THE SUBMARINE REVIEW

JANUARY 1995

A Quarterly Publication of the Naval Submarine League

EDITOR'S COMMENTS

Two of the three feature articles in this issue of **THE SUBMARINE REVIEW** offer a rare insight into the major Executive Branch policy decisions about the future of both the tactical and strategic arms of the U.S. Submarine Force.

The lead is a summary by Vice Admiral Guy Reynolds of the findings and conclusions arrived at by the select committee, which he chaired, that was convened by order of the Secretary of Defense for an independent appraisal of the proposed attack submarine building program. Admiral Reynolds presents his commentary in the form of an issue-by-issue high-level briefing, with a clear outline of the logic supporting each of the committee's specific recommendations.

The second feature is a collection of excerpts from official papers of the Department of Defense, the Senate, and the House of Representatives. The DoD release published the results of the Nuclear Posture Review which set the objective strength of the SSBN force and continued the nuclear weapons capability of the SSN force. The congressional excerpts highlight several of the concerns held by Congress about the SEAWOLF-New SSN building program, and may well presage the lines of the debate that will take place in the near future.

Captain Bill Norris, in the third feature, reports on the deliberations of the Nuclear Posture Review and describes the reasoning behind the number and type of submarines selected. His recounting of the problem caused the Navy by the NPR's decision to retain, and modify, some of the first eight C-4 equipped Trident submarines should be of interest to those who worry about the depth of support within the Navy for the Submarine Force in the coming national decision process.

Preservation of the submarine industrial base, of course, is an issue directly related to the proposed submarine building program. In reporting on that facet of the problem, **THE SUBMARINE REVIEW**, in the October 1994 issue, published the Executive Summary of the study which RAND conducted for the Office of the Secretary of Defense. We greatly regret that in our credits for that important work we inadvertently omitted the names of Captain Marc D. Goldberg, USN and Mr. James Chiesa as study panel members and authors of the report. We apologize for that omission and specifically congratulate them for a very thorough analysis and objective treatment of an extremely important, complex, and sensitive issue.

The World War II 50 year anniversary marked by this issue is of

BARB's Eleventh Patrol, for which the Commanding Officer, then-Commander Eugene B. Fluckey, USN, was awarded the Congressional Medal of Honor. There are many lessons for today's submariners in the story of BARB's Eleventh and for one successful SSN skipper's interpretation of those lessons, as he would make them for his own wardroom, see Commander Englehardt's review of Rear Admiral Fluckey's book Thunder Below in the January 1993 issue of **THE SUBMARINE REVIEW.**

There have been several comments about various articles which have suggested that more could be said about the particular subject if only the **REVIEW** had a dedicated section for continuing discussions. All readers should be assured that their views are valued and we seek their input to a wider understanding of the issues effecting our submarine community. Over the past several years more than one half of the issues have included a **DISCUSSIONS** section and it is the purpose of that section to air opinion, both in its original form and as extensions and rebuttals by others. If an objective case can be made which takes exception to a published opinion, or extrapolates a point from some article either to strengthen that point or make a related one, please take the time to frame the argument and send it to the Editor. Submarine warfare is entering an entirely new phase and no one has all the answers; we cannot afford to miss any element that should be considered.

Jim Hay

THE SUBMARINE REVIEW

THE SUBMARINE REVIEW is a quarterly publication of the Naval Submarine League.

Articles for this publication should be a maximum of about 2500 words. 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. In those instances where the NSL has taken and published an official position or view, specific reference to that fact will accompany the article.

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

FROM THE PRESIDENT

A recent Wall Street Journal article by Thomas E. Ricks featured a warning from Andrew Marshall, Director of the OSD Office of Net Assessment, that long-held military assumptions must be re-examined in light of current mind-boggling leaps in technology. "According to Mr. Marshall, the Information Age will spark a "military revolution", just as artillery did in the 15th century...". [Will the Submarine Force be prepared with high data rate communications?] Several other of his expectations should be of interest to us.

"The ascension of...standoff weapons may blur distinctions among air, land, and sea warfare. For example, the best way to halt an Iraqi tank attack may be not with U.S. tanks but with a submarine launching from 100 miles away "brilliant" missiles that zero in on the sound of Russian-built tank engines." [How about submarine-launched ATACMs?]

"Aircraft carriers also could lose their central role. Because of the proliferation of cruise missiles, ships may be smaller and stealthier [submerged?], yet able to strike farther with ballistic missiles or drone delivery systems. Manned aircraft in the Navy and the Air Force may increasingly be supplanted by such pilotless drones." [How about submarine-controlled UAVs conducting surveillance and providing targeting and bomb damage assessment from over the battlefield?]

As you might imagine, Andy Marshall's views are not universally accepted. The basic message, however, is rather clear: understand and embrace the "military-technology revolution", or run the risk of obsolescence or irrelevance. The Submarine Force should be the beneficiary of such thinking, especially as the concept of war without casualties gains acceptance. It is, however, imperative that decision makers, many of whom are not familiar with submarines, understand military utility, survivability, sustainability, flexibility, mobility, offensive firepower and cost-effectiveness over the life cycle. In fact, *"Forward...From The Sea"* should be spelled *submarine*. [Despite the fact that the word appears only once in the document.]

The value-added from submarines in the Joint Task Force is irrefutable. It is, however, necessary to keep focused on the more immediate problem represented by the fragility of the nuclear submarine industrial base. The very credible RAND National Defense Research Institute Study, *"The U.S. Submarine Produc-*

tion Base", found that based on the limited savings realizable and the substantial risks incurred in any extended production gap scenario, the third SEAWOLF should be funded in 1996 to provide an industrial bridge to the new attack submarine (NSSN) which should be authorized in 1998. Granted, the industrial base argument is not as sexy as roles and missions, but it must not be lost in the debate for resources.

The key questions to be answered should be: is the SSN 23 industrial base justification supported by accurate, complete and reliable data?...what are the threat and force structure requirements for the SSN 23?...and, are there viable alternatives? The thought process must include the Bottom-Up Review decision to maintain two nuclear-capable shipyards, the high cost and risk of shut-down and start-up given Navy plans to start construction of the NSSN in 1998, and the $900+M already authorized and appropriated for the third SEAWOLF.

Given an even playing field, the answers to all of those questions should favor construction of SSN 23.

In sum then, the goal for the upcoming FY 1996 budget is approval of (1) funding to complete SSN 23, (2) funding for research and development for the NSSN, and (3) funding for long lead material for the NSSN. The issues are not separable. It will be a tough battle. Let the games begin!

Bud Kauderer

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NEW ATTACK SUBMARINE (NSSN)

Independent Characteristics Review

Speed, Signature, Payload, Combat Systems, and Cost Trade-offs

NEW ATTACK SUBMARINE INDEPENDENT CHARACTERISTICS REVIEW

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

[Editor's Note: More than 10 years ago the Navy began concept definition for an attack submarine follow-on to the SEAWOLF class. In the early 1990s, the process matured to the point of requesting formal approval for the new attack submarine. After several delays, a NSSN Defense Acquisition Board (DAB) was held on 12 January 994.

Dr. Deutch's DAB decision memorandum requested an outside panel of experts be assembled to review the NSSN's baseline design's ability to perform its military missions from the viewpoint of its major characteristics. In response to that request, Ms. Slatkin, the Assistant Secretary of the Navy (Research, Development and Acquisitions) established the New SSN Independent

Review Group (INRG). The panel members, chosen by Dr. Deutch and Ms. Slatkin were: Stephanie Coulter, Frank Fernandez, David Heebner, Benjamin Huberman, Reuven Leopold, Chester Long, Peter Palermo and William Wegner. The panel was chaired by Vice Admiral J. Guy Reynolds, USN(Ret.).

The findings of that Group resulted in a report to Dr. Deutch, DAB principals and Navy leadership. The following article provides unclassified highlights of that secret report. Material presented in frames are INRG briefing slides with comments by Guy Reynolds.]

Preface

At the 12 January 1994 New Attack Submarine (NSSN) Defense Acquisition Board, Dr. John Deutch acknowledged that a nuclear attack submarine program is vital to our nation's security. He subsequently stated that "it is essential that we have the strongest possible rationale for proposed modernization programs if we are to be successful". In a 24 January 1994 memorandum, Dr. Deutch requested that the Secretary of the Navy undertake three actions to support the NSSN program milestone.

As one of the actions, Dr. Deutch sought the Secretary's assistance in assembling an independent review group to examine the ability of the NSSN design to perform its required military missions. Additionally, the review was to "to provide an independent check that we have asked all the right questions".

Ms. Nora Slatkin, ASN(RDA), appointed an outside group of technical experts to review the NSSN baseline design. That group met for several months starting on 1 March 1994. The group received briefings on every aspect of the NSSN design, including the threat the submarine will likely face and the missions considered appropriate for a nuclear attack submarine. The requirement for affordability caused the group to explore timing and industrial base issues.

In the early stages of the process, the group developed a set of "hard questions" to respond the Dr. Deutch's charge. Those

questions first considered the acceptability of the baseline speed and in turn examined the justification for SEAWOLF acoustic quieting across the NSSN speed range. Additionally, the questions were framed to stimulate "fresh thinking" with respect to traditional versus emerging submarine roles and missions. As a result, vulnerabilities and requirements associated with extended operations in the littoral battlespace were specifically examined. Cost saving trade-offs in speed, payload and combat systems were brought under close scrutiny. Lastly, the review group sought to identify those characteristics that must be established before the Milestone decision in contrast to the parameters that are more suited for definition during preliminary design.

In preparation for the Group's deliberations, I drafted an approach to provide a logical progression though the large volume of information necessary to review the New SSN's characteristics. The approach structured an examination of the projected missions, threat environments and the appropriate portions of the Department's Bottom Up Review.

With the foundation in place, the panel set about examining the specific characteristics as defined for the DAB by the Operational Requirements Document.

Since affordability was the driving motivation behind design tradeoffs, a clear understanding of cost factors and Industrial Base issues was fundamental to panel deliberations.

The briefing to Dr. Deutch focused on the conclusions and recommendations with a significant amount of backup to support the panel's findings including the answers to questions raised about the *New SSN* program during pre-briefs to the DAB membership.

Conclusions - Top Level

- *NSSN program is consistent with Department of Defense objectives (Bottom Up Review)*
  - *-Preserves the Industrial Base*
  - *-Addresses New Mission Requirements*
  - *-Maintains Force Level Options*
  - *-Reduces Cost*
- *There are no Emerging Technologies on the horizon that warrant delay of NSSN*

The panel unanimously found that the *New SSN* program supports expected missions against the projected threat of the 21st century.

The panel devoted a significant amount of time reviewing Emerging Technologies. *Two and a half* days were spent in round table discussions with representatives from ARPA, the Office of Naval Research, and Naval Reactors.

Briefers were requested to categorize their efforts by *level of maturity* and potential for meaningful contribution to submarine performance. They were asked to specify during which time *period (Present to 1998, 1998 to 2005, and 2005 to 2015)* each technology would potentially be available for transition to the start of Engineering and Manufacturing Development.

Many of the technologies examined are exciting and hold promise for the future. However, it was the opinion of the scientists that with one exception, none of the technologies were at a level of maturity that warranted consideration for inclusion in the NSSN design. That one area identified was the Light Weight Wide Aperture Array technology.

The panel concluded that NSSN *program delay* to accommodate emerging technology is not *warranted*. <u>This is one of the key findings of the panel</u>.

Agenda

- ***Conclusions***
  - *-Top Level*
  - ***-Characteristics***
    - *> > Speed* *> > Signature*
    - *> > Payload* *> > Combat Systems*
  - *-Cost Considerations*
    - *> > Lower cost submarine*
    - *> > Industrial Base*
    - *> > Timing/Force Structure*
    - *> > Innovatlive Acquisition Approach*
- *Recommendations*

The panel examined the trade-offs between individual characteristics and the trade-offs between characteristics and cost.

Each characteristic will be discussed individually. However, it is extremely important to recognize the *synergism* between the characteristics. This synergism allows *performance retention* while backing off on *individual* performance characteristics.

Synergism between *speed, acoustic signature and combat system performance* is especially significant. Submarine superiority is dependent upon the establishment of "tactical control" across a wide spectrum of scenarios in varied environmental situations including high speed transit, deep ocean search and operations in shallow water.

NSSN characteristics were examined individually beginning with speed, then moving on to signature, payload and then combat systems. At each step, the synergism between characteristics was reexamined.

Conclusions - Speed

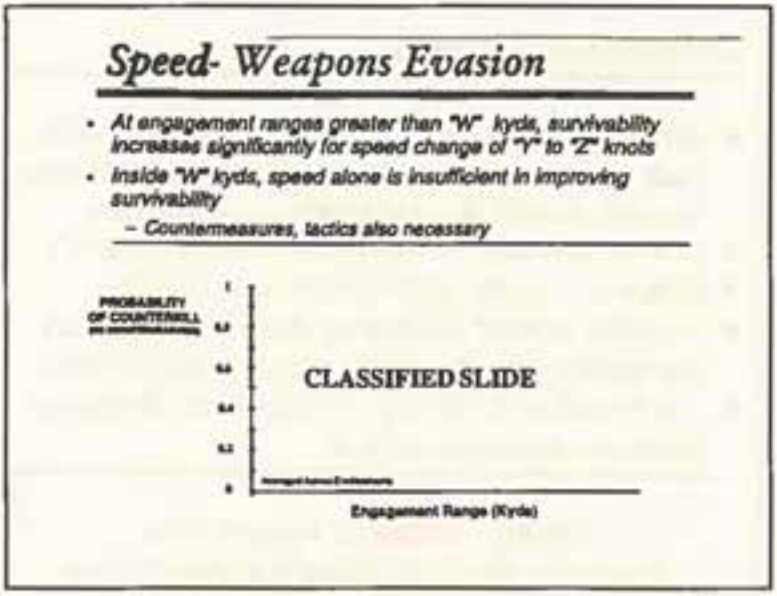
- *Speed is a characteristic that is very difficult to increase once design is established*
  -Must be specified as a design requirment at Milestone I
- *Speed drivers - evasion, mobility, search*
- *Evasion - most discriminating factor*
- *Trading speed for lower cost emphasizes necessity for retaining tactical advantage*
- *-Submarine Quieting ⟷ Combat System/-Sensors balance critical*

Speed Trade-off Acceptable
Maximum Speed ≥ 28 knots is satisfactory

The *New SSN* design trades *speed for cost.*

The strong relationship between *speed* and *shaft horsepower* dominates ship size. Conversely, for a specific shaft horsepower (determined by the maximum speed requirement), the relationship between *speed* and *displacement* provides considerable latitude in ship size. Examination of the facts shows that ship size is a function of the combination of speed, signature (quieting) and payload. It is just not possible to have a small, fast, quiet ship with reasonable payload.

Given the relationships between shaft horsepower and size, and with an understanding that speed is one of the characteristics that must be specified at Milestone I, the review group closely examined the factors that contribute to the selection of maximum speed.



The speed drivers are mobility, search and *evasion*. Of these, *evasion* is the most discriminating characteristic.

This curve describes the *probability of counterkill* during an engagement. By dividing this graph in half, two interesting facts emerge:

- For some engagement ranges evasion speed is not dominant. Details classified.
- For other engagement ranges evasion speed is the most important survivability. Details classified. (In all scenarios a higher evasion speed continues to improve survivability.)

The review group concluded that the trade-off of speed for cost was justified when other factors contributing to maintaining tactical *advantage* are considered.

An understanding of the *synergism* between speed, acoustic signature and combat system performance is necessary to support the conclusion that the trade-off of speed for cost is acceptable. Specifically, by maintaining a platform with SEAWOLF level of acoustic quieting and a complementary combat system, the platform can engage the target at preferred ranges outside "W" kyds, supporting the trade-off in maximum speed for cost.

Conclusions - Submarine Signature 1

- *Acoustic radiated signature is a characteristic that is very difficult to improve once design is established*
  - *-Must be specified as a design requirement at Milestone I*
- *Acoustic quieting is a central characteristic to mission performance and survivability*
- *688I quieting - inadequate against the projected threat*
- *"SEAWOLF quiet" acoustic signature is necessary*
  - *-Supported by threat requirement*
  - *-Justified across NSSN speed range*

"SEAWOLF Quieting" is essential

Signature is addressed in two slides. Like speed, *acoustic signature* is a characteristic that must be specified at Milestone I.

Acoustic quieting is central to total submarine system performance: search, attack and evasion.

688 and 688I class submarines are *limited* by platform noise.

U.S. submarines maintain success in encounters with Russian AKULAs because of the margin provided by *sensors and inboard electronics*.

Early 80s advances in enemy submarines and weapons prompted a dedicated research and development effort that culminated in "SEAWOLF quieting". NSSN is benefiting from that research. Without the advances made in SEAWOLF, it would not be possible to build a NSSN sized submarine with SEAWOLF quieting across the speed profile.

The review group concluded that *SEAWOLF quieting* is an essential characteristic for the NSSN based on the current and projected threat.

The necessity for SEAWOLF quieting is another key finding.

Conclusions - Submarine Signature 2

- *"Stealth" means much more than acoustic quieting*
- *Low frequency active acoustic (LFAA) threat emerging*
- *Littoral operations increase other non-acoustic vulnerabilities*
  - *-Electromagnetic detection; MINE THREAT*
    - *➤Degaussing capability needed (Circuit "D")*
  - *-Radar, Infra-red, visual detection*

Active Target Strength/Non-Acoustic vulnerabilities must be closely examinedin preliminary design

The INRG was charged with examining the ability of the NSSN design to meet its *intended missions*.

Much has changed since the initial round table discussions that framed NSSN attributes. Naval participation in Joint *Near Land* Operations has emerged as an increasingly important *mission*. The worldwide diesel submarine threat continues to grow and the proliferation of technology increases the risk to some combatants.

The inherent covert nature of submarines make them especially well-suited for many *close-in*, hostile area missions.

With littoral operations requirements increasing, the INRG found that more attention must be focused on *exploitable* signature characteristics other than *passive acoustic*.

It is the conclusion of the Review Group that the design features associated with NSSN *active acoustic and non-acoustic signature* require further review during Preliminary Design.

Conclusions - Payload

- ***Internal payload** is a characteristic that is very difficult to alter once design is established*
  - *-Must be specified as a design requirement at Milestone I*
- *Payload traded for lower recurring cost*
  - *-torpedo tubes ⇒smaller ship diameter*
  - *-horizontal stows ⇒smaller displacement*
- *Payload flexibility incorporated in design*
  - *-Reconfigurable weapons room enhances adaptability*
  - *-Hull design/interface facilitates incorporation of future modifications*
  - *-VLS capacity supports expanded strike role*
- *Nuclear weapons capability should be included in design*

Payload Trade-off Acceptable
given vertical launcher system

The NSSN design has *fewer* internal weapon stows than SEAWOLF. This characteristic coupled with a reduction to four 21 inch torpedo tubes had allowed a significant decrease in the size and cost of NSSN.

The review group examined the weapon demands needed to support the projected NSSN missions.

The panel considers the internal payload as **sufficient** for the full range of missions. Further, the NSSN design provides increased payload *flexibility* as compared to previous submarines through the *reconfigurable* weapons room.

During the payload review, the panel came to the conclusion that the decision to eliminate the NSSN's capability to carry *tactical nuclear weapons* was overly restrictive and should be reversed.

The NSSN's payload reduction for cost savings is acceptable given the inclusion of the reconfigurable weapons room and vertical launch cruise missile capability.

