born and raised in Bangor, Maine, attending public schools in the area, and the University of South Carolina on a NROTC scholarship. Upon graduation in 1951, he was ordered to USS J.R. PIERCE (DD 753) in Korea and was wounded in offshore combat action. From 1953-74 he had various assignments including commanding of a patrol craft, two submarines (MACKEREL and DARTER) and the bathyscaph TRIESTE II.

In the latter capacity, with Lieutenant Geroge Martin, he took TRIESTE down for its first deployment to USS THRESHER, and identified the probable cause of her loss. This was written up in a 1963 National Geographic feature article. The information on this and later deployments led by then Lieutenant Commander Brad Mooney, contributed to the preparation of procedures implemented in the SubSafe program, initiated in response to the THRESHER incident.

In 1971, Captain Keach was ordered to Washington as Director of Navy Laboratories, Naval Material Command. In this position he also became part of the ASN(R&D) staff, serving under Drs. Robert Frosch and David Potter. He soon became involved in looking into research in the area of non-acoustic antisubmarine warfare, commissioning, under Dr. Potter, an in-depth and broad review of Navy programs in the area. The ensuing report became the premier document in the field, and is still in use today. The report was remarkable in that many of its panelists, although young at the time later became scientists with international reputations. Another ongoing activity was to upgrade the quality of personnel in the laboratory leadership pool, from the Technical Directorship and Commanding Officer level on down. He worked exceptionally well with the senior civilians in the Department, many of whom during

those years were private sector executives of the highest caliber.

Reminiscing about this period, Keach recalled it as the *golden years* of the Navy Secretariat. Bob Frosch was the ASN(R&D) at the time, and made a point of refusing to increase his professional staff beyond seven on the premise that they should not get in anyone's way in their various constituencies. He viewed his role as gathering information and trying to help, but never being a nuisance. Keach recalled Frosch telling his staff that "You can't run this kind of office hiding behind your Rolodex; you have to be hunkered down in a rice paddy or out on the flight line finding out if our stuff works. If not, why not, and how can we make it work better?"

It might also be noted that when Captain Keach chose to support an individual or cause, he did so in an exceptionally understated manner, and with great effect. It was always possible to count on his professional integrity and personal loyalty.

Upon retirement in 1974, Keach became the Deputy Executive Director of the Marine Board. Although he revitalized what had become an almost moribund organization, an opportunity arose for him to join his Navy shipmate and friend, the brilliant and charismatic Don Walsh, at the University of Southern California's newly founded Institute for Marine and Coastal Studies. In 1983, Keach became Director, a position he held until 1992. Walsh and Keach founded a consulting business, International Maritime, Inc., in 1976, and purchased a commercial diving business, Parker Diving. Keach retired from business in 1994, moving to Homosassa, Florida. He became ill with cancer in 1998. His two daughters, mother, and sister were with him when he died.

He won the following Navy awards and decorations:

- The Purple Heart
- Navy Commendation Medal (2)
- The Antarctic Service Medal
- The Legion of Merit

In addition, Captain Keach was elected Fellow of the Explorers Club and a fellow of the Marine Technology Service. He served as a director of many companies and projects associated with maritime operations.■

"GETTING OUT...BECAUSE I'M FROM PHILADELPHIA"

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

The current spate of articles regarding retention, most authored by those who have left the service and characterized as "all the good guys are getting out", recall earlier periods of similar difficulties. They create a sense of deja vu in veterans who know that these are issues more often present than absent over the time span of a career. Probably few years exist in which similar discussions have not appeared in the *Naval Institute Proceedings* and other military-related publications. Almost invariably these essays beg the real issues associated with mature individuals who chose to terminate their service before the service ends its need for them.

The whining for more training, faster spare parts, more honesty from leaders and so forth are neither original nor unique. Readers of *Air Force* and *Army Times* will find similar whimpers associated with those services. The armies of the Hittites and Assyrians probably had like complaints. However, insights from earlier days still obtain. First and foremost of these lessons is that contrary to the claims of the authors of these essays not all the good guys get out regardless of the worst vicissitudes of the service.

Contrasting with this encouraging news, experience indicates there are sound reasons officers leave the service that even the most articulate detailer or eloquent career counselor cannot answer or overcome. When presented with one of these, captains and career counselors should yield gracefully and not waste energy in further attempts to encourage continued service. In their absence, the real motivation of the departing sailor or marine remains unclear—perhaps to the person leaving as well.

The first of these descriptive statements is "I hate this **expletive* outfit". Not everyone comes to the service with an expectation that they will enjoy their work. Even many of those who do enjoy service life find some conditions intolerable. The separation from family, the lack of regular hours, the routine sleep deprivation at sea, the endless demands for perfection, the exercise of authority by people seen as immature, irresponsible or stupid are irritants that

for many overwhelm any enthusiasm or enjoyment of Navy life. Those who cannot or will not adjust are perfectly correct in seeking other vocations.

Associated but separate from the first is the recognition that "...my wife says it's her or the Navy." If the difficulties of the service outlined above weigh heavily on some, these and associated additional burdens lay even more heavily on the spouses and children left ashore. Six-month deployments are hard on individuals and relationships. Not every family can sustain itself in these circumstances. While in many cases the relationship between a couple has problems much deeper than those which can be solved by ending naval service, those in this bight have to take whatever step might ameliorate the danger to their marriage.