Conclusions - Combat Systems

- *Combat Systems functionality - Milestone I design requirement*
- *NSSN requires combat system/sensor suite consistent with it's signature and mission*
- *Developing an open system architecture with appropriate use of COTS/NDI is necessary for affordability and technology insertion*
- *Private sector involvement in determining technical approach to open system architecture is necessary*
- *Wide Aperture Array (WAA) is the optimum sensor against the littoral diesel threat*

Combat System management and development approach requires refinement/redefinition

COTS - Commercial Off the Shelf *NDI - Non-Developmental Item*

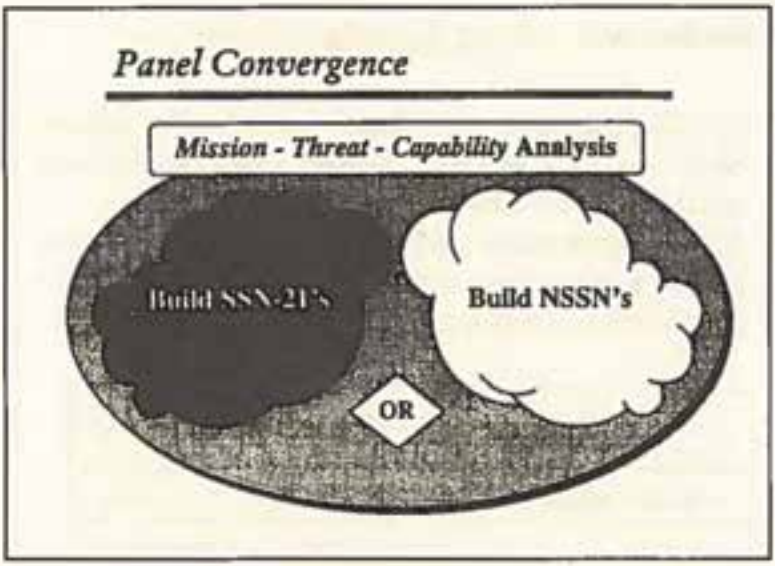
Speed and acoustic signature are *fundamental* to NSSN *performance*. The *combat system and sensor suite* are no less important to tactical advantage. The combat system design and acquisition strategy proposed for NSSN caused the panel's greatest concern.

Unlike speed and acoustic signature, the INRG considered definitive decisions on a combat system architecture premature. The rate of the change in electronics technologies is being set by the commercial industry. This situation provides opportunity and flexibility for military application.

NSSN combat system *functionality* has been adequately described in most areas. The INRG felt that Preliminary design should be used to re-describe the most cost effective approach to an open system architecture with appropriate use of COTS and NDI.

Strong private sector involvement is necessary at the system level to take advantage of the technology and cost reduction momentum in the private sector.

Additionally, the panel concluded that the Wide Aperture Array, which had been provided space and wight, is the optimum sensor against the littoral diesel threat and should be included in the baseline submarine.



At this point, I would like to comment on the panel and its deliberations.

The panel members are listed in the front of this report (see Editor's Note). They possessed broad experience in technology, acquisition and submarine design, construction and operation. The diverse backgrounds of this group contributed to the intellectual integrity of panel deliberations. During the entire process there was frank, open, and sometimes, spirited discussion. Every issue was pursued to consensus.

The panel converged to consensus in stages as the study progressed. The cartoon on this slide is a snapshot of the panel after completing the review of threat, missions and characteristics. The deliberations to this point solidified two conclusions:

- Advanced nuclear submarines are an essential part of the U.S. military capability, and
- Restart of 688I production could not meet the nation's future needs due to platform quieting limitations and insufficient design margin for future growth.

Emerging missions in the *near-land warfare* scenario made a persuasive argument for NSSN.

The case for continued SSN-21 production hinged upon near term cost avoidance of NSSN non-recurring cost.

Conclusions - Cost Considerations

- *NSSN program has responded to the direction for a capable, lower cost follow-on submarine to SEAWOLF*
- *NSSN optimized JMA mission requirements at an estimated cost ~30% less than the SEAWOLF program*

TY$(M); FY98 BASE	SEAWOLF	NSSN
NON-RECURRING	7,089	4,681
1ST SHIP 2ND SHIP 3RD SHIP	FY89 2,676 FY91 2,192 FY96 2,499	FY98 2,237 FY00 1,843 FY01 1,746
TOTAL	14,456	10,507

JMA - Joint Mission Assessment

At this point, the INRG moved from performance characteristics to *cost* considerations.

The department had scrutinized the program cost and found them within estimating standards. The panel did not consider it productive to re-perform that scope of analysis. Recognizing the significant change in future submarine procurement, we decided to examine the cost implications of *low rate production*.

With that focus, we made a comparison of SSN 21 and NSSN non-recurring and SCN costs for the first three ships. This comparison was made with the understanding that a large portion of the SSN 21 costs were sunk costs.

The NSSN design has made acceptable *trade-offs* in *speed* and *payload* for cost. Those trade-offs have resulted in a smaller submarine that retains the essential level of performance. With respect to *acoustic signature* this is a considerable achievement. SEAWOLF quieting had been maintained in a smaller ship, thus reducing recurring cost.

No attempt was made to estimate the cost associated with modifying future SSN 21 class ships with the littoral warfare attributes planned for the NSSN. The cost savings evident in this comparison make a strong case for moving on to NSSN.

BACKUP
New SSN Design Features

- *Mission focused design improvements*
  - *-Photonics mast*
  - *-Advanced ESM suite*
  - *-Lockout Chamber for SOF*
  - *-Mine hunting sonar (AMDS)*
  - *-Reconfigurable weapons room*
  - *-ASDS/DDS capable*
  - *-Improved Communications suite/antenna*
- *VLS strike capability*
- *Reliability with reduced redundancy*

A frequently encountered criticism of NSSN was that it was nothing more than a "*cheap* SEAWOLF". During the characteristic and cost reviews, it became apparant to the INRG that this was far from the case. NSSN was a very different submarine from SEAWOLF. The slide above provides some of the design features that tailor NSSN design for the missions envisioned for the next century.

A more correct characterization of the NSSN design is a flexible submarine design that retains traditional submarine capability, meets littoral warfare needs, and provides long-term flexibility while taking advantage of technology to become more affordable.

At this point in the deliberations, the INRG came to the conclusion that it was important to move on to NSSN as rapdily as possible.

The question to be resolved was one of timing, not one of whether it was in the best interest of the United States to move forward with NSSN. The combination of threat, characteristics requirements, cost and industrial base issues convinced the panel that NSSN was more than justified, it was needed.

Conclusions - Cost Related Factors
Industrial Base Observations

Uncertainty Jeopardizes Vendor Base	Production Bridge Provides Continuity
• Nuclear component manufacturers - sharp decline • Non-nuclear component suppliers leaving market • Production capability threatened	• SSN23 in FY96 is essential • CVN76 supports nuclear skills

Industrial Base transition to NSSN dependent on SSN23 in FY96

The panel received Industrial Base inputs from Newport News, General Dynamics, four non-nuclear vendors and government representatives. The *draft* RAND study (March 1994) was studied and provided valuable insight.

The conclusion of the panel was that the submarine industrial base, especially the vendor base, is extremely fragile. SSN 23 authorization in FY96 and NSSN authorization in FY98 each play an important role in maintenance of the submarine industrial base.

SSN 23 authorization in FY96 is necessary to provide the production bridge to NSSN construction in this century or early in the next century.

NSSN authorization in FY98 is necessary to provide indication of government commitment to continued nuclear submarine construction. The hope of low rate SEAWOLF production or the promise of restarting the 688I production line does not provide the necessary confidence to encourage the fragile vendor base to stay the course. Without indication of commitment, the long list of submarine unique vendors that have left the market place would grow to the point that reconstruction of the base necessary to remain a superior submarine nation would be prohibitively expensive, if possible at all.

Conclusions - Cost Related Factors
Timing/Force Structure Observations

- *Draft RAND study (18 March 1994):*
  - *"Less than a billion dollar savings given longest gaps feasible"*
  - *"Further risks may jeopardize nuclear submarine program"*
  - *"Recommend continued submarine production"*
- ***FY98 Authorization** needed to maintain minimum force structure*
  - *One year delay removes decision maker's force level options*
  - *Delay makes "10-12 by 2012" Joint Staff objective unachievable*
- *Low rate NSSN production signals long term commitment*
  - *Provides stability during industry restructure*
  - *Preserves **submarine design capability***

Production Gap savings do not justify the risk
-FY98 NSSN recommended

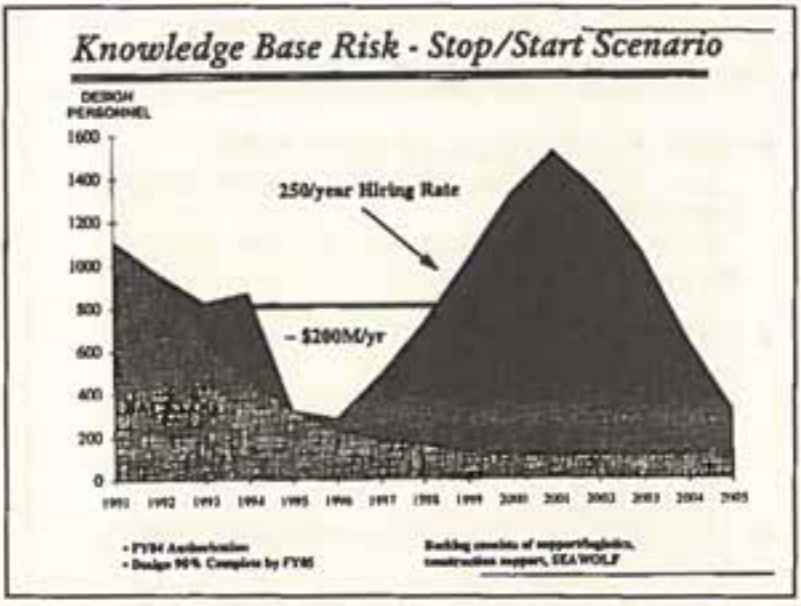
The draft RAND study encourages continued submarine production over a suspension or Gap approach. Further, RAND identifies a minimum acceptable time between consecutive submarine delivery.

The FY98 NSSN authorization accommodates this interval. The case for the FY98 start becomes more persuasive when examined from a building rate perspective.

A delay from the strategy of record increases cost and extends production time of the lead ship by four years. First ship delivery in 2009/2010 removes long range force planning flexibility and jeopardizes the Joint Staff objective of 10-12 submarines with SEAWOLF quieting by 2012.

SSN 23 construction provides the *near term* bridge to the vendor and production Industrial Base. A concurrent area of concern is the white collar knowledge base. Without both SSN 23 in FY96 and NSSN in FY98, the United States' ability to maintain worldwide submarine superiority will be in question.

The third key finding is that a production gap is extremely high-risk not justified by projected savings.



A "Fill in the Gap" strategy has been proposed by some as a solution to the knowledge base problem. The theory is to fill in lean years with *make work* designs or study projects. This approach was believed to be seriously flawed by the INRG. The drawbacks are:

- Executability is questionable:
  - Aggressive, innovative engineers are not attracted by *make work* projects with no end product
  - Hiring rate of 250 per year is unachievable even with gap fill
  - Experience level of the design force is inadequate.
- Spending $200M per year for *make work* effort would be extremely difficult to defend in any fiscal climate.
- The essential characteristic for U.S. weapon systems is *superiority*. The *make work* approach will not achieve this key objective.
- Embracing a "Fill in the gap" strategy sets a dangerous precedent for other troubled defense industries.

Conclusions - Cost Related Factors
<u>Innovative Acquisition Approach</u> Observations

- *Low Rate Production necessitates adjustments in acquisition policy*
- *Traditional acquisition requirements/regulations are not suited for restructured submarine industry*
- *Integrated Product & Process Development (IPPD) shortens design time/reduces cost*
  -Concurrent Engineering: event based, product driven
  -Phasing replaced by seamless engineering process
  -Cross functional desing/build teamwork approach
  -Team players: government, shipbuilder, suppliers, operator

Integrated development approach valid for NSSN-
Government participation a key factor

The INRG came to the conclusion that the necessary transition to *low-rate production* provides opportunity as well as challenge. There has been a lot of focus on the challenge. NSSN production by a *single* entity provides the opportunity for an *innovative acquisition approach* that reduces administrative churn and cost. Strong private sector teams working together to minimize administrative churn, optimize schedule and make engineering trade-off provide the best chance to control change and manage cost.

An integrated development approach with the builder, combat system prime and government sitting at the same table is an opportunity too good to pass up.

Recommendations

1. *USD(A&T) Grant Milestone I Approval to Proceed*
2. *Support FY98 Authorization of the NSSN following the SSN23 in FY96*
3*. *Characteristic refinement during preliminary design:*
   a. *Establish MS I exit criteria for active and non-acoustic signatures, and information exchange capabilities*
   b. *Conduct a review of the Combat System acquisition strategy and develop an approach that optimizes private sector expertise in planning an open system architecture*
   c. *Identify realignments necessary to consolidate management and funding authority of key NSSN combat systems related programs*
   d. *Include a nuclear weapon capability in the baseline*
   e. *Include the Wide Aperture Array in the baseline*
4. *Designate NSSN as an Integrated Product & Process Development (IPPD) program*

Neither emerging technology nor near term cost savings justify the high risk of delay

Action directed by ASN(RDA) memos dated 9 May 1994 and 27 May 94

And finally, the Recommendations. The panel concluded that recommendations 1 and 2 are justified by the *maturity* of the NSSN program and are necessary to maintain a viable submarine Industrial Base. Additionally, NSSN is a necessary follow-on to the SSN 23 in order to support force level objectives with a more affordable platform.

Recommendation 3a will provide the incentive for Navy to focus on those characteristics that will tailor the NSSN design to

match the emerging *near-land* warfare missions.

Recommendation 3b seizes the opportunity to capitalize on the private sector momentum in open system architectures. The management realignments suggested in 3c will substantially reduce NSSN program risk.

Recommendations 3d and 3e will provide NSSN capability in two essential mission areas.

Recommendation 4 seizes the opportunity to take advantage of the transition to low-rate production.

Since the briefings to Dr. Deutch and Navy leadership in May and June significant progress has been made. NSSN successfully completed a Milestone I DAB on 1 August 1994.

Editor's Postlogue

Vice Admiral Reynolds included a Chairman's Summary in the record of the briefing to Dr. Deutch. That summary follows:

Chairman's Summary

Dr. Deutch requested that an outside group of "technical experts" review the NSSN baseline design. The panel members selected for the New Attack Submarine Independent Review Group are recognized as authorities in their respective fields, possessing broad knowledge and experience in technology, acquisition, submarine design, construction and operation. The members answered the call for an independent review with eagerness, professionalism and impressive clarity of thinking.

Each member approached the research with enthusiasm and thorough investigative skills. During their review, they exhaustively explored numerous analytical studies, the latest all-source intelligence information at the technical and policy level, as well as detailed NSSN engineering data. They closely examined each characteristic and explored the synergism between characteristics. Each conflict was pursued to resolution. In this way, the panel was able to converge to a final set of conclusions and recommendations.

As the briefing of the panel's work was delivery to Navy and OSD leadership, I was careful to characterize myself separately from this eminent panel of technical experts. My responsibility was to consolidate their findings while ensuring that all the right questions had been considered. Throughout the study, we pursued the common goal of developing an indisputable package of

conclusions and recommendations. From my position as chairman, I observed four overarching findings. They are:

- **First and foremost, nuclear submarines remain vital to our National security.** Intelligence estimates and numerous studies conducted since the end of the Cold War accentuate the enduring need for these versatile and capable platforms.
- **With the implementation of the panels' recommendations, the NSSN design is technologically robust and reflects the correct balance between cost and state-of-the-art technology.** There is nothing on the horizon that justifies delay.
- **The industrial base is nearing the breaking point.** The lack of a commercial market makes the most fragile elements the nuclear and non-nuclear vendor bases and the submarine designer work force.
- **A long term commitment is essential to provide stability** during this unprecedented period of restructuring. Lack of government commitment will exacerbate this tenuous situation while risking the preservation of this vital national asset.

I have served with several committees and study groups. This effort stands out as an example of open, competent, professional dialogue. I feel privileged to have been associated with the "panel of experts".

J. Guy Reynolds

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THE NEW SECURITY ENVIRONMENT

[The following are extracts from official government releases. They are presented here both as specific points of information on issues of interest to the submarine community, and as indication of the general perception U.S. policy makers hold of the current status of security problems facing the nation.]

Secretary of Defense Press Release, September 22, 1994

DOD Review Recommends Reduction in Nuclear Force

Secretary of Defense William J. Perry today announced the results of the department of Defense's Nuclear Posture Review (NPR).

"In light of the post Cold War era, President Bill Clinton directed the Defense Department to reexamine its forces," said Secretary Perry. "First, there was the Bottom Up Review of U.S. conventional force structure conducted under Secretary Aspin. Now we have just completed a review of our nuclear forces."

The NPR is the first such review of U.S. nuclear policy in 15 years, and the first study ever to include policy, doctrine, force structure, command and control, operations, supporting infrastructure, safety and security and arms control in a single review.

Strategic Nuclear Forces. The most important results of the NPR can be seen in the decisions made to reduce the strategic nuclear force structure the U.S. plans to retain after the START II Treaty is implemented. The NPR recommends the following strategic nuclear force adjustments:

- 14 Trident submarines carrying Trident II (D-5) missiles—rather than 18 submarines, 10 carrying D-5 and 8 carrying C-4 missiles
- 66 B-52 bombers, reduced from the 94 planned a year ago
- No requirement for any additional B-2 bombers in a nuclear role
- All B-1 bombers will be reoriented to a conventional role
- Three wings of Minuteman III missiles carrying single warheads (500-450).

No new strategic systems are under development or planned.

"NPR decisions allow us to put U.S. nuclear programs on a stable footing. But a fundamental underlying judgement of the

Review is that we are at the threshold of a decade of planned reductions, and we will continue to reassess the opportunities for further reduction or, if necessary, respond to unanticipated challenges as time goes on. The NPR strategic force provides that needed flexibility," Secretary Perry said.

Non-Strategic Nuclear Forces. In the Non-Strategic Nuclear Forces (NSNF) arena, the NPR makes the following recommendations, including eliminating entirely two of five remaining types of NSNF:

- Retain our current commitment to NATO of dual-capable aircraft based in Europe and the deployment of nuclear weapons in Europe (less than 10 percent of Cold War levels).
- Retain continental U.S.-based dual-capable aircraft.
- Eliminate the option to deploy nuclear weapons on carrier-based dual-capable aircraft.
- Eliminate the option to carry nuclear cruise missiles on surface ships.
- Retain the capability to deploy nuclear cruise missiles on submarines.

The effect of the NSNF recommendations is to eliminate the capability to deploy nuclear weapons on surface naval ships, while maintaining a non-strategic force capability to fulfill our commitments to allies.

Nuclear Safety, Security and Use Control. In addition to the reductions on overall numbers of weapons as noted above, since 1988 the U.S. has taken a number of steps to improve the safety and security of nuclear weapons. U.S. bombers no longer stand day-to-day alert and strategic missiles are no longer targeted against any country. The U.S. has reduced the number of nuclear storage locations by over 75 percent and the number of personnel with access to weapons or control by 70 percent. The NPR examined ways to ensure U.S. ability to continue to meet the highest standards of stewardship of its nuclear forces and identified several areas for further improvements in U.S. forces' safety, security and use control. The NPR recommends that:

- The U.S. equip all its nuclear weapons systems, including submarines, with coded control devices by 1997; and upgrade coded control locking devices on Minuteman III

ICBMs and B-52 bombers.

"These adjustments reflect the changed political situation at the end of the Cold War and the reduced role nuclear weapons play in U.S. security, "said Dr. Perry.

"As we make adjustments in our future plans for the U.S. nuclear posture, uppermost in our minds is the fact that the states of the former Soviet Union are yet in the early stages of implementing the agreed reductions called for by the START I and START II agreements," Dr. Perry said. "We are trying to hasten that process through, among other things, our Cooperative Threat Reduction programs with Russia, Ukraine, Kazakhstan, and Belarus. But we kept in mind as we conducted the NPR that START I has not yet entered into force, nor has START II been ratified. For this reason, and because of the uncertain future of the rapid political and economic change still underway in the former Soviet Union, we made two judgements in the NPR.

"First, we concluded that deeper reductions beyond those we made in the NPR would be imprudent at this time; we took several actions to ensure that we could reconstitute our forces as the decade went along, if we needed to," Secretary Perry said.

"The results of the NPR strike an appropriate balance between showing U.S. leadership in responding to the changed international environment and hedging against an uncertain future," he said.

Background: Reductions in the U.S. Nuclear Forces Underway. Since 1988, the U.S. has made a number of significant changes in its nuclear posture.

- The total U.S. active nuclear stockpile has been reduced 59 percent and will be reduced a total of 79 percent by 2003.
- Strategic warheads have been reduced 47 percent to date and will be reduced a total of 71 percent by 2003 with the implementation of START I and START II.
- Strategic bombers have been taken off alert.
- Nuclear weapons storage locations have been reduced by over 75 percent.
- We have eliminated the nuclear roles of the Army and the Marines. The Navy no longer routinely deploys non-strategic nuclear weapons, and the Air Force has dramatically cut its tactical nuclear stockpile.

We have terminated almost all of our nuclear modernization programs.

Senate Appropriations Committee Report on DOD Appropriations for 1995

Submarines Plans

Over the next five years, in constant fiscal year 1995 dollars, the Navy plans to spend $7,690,000,000 to develop and produce the first new attack submarine and to complete payment on the SSN 23. Over 10 years, the costs would be $18,600,000,000. The Navy plans would develop the new attack submarine as a lower cost alternation to the Seawolf Program. The Navy argues, that production of one Seawolf every other year is adequate to sustain the nuclear submarine industrial base in the near term, but it must purchase the new attack submarine to lower total costs and, because continuing Seawolf production at this rate would be insufficient to sustain a force structure of between 40 and 55 attack submarines in the long term. Further it argues, that a new submarine design is needed to sustain the industrial base for submarine design capability.

Clearly the concerns expressed by the Navy while not inconsequential are based on costs and future force structure requirements. It appears, based on the 30 year life of the Navy's SSN-688 Class submarines, that a shortfall will not begin until the middle of the second decade of the next century, raising questions about the need to finance a new low-cost alternative to the Seawolf during the current five year plan. The quandary is how can DOD best protect the industrial base at the lowest cost until it is time to purchase a relatively large number of SSN 688 replacements.

The cost of the Seawolf, at approximately $2,500,000,000, is expensive. However, the first New Attack Submarine will cost more than $3,100,000,000 to produce, in 1995 constant dollars. This is about 25 percent more than the SSN 23 is expected to cost. Furthermore, in conjunction with ordering the first NAS, the Congress will need to provide an additional $2,068,000,000 to complete development of this alternative submarine. Recently, Deputy Secretary Deutch instructed the Navy to reduce its NAS spending by $1,000,000,000 over the five year plan. One alternative would be to delay the NAS. The Committee finds that the NAS program could be delayed eight years and still satisfy the requirement to maintain an acceptable attack submarine force structure. However, this alone will not sustain the submarine industrial base.

If an alternative submarine construction program continued during this eight year period, the industrial base could be sustained. The Committee notes, for example, that purchasing one Seawolf every other year through 2004 while delaying continued NAS development until 2003 would cost approximately $4,700,000,000 over the five year plan, and $14,400,000,000 over the next 10 years. This amounts to a savings of nearly $3,000,000,000 over the next five years and nearly $5,000,000,000 over the 10 year period compared to the current plan. Such an approach would minimize the financial burdens facing the Navy and the Defense Department over this period, and could allow for the much needed recapitalization in others areas, such as Marine Corps amphibious ships.

The Committee shares the Navy's concern that the submarine design base would not be entirely safeguarded by this type of approach. The Committee believes continuation of a technology demonstration program studying advanced submarine concepts, especially with the objective of reducing the costs of the new attack submarine would be a useful and cost effective method for sustaining these design skills, A $1,000,000,000 program over the eight year period could offset this need. Together, this approach would still save the Navy nearly $2,400,000,000 over the next five years, including more than $900,000,000 next year alone.

The Committee directs the Navy to consider an alternative to the new attack submarine program before going forward to Milestone III. The Committee expects this review to be completed before the Navy will need to obligate more than 50 percent of the fiscal year 1995 development funding associated with the new attack submarine. **It therefore directs the Navy to withhold from obligating 50 percent of the fiscal year 1995 new attack submarine funds until the review has been completed and a report on the review has been submitted to the congressional Defense committees.**

House Appropriations Committee Report on DOD Appropriations for 1995

New Attack Submarine

The budget request includes $508 million in fiscal year 1995 for development of the New Attack Submarine (NAS). The

Department of the Navy has reported to the Congress that the total development cost of the NAS is expected to be $3.5 billion and procurement costs are expected to be $57.8 billion. The Committee believes that an investment of this scope must be very carefully reviewed to achieve the highest possible return in capability at the most realistic cost. The Committee further believes that a program of this magnitude deserves special attention early in its development phase to ensure that the Congress and the Department are fully aware of financial implications for the future, in particular the potential drain on budgetary resources available for other Navy shipbuilding programs as well as overall Department of Defense requirements.

Much of the testimony and correspondence received by the Committee this year has concentrated on preservation of the submarine industrial base. The Committee recognizes the importance of this aspect of the NAS program and also notes that the end of the Cold War has not resulted in an end to submarine mission requirements.

At this time the Committee is prepared to offer a limited endorsement of the role NAS plays in the Navy's overall plan for preservation of the submarine industrial base. However, the Committee is concerned that the current plan needs to be refined to control total program cost while keeping open the option for improvements to adequately address the threats of the future.

First and foremost, the Committee has added $100,000,000 to the fiscal year 1995 budget request for Advanced Submarine System Development (P.E. 0603561N). The funding is to be dedicated to improvements in *producibility* with the overall goals to be (1) a reduction in risk associated with the program, (2) a reduction in follow-ship procurement cost to no more than $1.2 billion versus the current estimate of $1.54 billion, and (3) allow for future insertion of new technology. Along these lines, the Committee directs the Navy to incorporate full modular reconfigurability into the design for NAS. Such reconfigurability at a minimum must allow for insertion of large scale new technologies that become available or adapt the design to shifts in mission focus or operating environment. Such modularity must also include the ability to accept replacement of machinery plant, entire propulsion plant (machinery and reactor), sail, and the forward end, as well as insertion of special mid-hull mission modules forward of the reactor plant.

Second, the Committee recommends a reduction of $137,322,-000 for Ship Contract Design (P.E. 0604567N). This is the total amount specified in project F2199 for New Design SSN. The Committee has deferred embarking on the new design effort until completion of producibility studies to reduce future costs. The Committee further recommends a reduction of $62,678,000 for New Design SSN Development (P.E. 0604558N) for similar reasons. The Committee has recommended no reduction to the funding request of $82,412,000 for S9G nuclear propulsion plant development (P.E. 0603570N) since this effort is essentially in its sixth year of development and the Committee believes it is too late to re-think the size and power of the system. However, the Committee directs the Navy to use a portion of the funding requested to continue efforts to find better and cheaper ways to produce the propulsion plant.

The Committee advises the Department of Defense that future funding for NAS will be dependent upon the Secretary of Defense certifying that the follow-ship procurement cost goal of $1.2 billion in constant dollars will be met and that the Navy cost estimate has been verified by an independent Department of Defense cost estimate. In addition, the Committee directs the Secretary of Defense to submit detailed quarterly reports to the Congress on the efforts being undertaken to reduce the cost of the submarine. The first report is to be submitted on March 31, 1995.

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***** IN MEMORIAM *****

CAPT James G. Partlow, USNR(Ret.)

NUCLEAR POSTURE REVIEW AND THE NAVY

by CAPT Bill Norris, USN
Chief Nuclear Division
Joint Staff

The Nuclear Posture Review (NPR) recommendations of the Secretary of Defense were approved by the President on 15 September 1994, nearly 11 months and 50,000 man-hours after its start in October 1993. This effort was conducted totally within the Department of Defense although the input of other interested departments (State and Energy) and several *experts* was sought. All of the CINCs, Services, Joint Staff, Defense Agencies and Office of the Secretary of Defense provided personnel for the six working groups that developed and reviewed the options for those recommendations. The goal was to look out 25 years; make decisions that would define our posture for the next 10 years and cast a shadow for the following 15 years.

The NPR had two major effects on the Navy. First, it selected an SSBN force of 14 Trident submarines, all carrying the D-5 missile and operating from two bases. Second, it directed that the capability to carry non-strategic nuclear weapons (NSNF, i.e. those weapons not included in the START treaties) be eliminated from the carrier and surface warship Navy, but that TLAM/N capability be maintained on SSNs. (Note that in the Presidential Nuclear Initiative of September 1991, President Bush directed that all NSNF weapons be removed from our ships and maintained in storage so that only our SSBN's carry nuclear weapons on a day-to-day basis.) The NPR further directed that all TLAM/Ns be configured for submarine launch.

The Navy was not prepared for this outcome, as their current POM submission had been for only 10 D-5 Tridents, a change from the previous budget for 10 D-5 and 8 C-4. The Navy had made no budgetary plans for the first 8 C-4 Trident submarines or for a second Trident support base, and thus had about a $2B shortfall. The NSNF decision was, on the other hand, what the Navy was hoping for so that money could be saved on the specifications for the F-18 E/F (no nuclear capability) and on surface ship nuclear weapons handling and fire control systems. These savings are less than $50M per year, and so do not help in solving the monetary shortfall resultant from the Trident decision.

Why was the Navy caught unaware? They might have been led

astray by the early opinions that the nuclear forces might be a cash cow. This was further fueled by those who wanted to work on START III, and believed that further reductions were inevitable. Blindly reading the START II provisions and using *back-of-the-envelope* math can lead to a conclusion that the *less than 1750 sublimit* on SLBM warheads could be met by as few as nine (9 X 8 X 24 = 1728), but more likely 10 submarines carrying 7 reentry vehicles (RVs) or 18 with 4 RVs. Or maybe they wanted to avoid the annual battle for Trident missile procurement funds. Undoubtedly, some or all of this rationale played in the Navy's budget decision. In any case, it would appear that in the Navy budget process, there are few submarine advocates.

Why then did the NPR select the 14 D-5 Trident option? It was best summarized by Secretary Perry in his lead and hedge explanation. The only potential adversary who has the capability to destroy the United States is Russia. Russia's future is anything but predictable and they have not yet ratified START II and have prevented START I from entering into force until Ukraine agrees to become a non-nuclear state. During the NPR deliberations, it was no sure thing that the other three nuclear republics of the former Soviet Union (Belorussia, Kazakhstan, and Ukraine) would sign up to the Nuclear Non-Proliferation Treaty (NPT) as non-nuclear powers. Discussions with the Russians at all levels revealed that although they were interested in deeper reductions, they were looking into the future since they had neither the capability nor the money to decrease forces much faster. Therefore, although the U.S. must continue to demonstrate our leadership toward meeting the limits of the START treaties, no irreversible changes or inactivations should be accomplished lightly.

So first, the new force level had to have the ability to counter a Russian slowdown in their inactivations or dismantlements from their present levels near the higher START I limit as well as have the flexibility to go lower in the future. The 10 Trident Submarine Force loaded at seven RVs had less than one-fourth the hedge capability of 14 ships loaded at five RVs.

Second, the security of the Trident force had to be protected. No one can ever be sure that in the heat of battle the President will believe he has adequate credible indication of an incoming nuclear attack. In today's less threatening environment with no bombers on alert, the only survivable force is the Trident force. Keeping that force in two oceans only makes sense, much the

same reason that we built a submarine base in Bangor, Washington for the first Trident submarines.

Third, the security of the Trident force is further enhanced by the ocean area in which it can operate, or in layman's terms, the range of its missiles. After all, getting our SSBNs out of the area north of the Greenland-Iceland-Faroes Gap and the Mediterranean was part of the genesis of the Trident missile and its backfit onto the earlier SSBNs. It general, the range of any missile is determined by the weight of its payload. Therefore, again the ocean patrol area available to the 14 Trident force is significantly larger than that of the 10 Trident force. As a side issue, target coverage for an Atlantic based Trident force of the southeast extremities of Russia is extremely problematic for the more fully loaded Trident missile.

Fourth, as we look at the decreasing target base in Russia as the arms control regimes enter into effect and their forces are downsized, clearly the mean distance between targets increases. This means in targeting our MIRVed systems, such as Trident, the larger the footprint and the more footprints we have, the more efficient our SIOP can be. A 14 SSBN Trident force was found to be significantly more effective than a 10 ship force. There are no *extra* weapons in today's reduced forces. Inefficiencies will result in non-coverage of SIOP targets and hence, a SIOP with more risk should deterrence fail.

For all the reasons above, the 14 SSBN option won out over the 10. The almost universal view of either the 10 D-5/4 C-4 or the 10 D-5/8 C-4 SSBN option was that they were only intermediate steps to 10 D-5 Trident platforms. Also, for many of the same reasons given in the preceding paragraphs, an 18 D-5 Trident force is more attractive than the 14. However, the additional cost of C-4 to D-5 conversions and the additional missile procurement made this less attractive. The true knee of the curve for D-5 is 5 RVs and the marginal improvement from 5 to 4 is less than 6 to 5 or 7 to 6.

In the NSNF decision, the attack submarine force was left as one of only two nuclear capable forces, the USAF attack aircraft being the other. Obtaining basing rights for USAF nuclear capable aircraft in a crisis in some parts of the world may not be easy. Therefore, the attack submarine will have a unique role if the nation elects to not use a strategic weapon for a non-strategic mission. There is clearly a price to pay here in the administration,

people and systems, and certified capability, materiel and fire control, that must be maintained for any nuclear delivery system. An SSN loaded TLAM/N is the only remaining Navy NSNF system and hedges the issue that the USAF does not have guaranteed worldwide NSNF delivery capability.

The end result of the NPR, in minds of many people, was more hedge than lead. These are uncertain times and we can only hope that the democratization of Russia works. With neither new nuclear delivery nor nuclear weapons systems under development, every present system is truly a national treasure not to be surrendered too easily. The United States can ill afford either the cost or time to replace them if any present trends reverse. Further steps forward in the arms control arena must hopefully await a more clear definition of what Russia will be and the mutual achievement of START II levels. Because of the NPR, the Submarine Force will truly be leading strategically (Trident) and hedging tactically (TLAM/N). ■

SECNAVs AND SUBMARINES
Part 2: Building the Force

by CDR Sam J. Tangredi, USN

[Editor's Note: This is the second part of a brief history of the role of the SECNAV in building and maintaining the submarine force. Commander Tangredi currently serves as Special Assistant and Speechwriter to Secretary Dalton. The views expressed are his own and do not necessarily represent the official position of the Department of Defense.]

Roles and Stages

In playing the varying roles of translator, advocate and shield, Secretaries of the Navy have successively nurtured the development of increasingly more powerful and effective naval weapons and platforms. Throughout the history of the Submarine Force, SECNAV support has remained relatively steady, with the predominant role being determined by the stage of development of undersea warfare and the aggressiveness of the particular Secretary in increasing the overall structure of the Department.

An excellent initial illustration of this *steadiness* is found in the fact that following the acceptance of the Navy's first submarine, HOLLAND in 1900, 28 submarines were built in the ten year period of 1900-1910, an average of three per year.[1] In overall American naval history, this is an impressive rate for an untried and unproven weapon system. Although other factors, including continuous lobbying of Congress by the Holland Company (later Electric Boat), Simon Lake and other potential submarine builders, were significant, SECNAV support (or at least acquiescence) was also critical.

But with shifting American political priorities, this steadiness of support has required a continuing adjustment in SECNAV roles. Role shifts occurred frequently during the stages of *conventional* submarine development, which can be conveniently characterized as the *experimental* period (roughly 1887-1910), the *developmental* period (about 1910-1933), and the *tactical weapon/fleet unit* period (1934-1950).

To a lesser degree, shifts from advocate to translator and back to advocate also occurred in the nuclear era.

Justifying the Experiment

Beginning with Secretary Whitney's initial advertisement in 1887, SECNAVs have been uniformly positive about the development of the submarine for at least three reasons.

First, development of such a novel invention was in keeping with the scientific and technical progress the nation craved. This was as true in the era of the *New Navy* (circa 1880) and the conversion from sail to steam and armor, as it was in the age of Sputnik.

Second, the initial concept of the *submarine torpedo boat* seemed to promise a way of neutralizing the battle strength of more powerful navies, or, as in the era of nuclear deterrence, provide a practical solution to an otherwise insolvable strategic difficulty, such as how to build an invulnerable deterrent.

Third, submarine development appeared to promise a cheaper alternative to constructing the capital ships considered to be the backbone of the fleet. While admittedly not a justification in the age of nuclear power, this cost-savings incentive was an underlying factor that prompted submarine construction between the two World Wars.

While Whitney's unsuccessful effort at acquiring a working submarine was continued by his successors, one notable exception to early SECNAV enthusiasm for submarines was Secretary Hilary A. Herbert (1893-1897). A former Congressman from Alabama (and Chairman of the House Naval Committee), Herbert reportedly opposed submarine experimentation because of the fate of the Confederate submarine CSS HUNLEY. Secretary Herbert, who had been a Confederate Army officer, was convinced that the risk of a "horrible fate" of death underwater was something to which he could not subject sailors.

Herbert's opposition also appears grounded in an unwillingness to dilute his efforts to obtain funding for the construction of battleships, an effort prompted by writings of Alfred Thayer Mahan. SECNAV Herbert associated schemes for the development of torpedo boats (whether submerged or not) with a traditional Congressional proclivity to fund unarmored cruisers instead of armored ships. Fit only to "destroy merchant ships", overfunding of cruisers smacked of another Confederate strategy that failed—commerce raids by the CSS ALABAMA.[2] Given Herbert's position, it is ironic that the submarine would be the weapon

to make wartime commerce raiding effective.

Fortunately for submarine proponents, later SECNAVs were much less influenced by the history of the Confederate States Navy and more by the potential for revolutionizing naval warfare, leapfrogging potential opponents, cutting the budget, or all three. Once the first Holland submarine was accepted in 1900, the question was not whether submarines should be developed, but rather: how fast, how publicly, and towards what mission?

Interpreting a Role

As long as the concept of a *submarine torpedo boat* was experimental, the Secretary's role was primarily that of public advocate. This advocacy role was not just directed towards heightening awareness of the submarine's potential to the President and Congress; like today, the SECNAV also performed an advocacy function throughout the debate on distribution of resources within the overall Navy budget. He had to explain to both President and Congress (as well as the Admirals and, now, the SECDEF) why funds should be spent on submarines rather than battleships or other construction.

Even with pro-Navy presidential administrations, this required some work in dispelling skepticism. President Theodore Roosevelt, although the progenitor of a naval renaissance leading to the Great White Fleet, expressed a bit of this skepticism in 1905, saying that while "a good deal can be done with these submarines... there is always the danger of people getting carried away with the idea and thinking they can be of more use than they possibly can be."

While few SECNAVs could stand up to the forceful personality and naval expertise of Theodore Roosevelt (hence his six SECNAVs in eight years), their routinely positive reports on submarine progress proved helpful. Submarines were *good news* to report even if their role was still a bit fuzzy. As Secretary Victor H. Metcalf stated in his FY 1908 Annual Report: "...all of the newer ones [submarines] have been employed with gratifying results. The enthusiasm and zeal displayed by the officers and men of these craft point to real efficiency and indicate that they will prove valuable auxiliaries to the service in time of need."[3]

As the diesel submarine indeed developed towards the status of auxiliary unit to the battle fleet, this advocacy role changed more

to translator/interpreter of Presidential preferences and shield when the inevitable developmental accidents occurred.

Questions of strategy and employment, prompting the need for translation/interpretation, increased in importance. Secretary George V. L. Meyer reported in 1911: "The submarine has been developed to a point where it may be considered as a possible fleet unit; also, owing to the lack of proper defenses in our territorial possessions, the necessity for submarines in connection with the defense of bases from which the fleet must operate is greater than ever before."[4]

World War One gave great impetus to the continuing development of the submarine, but in a completely different direction. It also raised a continuing controversy and modern justification.

ASW: A Mission Too Soon

German U-Boat successes in World War One proved the worth of the submarine beyond *defense of bases*, giving naval authorities an outstanding display of its strategic role as commerce raider. But as valuable as the submarine might appear, this success caused several quandaries for the SECNAVs of the era.