"I want to make a lot of money" is the third unanswerable argument. Money is not the coin of the realm in the Navy. For those individuals whose life goals include more than modest and steady economic gains, or who view the conditions of a career as genteel poverty and unacceptable, separation is necessary to pursue richer economic goals than is possible in the service. Opportunities to amass fortunes, large or small, in the Navy are possible only through marriage or inheritance. Because *money grubbing* is not entirely acceptable in the service culture, only those who possess great candor usually admit this motive.

A subset of the get rich motivation is "I have a unique opportunity which will not come again". This is not as ironclad as the other reasons and ought to be plumbed in order to determine how valid is the opportunity. The opportunity is not always economic. Sailors leave to serve as missionaries, to return to higher education interrupted for economic necessity or lack of interest, or to take over the family farm even though that may mean a hardscrabble existence.

Finally is the person who reports his reason for departure is that "...I am from Philadelphia." It may be another place though the author has never found one as regularly cited as the City of Brotherly Love. This report is short hand for a need to return to the home of one's ancestors, where the new residence will be around the corner from the parent's home, in the same parish as the

uncles and grandparents, and where children will attend the same school as the three generations before them. No amount of cajoling or praise of the life of travel, service or adventure will lure this person out of Philadelphia, i.e. from the bosom of his family. He may have been educated out of town, traveled widely, adopted cosmopolitan airs, but he has not disentangled himself from the very strong bonds of love and fealty which bind him to a locale and a familial group.

Presented with any of these reasons, the best course of action for even the most energetic Captain dedicated to shipping over everyone in his command is to wish the young person well, thank him or her for their service and turn one's resources to re-enlisting or retaining more likely candidates. This not only makes the departure from ship's company more comfortable for all but properly indicates the country's appreciation for the person's efforts—particularly if the person has served exceptionally ably—and leaves a good feeling in the individual.

If none of these reasons fit, the motivation for departing may be unclear or unsure or immature or all three. Those leaving the service for reasons other than these four would do well to examine their motivation. If one of these shoes doesn't fit, any other probably won't either.■

Jerry Holland enjoyed even his Plebe Year, has a patient wife who on occasion wondered if it wasn't time for him to go to sea, was too old to get responsibility pay or a nuclear bonus, and was raised in Iowa.

(Editor's Note: Jerry Holland is a submarine officer who served in several attack submarines, commanded one and was Commodore of an SSN squadron. He retired as a Rear Admiral.)

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WWII SUBMARINE VETERANS MEMORIAL SERVICE

by RADM Arleigh Campbell, USN(Ret.)
November 3, 2000
Kings Bay, Georgia

Admiral Fluckey, friends of submariners, submariners.

I am very proud and pleased to be here today as we remember the history of the US Navy's submarine service and honor submariners. Thank you, particularly Dana Raley, for the opportunity to address you today.

It is hard to believe it has been over eleven years since I had the pleasure of forming Submarine Group 10 here and more than ten years since I left that assignment. Ten years passes so quickly, but we are here to remember one hundred years of submarine history in our Navy.

While I will dwell on those one hundred years, it would be wrong not to mention some very real submariners who served well and died in the service of their country, a part of which we stand in today. Their service preceded the establishment of our Submarine Force in 1900 by more than thirty-five years. Of course, I allude to the gallant men of the CSA's HUNLEY. It is somehow fitting that this ship was finally raised from the depths of Charleston Harbor during this our centennial year.

In many ways that ship, while small and unsophisticated by today's standards, was not deficient in many areas that have always marked our Submarine Force; dedication, service, gallantry, and just plain old heroism! I do not think it inappropriate at this time to salute them....they, too are a part of our great heritage.

How does one begin to give the adequate due to the 100 years of submarine service to this great nation in a short speech? That answer is easy...one doesn't; one can only hit a few highlights realizing that much gets left unsaid that merits coverage and many who deserve mention don't get even one word of acknowledgment. I hope that these apparent slights are never interpreted as being due to lesser service or service of less importance....nothing could be further from the truth. In my estimation, all who have served in our Submarine Force deserve mention, all are heroes to me; all of

them from those lost in CSS HUNLEY to those currently serving alongside my son-in-law, Lieutenant Commander Oliver T. Lewis, Engineer Officer of USS PITTSBURGH (SSN720), now on deployment.

One obvious way to try to put some perspective on our service is to divide the past one hundred years into significant bits that provide a reasoned theme. Many could do this better than I, but here is my outline for today:

1900-1940	Our learning and formative years
1941-1946	The years of heroes, the years of finding our service's soul
1947-1959	Post W.W.II, Cold War stirrings, Technological advances
1960-1989	The Cold War, Nuclear Years
1990-2000	Post Cold War, Draw Down and Over Commitment

Our Learning and Formative Years

...Or the *early years* spoken about so eloquently by Admiral William Crowe at the Naval Submarine League Symposium this past June. I would commend his speech to you if you have not read it. A copy of his text can be found in the July 2000 **SUBMARINE REVIEW**.

He stated that the story of our Submarine Force during this period is "not a well known story, but it is an amazing one".

While other nations were starting to dabble in the submarine realm, it took two brilliant inventors in the U.S. to get us going. We owe much to J.P. Holland and Simon Lake. SS-1 was the HOLLAND, and we bought her in 1900. At 53 feet in length, 10 feet in diameter and a 63 ton displacement, powered by a 45 hp gasoline motor and having a test depth of 75 feet, it is no wonder she struck no fear in the eyes of the Navy's leadership of the day. But some of those bred to battleship greatness, particularly the hero of Manila Bay, Admiral George Dewey, then head of the General Board, threw his weight behind the purchase of SS-1. His involvement was the start of what I call the submarine family concept. We all have submarine families, those who were and are closest to us

and with whom our lives are forever entwined. Let's look at this particular one...and call it the Dewey-Caldwell branch of the family. The first CO of HOLLAND was Lieutenant H.H. Caldwell, a former aide to Admiral Dewey. His son graduated from the Naval Academy in 1944 and served in submarines in WWII and the Cold War retiring as a Captain.

With the coming of manned, heavier than air flight and its' impact upon warfare, it was hard in those early years for submarines to generate much interest and therefore money. But farsighted individuals like Frank Cable and L.Y. Spear kept our Force at the technological forefront, thus allowing our active duty submarines to start becoming a viable part of the fleet. We learned to operate these early boats, which we know as the letter classes. Operating and fighting are two separate things, however, and it took a later generation to learn to effectively *fight* our submarines. So the real history of these first 40 years was its' people...isn't that always the case? Admiral Crowe continued that "It took time to build a corps of people who were knowledgeable and dedicated advocates. They didn't fully understand the future potential of their boats, but they were enthusiastic believers."

Let's look at some of them. Ensign Chester Nimitz took command of C-5 in 1910, this was the first of his five submarine commands. Charles Lockwood commanded eight different submarines including a captured German U-boat. Other names leap from the pages of this period in submarining; English, David Taylor, Denfield and more.

Our actual participation in W.W.I was nothing to write home about, however. We sent about 20 boats to Ireland and the Azores to assist the Royal Navy in Harbor defense. But, German U-boat successes in that war woke up many to the potential of submarines and stimulated the entire community.

In 1925 Captain Ernest J. King took command of Sub Base, New London. This assignment gave him a real appreciation of the potential in the boats. This stood the Force in good stead in 1941. He even recommended a special service device for qualified submariners. The dolphins we so proudly wear today was the result. We know that there was some design help from Admiral

Nimitz.

We learned many things the hard way during this period, suffering 13 major accidents resulting in 146 casualties by 1927.

At the end of this segment of our history, in 1939, the year of my birth, we experienced the SQUALUS sinking and the saving of many lives through the personal efforts and inventions of Swede Momson. Wasn't it wonderful and fitting that less than two months ago it was announced that a new Arleigh Burke Aegis destroyer is to be named in his honor? Fitting, if somewhat tardy recognition to this great submariner!

The Years of Heroes and Finding Our Souls

It is altogether fitting and proper that more has been written and said about this period of just five years in our history than all of the other 95 years combined. As a Force and a brotherhood these were our defining times. You who participated during that time have been and always will be my heroes, collectively and individually. But my praise is somewhat shallow when compared to that of others, so let me pause here and quote to you some of what others have said of your service during this very difficult crucible of war and advancement.

At the recent Naval Submarine League Symposium, Admiral Bill Smith paid respects to al WWII submariners. In his remarks, Admiral Crowe noted this and praised Admiral Smith's words by saying and I quote: "I found it a gripping moment. My generation came into the boats just as the golden age ended. We worshipped those men who had brought the submarine into the front line. They fashioned new and suitable strategies and tactics for the underseas force and proved that it could harass an enemy thousands of miles from our own shores. Their remarkable war record is well know to this audience and it certainly speaks for itself".

Let's pause here to remind ourselves just what is it that speaks foritself? It must be something quite extraordinary to do that. While these facts and figures are well known to you, they bear repeating again.

- Ships sunk 1,314 which equates to a percentage of enemy ships lost of

	55 percent
• Tonnage credited	5,3000,000
• Submarines lost	52, a casualty rate the highest of any part of any U.S. service in the war
• Submariners who served	16,000, just 2 percent of the Navy
• Submariners lost	3,506
• Medals of Honor awarded	7
• Heroes serving with courage	16,000

How can I say 16,000....that's all that served. Let me quote the Captain of the USS TIRANTE, himself one of the 7 Congressional Medal of Honor winners, about the action that earned that singular honor. At the ceremony at the White House where President Harry Truman hung the medal around George Street's neck, the captain allowed that the Presidential Unit Commendation given to TIRANTE for the same action was more important and meant more to him as it was awarded to the whole crew. Let me quote him exactly: "Every man of that ship's company was there, all the way, and all of them have the right to share in the awards, too". I know similar thoughts went through the minds of all of our WWII skippers. No captain at sea does it on his own, he relies totally on the dedication, expertise and hard work of his crew. And believe me I personally know this to be true. All share everything in submarines from the output of the galley, to the air breathed, to the very results of every patrol and action.

Captain George Levick Street III, whose first patrol on TIRANTE was so successful as to earn this award at a time when 70 percent of submarine patrols were failing to sink a single ship (there weren't that many left), passed away this year. A great loss to our community, but so fitting that he went on eternal patrol during our centennial year. I was fortunate to have met Captain Street at a submarine birthday ball in Groton in the early 1960s when I was a junior officer on my first submarine, USS THEODORE ROOSEVELT (SSBN600).

Admiral Gene Fluckey, author of Thunder Below and whom we

honor later today with the naming of the headquarters building here at Kings Bay in his honor, was the head of the Electrical Engineering Department during my time at the U.S. Naval Academy. Admiral Lawson P. (Red) Ramage was our Flotilla Commander in New London during the early '60s and I had several conversations with him about his ham radio pursuits much later in my career, when I headed the Naval Telecommunications Command.

Who hasn't marveled at the exploits of Admiral Dickie O'Kane, for whom another Aegis destroyer is named, as related in his books, Clear the Bridge and WAHOO.