On the one hand, continued development of what would become a valuable strategic weapon could be clearly justified on naval grounds. Submarines were now an effective weapon system. On the other, revulsion at the thought of unrestricted submarine warfare, the *tool of the Hun*, made public justification of a large submarine force embarrassing. This was another factor tempering the public advocacy role, and increasing the translator/interpreter role.

It was in this context that the concept of submarine as the *best* anti-submarine weapon was first discussed. Later used as an argument for our strong attack submarine program throughout the Cold War, the first official statement of this concept was by Secretary of the Navy Josephus Daniels (1913-1921) in 1918. Assessing naval operations in World War One, Daniels reflected, "The principal antisubmarine efforts were at first carried on by surface craft, but it was later realized that the submarine itself is the enemy of the submarine, especially when our enemy's submarines are forced to work on the surface..."[5]

Whatever the effectiveness of the early diesel boats in this role—and historical analysis seems to indicate they were not very

effective—Secretary Daniels' observation was an important one to make in justifying a post-war submarine program during President Wilson's administration. Wilson had used Germany's declaration of unrestricted submarine operations as a prime justification for U.S. entry into World War One. He and subsequent Presidents could not publicly justify submarine construction on their role as commerce destroyers.

Wilson and his successors also had to contend with Royal Navy pressure to codify an international ban on submarines in order to lessen the danger to the capital ships of their dominant fleet. The sub versus sub argument was useful, even if such operations were then not demonstrably productive.

Technical difficulties and the ineffectiveness of Japanese submarine strategy both precluded ASW as a dominant role for American submarines in World War Two. But the **Submarine-as-the-best-ASW-Platform** remained an ideal long before the SSN made it a reality.

Ban or Standardize the Submarine?

While intrigued by the submarine as a technical marvel, much of the American public—particularly members of the vocal and growing disarmament movement—were not necessarily disposed towards a larger submarine force. With memories of the *U-Boat menace*, the effort to "ban the submarine" was one of the elusive objectives that lead to the Washington and London Naval Treaties of 1921-22 and 1930.

The result was the signing of codes and international protocols regulating submarine attacks in 1922 and 1936. Incidentally, the 1936 protocol against attack on merchant shipping is technically still in effect although it was ignored by all the belligerents in World War Two.[6]

The result was also quieter SECNAVs. The influence of public attitude is reflected in the fact that, with the exception of the 1923 Report, which discussed the Organization and Administration of Submarines, submarines were only infrequently mentioned in the Annual Reports of the Secretary of the Navy during the 1920's and early 1930's. SECNAV advocacy had given way to translation/representation of Presidential preference, and the continuing preference was **not** to fan public debate about submarines.

However, SECNAVs recognized the potential for submarines as sea control/sea denial platforms and made practical decisions

for continued development.

One of the first practical moves was to help standardize submarine design, which can be traced to Secretary Daniels' establishment of a Submarine Standardization Board in 1917 (known as the Stirling Board). While Stirling Board recommendations were modified by subsequent boards (such as the Doddridge Board), the keel was laid for continuing design development.[7]

At the same time, steps were taken to integrate the submarine force into the fleet. Much of this effort occurred during the administrations of SECNAV Daniels and his successor, Edwin Denby. In 1915, a flag officer was designated Commander Submarine Force, Atlantic Fleet. In 1918, a submarine section (later a division) was established in the Office of the Chief of Naval Operations. In 1921, submarine flotillas (redesignated divisions in December 1922) were established on both Atlantic and Pacific coasts. In his 1923 Report, SECNAV Edwin Denby could declare: "Submarine affairs are now administered in the department in the same manner as those of other units of the fleet."[8]

From Tactical to Strategic Weapon

The concept that the submarine was now a significant weapon system gained steady ground through the 1920s as their participation in fleet exercises and operations increased. Once again it was SECNAV Josephus Daniels who articulated this potential for progress most succinctly in his Annual Report for 1920:

> "No nation, if it is to be prepared to engage in warfare upon the sea, can afford to neglect the submarine or to spare any pains to develop it to meet its needs. This type has come to stay as a factor in naval warfare unless outlawed by international agreement. Its abuse by the Germans in their ruthless campaign should not blind us to the fact that there is a large field for its legitimate use. Without accepting the theory of the enthusiasts, that submarines alone can be developed to meet adequately all needs of naval warfare, we must agree that the submarine can not be ignored and has a field of its own in the conduct of war upon the sea which can not be filled by any other character of ship."[9]

This remained the general sentiment of subsequent Secretaries

even if few stated it directly.

One positive factor that helped continue *steady* submarine development throughout this period was that construction of submarines was a lot cheaper than that of battleships, thus allowing Congress to view subs as a low cost alternative to the Battle Fleet. This corresponded well with efforts of the Harding and Coolidge Administrations to reduce government spending and particularly spending on military armaments.

Another particular feature of this era was the SECNAV-directed development of naval shipyards capable of submarine construction. The result was a ten year dry spell (1921-1931) in commercial submarine contracts that bankrupted Simon Lake's company and left Electric Boat as the lone, struggling competitor.[10] But it also provided the naval shipyard base that could handle a wartime surge.

As noted, submarines were not prominently discussed in the SECNAV Annual Reports of that era. For example, while it became standard for the SECNAV Reports to discuss all combatant ship types under their own title headings, submarines were instead discussed only in the *new construction* or *fleet training* sections.

When discussed separately, it was usually in relation to submarine accidents, which electrified the press and caused SECNAVs to assume the shield role (such as O-5, rammed and sunk in 1923 with loss of five men, S-4 sunk in 1927 with loss of 39 men). SECNAVs took the heat in the press, although none actually were forced to resign. When in 1929 submarines were given their own Annual Report heading, primary impetus was the SECNAV's need to respond to public calls for "much study and investigation" into "improving safety in the operation of submarines."[11]

Undoubtedly the most significant move in increasing the Submarine Force was the passage by Congress of the Vinson-Trammel Act of 1934 which authorized building the Navy, including submarines, to Treaty limits. Simultaneously, President Franklin D. Roosevelt, himself a former Assistant Secretary of the Navy to Josephus Daniels, utilized National Industrial Recovery Act (NIRA) funds for naval shipbuilding, revitalizing America's commercial shipyards and preparing the fleet materially for a potential future war.

Although picking enthusiastic and capable Secretaries, FDR

routinely intervened in decisions regarding *his Service*, once openly stating that he considered himself his own SECNAV. It is interesting to speculate to what extent, as Assistant Secretary, he had participated in drafting SECNAV Daniels' 1920 statement on submarines. His choice of Admiral Nimitz as CINCPAC demonstrated considerable in-depth knowledge of the capabilities of his flag officers, including those with service in submarines.

World War Two confirmed, once and forever, the submarine's importance as the premier sea-denial platform, after which the increasing development of more capable submarines was never in doubt.

Naval Reactors and the SECDEF

The development of nuclear power occurred following the creation of the Department of Defense and reduction in the statutory power of the SECNAV. This adjusted, but in a very real sense, broadened and made more difficult the advocacy role of the SECNAV, since the previous audience of President, Congress and public now included an official with the authority to reduce the SECNAV access to these audiences. For the first time, individual Navy and Marine Corps programs had to compete directly against Army, and subsequently, Air Force programs for funding.[12] Thus, the SECNAV was forced to take on an internal bureaucratic role that was different and programmatically more challenging than before. He now had to make his case at least four times for Navy programs in an increasingly competitive environment.

The organization of the Department of Defense and the new internal bureaucratic role was also a factor--unacknowledged in most historical accounts--in the rise of the power and control of Naval Reactors as the prime proponent of submarine development. While the potential dangers of nuclear power, Congressional desires on *consolidating* controls over atomic energy, and the forceful personality and political skills of Admiral Rickover were undoubtedly prime factors in fashioning the practical independence of Naval Reactors from the rest of the Department of the Navy, this probably would not have occurred if the SECNAV had remained a cabinet level official with routine access to the President.

The *independence* of Naval Reactors not only increased the direct involvement of Congress in decision-making on naval programs, but also gave the Secretary of Defense a means of

maintaining a separate focus on submarine programs.

None of this significantly changed uniform SECNAV support for the development of nuclear-power for **submarines** and advances in hull design such as the ALBACORE. Cost did not seem to be, in light of the Cold War threat, a debilitating consideration. Most of the SECNAVs' attention during the nuclear developmental period was directed towards the more contentious issue of nuclear power for **surface** combatants.

Cold War and Beyond

Development of the Fleet Ballistic Missile and the SSBN force was solidly supported by successive SECNAVs. SECNAV Charles S. Thomas (1954-1957), a strong Navy advocate, established the Special Projects Office and was persuaded by the CNO, Admiral Arleigh Burke, to give Admiral "Red" Raborn the *hunting license* required to make the SLBM project a success.

As the SSBN was perfected, however, its status as an element of *strategic forces* moved control of its future solidly within the hands of SECDEF. No longer was it considered a "naval" matter, and SECNAV influence lessened accordingly. While this may have proved an advantage in obtaining steady funding for the Polaris, Poseidon and Trident programs, this may prove less advantageous in the post-Cold War environment when the apparent need for strategic deterrence is *diminishing*.

The near-termination of Soviet/Russian naval operations and subsequent reduction in the immediate need for ASW forces has had a significant impact on America's SSN force. This in turn has resurrected the need for a strong advocacy role by SECNAV. Recent SECNAVs have concentrated on the *industrial base* argument for preserving submarine construction. The issue of affordability has become paramount, the irony being that after many years of selling submarines as *cheaper alternatives* to other naval forces, SECNAVs are forced to justify the expenses involved in building a capable nuclear submarine.

Here we are at the realm of current policy rather than history, where the future is subject to continual change. Yet, if the past is but a prologue, current SECNAV John H. Dalton's words should continue to ring true: "We will continue to build the most capable submarines in the world and crew them with the most capable sailors."[13]

■

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2. Harold and Margaret Sprout, The Rise of American Naval Power 1776-1918, 1966 edition (Annapolis, MD: Naval Institute Press, 1990), p. 253.

3. Annual Reports of the Navy Department For the Fiscal Year 1908 (Washington, DC: GPO, 1908), p.7.

4. Annual Reports of the Navy Department For the Fiscal Year 1911 (Washington, DC: GPO, 1912), p. 41.

5. Annual Report of the Secretary of the Navy For the Fiscal Year 1918 (Washington, DC: GPO, 1918), p. 17. However, with the development of naval aviation, the anti-submarine role for submarines gradually receded in importance until the development of nuclear power. Submarine were just too valuable in anti-surface and commerce warfare and aircraft had the advantage of speed.

6. Richard Dean Burns, "Regulating Submarine Warfare, 1921-41: A Case Study in Arms Control and Limited War," Military Affairs 35 (April 1971), pp. 56-63.

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8. Annual Reports of the Navy Department for the Fiscal Year 1923 (Washington, DC: GPO, 1923), p. 11.

9. Annual Report of the Secretary of the Navy for Fiscal Year 1920 (Washington, DC: GPO, 1920), p. 8.

10. Weir, p. 54.

11. Annual Reports of the Navy Department for Fiscal Year 1929 (Washington: GPO, 1929), p. 13.

12. Previously, Army and Navy programs were addressed by different Congressional committees. The budgets for both Departments were subject to the approval of the President and Congress at the same time as the rest of the federal budget and therefore could be *compared*. However, it was rare and difficult to compare *competing* weapons systems between Departments—with the exception of General Billy Mitchell's prolonged aircraft versus battleships debate.

13. John H. Dalton, "A Submarine Force "...From the Sea," The Submarine Review (July 1994), p. 12.

THE NAVAL UNDERSEA MUSEUM

Established by the Secretary of the Navy in 1979, this facility in Keyport, Washington is on its way to becoming a world class institution. It is unique as the only museum in the United States wholly dedicated to undersea technology and history.

The museum's first permanent exhibit, The Ocean Environment, presents the environment of the undersea world, providing the backdrop for all subsequent exhibits. The Ocean Environment exhibit creates an aura of awe and expectancy for what is to be discovered about the ocean depths.

After many months of research, collection, restoration and creation of a first-rate design, the Undersea Weapons exhibit will open in early 1995. This collection of mines, torpedoes, and underwater tracking systems, dating from the American Revolution to the present, will fascinate and educate with a blend of history, science and technology.

When the full plan for the museum is realized, 18,000 square feet of exhibit hall and mezzanine will hold permanent exhibits that include: The History of Diving Salvage, Undersea Exploration, Saga of the Submarine, Underwater Vehicles and Anti-Submarine Warfare.

Public response to the museum has been excellent. The museum now draws some 7,000 visitors per month, from all 50 states and many foreign countries. More than 100 retired persons find meaningful work as volunteer docents. The museum's education focus is in science and math, and has brought more than 20,000 school children to the facility for projects such as *Jason*. A grant from a local foundation enables the museum to develop its library as a center for undersea history and technology research. A 450 seat auditorium is widely used by community and military groups for meetings and conferences.

The Naval Undersea Museum Foundation supports the facilities, exhibits and programs of the museum and works with museum staff to bring the vision for the museum to completion. For more information, please write: Naval Undersea Museum, P.O. Box 408, Keyport, Washington 98345. (206) 697-1129 (area code 360 after January 1995).

THE ORIGINAL STEALTH FIGHTER.

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Electric Boat Division, Groton, CT.

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GENERAL DYNAMICS
Electric Boat Division

RETHINKING TOMORROW'S ATTACK SUBMARINE FORCE

by CDR P. Kevin Peppe, USN
Commanding Officer
USS ATLANTA (SSN 712)

A Cold War Beneath a Frozen Sea

On January 5, 1968 this nation's leadership faced a sobering reality. A Soviet November Class attack submarine was observed doing what it was she wasn't supposed to be capable of. Sent by the Soviet government to monitor the activities of USS ENTERPRISE and her battlegroup, the November reached a top speed far greater than any U.S. intelligence estimates had predicted.

The Soviet attack submarine had been the subject of an intense U.S. ASW effort for some time. Tracking this noisy submarine didn't present the battle group any real tactical challenges. The problem surfaced when ENTERPRISE, taking advantage of the situation, began to slowly step up her speed to test the top speed of this older November. The shocking result of this secret trial was this. The November was fast. Very fast. So fast in fact that she could not be shaken by ENTERPRISE. The centerpiece of American naval might, the nuclear powered aircraft carrier, was vulnerable to repeated torpedo attack by what were even then old Soviet attack submarines.

And this troubling episode was by no means the end of American undersea worries. There was the nagging concern that the Soviet ballistic missile submarines, each capable of devastating first strikes against the U.S. mainland, had taken to conducting patrols near or even under the Arctic ice. This routine made these vessels invulnerable to all but one U.S. asset: the attack submarine.

For at least 30 years, from 1959 to 1989 the U.S. Submarine Force fought a secret war the likes of which mankind had never known. Centered on forces capable of destroying entire civilizations in the course of 20 minutes, this war beneath the sea consumed much of both nations' industrial might, and much of the activity of both the U.S. and USSR submarine forces. For nearly 30 years the U.S. attack submarine force provided some measure of positive insurance against thermonuclear attack from the tremendous threat resident in Soviet ballistic missile submarines. The force became the premier antisubmarine warfare instrument

the world had known. Attack submarines were soon conducting extremely sensitive strategic operations in the most remote reaches of the globe, going where and doing what no one else could.

In the end the superiority of U.S. undersea forces proved a *bridge too far* for the Soviets. The enormous demand made on that nation's military-industrial complex, although understood by very few in this nation, will in time take its place as a principle cause in the sudden Soviet collapse.

The Winners?

In an ironic twist of fate, the U.S. Submarine Force today suffers from its own success. An entire generation of naval professionals, both civilian and military, was raised during this period. This new generation came to believe that *bastion-busting* was what U.S. attack submarines did. Period. What the force had done, because no other could, has become an albatross after the collapse of the Soviet Union.

In the short span of seven years the most powerful attack Submarine Force the world has even known will shrink from ten squadrons to six. By most measures still dominant, the force will nonetheless be faced with meeting worldwide crisis and commitments with a force 40 percent smaller, smaller in fact than any Submarine Force this nation has fielded since well before the Second World War. If we simply continue as we are we'll be faced with this: there will be too few submarines trying to do too many things. What is more, due to the peculiar nature of submarine missions, some of the too few submarines will not be equipped to do some of the too many missions, further exacerbating an already unsatisfactory condition. If we take as a given that fiscal pressures will not allow for more resources, what options are available in affecting this dramatic down-sizing without unduly putting our nation's security at risk?

Reduced Requirements

First and most obviously, we could reduce the requirements imposed on the remaining attack squadrons. This, after all, is the presumption of untold stacks of studies extant within the halls of the Pentagon, studies where analysts have determined *proper* force levels. Simple arithmetic shows that, were the nation able to make do with about half the submarines currently in use, there would be little to no issue. Things would move along pretty much as they have in the past, with submarines spending about half their

operating time in port and half at sea.

Unfortunately, things aren't quite so simple. The fact is that today, nearly five years after the fall of the Soviet Union, nearly five years after the *next best* submarine force suddenly became a lot less threatening, this nation, on a day in-day out basis, continues to require the services of about eight attack submarine squadrons. What's more, it is not at all clear that requirements aren't going to grow even larger in the near future.

It certainly isn't as if those leading the Submarine Force are making these demands on the ships. It's also not as if we can unilaterally act to lessen the requirement. These submarines are out there doing the nation's business; some required by the Unified Commanders, some by the National Command Authority or NCA, some fulfilling international treaty and alliance commitments. These customers are the ones who must begin to make difficult decisions. Those at the highest levels must make the difficult choices of where not to go, of what not to do.

Roles and Missions: A Historic Perspective

In order to understand how it is that so many submarines continued to be called on after having lost what many naively perceive as the force's principle reason for being, it is necessary to examine just what it is this nation has required in the past, and will require in the future of these particular ships. The following, taken from a letter written on September 4, 1861, shows just how enduring submarine roles and missions really are.

> *To His Excellency, Abraham Lincoln, President of the United States*
>
> > *I wish to propose to you a new arm of war, as formidable as it is economical. With a submarine boat, well constructed and properly equipped, it becomes an easy matter to:*
> >
> > - *Carry explosive bombs under the very keels of vessels*
> > - *Land men, ammunition, etc. at any given point*
> > - *Enter harbors*
> > - *Reconnaissance the enemy's coast*
> >
> > *I have the honor to be with distinguished consideration*

Your Excellency's most obedient servant
De Villeroy, 4 September 1861

Throughout their relatively short history as an instrument of war, submarines have generally fulfilled these four basic taskings, or in today's vernacular, roles and missions. The first, that most commonly associated with the heroes of the Pacific submarine campaign of World War II, is the sinking of enemy surface ships and shipping. The ability of a well armed man-of-war who, through the advantage of near complete invisibility or stealth, was able to engage nearly at will is apparent. How early in the history of the vessel this enduring mission became obvious is illustrated in the following.[1]

Sinking Ships and Shipping

Sergeant Ezra Lee was spent. The TURTLE stank, her air was tepid and foul. It was the devil's work, self-propelling this machine towards its intended victim, and he hadn't the energy to curse as he would've liked. After some 40 minutes in New York Harbor he found himself less than halfway to his intended target, HMS EAGLE. Worse, he had TURTLE completely spun askew and was pointed back to whence he came.

It was, as he had supposed nearly a month ago when first convinced to give Bushnell's idiot machine a chance, the stupidest thing he'd every done. And yet here he was, an Army sergeant floundering at sea on this warm September night in the year of Our Lord 1776 in something called a diving bell trying to surreptitiously attach a time bomb to the bottom of the British man'o war.