I met them all and was awe struck by their presence and their down to earth demeanor. I'm sure that if I could have had the honor of meeting Cromwell, Dealey and Gilmore, I would have felt the same way.

A wonderful article about the passing of Captain Street can be found in the July 2000 *U.S. Naval Institute Proceedings*.

Others have had things to say about the service of WWII submariners:

Historian Theodore Roscoe wrote that "He who lived by the Samurai Sword, died by the submarine torpedo...the atomic bomb was the funeral pyre of an enemy who had already been drowned." From Fleet Admiral Chester Nimitz: "We shall never forget that it was our submariners that held the line against the enemy while our fleets replaced losses and repaired wounds."

Clay Blair simply called that period "SILENT VICTORY"

It would be wonderful to have the time to recount many tales of WWII submarine daring-do. I have read so many books and articles about these exploits. All are worthy of retelling here. But time does not permit such an exercise. Let me close this era by just saying that I have been blessed to have gotten to know so many WWII submariners over the years. Each has made a lasting impression on me and aided and inspired me in my career in the boats. You are a wonderful group and I salute you collectively and individually. Thank you for your service during our nation's time of great need. I would like to close this period by reading a poem. I do not usually care for poetry, but this one written by one from a following generation to the WWII generation and lifted from the pages of your own excellent publication, *Polaris*, bears reading

now as it well expresses the feeling of we submariners who follow in your wake.

WE KNOW by John Chaffey

Your numbers are dwindling,
but before you go.
Every sailor wearing dolphins,
wants you to know.
That you have passed down a heritage,
of honor and pride.
We know of the boats,
and submariners who died.
We know of the deeds,
of you World War II men.
We know of the bravery,
in the Combat Patrol Pin.
We know you endured,
the "gut wrenching" fears.
We know of your courage,
We know of your tears.
We know the meaning,
to the tolling of the bell.
We know you have spent,
your time in hell.
When we travel to Groton,
to visit the wall.
We promise to walk softly,
we promise to stand tall.
So when your final orders are cut,
and you slip out to sea.
Remember this shipmates,
we will not forget thee.

Post WWII, Cold War Stirrings, Technology and Advances

While much can be said about this period in our history, let me

fall back on a few recent quotes by a couple of friends, ship mates and contemporaries of mine. Admiral Skip Bowman, current head of Naval Reactors and Admiral Rich Mies, current Commander in Chief, US Strategic Command.

When asked in an interview recently what stands out in your mind as the most significant aspect of the Submarine Force's 100 years, Bowman said "A century is a long time. Certainly on the technology side, there have been some amazing achievements. The advent of nuclear power and all of Admiral Rickover's work ranks number one in my mind, but the submarine launched ballistic missile, the submarine launched cruise missile and even more mundane areas like improvement in sensors and antenna capability are all impressive developments.

But rather than the hardware, the most impressive thing to me over the past 100 years has to do with the submariner's culture of adaptation. This *can do* spirit is an ability to respond to the world situation with new technology to accomplish new missions."

Admiral Mies stated in a talk at the recent Naval Submarine League Symposium that "at the end of WWII, a second transformation took place. As the Navy downsized, the Submarine Force was in enormous turmoil. Many aviators and surface sailors thought the Submarine Force no longer had a mission. Once again, our submarine leaders had to reinvent themselves. They made an historic decision to pursue an anti-submarine warfare role. Why did they do that? What gave our predecessors the foresight and courage to undertake ASW against an emerging Soviet submarine threat? After all, there were no significant submerged sub-on-sub encounters during World War II. Why not exploit the successes of the war and continue to pursue anti-shipping as their main focus? I suspect that is because we were an island nation with huge dependence on our sea lanes for commerce, the threat posed by a potential enemy's Submarine Force was considerable. Once again they succeeded." Succeeded in making the correct decision that is. We will see in the next era just how important that decision was.

The Cold War, Nuclear Years

I reported to my first submarine in April of 1963. Two days later

we lost USS THRESHER and 129 brave souls. Some of them were my U.S. Naval Academy, Nuclear Power School, Prototype and Submarine School classmates. We were in the midst of the largest expansion of the Submarine Force since the early '40s. I lived and served as a full time submariner throughout this period and if allowed to ramble on I could say much about this time, a time when we once commissioned 12 FBM submarines in one year, built 41 of them in just 7 1/2 years, lost USS SCORPION and another room mate of mine and won the longest, most potentially devastating war in the history of mankind. Instead, let me give you just a few quotes that encapsulate the era.

Of this period, Admiral Mies said "There are many symbolic parallels between our submarine operations in World War II and those of the Cold War. Considering their size, the valiant submariners were probably the most highly decorated Force of that war....7 Congressional Medals of Honor, countless Silver Stars, 49 Presidential Unit Commendations, 53 Navy Unit Commendations...the list goes on. And I would venture a guess that submariners of the Cold War years are the most highly decorated Force of the peacetime era."

While I would disagree that it was a very peaceful era, I would agree that submariners were recognized significantly for their service during this time. The popular book Blind Man's Bluff has a listing of unit awards given to submarines and submariners during those years that is most impressive. The individual awards that were earned during this same time is too exhaustive to be further mentioned.

Right here in Kings Bay, General Colin Powell, Chairman of the Joint Chiefs had this to say about submariner's of this era. "The Cold War was won especially by American's blue and gold crews manning America's nuclear powered ballistic submarine fleet...no one...has done more to prevent conflict...no one has made a greater sacrifice for the cause of peace...than America's proud missile submarine family. You stand tall among all our heroes of the Cold War.