And as if that wasn't enough, supposing he did get the wretched TURTLE turned back around and out to the EAGLE. Suppose he could actually submerge below the ship. Supposing he could actually work this bore and attach the bomb. Supposing after all this he was then faced with the near impossible mission of getting himself far enough away from the supposed victim so as not to get himself blown up. It all seemed a bit much to ask of

[1] The short stories that follow are true. The author has taken some liberties with the dramatics in an attempt to improve readability.

this one man crew, an Army sergeant at that.[2]

In the event, which none other than George Washington in a letter to Thomas Jefferson called "an effort of genius", Sergeant Lee was foiled. Although he did eventually make it to EAGLE and really did get himself into position below the waterline to attach the time bomb, a cruel twist of fate saw him trying to drill not through the wooden hull but through one of many steel bands that held EAGLE together. After all he had been through this simply proved too much.

Lee escaped unharmed. History has taken little note of his failure and forever recorded the effort. While it remained for the submersible HUNLEY to draw first blood in combat nearly 90 years later, TURTLE had opened the minds of the Fultons and the Hunleys to the possibilities. Submarine warfare, and in particular the potential for these ships to wreck havoc among surface vessels, was indeed born on that warm night over 200 years ago.

While few question the historic pre-eminence of the submarine in the ship sinking role, some today have a difficult time envisioning just where and when submarines might be again called upon to perform this vital mission, just where and when submarines might be asked to cripple a nation as the U.S. submarines of World War II were able to do in the Pacific. It seems we, as a nation, need to take the time to look back over the history of man, to decide for ourselves just how long one nation remained unchallenged, to muse over just how likely restricted war at sea really is, when a nation is not clearly strong enough to deter it.

Enabling Strikes Against Targets Ashore

In typically British fashion, Lieutenant Commander Cochrane just couldn't leave it alone. It seemed enough that he had somehow managed to run E-7, his submarine, hard aground on the beach at Constantinople. Alone in the Marmora Sea, deep behind enemy lines, his little 800 ton, 180 foot submarine was high and dry, in broad daylight, well within range of the Turkish shore guns. What's more, he had run the ship aground at nearly 10 knots and now found the bow of his ship almost completely out of the water and pointed directly ashore.

A lessor man might not have spied the opportunity. Cochrane

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[2] Compton-Hall, Richard, Submarine Boats: The Beginnings of Underwater Warfare, Arco Publishing, Inc., New York, 1984, p. 35.

did. After having directed the engineer, in so many words, to get the ship off the beach (micro-management does not seem to have been one of his faults), he turned his attention to the Turkish Imperial Arsenal, a principle storage site for enemy weapons. As luck would have it this building was hard against a quay, the warm May waters of the Dardanelles lapping at its foundation. Further, E-7 was pointing directly at it.

Two bow tubes were made ready and, as the engineer struggled to get the ship off the rocks the Captain engaged. A single torpedo was launched against the building. Yes, against the building. There was a violent explosion. Not possessing the sophisticated tools required to conduct conclusive BDA, Cochrane left without knowing the extent of the damage he had inflicted against his key target ashore.

Such was not the case that evening. In making his way clear of the beach into the Bosphorous, Cochrane had sighted the Zeitun powder mills in the western suburbs of Constantinople. He immediately bottomed E-7, waiting for the cover of darkness. Just before midnight on May 15, 1915 Lieutenant Commander Cochrane took his ship to the surface. His gun crew raced along the narrow deck and began bombarding the explosive factory. Her tiny six pound shells caused little material damage but they tore Turkish morale to shreds.

Wild rumors spread through the city that British surface units had forced the Dardanelles, all work stopped, and many of the panic stricken inhabitants fled into the countryside. Such was the impact a single submarine had in the conduct of a primitive but extremely effective enabling strike ashore.[3]

The further exploits of the British submarine force in the First World War would lead Sir Winston Churchill to write:

> "The Naval History of Britain contains no page more wonderful than that which records the prowess of her submarines at the Dardanelles."

Today the ability of submarines to conduct precision enabling strikes ashore is nearly without equal. Combine the reach and lethality of submarine launched Tomahawks with the virtual

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[3] Edwyn Gray, The Underwater War: Submarines 1914-1918, Charles Scribner's Sons, New York, 1971, P. 145.

invulnerability of the ship and you have a weapons system that is invaluable in minimizing the risk to U.S. forces. Before manned air strikes, before amphibious operations, before the enemy knows what hit him, submarine launched Tomahawks can destroy entire command and control networks, knock out key power generating stations, render impotent surface-to-air and surface-to-surface missile defense sites. Having completed this key enabling strike it now becomes possible to introduce manned aircraft, Marines, and soldiers without subjecting them to unnecessary risk. Used just so, the submarine is a key element in modern warfare.

Support Amphibious Operations

NAUTILUS had been here before. In support of the long awaited Operation Galvanic, the first truly planned amphibious offensive in the Pacific, Commander Irvin and NAUTILUS had recently completed a critical reconnaissance mission off the islands of Tarawa, Makin and Abemana. The information she had passed back to commanders ashore provided the direct warfighting support the best American charts could not.

But here, now, late on the night of 20 November 1943 the furthest thing from Irvin's mind were those pictures. He was thankful to be alive. His mission was to land 78 Marines on Abemana in the Gilberts just ahead of the first assault echelons. The Marines were to support the landing with vital reconnaissance information. He and his Marines almost didn't make it.

NAUTILUS had just survived a battering at the hands of one of her own, the American destroyer RINGGOLD. Mistaking NAUTILUS for a Japanese submarine, RINGGOLD had done everything in her power to put NAUTILUS on the bottom. She failed, the Marines were landed, and Operation Galvanic was off and running.[4]

While it can hardly be argued that the landing of 78 Marines by NAUTILUS on Abemana led to the successful conduct of Operation Galvanic, it is just as wrong to discount the role submarines have played and will play in supporting amphibious operations. The covert nature of submarines and the acknowledged leverage a few highly placed troops can have if they can get where they need to be when they need to be there are key to

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[4] Hoyt, Edwin P., Submarines at War, Jove Books, New York, 1992, pp. 212-213.

minimizing the risk to amphibious assault forces.

As important as putting special forces ashore ahead of the main body is, there are a number of other unique ways in which submarines contribute. If the Amphibious Commander wants to track the movement and activities of enemy mine laying forces without tipping his hand, he will employ an expeditionary submarine. If the Commander wants to conduct offensive mining operations in an enemy harbor proximate to a planned landing location, he will employ an expeditionary attack submarine. If the Commander wants to decide where mine fields are and, as important, where they are not, he will again employ the expeditionary submarine. Finally, if the Commander wants to disable mines that block his approach he will, with the fielding of covert, submarine launched advanced unmanned underwater vehicles, employ an expeditionary submarine. As was the case with submarines employed in conducting enabling strikes ashore, the proper utilization of expeditionary submarines in support of amphibious operations will minimize the risk to American troops.

Battlefield Preparation

For years now U.S. and allied submarines have been preparing tomorrow's battlefields. While discussions of specific tasks and accomplishments remain classified, the utility of the submarine in this role is well understood by both civilian and military officials.

Submarines stationed off distant coasts have consistently provided military planners with information required to formulate necessary contingency plans. They have provided locating data on key communication facilities, they have covertly monitored, recorded, and they have sent to the commanders real-time status of both military and commercial shipping. They have monitored embargo compliance, examined the status of military forces, and in general kept the NCA apprised of the dynamic and unfolding situation in troubled parts of the world. In short they have provided a wide range of information and observations considered key to preparing the battlefield.

Why submarines? Wouldn't it be easier to do the same thing with men on the ground, with airplanes or satellites, with surface ships or remote intercept sites. The answer is simple. No. It's not possible to get what the submarines get, here, today, with any of those other things. And the reasons, although relatively straightforward, are often overlooked.

First, submarines, by their very nature, do not disturb the

environment in which they work. The antagonist has no idea that he is the subject of this preparation effort. He has no idea that just off his coast a submarine is and has been stationed for months or even years, collecting valuable data.

On the other hand, this same leader does know when an aircraft or surface ship attempts the same mission. He does know, or at least has some idea, when most satellites are in a position to collect. He does know and this knowledge affects his actions. It therefore affects the collection.

Second, the nuclear submarine has the strength of endurance. Today's nuclear powered attack submarine can remain on station, watching and listening 24 hours a day for a long, long time. Most other assets are limited in their staying power. For instance, valuable as overhead collection assets might be, they are not always overhead. If they happen to be out of position during that one communique that gives the enemies game away they will have been of no value.

In general this mission, preparing potential battlefields for possible military action, makes the greatest demands on submarines during *peace*. By their very nature such operations are extremely sensitive and therefore do not lend themselves to a great deal of public debate. The need, however, is no less real.

One has only to look around this rapidly changing world to understand the wide variety of potential troublespots where this nation might employ a submarine, might begin an early collection effort in anticipation of future troubles. Such potentialities, by most measures, have grown over the last couple of years. It is just possible this growth will continue in the future.

Perhaps then, the analysts and staffers who have so carefully studied and written on this question of requirements have erred. Perhaps, despite all the rigorous analysis and mathematics and general hocus pocus, the reality is that the world is still a dangerous place, one characterized by innumerable trouble spots, each demanding some of what submarines bring. If we suppose, for the sake of argument, the need for U.S. attack submarines does not diminish in any real way, then what? How do we proceed so as to do best with what we have?

Multi-Mission Flexibility

The nation neither needs nor wants a submarine, alone and on station at some distant outpost, telling it that while thus-and-such a task has been ordered, this-and-that platform limitation make

carrying out that order impossible.

It is axiomatic that the Submarine Force of the future must consist of ships and crews able to engage and succeed in the full range of missions. The fact is that today's Los Angeles class multi-mission submarine does not have the room for improvement required to satisfy this need. The next generation of attack submarine must be designed so as to recognize the particular requirements of each of the enduring mission areas and be fully able to accommodate them. This may mean that during construction certain hulls will be fitted with certain equipments uniquely suited to a particular mission. By its very nature this fitting of a particular piece of mission specific equipment must add to a specific mission without detracting from the fundamental multi-mission requirement.

Tailored Capabilities

There is, on the other hand, the matter of money. Perhaps the time is coming when our submarines cannot or should not be expected to do it all. For years we have relied on the multi-mission flexibility of each unit of the force to meet a wide range of requirements. From sinking ships to preparing the battlefield, one unit was every bit as good as the next. While this flexibility seems a necessity rather than a luxury, fiscal pressures might dictate a re-examination of this fundamental precept.

The specific and particular requirements for a submarine engaged in anti-submarine warfare differs markedly from that of a submarine engaged in amphibious support. Whereas the ASW or strategic attack submarine might be outfitted with the very best in passive sonar systems and sail with a room full of advanced capability heavyweight torpedoes, the amphibious support submarine might go to sea with the most advanced active mine detection and avoidance sonars and a full load of offensive mines. There also exist significant differences between those submarines tasked with conducting operations against enemy shipping and those conducting precision enabling strikes ashore. If we were able to tailor specific platforms to specific missions then perhaps we can provide a more cost effective force.

Unfortunately, today's Los Angeles class submarines have nowhere near the mission flexibility left to tailor them to meet the full range of options required. Besides, there exist a fundamental, bedrock set of skills and capabilities each and every attack submarine and her crew must possess in order to survive in the

harsh undersea environment. **If we were to embrace in pure form this tailored alternative we would be doing the Navy and the nation a great disservice.**

We are left with this. We recognize the difficulties a smaller, general purpose Submarine Force will face in trying to accommodate all that will be asked of them in the future. Further, it is recognized that tailoring specific submarines and their crews to specific roles and missions just doesn't pass any sort of reasonableness check. The solution, as is so often the case, appears to be a compromise.

Submarine Squadrons—By Functions

In the Submarine Force of the future all these pressures may mean that the remaining submarine squadrons will become functionalized. The squadrons, their supporting doctrinal, tactical, and maintenance teams will focus their energies and skills in a particular mission area. For instance, there might someday exist a Strategic Attack Squadron on both the Atlantic and Pacific coasts, dedicated to satisfying those particular national needs as determined by the NCA. There might be a Battlegroup Attack Squadron. Submarines in this squadron would be outfitted for and be expert at putting SEALs ashore, at conducting offensive and defensive mining, at providing the long lead time indication and warning product the Amphibious Assault Group requires in support of battlefield preparation.

The need for multi-mission submarines would remain. The individual units, although formally assigned to one of the functional squadrons, would have the inherent capacity to shuttle from function to function. The submarine squadrons would act as the proofing filter, ensuring that each ship and her crew were fully certified to perform the particular mission.

The benefits of such an arrangement are many. This scheme would allow the force to retain its historic multi-mission flexibility. It would sharpen particular skills in particular areas. It would provide a tighter link between the customer, be it the Battlegroup Commander, the Amphibious Ready Group Commander, or the NCA, and the submarine. It would allow submarine squadron staffs to support the battlegroup in a fashion analogous to the support provided by Destroyer Squadron staffs.

Finally, the functional squadron option may make the best use of what in the near future will become an over-taxed asset. The nation and the Navy must soon decide when, where, and how

these increasingly scarce resources will be put to use. By tailoring the Submarine Force of the future within the functional framework described we may be in a position to provide the nation the most cost effective return on its defense dollar.

Summary

The U.S. attack Submarine Force was, by necessity, a principle and motive element in winning the Cold War. Relied on to conduct a wide range of taskings, the force was able to succeed in regions, roles, and missions others found impossible.

With the end of the Cold War came growing fiscal pressures which forced a critical re-examination of all elements of U.S. defense posture. As it affects attack submarines, this analysis has suffered in that decision-makers, in some cases, have overlooked the unique and extraordinary contributions submarines have made in the past and will make in the future in support of the nation's defense. These traditional roles and missions—sinking ships, conducting enabling strikes ashore, supporting amphibious assault, and preparing future battlefields—are the more important today as our focus shifts from blue water, open ocean threats to coastal missions. Despite the analysts' rosy projections about decreased requirements, the Submarine Force must, of necessity, find a way to do more with less.

It must do so while retaining both the multi-mission flexibility such an independent instrument of war requires, while honing its skills in the traditional mission areas. Such contrary requirements in an era of declining budgets requires new and innovative solutions.

One possible solution, that offered above, has two critical elements. First, the nation must provide the force with a future submarine possessing the size and weight required to accommodate true multi-mission tasking. Such is not the case with America's current frontline SSN, the Los Angeles and improved Los Angeles class attack submarines. Finally, today's Submarine Force should consider realigning the remaining attack squadrons along functional lines, providing the institutional expertise tomorrow's battlefield will require.

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SUBMARINE-LAUNCHED UNMANNED AERIAL VEHICLES (UAVs)
A Rationale for Operational Utilization with Concepts for Shipboard Integration

by James E. Miller
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[Editor's Note: This presentation was made in an unclassified form at the Submarine Technology Symposium on 11 May 1994.]

Introduction

As the priority for U.S. national security continues to shift from conducting global war to containing regional conflict, the focus of naval warfare strategy is changing as well. This is illustrated by the transition of emphasis from open-ocean war-fighting capability to joint operations conducted in the littoral (near-shore) regions. As articulated in ...From the Sea: Preparing the Naval Service for the 21st Century, U.S. maritime forces will be called upon to provide strategic deterrence, sea control, extended and continuous on-scene crisis response, and power projection—all within the technically and tactically demanding littoral environment. The challenge is to develop new and innovative technological approaches that can support these new missions in a declining resource environment.

This change in warfare priority presents the U.S. Submarine Force with some daunting challenges. Consisting of shallow and confined waters with high shipping densities, the littoral regions are not optimum areas for submarine operations. Maneuvering is restricted and contact detection, classification, and localization are difficult, as is the effective employment of submarine weapons.

While the nuclear attack submarine (SSN) will move forward into the littoral regions and continue to fulfill many of its traditional roles, new and fundamentally different missions will be mandated—missions which will continue to take advantage of the SSN's inherent stealth, endurance and agility. These new roles are to provide the National Command Authority and any Joint Task Force Commander with:

1. Early, accurate knowledge of the battlefield on which power may be projected from the sea;
2. Sea-based forces capable of deterring regional aggression or nuclear attack;

3. Covert striking power against critical targets ashore;
4. Capabilities to enable the establishment of an expeditionary force on land; and
5. Maritime strength to destroy enemy naval forces and to interdict seaborne commerce.

The Submarine Force is, today, aggressively adapting its operational philosophy and methodologies to support these new roles. However, as littoral warfare requirements continue to evolve and intensify (i.e., more timely and detailed surveillance is needed, more sophisticated strike weapons are deployed, threat offensive and defensive capabilities improve), there must be corresponding improvements in the capabilities of the submarine. Those technologies that enhance the SSN's ability to observe the adversary (surveillance), influence his thinking (deterrence), and punish him (strike) will become preeminent. In addition, increasing emphasis is being placed on limited strike/low collateral damage, strike warfare, and real-time battlespace surveillance.

Emerging Warfare Requirements

Department of Defense (DoD) technology development emphasis and funding priorities suggest that the future weapon-of-choice in regional conflicts will become the precision-guided, man-in-the-loop cruise missile. This statement is substantiated not only by the experiences of Desert Storm, but also continued funding support for the Standoff Land Attack Missile (SLAM) program and initial funding for the Tomahawk Land Attack Missile (TLAM) Block IV improvement.

While improving overall strike capability for the fleet, the move toward precision-guided weapons will create new challenges for the Submarine Force. Most notably, the inherent Over-the-Horizon (OTH), submarine-to-weapon Command, Control, and Communication (C^3) problem must be resolved before submarines can fully exploit the tactical advantages of these advanced weapons. Without the associated capability to update targeting information and/or control the terminal guidance of these weapons in real-time, the SSN strike role, although still viable, may be limited to attacking lower priority targets or conducting second strike follow-ups that do not require *on-the-fly* re-targeting or man-in-loop terminal guidance. While submarines can support strike warfare in the role of carrying their advanced cruise missiles to

the forward area, launching them, and then passing control to another platform, this approach does not reflect a fully optimized employment of SSN forward presence.

Certainly the submarine has other important roles to play in the littoral regions. These include intelligence data collection, anti-submarine warfare (ASW), anti-surface warfare (ASuW), mine and mine countermeasures warfare, and special operations support. All of these roles, however, imply the ability to detect, geo-locate, identify, and track contacts in the crowded and complex environment near the shore. The common denominator for success in all of these tasks will be the ability to obtain timely, high-resolution surveillance data from beyond the horizon. Accurate and detailed OTH surveillance data will become one of the submarine's most highly-valued war-fighting resources.

Current submarine OTH surveillance capability is somewhat limited. Beyond direct visual observation, the SSN relies on the monitoring of acoustic/electronic signals and/or the insertion of Special Operations Forces (SOF) to perform this function. These techniques have their advantages, but they also can be recognized as being environmentally limited and not providing the necessary *reach* for SSN missions of the future. While third party surveillance data is available to the submarine, it generally lacks the required resolution to support stringent targeting requirements. Additionally, the operational tempo of the submarine must be planned around the schedule of the data *sender*. Unless a more robust OTH surveillance approach can be developed for the submarine, it will be relegated to support roles that reflect the envelope of its passive sensors.

Worth noting is the fact that the submarine OTH surveillance issue couples back into the submarine strike warfare problem. Given a real-time, high-resolution surveillance capability, a range of new options are created for the SSN in supporting strike warfare. These include monitoring of pre-conflict Indications and Warnings (I&W), aimpoint refinement, and Battle Damage Assessment (BDA). These capabilities would facilitate the refinement of targeting data for initial strike and alleviate the occurrences of re-striking targets already destroyed. An effective submarine OTH surveillance capability would serve as an ordnance multiplier.

A conceptual solution to solve the problem of weapon C^2 and OTH surveillance is to provide the submarine with an independent capability to launch and control an Unmanned Aerial Vehicle

(UAV). As highlighted in the DoD Unmanned Aerial Vehicles (UAVs) 1993 Master Plan, the UAV is a versatile and proven platform for Reconnaissance, Surveillance, and Target Acquisition (RSTA). It can also provide substantial capabilities in Electronic Warfare (EW), Electronic Support Measures (ESM), mine warfare, C^3, and special operations. It can readily perform a multitude of inherently hazardous missions and is a viable alternative for littoral missions. Given this rationale for a SUB-UAV, the remaining discussion will focus on issues of SUB-UAV operational benefit, general UAV missions, payloads, communication issues, and three options for shipboard integration.