During that era, submariners served in both fleet ballistic missile submarines and fast attack submarines. Our ability to hold the

Soviet's under our missile gun from an undetected vantage point while at the same time holding their Submarine Force in our SSN torpedo sights finally convinced them of the folly of challenging the freedoms we hold so dear with the corrupt system that communism and socialism uses to destroy its' own people and their will to succeed.

Post Cold War, Draw Down, Over Commitment

So what of our most recent decade of submarine service to the nation?

Well, we have once again had to redefine our missions. ASW faded somewhat to be replaced by near shore surveillance, Tomahawk land attack, seal team insertion, active response and forward presence where ever and whenever needed. Of course, strategic deterrence remains a high priority as exemplified by the wonderfully capable Trident submarines this base and one at Bangor, Washington were built around. You can be sure that whatever the need in the future by our nation, our Submarine Force will stand alert and ready to fulfill it. Provided, of course, that our nation supports our military and Submarine Force. A resolution in Congress on 19 November 1999 commended us on our Centennial, BUT this current and thankfully soon to be completed administration has asked much of our Submarine Force and all of our greatly depleted armed services. But has it supported them? I leave that to each of you to decide for yourself. As for me, I find this administration has over committed our forces and over taxed our troops, while at the same time both underfunding and what is even worse, under appreciating them. I trust that you all will work to remedy this as we all go to the polls next week.

Let me conclude with a few more appropriate words from Admiral Bill Crowe: "Put simply, over the last century, American's submariners have risked, served, fought and on occasion died so that Americans might have a safer and freer life. In the process, they have given a full measure to the Navy, the nation and the free world. I can think of no higher price."

May God bless you all, God bless our current submariners and God bless these United States of America.■

AN ODE TO LUM

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

The Submarine Force has never had a shortage of heros. There have been the bona-fide wartime variety, the Fluckeys, O'Kanes and Gilmores, and the peacetime versions, whose immediate impact was less dramatic, but no less worthy of respect—Rickover, Wilkinson, Beach and so on and so on. In fact, if the measure of a hero is what he accomplishes, the Submarine Force was pumping them out by the gross during the sixties and early seventies—enough to, a decade or so later, virtually control the Navy.

In the Fall of '61, as an Ensign and brand new product of the experimental *direct input* program, I found myself reporting aboard SCORPION (arrogant and largely unmotivated) fifteen minutes before she left post-shakedown availability at EB enroute to being the first SSN in Norfolk. As I met the other officers in the Wardroom, Lieutenant Holland was glad to see me, since he had been *George* on his destroyer, and his diesel boat, and was still so on SCORPION. "Call me Jerry", he said, which I still find hard to do; Lieutenant Fountain said "Call me Bob", and Lieutenant Commander Carr, the XO, introduced himself as Ken. The other officers followed suit except for Lieutenant Commander Lumsden, the 3rd—"I'm Lieutenant Commander Richard E. Lumsden—my first name is Sir". A hulking and physically powerful bear of a man, I was soon to find out that he tried hard to be scary, but really was a softy with a heart of gold.

The SCORPION wardroom then was an intellectually intimidating crowd, with the likes of Holland, Fountain, Carr, Baciocco, and Shaffer either there or having just left, and was to soon become even more so as Trost and Kaufman shortly reported in—at least 21 stars came out of that bunch. Lum was sometimes the brunt of an observation that he was the only one there from the *bottom half* of his class—USNA '52—famous for having, to a man, stepped out of their shoes and marched off in socks at their final June Week Graduation P-rade. Starting with Lum, however, and reinforced

through the next few decades was a personal observation that any nuclear submariner had already been pre-certified as *smart enough*. Some of the greatest failures observed were those who thought that sheer *intelligence* was all that it took—as if being the fattest in the crowd would make one the best Sumo wrestler.

Like any other *trade-school* product, I had been force-fed concepts of leadership and responsibility until they ran out of my ears, but they hadn't necessarily *taken*. Serving with that crowd, particularly *Lum*, for the next 13 months made them all very real. As 3rd, Lum was the Navigator—a job that took only 2 hours a day as long as one realized that meant 5 minutes each and every hour. The Dead Reckoning Analyzer Indicator position (DRAI), then an electro-mechanical device which used EM log speed and gyro heading to calculate (exclusive of set and drift), was his exclusive domain. No one *reset* it but him, and to watch the mental and emotional investment he made, after poring over such as LORAN ALFA or shaky visual fixes on a foreign shore, was a study in applied appreciation of not just responsibility, but the next step, accountability. He also tried, but failed, to portray that same hard and gruff exterior towards his troops. They too saw through it, loved him as a leader, served him well and knew that whatever flak they might take on some leave or special request chit, he would invariably approve it.

The relationship soon took on all of the characteristics of a *good* Plebe versus Firstie situation. He would *rag* on me, and, with obvious feigned obsequiousness, I would get my *shots* back in return. While the cut-throat Bridge others in the wardroom played wasn't Lum's forte, he was eager to learn cribbage. Lum would *order* me to play with him, and I'd do that "...only if I get to take the points you miss, Sir". When he would count his hand and reach for the pegs, I'd reach for mine—"Wait a minute..." he'd say, and count them again—"Right?" he'd demand. "Take whatever you think is right, Sir" his very junior subordinate would respond, getting an ursine scowl in return.

Shortly after arriving in Norfolk, SCORPION was sent to drydock in Newport News to have her shaft replaced, another 588 class having literally *twisted it off* during an Emergency Back bell on the surface. Lum's strong advice to an unqualified JO was to

tour the drydock and study the ship from the bottom while it was on the blocks. One needed a *hardhat* to go into the dock, however, so I asked Lum if I could borrow his—a treasured artifact from new construction emblazoned with a metal naval officer's device. Anxious to get this task over with, I went scurrying up a ladder near the stern only to literally *crash* into the bottom of an immovable stern plane and (you guessed it) split the hard hat in two. He wasn't happy about that. However, the lesson I learned then about moving slowly and carefully in the dangerous shipyard environment served me well in five subsequent new constructions or refueling overhauls, and was well worth the pointed *advice* Lum gave me that night.

Commander Buzz Bessac had been the SCORPION commissioning and my first CO. He loved to be argued with, especially by the really junior officers. It was a very effective training technique, since there is great merit in not only hearing the right answer, but also being first encouraged to fully articulate a wrong one. Halfway through my 13 month tour, Buzz was relieved by Commander Yogi Kaufman. Now naturally assuming that all COs liked to be argued with, I continued to do that. It was years after I had left the ship that I realized what a *flak shield* Lum had been when he was called to the COs stateroom for 30 minutes or so after one of my "Captain, that's the dumbest thing I've ever heard ..." outbursts. His advice after one of these sessions (which went right over my head at the time) was "Patton, aren't you ever going to learn to keep your mouth shut?" In spite of everything, Lum, Yogi and I all survived these events, and I now consider it a great honor that Yogi and I are great friends, and that he considers me a (perhaps imperfectly done) *Kaufman-trained* person.

Lum didn't stop being a colorful and lovable character upon leaving SCORPION. While XO on a Holy Loch deployed SSBN whose crew had just been relieved, for several days he checked at the local air base about why the USAF MAC flight couldn't fly his crew home to Charleston. The answer was that "...this front, or that front, the weather...", and so on. His, perhaps irreverent, quotable quote in classic North Carolinian was "...Jesus Christ, for the sake of the Air Force, I sure hope that the Great War starts on

a fair day."

Lum commanded JAMES MADISON in the late '60s. After I reluctantly took my engineer's exam, and by then having realized that it's not the ship that's important but its skipper, I asked that I be sent there. BuPers instead decided that it would be nicer if I were the Engineer of DANIEL WEBSTER for a decontamination/refueling overhaul—thanks, BuPers—what fun! The story that emerged during my purgatory was that Lum was underway from Charleston on the first ever SSBN ORSE reexam (it was tense—the JCS were reportedly concerned about a few days of *missed* target coverage). During maneuvering watches on the treacherous Cooper River, Lum liked to sit on a partially raised VLF mast. In any case, outbound, with the first head of the ORSE, then Captain, now Admiral(Ret.) Paul Early on the bridge, Lum told essentially the following:

> "All of a sudden, everything started falling out below me. The VLF mast was untypically being raised as part of the rig for dive checks. Paul Early was looking up as if to say 'so this is an indication of your onboard control of events'. Knowing I had to somehow salvage the situation, I waited till the mast was fully raised, took a sweep downstream with my binoculars, then looked at the OOD, said 'very well, channel clear, lower me to the mark'. Being a sharp officer, he calmly rogered the order, forwarded it to control, and a few seconds later Early and I are staring each other down (VLF loop now at the original 2 or so feet) with my unspoken message being 'doesn't everyone take this additional safety precaution?', and his being 'you've got to be s---ing me!'. Early then went below and we passed the reexam".

I never got to serve with Lum again, but we stayed in touch. Once I was in a men's store and saw a rack of *clan* tartan ties. One was Lumsden—I sent it to him.

Promising to be the last (of too many to tell here) Lum stories, it is one that doesn't involve he and I, but he and my youngest son. In 1994, just after graduating from college and committed to

starting three Peace Corps years in Paraguay that Fall, he conned me into *secretly* (my wife would have killed me) underwriting the purchase of a used Honda motorcycle with which to conduct an *unstructured* tour of the U.S. He left armed with a hundred or more addresses and phone numbers of relatives and friends across the country, but a few days out, calling from a Buddhist rest camp in South Carolina, he asked if I knew anyone in North Carolina, where he was headed the next day. I told him to check the phone book for a *Lumsden, Richard* in Raleigh.

After a few days, Lum called and related how he thought I had really been a handful, but that youngest son had outdone me, calling to say "I'm Jim Patton, Jim Patton's son, can I come use your shower?" In any case, Lum and I had a great conversation—he gave me a blow by blow description of the cribbage games he and the younger had played, and we traded a few reminiscence, sea stories and lies.

Two weeks after that call, Lum's daughter called. "My father died last night", she informed me. Stunned, I managed to mumble my sincere regrets and sorrow. "Thank you", she said, "...but I really wanted to tell you just how much your son's visit meant to him. Dad knew he was dying for the last year, and honestly, hadn't been too much fun to be around. For the last two weeks he was his old self—joking and outrageous—please thank your son for all of us here when he gets back from his trip."

I couldn't make it to the funeral, but Lum endures as one of a very select group of my personal submarine heros. He taught me a dimension of the submarine profession impossible to cover in the curricula offered by the Naval Academy, Nuclear Power School or the Naval Reactors/Type Commander's PCO courses. Unlike some other more *brilliant* people I served with, there was not an iota of arrogance behind his pseudo-gruff exterior—he was a careful and consummate professional with that essential degree of humility necessary in a true leader. I miss him, and only hope that a small degree of his professional excellence and sincere humanitarian concerns were passed on during my brief opportunity to influence others.■

E-MAIL ADDRESSES

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

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LETTERS

FROM A LITERARY AWARD WINNER

17 October 2000

Dear Vice Admiral Cooper:

I can honestly say that I was in a state of disbelief when I was told that I was awarded the Active Duty Literary Award at the Annual Symposium. In any case, I am honored that the Naval Submarine League recognized my essay; I feel strongly about the state of information technology onboard current and future submarines and I wanted to share those feelings.