Operational Considerations

To understand the operational benefit that can be derived from a SUB-UAV, one must appreciate the significant advantage that a SSN's forward presence can provide, particularly during the early phases of a conflict scenario. A likely sequence of events that could be expected to occur during future littoral conflicts includes:

1. Continuous and on-going surveillance of an antagonist's capability and intent to commit aggression;
2. Covert and aggressive acts by an antagonist which result in rising political tensions, international warnings, and economic sanctions;
3. Deployment and build-up of U.S. and coalition forces to enforce sanctions and prepare for conflict;
4. Open hostilities;
5. Neutralization of the adversary's capability to make war resulting with a cease fire or surrender; and
6. Withdrawal of U.S. and coalition forces with continuous monitoring for compliance with cease fire/treaty terms.

Without doubt one of the earliest players on the scene, and present throughout such a scenario, would be the SSN. With the ability to covertly move into forward areas without waiting for the arrival of supporting forces, the SSN is a national asset that can provide early and continuous surveillance of enemy activities. It is the SSN's stealth and independence and its ability to covertly approach the shore in a pre-and/or early hostilities phase that would leverage the war-fighting effect of a SUB-UAV the most. Through deployment of a SUB-UAV, the SSN could provide early

and accurate information on the enemy's intentions. The SUB-UAV could also allow early strike planning refinement and open the door for submarine preemptive and/or punitive strikes using its own advanced cruise missiles prior to the arrival of other forces. Another important role for the SUB-UAV could be the direct support of Special Operations Forces (SOF). The SSN could inject these forces, launch a SUB-UAV for their support, and then pass control of the SUB-UAV to them.

In light of third world proliferation of advanced surface-to-air defense systems and ballistic missile technology, the SSN's ability to covertly penetrate close to shore could be of critical importance. The SSN may provide the only viable capability to conduct real-time, on-the-scene surveillance in the initial phases of a confrontation before airspace dominance is established. Submarine operations would not be restricted by the long standoff distances required by air and surface forces to protect themselves from missile batteries and weapons of mass destruction. The intelligence data gathered by the SSN could then be passed to the Task Force Commander for further dissemination to his forces. Obviously, as the conflict scenario progresses with allied forces establishing battlespace dominance, the prominence of SSN surveillance lessens. Land-based UAV systems could assume surveillance and data-relay functions. The SSN strike role, however, could remain viable through connectivity with those land-based UAV systems.

Any approach for analyzing the benefits of a SUB-UAV should correlate established UAV missions with desired SSN roles. While this approach suggests that substantial benefit could be gained from a SUB-UAV, further analysis which defines specific Measures of Effectiveness (MOEs) should be performed. As an example of the quantifying analyses needed, imagine a hypothetical scenario in which 100 advanced cruise missiles are to be fired in an initial attack preceding massive air strikes. If the surveillance and aimpoint refinement provided by a SUB-UAV in a pre-hostilities environment increases strike effectiveness by 10 percent, what would be the impact? It could be surmised that as many as ten weapons would be *saved* in the initial strike. Likewise, the additional missiles that would be required for re-strike of missed targets would be saved. This represents a cost savings for inventory replenishment. It also increases flexibility for future strike planning by preserving assets in the forward area. Reduced

attrition of aircraft during the subsequent air strikes would only amplify the benefit of this increase in strike effectiveness.

There are, of course, trade-offs that must be accepted in implementing a SUB-UAV system. Any analysis, as detailed above, would also define the penalties for such a concept in a quantitative way. Some of the obvious detractors to the concept include:

1. Reduction of submarine stowage space for weapons;
2. Inability to recover the UAV results in a high cost per mission and risks capture of the unit;
3. Additional on-board equipment/systems are required for UAV mission planning and communication and control;
4. Increased submarine vulnerability/detectability during launch and communication with the SUB-UAV; and
5. Increased manpower/training requirements.

A final detracting argument that can be raised is that orbiting satellites negate the need for a SUB-UAV. Certainly, satellites possess communications relay capabilities and surveillance features. The key issue, however, is the SSN's accessibility to what the satellite can provide in real-time. Given that a satellite asset is available, that the SSN's operational tempo can support that satellite's orbital and communications schedule, and that the submarine retains dedicated access and priority, satellite utilization could support many of the roles suggested for the SUB-UAV. However, due to the high demand on satellite resources expected during periods of increasing tension and conflict, it is unlikely that all of the criteria listed above could be consistently met. Additionally, the flight and arrival of a SUB-UAV could not be predicted in the same way as overflight of a satellite. The adversary would not have the advantage of *clear sky* periods to conduct operations when surveillance satellites are not in position.

Given that a SUB-UAV would enhance the SSN's capabilities in the littoral environment, a preliminary listing of desired operational characteristics can be defined for it. The *ideal* SUB-UAV capabilities needed to support the requirements defined above would include:

1. Compatibility with existing submarine launcher systems;
2. 10 to 12 hour flight endurance with a minimum 75 kt speed;

3. 50 to 75 lb payload capacity;
4. Size and geometry which allows tandem stowage in torpedo room (i.e., stow two SUB-UAVs per weapon stow position);
5. Command and control system compatibility with UAV baseline data link;
6. Configurable payloads that could be changed on-board the submarine;
7. Minimized need for submarine to remain at periscope depth during SUB-UAV flight;
8. Compatibility with existing SSN equipment for SUB-UAV mission planning and control; and
9. Recoverable (either the SUB-UAV with its payload or just the payload alone).

UAV Issues

In examining the concept of a SUB-UAV, it is useful to examine proposed SUB-UAV missions in light of current UAV program planning, payloads, and command and control data links. A general discussion of these UAV issues is provided here, as adapted from the DoD Unmanned Aerial Vehicles 1993 Master Plan which is published by the Program Executive Office, Cruise Missile and Unmanned Aerial Vehicles Joint Program Office in Washington, D.C. The reader is referred to that document for more detailed information.

Based on the discussion in the "Operational Considerations" section, a listing of some of the more prominent missions would include:

1. Surveillance and Reconnaissance;
2. Pre-Conflict Indications and Warnings;
3. Aimpoint Refinement for Cruise Missile Strike;
4. Relay for Weapon Command, Control, and Communication;
5. Battle Damage Assessment;
6. ASUW Detection, Identification, and Localization;
7. ASW Surveillance;
8. Mine Field Identification and Localization;
9. Special Operations Support;
10. Electronic Warfare and Electronic Support Measures;
11. Air Strike Support;
12. Environmental and Atmospheric Monitoring; and

13. Cease Fire and Treaty Compliance Monitoring.

Without doubt, the heart of the UAV is its payload. Multi-mission payloads provide UAV systems with the capability to simultaneously perform missions of Reconnaissance, Surveillance, and Target Acquisition (RSTA), Electronic Warfare (EW), and communications relay. The UAV Joint Project Office (JPO) is monitoring and coordinating such multi-mission payload development efforts for future UAV integration. The following summary provides descriptions of a number of UAV payload efforts that would be of interest for a SUB-UAV concept:

1. **Lightweight Common Forward Looking Infrared (FLIR)** A FLIR is the primary imaging sensor for the UAV in performing RSTA functions. Recent advances in FLIR technology allow better sensitivity and greater resolution, resulting in improved performance. In addition, multi-spectral coverage will improve target detection capability and aid automatic target recognition and cuing.
2. **Moving Target Indicator (MTI) Radar**—This is a radar payload capable of detecting and automatically tracking moving targets and classifying moving vehicles. It incorporates a spotlight mode Synthetic Aperture Radar (SAR)/-Inverse Synthetic Aperture Radar (ISAR) to detect stationary targets by highlighting small, selected areas individually. It can be used for surface sea search to track ship formations with the ISAR mode being used to highlight individual ships for target identification.
3. **Multichannel UHF/VHF Communication Relay**—This payload will support a communications relay capability that will extend communication ranges and overcome horizon limitations. The UAV JPO plans to develop a lightweight, miniaturized five-channel Very High Frequency/Ultra High Frequency (VHF/UHF) relay to satisfy multi-service needs.
4. **Mine Countermeasures (MCM)**—This development effort addresses a mine countermeasures payload that can detect and localize mines in the surf zone and in shallow water.
5. **Electronic Countermeasures (ECM)/Decoy**—This ECM-/decoy payload will have the ability to disrupt/harass/deny operation of the enemy's communication systems and radars. The payload includes a Very High Frequency

(VHF) noise jammer, a High Frequency (HF) jammer, a VHF frequency hopping jammer, and a radar jammer.

6. **Signal Intelligence (SIGINT)**—This payload provides a SIGINT capability for intercepting and locating enemy communications and providing non-obtrusive monitoring of potential adversaries in peacetime. It will include an Electronics Intelligence (ELINT) system capable of intercepting and locating enemy radars to provide information concerning the enemy's electronic order of battle.
7. **Self Protection Radar-Warning Receiver Jammer/Decoy Payload**—This payload will improve survivability of future UAVs in a hostile and saturated air defense environment. This system would operate in several modes by providing radar/missile warning, self-screen jamming, and electronic decoy functions.
8. **Meteorological (MET) Sensor**—This development effort will result in a lightweight Meteorological (MET) payload which can measure temperature, humidity, and atmospheric pressure and will contain software for computation of wind velocity using UAV navigation data.
9. **Chemical Agent Detection**—This payload uses an interferometric Infrared (IR) sensor to analyze chemical agent clouds. It would provide a standoff capability in alerting military forces of chemical munitions events.

A final important issue for SUB-UAV utilization would be its C^3 data link. Because current submarine communications systems do not support the designated baseline data link for UAVs (the AN/SRQ-4), a specific method of SUB-UAV command and control remains undefined. Development of a new and unique submarine-to-UAV data link is not desirable because of the established and fundamental communication requirement that UAV control stations universally be able to control, receive, and exploit mission data from different platforms. The control of data link growth is a key issue for maintaining universal UAV connectivity.

Future options for data links are being considered by the JPO. A modification of the Common Data Link (CDL) used by the Medium Range (MR) UAV is under study by JPO to augment the existing baseline architecture for future UAV upgrades. Several proposals for a modified Joint Tactical Information Distribution System (JTIDS) data link have been put forward. All of these, however, do not solve the basic submarine equipment and antenna

incompatibility problem. A better approach may lie with data modification techniques. A new concept proposes a compression/decompression technique for IR imagery that would allow use of standard 16 kilobyte digital UHF voice radio circuits. This UHF technology applied as a SUB-UAV data link would result in both equipment size reductions and elimination of specialized hardware. Quality images provided at a usable rate for target identification on existing UHF radio circuits would be the result.

Submarine Integration Issues

Providing the SSN with a SUB-UAV capability would not be a trivial task. The primary challenge would be to package the UAV within a 21-inch diameter cylindrical envelope in order to allow launcher system compatibility. A second important consideration would be providing the UAV with the capability to travel underwater to the surface so it could then transition to flight. A final important issue would be providing the submarine with a means to perform SUB-UAV mission planning and command and control.

The integration of cruise missiles into submarines does set a precedent for accomplishing these goals. Two basic approaches have been used for missiles. The first, used for the Harpoon missile, is to *encapsulate* the weapon in a buoyant capsule so that it remains dry during an unpowered but controlled trajectory to the surface. Upon capsule broach, a nose cap flies off and the missile is boosted out by a rocket motor allowing fin deployment and engine start. In the second approach, used for Tomahawk, the missile is launched into the water environment where a booster rocket motor ignites and then propels the weapon to the surface and beyond in a controlled fashion. Wing deployment and engine start then occur in the air. Based on the techniques used for cruise missiles, two SUB-UAV integration options become apparent.

The first option would be to design/adapt a UAV to fit inside the existing Harpoon capsule. It then could be launched and transition to flight in much the same way as the Harpoon missile does. A SUB-UAV with an *X-wing* design (one in which the air foil surface pivots on its center at an attachment point on the fuselage) would allow the wing to be stowed parallel to the longitudinal axis of the SUB-UAV. In this manner, wing spans of up to 15 feet could be accommodated. However, a restrictive 18-inch capsule inside diameter would limit fuselage size and air foil

width. The design would also have to accommodate a folding prop with universal joint attachment to the engine. A small booster rocket motor would also be required to power the SUB-UAV up and away from the capsule after surface broach. Large enough to push the SUB-UAV to sufficient altitude for wing/prop deployment, aerodynamic stabilization, and engine start but not so energetic as to damage the unit with violent acceleration, the booster design would be critical. The design would have to account for the fact that, during boost, the SUB-UAV would experience velocities much in excess than those of normal flight and could result in aerodynamic damage or instability. An aerodynamic *sheath* might be required which would fall away after boost velocity decreases. Also important would be the unit's control system that could sense air speed and altitude to properly time wing deployment, booster release, and engine start. If these design challenges could be met, the advantage of existing Harpoon capsule compatibility with the SSN would greatly facilitate the integration for submarines with 21-inch torpedo tubes. Unfortunately, no UAV in the current inventory would lend itself to easy adaptation for this concept. Given the combined cost of a Harpoon capsule and a unique SUB-UAV design effort, this approach would be costly. Additionally, the restrictive interior dimensions of the capsule would limit SUB-UAV size and therefore, payload lift capacity.

A second option would be to adapt the existing Tomahawk missile to accommodate a dedicated UAV sensor/communications payload in place of its warhead. It could be loaded and launched in exactly the same manner as a tactical Tomahawk missile in either vertical or horizontal launch tubes. This would provide a capability not unlike that of the existing MR UAV and immediate submarine compatibility for loading and handling. MR UAV capabilities address the need to provide pre- and post-strike reconnaissance of heavily defended targets and to augment manned reconnaissance platforms by providing high quality, near-real-time imagery. The MR UAV differs from other UAVs in that it is designed to fly at high subsonic speeds and spend relatively small amounts of time over areas of interest. A disadvantage of this approach for the submarine would be the unit's relatively limited "on station" time for applications as a communications relay. Another disadvantage would be cost. The use of a Tomahawk air frame adapted to carry a sophisticated UAV payload would likely

be cost prohibitive. It should be noted that current proposals for the Tomahawk Block IV improvement include a capability to relay surveillance data to the Task Force Commander via satellite during inbound flight to attack targets. This would allow in-flight BDA; however, it means that an attack must be in progress before any surveillance data can be gathered.

In implementing either of the above integration concepts, it can be seen that many of the *ideal* operational characteristics for a SUB-UAV, as described in the Operational Considerations section, would not be provided. Additionally, it is likely that the cost and effort to implement either approach would be considerable. For this reason, a third concept which starts with *a clean sheet of paper* to address the stated requirements will be described.

The ability to recover the SUB-UAV, or at least recover its payload, would be best addressed by a Vertical Takeoff and Landing (VTOL) capability. Several prototype configurations for VTOL UAVs have been evaluated by JPO. The most applicable VTOL design for a SUB-UAV is the Maritime Vertical Takeoff and Landing Unmanned Aerial Vehicle System (MAVUS). Basically a small, unmanned helicopter, the MAVUS is comprised of a Power Module (with gas turbine and integral differential/reduction gearbox), a Propeller Module (with transmission and dual counter-rotating hubs with three rotor blades each), and a Payload Module (which can accommodate payloads for Day TV, ESM, Communications Relay, or FLIR). With modifications to increase its flight endurance (currently 2.5 hours), reduce its body diameter (currently 25 inches), and allow folding of its rotor blades, a modified MAVUS with an associated launch capsule could address most of the SUB-UAV requirements described in the Operational Considerations section. The following design concept presents the basic operational sequence for system deployment and use.

Prior to launch, the SUB-UAV (with folded rotor blades) would reside in a 21-inch diameter capsule with a length of no more than 10 feet. This would allow ejection from standard diameter, horizontal torpedo tubes and accommodate tandem rack stowage. Removable, watertight panels on the capsule would allow crew access to the Payload Module so the SUB-UAV could be configured for different missions. Also in the capsule would be a transmitter and antenna module which would provide the radio communications link to the SUB-UAV during flight.

Once in the torpedo tube, an umbilical cable would provide initial operating power and allow monitoring of internal functions to satisfy launch interlock requirements. Data communication for navigation/payload initialization and mission plan download would be provided via fiber optic cable. After launch, the positively buoyant capsule would transit to the surface and be ballasted to float vertically. The SUB-UAV would be on internal battery power at this point but continue to maintain communications with the submarine via the fiber optic cable which would deploy from a spool in the torpedo tube. The payout of fiber optic cable would allow the submarine to maintain communications with the capsule transmitter/antenna module and thus communicate with the SUB-UAV while submerged. Limited maneuvering of the SSN would also be possible during flight of the SUB-UAV.

On the surface, capsule buoyancy and stability would be augmented by an inflatable collar. Upon command from the submarine, a capsule nose cap would fly off and an internal platform would push the SUB-UAV upward to a position that would allow the rotor blades to unfold and lock in position. On command, the unit engine would start and the SUB-UAV would lift off the capsule platform to complete its mission. If available, a surface ship could provide recovery services for the SUB-UAV. It would then be possible to refuel and re-deploy the unit with an alternate payload if so desired.

Command and control data generated by the submarine operator would be passed to the UAV via the fiber optic cable and capsule transceiver/antenna module. Data from UAV would pass to the submarine via the reverse path. The SUB-UAV could also up-link data directly back to the Task Force Commander. While this communications approach would require submarine modifications to accommodate the fiber optic cable and its spooling mechanism, it would solve the data link problem with regard to communications equipment and antennas.

Current plans call for MAVUS mission planning to be hosted on the USN Tactical Advanced Computer—III (TAC III). This computer is now being deployed on SSNs and would support SUB-UAV mission planning and control. Given the planned universal connectivity planned for UAVs, control of the SUB-UAV could be passed to a third party.

It should be noted that the current MAVUS design would require significant modification to fit within a 21-inch diameter

capsule. The new design would also have to accommodate increased flight endurance requirements and address capsule stability issues for launch from the sea surface. While this design would result in a new and unique maritime UAV for submarine applications, the new system would be compatible with and support surface ship applications.

Summary

The U.S. Submarine Force faces new challenges as the emphasis on littoral warfare continues to grow. These challenges will demand new ways of thinking and new technological solutions. As the development of advanced, precision-guided cruise missiles progresses and these weapons transition into the fleet as operational systems, the capability of the submarine to effectively utilize them must keep pace. This means that submarines must be able to survey target areas in detail and then communicate with their weapons at long ranges. An option that can satisfy this requirement is to integrate a SUB-UAV capability into the submarine. While imposing significant technological challenges, a SUB-UAV integration effort is no more daunting than the challenges posed and met 20 years ago in integrating air-breathing cruise missiles into submarines. Unless the Submarine Force is provided with a SUB-UAV system, or an alternative system which provides equivalent capabilities, its role in littoral warfare will diminish.

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[Editor's Note: James E. Miller is the Encapsulated Harpoon Weapon System Program Manager at Naval Uncersea Warfare Center Divison, Newport, RI. His work there has led to the award of four U.S. patents for devices and processes that support submarine launched weapons.]

SUBMARINE RESCUE AT NIGHT

by CDR Joseph L. McGrievy, USN(Ret.)

Somewhere on the island of Timor, a transport landed and discharged a group of Australian Air Force personnel. These men were sent to beef up the base maintenance group which had arrived at Timor earlier in September 1941. They quickly settled into their barracks, enjoyed good solid meals served by Timornese waiters. They experienced another culture, drinking in both their beauty and their beer.

About this same time the submarine SEARAVEN (SS 196), with an American crew of about 65 men and officers, was operating in and around the seas that surrounded the Philippine Islands. Fully aware of the possibility of war, all units of the Asiatic Fleet were on full war time footing. What part did fate play in the lives of these groups?

On December the 7th, Pearl Harbor Day—actually 8 December in the Western Pacific, SEARAVEN was preparing to enter the Cavite Naval Shipyard for a short upkeep and overhaul period.

Suddenly bombs rained down on the capitol city of Manila, on the American ships in Manila Bay. The war was on!!!!