I recognize that there will be many future discussions in this area and I hope that my essay is able to further the dialogue. I have noticed that it has received some response in your quarterly publication.

In my opinion, the Naval Submarine League is doing superb work in expanding the horizons of junior officers; however, there is still a long way to go. I truly enjoy **THE SUBMARINE REVIEW**, especially the articles from the junior officers—the more articles we receive from young officers the better our future Submarine Force will be.

Best wishes for the continued success of the NSL.

Very Respectfully,
T.R. Buchanan

REQUEST FOR INFO RE: VADM LOCKWOOD

I am starting a project about Vice Admiral Charles A. Lockwood, COMSUBPAC and am seeking information about the admiral during World War II. I am especially interested in personal reminiscences, and would also like to contact surviving members of Lockwood's wartime staff. Steven T. Smith, 2109 Lombard Street, Philadelphia, PA 19146; tel: 214-985-4541; e-mail; stscam-@bellatlantic.net. Thank you very much.

Sincerely,
Steven T. Smith

BOOK REVIEW

UNDER ICE: THE STORY OF WALDO LYON AND THE DEVELOPMENT OF THE UNDER ICE SUBMARINE

by William M. Leary
Texas A&M University Military History Series, 1999
ISBN 0-89096-845-4
Reviewed by CAPT T.F. Davis, USN(Ret.)

Under Ice is a story of the life's work of Dr. Waldo Lyon as told to the author through interviews with Dr. Lyon and through the copious notes compiled throughout his scientific endeavors. Woven into the story of Waldo is the story of the Under Ice Program, instigated and guided by him, which gave the U.S. Submarine Force an operational under ice capability.

The author whets our appetites with an excellent history of early Arctic exploration and then leads into Waldo's early life as a student at UCLA during the Great Depression, his marriage to Virginia Bakus, and his continuing education which resulted in his Ph.D. During this time, Waldo was associated with professors and scientists, working in varied fields such as radar, acoustics, and spectroscopy. War was just around the corner and it was very prophetic that Waldo became involved with several Navy Labs in the San Diego area and eventually elected to follow that route rather than accept an offer to become a physics professor at UCLA.

December 7, 1941 gave the scientific community at Navy Labs, myriad challenges. Waldo soon became involved in ASW and worked closely with Canadian scientists in the British Columbia waters. His nomadic life was forming and he managed to include his family in some spectacular junkets into the Canadian Northwest. Along with mosquito bites, were *Ice Bug* bites and Waldo's future was formed.

The real story of Under Ice begins with Waldo's desire to understand the frozen North in the event the Navy had to extend its influence into the Arctic. He was determined to go to the ice pack and find out what problems had to be solved in order for ships to operate in the ice environment. He even went to the Antarctic to experience the differences or similarities between the two poles. After considerable excursions into the fringe ice he realized that surface ships lent little comfort in an ice floe and that a submarine

would be a more *user friendly* vehicle in which to continue his research and finally conquer the North Pole.

Waldo Lyon was a visionary and after his first voyage in a nuclear sub, he realized that the vast expanses of the arctic belonged to submarines and that it was up to submariners to conquer, tame, and rule, only they could live under the ice and therefore survey the topography and study the Arctic's changing moods and its fickle character. Even though Waldo's thoughts were those of a true scientist, he was able to grasp the military advantages and consequence of conquering the Top-of-the-World. His goal was to see a fleet of nuclear submarines, equipped to operate in and out of the ice canopy, safely, efficiently, and routinely. Waldo was "The Advisor" aboard all the early submarines that ventured under the ice, but his goal was to train the submarine crews to become independent through experience and knowledge.

Need I say that there were people in high places, wearing Navy uniforms, who did not share his enthusiasm? Some did, and author Leary pointed out that Waldo's Under Ice Program was like all other Navy programs in that personalities, budget constraints, and operational commitments wreak havoc with the best of efforts.

Waldo had his good years and his bad years depending on the personalities of the Submarine Fleet Commanders. The problems he faced in a peacetime Navy were great and when things looked most discouraging for Waldo's program, Admiral Rickover delivered NAUTILUS, the Russians delivered Sputnik, and President Eisenhower sent NAUTILUS under the ice to transit the North Pole. Politics be damned, the Under Ice Program was back on track and the nuclear submarine saved the day.

After NAUTILUS transited the Pole, SKATE, SARGO, and SEADRAGON paved the way for development of a truly capable under ice submarine. Readers of **THE SUBMARINE REVIEW** will recognize the submariners who played important roles in the Under Ice saga. Many are mentioned and all became well known to the Submarine Force. The author, in order to write a true and exciting book, used all of Waldo's notes, as well as those of the submarine commanders, contained in their detailed trip reports.

Books written by SKATE's Commanding Office, Jim Calvert, and SEADRAGON's George Steele, provided author Leary with breathtaking events to which he devotes entire chapters. SARGO's winter transit of the Bering Strait, with Jack Nicholson in com-

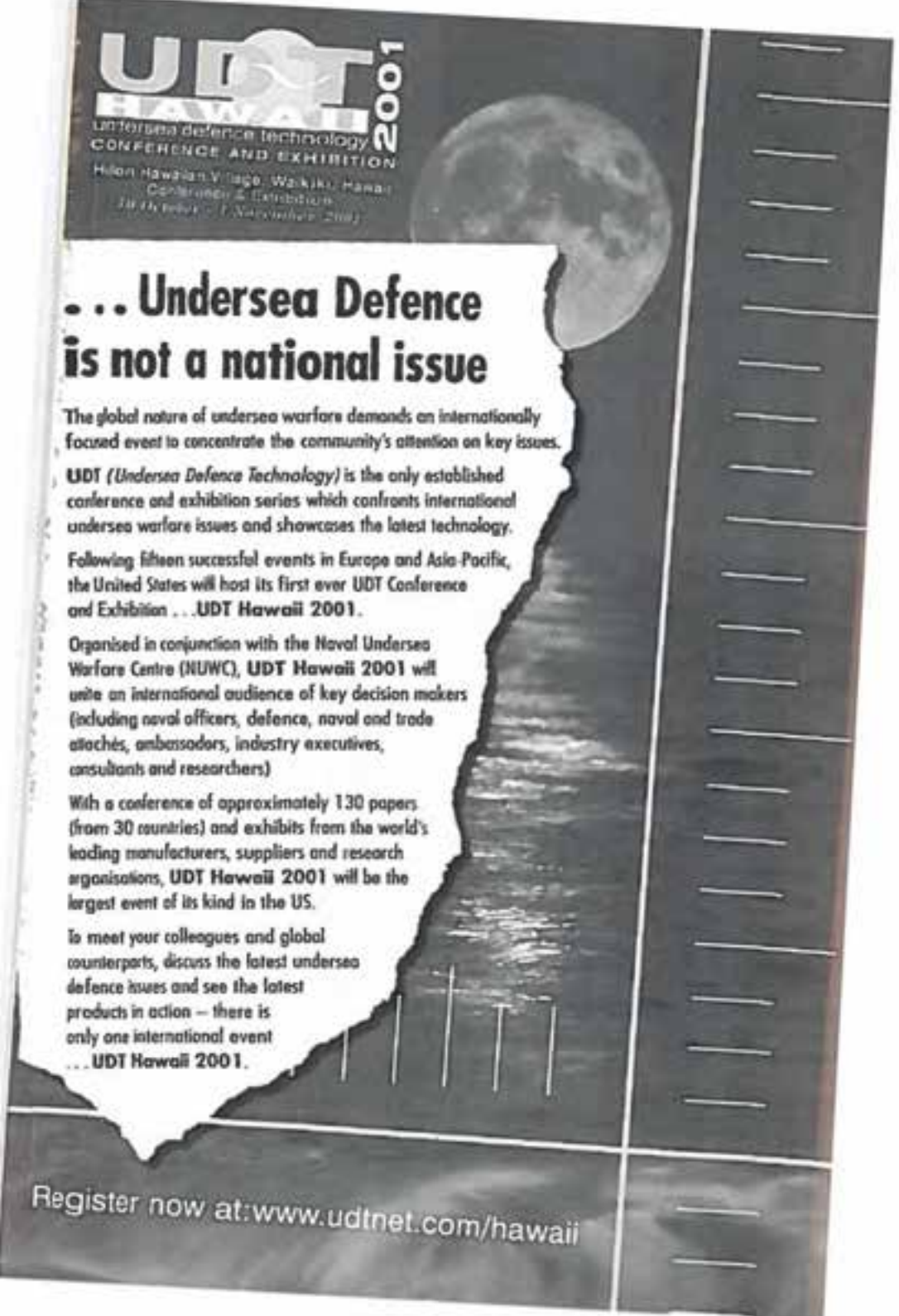
mand, fills another spine tingling chapter. This transit, deep into the frozen waters of the Bering Strait, through canyons of ice within a few feet of the top of the sail and the ocean bottom within a few feet of her keel, created some very tense hours. Mother Nature presented some formidable odds. Those uniformed explorers deserve a lot of credit. They did it their way and came through unscathed, scared to death, but elated at the finish line.

Once those early under ice submariners were operationally competent, and adequately equipped, they turned their attention to under ice fighting, the ultimate goal for Arctic supremacy. Along with the development of tactics came the test and evaluation of weapons—torpedoes. The chapter covering this aspect of our weaponry leaves the reader to wonder how we spent so much money developing such sophisticated weapons that would not work under ice. In fact, one begins to wonder if they work anywhere. Who would have believed that the underside of the ice canopy captures torpedoes and, should they blow a hole in the ice, it refreezes immediately.

At about this time in the calendar of events, Jim Calvert alerted Dr. Lyon that an outstanding officer who had served in SKATE was leaving the Navy and would be of value to Waldo's program. Dick Boyle was hired and became Waldo's man *Friday*. Though now retired, Dick is still actively carrying the torch for the continuance of a submarine capability of which we were once so proud. The new classes of submarines, under construction and on the drawing board, will be capable of deep water Arctic operations, but will have inadequate maneuverability to conduct shallow water operations under ice.

The author has done a remarkable job producing a biography and an historical account of ice exploration, each of which is a tribute to a great scientist. Waldo's ashes lie with his goal, his spirit, and his dreams—at the North Pole.■

Reviewer's Note: As the L. MENDEL RIVERS submarine goes out of commission and the 637 class disappears, we will probably never see another submerged transit of the Bering-Chuckchi Shelf. The Los Angeles, Seawolf, and Virginia classes will not have the low speed maneuverability to operate safely in shallow water under ice.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