The superior Japanese forces moved rapidly, extending their will and their power throughout the entire Southwestern Pacific region from the Northern Philippine Islands to the Great Barrier just north of Australia. The Philippines, Borneo, Celebes, New Guinea, Java and Timor were the constant targets of the Japanese Navy men o'war and the swift and deadly Zeros of the carrier forces. Continual bombing and strafing was followed by an invasion of paratroopers and finally, a landing of Army troops. This is the fate that befell Timor, and it became a Japanese stronghold.

SEARAVEN put to sea to conduct war patrols against the Japanese Empire. Between 11 December 1941 and early April 1942, SEARAVEN had completed two patrols against the enemy and was credited with one ship sunk and one ship damaged. (Remember, the submarine torpedo was found to be a very unreliable weapony.)

At this time, Corregidor, the last bastion of the American/Philippine defense, was in dire straits. The defenders desperately needed food, fuel and ammunition. Wheat, rice, flour and canned goods were carried to MacArthur's forces by other

submarines and a few thousand clips of .50 caliber machine gun ammunition found their way in along with the food.

Preparing for her third patrol, SEARAVEN drew a highly explosive mission. She was to transport over 50 tons of 3" 50 caliber dual purpose, high explosive anti-aircraft shells to Corregidor. This very dangerous cargo was divided between the forward and after torpedo rooms, necessitating the removal of the ladders to the top side area and loss of a full load of torpedoes. Underway for Corregidor, SEARAVEN drove north to deliver the vital cargo to the beleaguered MacArthur forces.

Prior to arrival at the final destination, SEARAVEN was informed that Corregidor had fallen to the enemy. She was ordered to put about and return to the business of sinking enemy shipping.

Meanwhile fate intervened. SEARAVEN received new orders to proceed to a rendezvous point off the island of Timor and endeavor to effect a rescue of some Australian Air Force personnel, who, after destroying the communication towers, the landing strip, ammunitions and fuel oil storage left the area in a state of ruin. These Aussies then took to the jungle seeking a means of escape.

Headquarters in Australia had informed the group that a rescue from their end was not possible. The promised corvette and later promised flying boats had all been destroyed by Japanese bombings of Broome and Darwin. They were on their own in a wild jungle, pursued by the Japanese Army.

Arriving off the shores of Timor, SEARAVEN reconnoitered the beach and surrounding jungles by periscope during the day, hoping to find evidence of the survivors or a visual signal from them. Surfacing later in darkness, they approached the vicinity of the rescue position as close to the beach as possible. A fire was seen on the beach, leading the submariners to believe this was the location for the rescue.

Three volunteers undertook the task of going onto the beach and bringing out the Australians to the submarine. Ensign George Cook was assigned as boat officer and was in charge of the operation. Joseph L. McGrievy, Signalman First Class (SS), and Leonard B. Markeson, Quartermaster First Class (SS) had agreed to go with him. A small 16 foot wherry, carried in the submarine's superstructure, was hoisted over the side to make the trip. Bad luck struck immediately. The diesel engine failed to start,

and no amount of elbow grease, cussing or repair work would get it to cough to life.

Paddles were hastily manufactured out of the tops of the ammunition boxes. With three very unwieldy oars in hand, the volunteers headed for the beach. The currents were swift; the sea was rough; the useless engine was an obstacle to rowing, and sharks *as big as torpedoes* were observed knifing through the water. The Japanese were all-round and there were no further signals from the beach.

The first attempt of rescue was a dismal failure. Cook swam to the beach, heading for a fire that was observed from seaward. Landing on the shore, he shouted out his name, called for the Aussies and continued to stride toward the fire area. Arriving in full sight of the fire, he saw a group of shadows hustling into the jungle darkness. Unsure, for they could have been the enemy, Cook returned to the small boat, and the volunteers beat a hasty retreat to the safety of SEARAVEN.

With dawn approaching, SEARAVEN headed to the open sea, changed course to the south, charged batteries and headed toward Australia. Before submerging, they sent a report to headquarters, reporting the events of the night. Surfacing that night, they were informed that the rescue was still in order.

As SEARAVEN again reached the rescue area, the small boat was hoisted over the side once again, this time without the engine, which had been removed and jettisoned the night before. The three volunteers, Cook, McGrievy and Markeson, outfitted with some first class paddles, were on their way to the shore line. When they reached a spot near the line of breakers, about 75 yards off the beach, a makeshift anchor was tossed over the side. The three men went over the side, heading for the beach, trailing long lines behind them. These lines were their only connection with the small boat.

Reaching the beach, the Americans were horrified by the sight of 33 Australians in various stages of near-death. Most of them suffered from malaria and malnutrition; many had tropical ulcers under their armpits or between their legs and three of them were stretcher cases.

It was decided the healthy men would go out first; they would live to fight again. The wounded and sickly would wait until the second trip.

The selected group was led out through the surf by the three

Americans, with Cook returning to the small boat in order to be available to hoist the weakened men into the boat. McGrievy and Markeson swam alongside the men who were going hand over hand along the line. All 16 men in the first group made it to the boat, but not without a close shave and two near casualties. Two of the men, weakened further by the exertion of hauling themselves along the line, swallowed a lot of salt water. They let go to see if they could get to the boat on their own. The found themselves being swept further away from the small boat. Cook, standing on the stern of the boat, directed McGrievy and Markeson to get them back in line. The two American swimmers got to the Aussies and wrestled them back toward the boat. Even in their weakened condition, they fought the rescuers, and it took almost super human strength to get them back to the boat.

Time was the major enemy. When the small boat reached the submarine, dawn was not too far away. The passengers were hurriedly lowered below deck, given first aid, bowls of hot tomato soup, sandwiches and cigarettes. The small boat was hoisted in, as the Commanding Officer decided the risk was too great to try another rescue trip at this time.

The remainder of the party still on the beach were notified that the submarine would return the next night and pick them up. Knowing the Japanese Army was within a half day's march of their position, these brave men sent a cheery message, "Okay, Yank; good on ya."

SEARAVEN returned to deep water, charging batteries enroute. The Australians were hurriedly indoctrinated into life aboard a submarine. Information slips were handed out to instruct them as to what to do in case of emergency, where and when smoking would be permitted and the all important task of how to *blow the head* (how to flush the toilet).

The Aussies were greatly concerned about the safety of their mates left on the beach. They knew the Japanese were not too far away, for they had received a note from the Japanese stating that they would be treated with kindness if they would surrender. The submarine crew tried to reassure them that the small boat would be able to beat the Japs to the punch. A peaceful day was spent submerged off the island, and plans were formulated as to how we would get the stretcher cases off the island. The Commanding Officer insisted that the volunteers not take the boat into the beach.

The decision was made to take one additional man who would remain with the boat and assist in helping the injured into the boat. The three swimmers would secure the wrists of the badly injured with bandage material, loop the bound arms around the neck of the swimmer and then swim them through the surf to the small boat. All agreed this was the best solution to the problem.

After dark, SEARAVEN surfaced and again headed for a position as close to the breakers as would be considered prudent. The submarine reached an acceptable position, and the small boat was hoisted over the side for a third trip to the beach. John Lorenz, a very hefty and strong Chief Machinist Mate, was the fourth man in the boat. He remained with the boat while the three swimmers swam to the beach to effect a rescue of the stretcher cases. Reaching the beach the volunteers were greeted with a cheer and a "Thanks Yanks, for coming back for us".

McGrievy took the first man on his back and entered the water. He had tried his best to instruct a semi-conscious man how he would have to act as they came to the breakers. Reaching a depth of water where the patient became less of a load, McGrievy took the line in hand and began the long rip through the surf to the anchored boat. Getting through the surf was a major undertaking, making sure the injured passenger did not swallow too much water.

When the swimmer reached the small boat, Lorenz made short work of getting the injured man into the bottom of the wherry. In a few minutes, Markeson arrived with his passenger, and close behind Cook deposited his man into the boat.

At this moment, the seas decided to change a very smooth rescue into a tragedy. The wind began to blow, and the seas began to mount. The small boat started to drag anchor and finally, turned her broadside to the waves. In a flash, the boat was swept toward the beach, smashing through the breakers and depositing the boat, the four Americans and the three injured Aussies onto the sands of the beach.

Fighting time, the rescuers got the injured men into the bottom of the boat and shoved the bow toward the breakers. All hands took hold of the boat, wherever they could grab. They were battered back to the beach on the first three tries. Finally, gathering their last bit of strength, asking the Almighty for a helping hand, they made another try. An invisible hand picked up the stern, and shoved the boat and its battling crew into calmer

waters. From there, the rowers were able to make forward progress. After getting all hands into the boat, they made their way back to SEARAVEN.

Transferring the rescued men onto the submarine and getting them below deck almost ended in another tragedy. The first man brought aboard was a semi-comatose Aussie, who drifted in and out of consciousness. He was shoved aft on the deck in order to facilitate getting the others aboard. Finally, the small boat was hoisted in and topside was secured. SEARAVEN prepared to head to sea and dive, for dawn was not too far away.

As a sailor came topside to close the after battery hatch, he thought he heard someone moaning and trying to call "Hey mate, what about me?" The seaman spotted the stretcher on the after deck area. After alerting the Captain on the bridge, SEARAVEN was slowed and a bunch of willing hands came topside to lower Phil Kean to the safety of below decks.

Enroute to Australia, a major fire broke out in the maneuvering room when a loosened bolt fell into the contacts in the main power electrical system. The crew fought the fire for an hour, finally taking all the unused extinguishers left aboard ship and throwing them into the engine room. With the hatches and ventilation secured, the fire snuffed itself out.

Radioing headquarters for help, the crew turned to, and after hours of hard work were able to jury rig the auxiliary engine to the main electrical system and produce enough power to proceed at about two knots.

After several hours of slow progress, HMAS MARYBOROUGH, an Australian corvette, took SEARAVEN under tow, returning the rescuers and the rescued to the port of Freemantle.

The injured men were taken from the submarine under highly secretive orders. The Allied governments did not want the Japanese to know that American submariners were being utilized as rescue and delivery vessels. The Aussies went to the hospital to recover and SEARAVEN went back to patrol to take up the business of sinking enemy shipping.

Fate—what a strange power. It often intervenes in the lives of strangers. Never underestimate its power!!!! ■

TAKING THE SUBMARINE FORCE TO THE PEOPLE

by LCDR Greg Smith, USN
COMSUBLANT Public Affairs Officer

When faced with the challenge of bringing the people of Tucson, Arizona, to see the U.S. Navy, the crew of Pre-Commissioning Unit TUCSON (SSN 770) decided to take the Navy to the people. As part of Commander Submarine Force Atlantic Fleet's Namesake Community Relations Program, 30 members of Team Tucson flew to Tucson, Arizona recently to meet with community leaders and participate in a series of events aimed at increasing the awareness of PCU TUCSON's upcoming commissioning planned for the fall of 1995.

The namesake program is critical in reaching out to communities which have submarines named for them. "We have developed a very strong relationship with the community leaders of Tucson," said TUCSON's Prospective Commanding Officer, Commander Duane Baker, "but until this visit, we haven't been able to reach out and meet that many citizens." The 17 year Navy veteran added, "this was a once in a lifetime opportunity for us all."

Baker and his crew were guests of the City of Tucson and participated in six days packed full of activities. "I'm not sure why I brought any civilian clothes, we went to one event after another and there was little time for much else. The people of Tucson were the greatest hosts you could have asked for," exclaimed YN2 (SS) Eric McCray.

According to TUCSON's Chief of the Boat, Master Chief Greg Determan, "the intent in setting up this trip was to help build a foundation with the people of Tucson that would last well beyond our commissioning. We wanted to make sure that everyone knew they had a ship named after their city and that the crew was proud to represent them."

TUCSON's crew flew from Naval Air Station Norfolk aboard a Naval Reserve C-9 and within hours of landing taped a news show with the local PBS television station and were guests of the famous Triple C Chuckwagon Restaurant, where everyone enjoyed a little taste of the *old West*. The next day began with interviews on local radio stations during the morning drive-time hours, tours of Hughes Missile System Company Tomahawk Assembly Plant and Sargent Controls Aerospace, a visit to a local shopping mall, more radio interviews and an evening spent at one of Tucson's

more famous night spots, the Wild Wild West.

A major goal of the visit was to try and include the news media in as many events as possible. "Exposure of our visit with local news media was essential in reaching the community. The radio interviews and coverage by local TV stations gave us an opportunity to get the word out that we were in town and were anxious to meet with as many citizens as possible and explain more about what their Navy and what their submarine was all about," explained Baker.

The crew was hosted by Tucson High Magnet School, where 1,200 members of the student body turned out to pay tribute. The visit to the school also gave the crew an opportunity to recognize Miss Susana Arias, whose art work became the official seal of USS TUCSON. The 17 year old junior was among more than 200 entrants who sent in proposals for the official seal of the new submarine. Miss Arias was presented a U.S. Savings Bond and a framed copy of the official seal. Also recognized was Miss Lisa Larabee, a 14 year old freshman, whose art work was used as the official crest by the submarine's builder, Newport News Shipbuilding, during the Christening Ceremony in Newport News, Virginia, this past March 19. The remainder of the day the crew toured historic sites and were hosted by local citizens for dinner.

For many in the crew, the highlight of the trip came when Team Tucson joined forces with hundreds of volunteers to help refurbish homes of needy Tucson residents. This important volunteer program repaired several homes in the Yaqui Indian Reservation.

"It was truly amazing to watch a home which was in need of repairs literally transformed before your eyes in a matter of hours," said Radioman Chief (SS) John Marsino. The crew were assigned to two different homes and participated in tasks ranging from painting to landscaping.

"We knew that we had a lot of talent in the crew, and all we had to do was turn these guys loose and they would perform miracles," said Determan. That evening the crew of the only other Navy ship to be named after the City of Tucson, the World War II anti-aircraft light cruiser USS TUCSON (CL 98), joined members for a reunion celebration.

On Sunday, crew members attended church services and teamed up with U.S. Congressman Jim Kolbe for a hike and cookout in the beautiful Sabino Canyon. The Arizona congress-

man thanked the crew for coming to Tucson and commented that their visit was a *huge success* in spreading the word about the Navy. Later that day, the crew and USS TUCSON Commission members were hosted by Lieutenant Commander Bob Webb, USN(Ret.) at the R.B. Webb Winery for a reception featuring a specially labeled USS TUCSON (SSN 770) 1993 Arizona Fumé Blanc Wine.

Before heading back to Norfolk, TUCSON's crew fanned out throughout the city and paid visits to each of the city's councilmen and county supervisors, as well as visits to the local Veterans Administration Hospital.

"We left no stone unturned during this visit," said Baker, "and the people of Tucson were more gracious than we could have ever hoped for."

Team Tucson left with a better understanding of their namesake city and met the challenge of bringing a small part of the Navy to the people of Tucson. ■

MEMBERSHIP STATUS

	Current	Last Review	Year Ago
Active Duty	856	870	925
Others	2667	2705	2728
Life	261	257	254
Student	23	24	25
Foreign	65	70	69
Honorary	21	21	19
Total	3893	3915	4020

P.M.S. BLACKETT
NAVAL OFFICER, NOBEL PRIZE WINNER, SUBMARINE HUNTER

by John Merrill

[Editor's Note: John Merrill is an electronics engineer emeritus of the Naval Underwater Weapons Center at New London, Connecticut. Following retirement he co-authored a history of the Center, Meeting the Submarine Challenge.]

Patrick Maynard Stuart Blackett, born 18 November 1897 in Kensington, London, was the son of a stockbroker. At thirteen, he entered Osborne Royal Naval College and in 1912 transferred to the Dartmouth Royal Naval College. Throughout World War I, he served at sea, initially as a naval cadet, and saw action in the battle of the Falkland Islands in 1914 and the battle of Jutland in 1916. Promoted to the rank of lieutenant in May 1918, the Admiralty sent him to study at Cambridge in January of 1919. He liked the Cavendish Laboratory and resigned from the Navy to continue his studies there as a civilian. After passing the final honors examination in mathematics in May 1919, he passed the physics final honors examination two years later.

Among his teachers at Cambridge was Lord Ernest Rutherford, one of England's greatest physicists. Rutherford won the Nobel Prize in 1909, and in 1919 had just been appointed Cavendish Professor of Experimental Physics at the university. As a student and after completing his physics studies in 1921, Blackett participated in experiments under Rutherford exploring the possibility of the artificial transmutation of the elements by alpha particle bombardment. For 10 years, he continued at the Cavendish Laboratory with Rutherford, who suggested that Blackett consider working on an improved version of the Wilson cloud chamber.

Blackett's Nobel laureate in 1948 was for the further development of the cloud chamber and discoveries in the field of nuclear physics and cosmic radiation. Earlier in 1946, he was awarded the highest award the United States can make to a civilian, the Medal for Merit. This was for his operational work in connection with the anti-U-boat campaign during the war.

His varied roles as a civilian in the technological aspects of warfare started in the mid-1930s. Along with his highly regarded

scientific acumen, Blackett brought a deep understanding of the system aspects of successful weaponry and the application of scientific analysis to the operations of war.

Blackett firmly grasped the importance of the relationships and understandings between the scientist and the equipment end user, the military. He understood the significance of collecting reliable data on the results of weapon usage as the essence of determining equipment performance. This was another aspect of Blackett's effective application of scientific methods and the use of statistics to wartime technological problem solving.

During mid-January 1935, Blackett was appointed to serve on the Committee for the Scientific Survey of Air Defence, under the chairmanship of Sir Henry Tizard, who had been selected to head the Committee the previous year. The Committee's purpose was "to consider how far recent advances in scientific and technical knowledge can be used to strengthen the present methods of defence against hostile aircraft."[1] During its five year existence, the support and implementation of radar stands out as one of the Committee's important contributions. When war came in 1939, the whole east and southeast coast of England had operational radar chains. This was one of the factors in winning the Battle of Britain in 1940.

In the beginning of World War II Blackett joined the instrument section of the Royal Aircraft Establishment at Fainborough, where he made a major contribution to the Mk 14 bombsight for the Royal Air Force. This bombsight, brought to completion by another scientist, removed the need for a level run before bomb release and was in use by the Bomber Command from 1942 until the end of the war.

By August 1940, Blackett was the science advisor at the headquarters of the Anti-Aircraft Command at Stanmore. Here he was involved in studies and analysis to enhance the use of radar data to direct gun fire. The analysis team for gun-laying radars included a physiologist, an astronomer, a mathematician, and physicists. The results led to a significant reduction from 20,000 to 4,000 in the number of rounds needed to down an enemy plane.

The magnitude of the U-boat problem and need to address a

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[1] P.M.S. Blackett, Studies of War—Nuclear and Conventional, Hill and Wang, New York, 1962, p. 102.

range of solutions directed his assignment in March of 1941 to the Operational Research Section of Coastal Command. His duties included studies of methods of attack and determination of the proper depth for depth charge explosions on submarines. Studies regarding planned flying and maintenance of Coastal Command aircraft resulted in a doubling of the flying hours per month for a given number of planes and personnel. To Blackett and his operational research colleagues is attributed the concept of painting the submarine-searching planes white instead of a dark color to lessen the opportunity for a U-boat to discern patrolling planes against the background of the sky.

In May 1941, Blackett wrote a memorandum proposing a detector buoy astern of convoys to detect shadowing or trailing enemy submarines acoustically and then to transmit the information by radio to the ship.[2] At about that time, J.T. Tate and L.B. Slichter of the United States National Defense Research Committee heard of the idea while in Great Britain on an exchange mission concerning anti-submarine devices. This ultimately led the following year to the development of the sonobuoy at Columbia University's Underwater Sound Laboratory in New London. The sonobuoy met with success during the war and to the present continues to play an important role in current anti-submarine warfare.

Additionally, Blackett's wartime interests included analysis of the strategic value of aircraft, escort duty on convoys, general sweeps over the Atlantic, patrolling of the Bay of Biscay, and the effectiveness of 10 cm radar. By June 1943, the U-boat menace was somewhat mastered.

After the war, Blackett's career continued at the University of Manchester where he had become Professor of Physics in 1937. He established a school of cosmic ray research and stimulated the development of other research interests, which led to the creation of the first chair of radio astronomy at the University of Manchester and to the building of the Jodrell Bank Experimental Station for radio astronomy 20 miles south of Manchester. Construction started in 1952 and the station was in operation by the fall of 1957. It has one of the world's largest fully steerable radio

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[2] W. Hackman, Seek & Strike: Sonar, Anti-Submarine Warfare and the Royal Navy 1914-54, London, Her Majesty's Stationery Office, 1984, p. 395.

telescopes with a reflector 250 feet in diameter.

Blackett's scientific and technical interests were broad, ranging from work with magnetometers and measurements of the magnetic properties of rocks back 500 million years in time, to conceptual thinking about the continental drift theory. In 1945, he worked at the highest government levels, to support the development of a computer industry. He became president of the Royal Society in 1965, an appropriate acknowledgment of his many talents.

A final note, Blackett is reported to have been kicking off at a students' football match when he was informed of his winning the Nobel Prize. ■

REMINDER
1995 SYMPOSIA

SUBMARINE TECHNOLOGY SYMPOSIUM

- May 10 thru 12, 1995
- Secret Clearance Required
- Johns Hopkins University Applied Physics Lab
- Invitation only: Contact Pat Dobes (703) 256-1514

* * * * *

NSL THIRTEENTH ANNUAL SYMPOSIUM

- June 6-7, 1995
- RADISSON MARK PLAZA HOTEL
- Alexandria, Virginia

MARK YOUR CALENDARS AND SAVE THESE DATES!!

THE HUMAN-COMPUTER INTERFACE

by LT Karl V. D'Ambrosio, USN

[Editor's Note: This article was the winner in the first Naval Submarine League sponsored SOAC (Submarine Officer Advanced Course) essay contest at Submarine School in New London.]

Recently, as part of the course in advanced submarining taught by Naval Submarine School, my class toured the Naval Undersea Warfare Center (NUWC) in Newport, Rhode Island. I was incredibly impressed with the technological capabilities that were demonstrated, state-of-the-art computer simulations, training scenarios, real time data links and more. But wait a minute. This was the Naval Undersea Warfare Center. Why was I so impressed with the technology there? I'm the one who *goes in harm's way*. Perhaps I was impressed because I came from a 594 class boat with a 15 year old fire control system based on 25 year old processors. However, I think many of my fellow classmates were equally impressed. After all, from an operator stand point the latest version of BSY-1 isn't much different from what we had on the old TINOSA-fish.

At NUWC we were shown the amazing advances of the BSY-2 combat system, and the open architecture of the New Attack Submarine (NSSN). That's great, but I have a more limited outlook. My understanding is a total of three BSY-2 boats (SEAWOLF class) will be built. Period. My classmates and I have around a 1 in 25 chance to serve on one. And the NSSN? Who knows? By some estimates, if we don't get the NSSN down to $1.2 billion and do some creative financing, there may not be any. Consequently, I'm concerned with the fire control systems we've got now. Like Mk113 (still out there as one of my classmates recently found out), Mk117, Mk118, CCS Mk1, and even CCS Mk2. CCS Mk2 is supposed to provide most of the front end capability of BSY-2 for the boats we currently have. Unfortunately, the installation of the first new operator interface since the late '70s has been cancelled for a number of platforms due to cost concerns.

There are many brilliant people at NUWC working hard to provide solutions to the complex problem of submarine warfare. It is evident to me that these people fully understand, and in many cases are at the forefront of, the transformation of warfare. Even

now, battles are often decided by superior information processing and transfer. In this new paradigm, the most critical interface is the one between the organic data processor, in other words the human operator, and the electronic data processor. In testimony to the truth of this statement, NUWC labs are replete with menu driven software, multitasking operating systems and high resolution three dimensional color graphics. Numerous LANs connect the engineers and scientists to each other and the internet. Evidently the government **can** purchase the kind of computer equipment we need. It's out there right now. It costs less than the systems we currently have.

Of course that is a naive point of view. As a submariner I fully understand the need for reliability. My life depends on it. This is the precious commodity that our present systems have. Sure, and there's a bridge in Brooklyn which I'd love to sell you. The **documented** mean time between serious program errors for most combat systems out there is around one week. Not willing to be caught with their pants down, most boats shut down their fire control and sonar systems daily to reload the programs that allow them to see (hear) and fight. Even when the programs are running properly, many uncorrected errors still distract the crew from doing their jobs. Errors that move torpedo safety boundaries the wrong way, inhibit command shutdown of the weapon, and cause the torpedo to turn the wrong way after missing the target. Sure there are ways to get around these problems, but after many program upgrades why are they still there?

The worst problem with the Mk117, CCS Mk1, BSY-1 and even the CCS Mk2 systems are the user interfaces. On TINOSA, my first XO made the mistake of making me CO's Tactical Display (COTE) operator. Suffice it to say I was one of the fire control system knob twiddlers. I don't remember how many times I embarrassed myself by screwing up yet another periscope observation. Or trying to figure out which knob did what in towed array mode. Or mixing up fire control trackers that had different names in sonar. Fortunately, I subsequently became the time-frequency plotter and gave much meaningful input to the fire control party. Though I chafed at the ignominy of plotting those little dots in the prescribed colors, evaluation was intuitive.

Just thinking of the training time that could be saved and put toward more useful areas if we didn't have to explain to every Submarine Officer Basic Course student, not to mention every

returning SOAC student, what a bearing difference dot was and what *Dmho* and *Cqts* stood for. Is there some arcane reason more obvious names could not have been used in the displays, for instance O/S speed and tgt AOB? I don't know about anyone else but it took me about one hour in the lab to understand how to create a geoplot and obtain every important piece of information it could give. I'll never forget how to do it. On the other hand, consider the procedure for detecting and analyzing a target zig in towed array mode. I supposedly learned that just a couple of months ago. That's not to say Submarine School did not do the best job they possibly could. They did. You simply cannot effectively teach information that doesn't make sense, that doesn't logically flow from basic principles. We all have an *I believe button*; it's just not connected to any memory cells.

With just a little training anybody can nail a contact solution on the geoplot and see the tactical situation at the same time. But don't think I'm a retro-grouch that wants everything on paper. I simply want the intuitive elegance of those **human interfaces.** The process of setting up each plot and plotting the incoming information is a huge waste of time for the human operators who ought to be spending their time performing high level evaluation. The physical act of plotting requires additional people in an already cramped space. Furthermore, it adds inaccuracy and time delays. Consider an electronic format that would provide the data plotted on correctly scaled axes. A computer derived data averaging interval taking into account source, frequency, perceived bearing rate, and desired accuracy would not only provide more accurate bearings but give the operator some objective evidence as to possible statistical errors. This would allow the human operator to concentrate on the critical task of evaluation and correlation with other data sources.

Already I can think of much information such a system could easily provide. Information that paper plotters would never have time to calculate. It could perform automatic curve fitting and ranging calculations, bad data screening, give meaningful threshhold alerts, and calculate error statistics for all derived quantities. You may think all this additional data is extraneous to the problem. It's not, and this is something a computer can do. The approach officer (AO) sets fire control range error based on input that comes from the time range plot through the fire control coordinator (FCC). This crucial quantity is often overlooked but

is a key to whether the target has time to evade and counterfire. Where does the time range plot get his error bars? From the fire control party. At best they are educated guesses with little or no statistical significance. Is this a training problem? No. Even if SUBSCOL taught statistical error analysis what operator would bother to learn it, much less do it while he or she were being attacked? I sure wouldn't want such a geek in my fire control party.

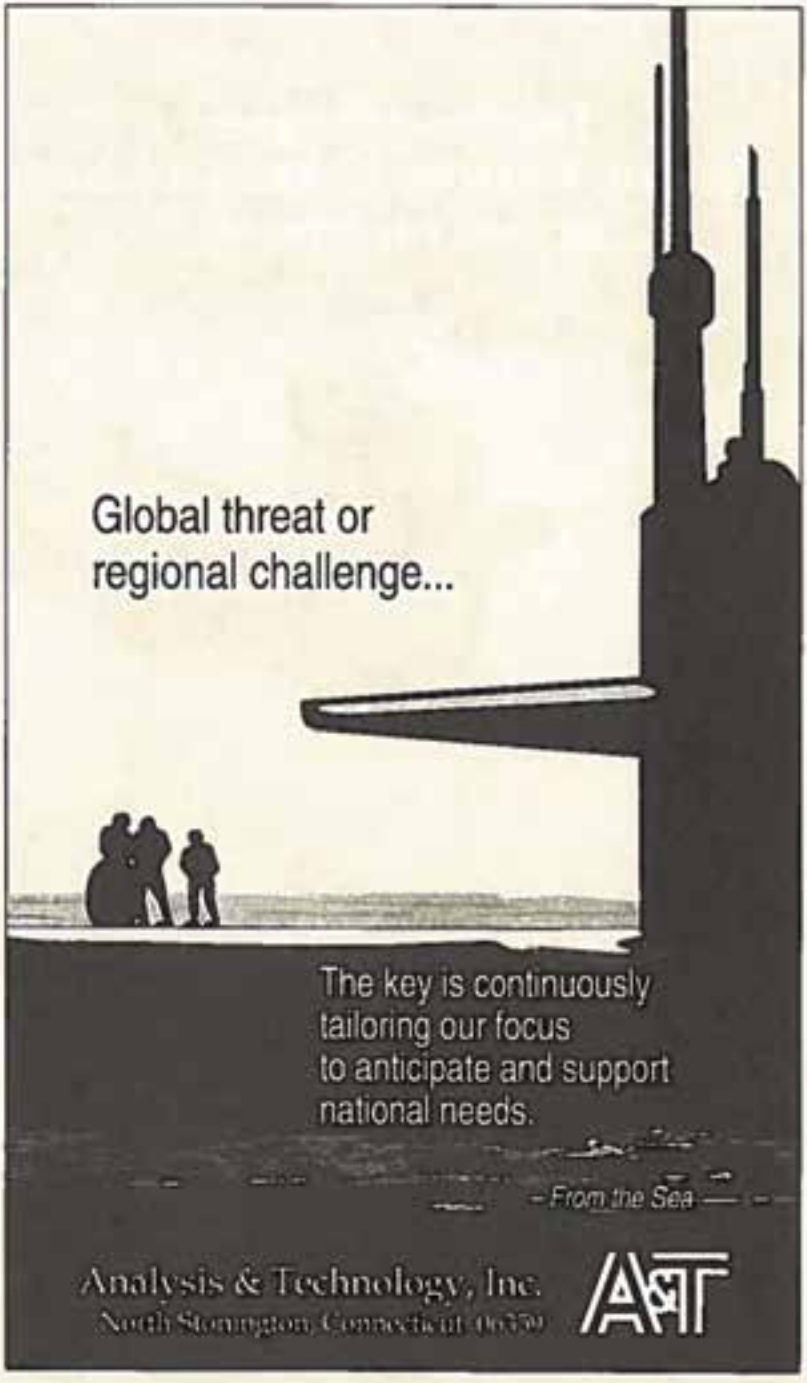
Some may say that these capabilities already exist in the HP9020 and the TAC-3. They do, but with significant drawbacks. There are add-on devices. In most cases they cannot send any information to fire control and ultimately to the weapons. Often they are located nowhere near the AO or the FCC. Out of sight, out of mind. Remember, the human interface is crucial. Automatic data entry (ADE) is an absolute necessity. Without it, the operator must enter all the raw data. This is about as efficient as plotting dots. Many boats only got this modification recently for the old HP9020s. ADE for the TAC-3 is still being developed. Finally, the HP9020 is slow and there are not enough TAC-3s to go around.

Fortunately the solutions are being pursued vigorously at NUWC, Submarine Development Squadron Twelve and many other places. As I stated previously, however, slashed budgets are destroying even the best laid plans. CCS Mk2 with its planned Joint Operational Tactical Software and Submarine Fleet Mission Program Library (SFMPL) inter-operability is only making it to the fleet slowly. Why? It's too expensive. Perhaps the emphasis should be on simplification, efficiency and cost reduction. I applaud the NUWC designed elastomeric torpedo ejection system. What a truly brilliant idea that could provide a quantum jump in submarine stealth while improving reliability and drastically reducing cost. Unfortunately, back in the fire control side, several managers were quite proud of the fact that the main programs of BSY-2 and SFMPL 5.0 used approximately two **million** lines of code. Somehow, I'm not sure that is an accomplishment of which I would be proud. We paid someone to write those 2 million lines of code. What's the possibility there is an error somewhere in that jungle? If all that code improves the user interface, great. If not, get rid of it. I'm tired of programs that degrade over time and are fraught with errors that can't be fixed.

My final question is really the first one all over again. Why

does it take so long for existing technology to filter down to the operator? The technology the Submarine Force needs I use every day on my laptop. It's the technology NUWC is using to support the Navy. The consensus at NUWC is that acquisition procedures are to blame. I don't find that hard to believe. During the short time I spent working at Hughes Aircraft Radar Systems Group, I became familiar with the MILSPEC system. I was dumbfounded to find detailed specifications for the threads on tiny nuts and bolts that held components on circuit cards. In fact, there were specification for the types of ink allowed on the circuit cards. I know how much Hughes paid me to ensure these ridiculous specification were met. But let's not forget the money spent on the federal employee or consultant who researched and wrote the specifications. In the end, who shelled out that money? The American public did, thinking they were buying the best equipment available for their military. Perhaps even more crucial, MILSPECs make new system design and manufacture move at the speed of a UYK-7, the laughable standard data processor on today's nuclear submarine.

The government still procures military systems essentially the same way it did 20 years ago, back when American car manufacturers took a half decade to build a Pacer and everyone still chuckled at the Japanese. In the 1990s, the average time the Big Three take to go from concept to production is about three years and as everyone can attest the results are impressive. Superior data processing and information networks have made the U.S. economy the most competitive in the world. The government's military acquisition policies have stifled this critical shift in the operation of our front line units. The procedural lag is most evident in areas where technology is changing most rapidly, i.e., information processing and transfer systems and human-computer interfaces. The very technologies that will determine the outcome of warfare in the future. Acquisition procedures for military platforms (specifically submarines) need to change now. The longer we wait, the more time and money are lost getting those crucial and ever improving human interfaces to our platforms. If we wait too long money and time may not be the only things we lose. ■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Shipbuilding

ON THE INACTIVATION OF SUBMARINES

[Editor's Note: With the reduction in size of the Submarine Force, there are many fine ships with honorable histories being retired, some well before the end of their planned service life. At each of those ceremonies, speeches remember the building and the operation of a proud ship, the dedication and skill of the crew who manned her, and the loving support of the families behind those officers and men. There are also sea stories to relate once more and, of course, there must be some predictions made about the future and the awesome task facing those still going down in the sea in submarines.

While it is not possible to publish all the many fine words that are being said at those ceremonies, several excerpts can serve as representative of the thoughts and emotions that go into such events. The following selections are taken from remarks given by three commissioning commanding officers in paying final respect to their ships.]

USS BATON ROUGE (SSN 689) Remarks by Captain Thomas C. Maloney, USN(Ret.), 18 September 1993

It is a very special privilege to participate in this ceremony commemorating the service of BATON ROUGE and honoring all who served in her. As you can see in your programs, I had the honor of serving as the first Commanding Officer of BATON ROUGE. So Captain Kolbeck and I represent the alpha and the omega, the first and last skippers of this fine ship. Between us, five officers commanded BATON ROUGE; and I'm delighted that two of them are with us today: Captain Ken Karr, who relieved me in command and promptly took the ship around the world; and Captain Jack Davis, now Commanding Officer of USS L.Y. SPEAR.

It is exceedingly difficult for me—and I'm certain for many others as well—to comprehend fully that 16-1/2 years have passed since BATON ROUGE first left her birthplace at Newport News Shipbuilding, and sailed down the James River on Easter Sunday morning, April 10, 1977. As the ship steamed past Old Point Comfort we could see the Easter sunrise service being held on the lawn at Fort Monroe. Great events have transpired in the intervening years; great events which have made our world a safer

place for humanity; great events in which our Navy and our BATON ROUGE played no small part.

But before we get to the serious part, let me tell a couple of sea stories. Just before a new submarine goes to sea for the first time, an intense training period called a *fast cruise* is conducted for several days. During the *fast cruise* the ship is tied fast to the pier—hence, the name—and the crew pretends the ship is at sea while practicing the ship's operating and casualty procedures. Following the BATON ROUGE *fast cruise*, I was meeting with the shipyard officials to review the ship's readiness for sea, when a messenger informed me that I was to call Admiral Rickover immediately—this was about 10 PM. I did so, and was asked by the Admiral what time the ship would sail on Sunday morning. I responded that the ship would get underway right at sunrise, 0540. I was then treated to a tirade regarding my inability to operate a ship during the hours of darkness, an admonition that he'd better not see any red lighting in the ship, and a reminder not to forget that he, Admiral Rickover, was in charge of the sea trial. I returned to the meeting, suitably chastened and as yet unaware that I was right in the middle of a fight over sea trial policy between Rickover and COMSUBLANT, the submarine force commander.

No sooner was I seated than the messenger returned to tell me to call COMSUBLANT at his quarters right away. Vice Admiral Joe Williams had a series of questions for me. The first was "What is the Submarine Force policy on leaving or entering port on sea trials?" "Only between sunrise and sunset," I replied. "What is the force policy on red lighting in the control room during the hours of darkness?" asked Admiral Williams. I told him that red lighting is required to protect the night vision of the navigation team. "Who is the operational commander for your sea trial?" was the next question. "You are," I responded. "Who signs your fitness report?" was Admiral Williams' final query. "You do, Admiral," was my prompt response. "Don't you forget that," were Admiral Williams' final words.

Well, the first thing the next morning I related these events to my Squadron Commander, then-Captain, now Rear Admiral Austin Scott, who was to ride BATON ROUGE on the sea trial as COMSUBLANT's representative. Captain Scott, a Texan who can charm the skin off a rattlesnake, and who could deal with Admiral Rickover as well as anyone I know, advised me not to

worry. He told me to concentrate on BATON ROUGE and the trials, while he would run interference with Rickover. So late that Saturday night, with the ship ready for sea, I wrote my night orders stating, "Continue preparations to get underway promptly at 0540. Call me at 0400."

The weather that Easter morning was clear and crisp, and the skies brightened well before sunrise; it was a perfect day to go to sea. By about 0515 the maneuvering watch was set, the ship and crew were ready to go, and Captain Scott and I saw no reason to wait further. I went to the Executive Officer's cabin, awakened Admiral Rickover and told him that the ship was ready to get underway. He asked what time it was and, when told it was 0515, he yelled "You can't go to sea yet—it isn't sunrise!" I responded that I would be on the bridge and ready to sail at his convenience. Nothing more was said. It didn't take Rickover long to dress and come to the bridge; and with the help of the shipyard tugs, the ship was soon headed fair down the James River, underway for a nearly flawless sea trial.

This initial sea trial was the first of many underways that BATON ROUGE would make during the 16-1/2 years of history that have raced by since that Easter dawn. During those years the ship made 14 major deployments to all parts of the world's oceans. While deployed, BATON ROUGE was tasked with a variety of missions such as surveilling potentially hostile forces, collecting military intelligence, exercising with allied navies, conducting anti-submarine warfare operations, and serving as an ambassador of the United States' goodwill and commitment in ports around the world. Although the details of the ship's operations remain classified, their success can be inferred from the ship's Navy Unit Commendation and Meritorious Unit Commendation pennants you see flying from the back of the sail, and from the numerous personal awards which have recognized the individual accomplishments of BATON ROUGE officers, chief petty officers and sailors over the years.

Over the years, the hard work, sacrifice, and separation endured by the BATON ROUGE crew and their families continued, fully appreciated only by those that have shared the hardships and rewards of the life of military service to our country. It is sometimes difficult to identify those rewards—they are often well camouflaged—and they certainly aren't financial!

However, I believe that today's event represents one of those

awards—it certainly does for me. For we are gathered here today in a ceremony of thanksgiving and celebration for what I term a great *Silent Victory*. The inactivation of BATON ROUGE is a direct and proximate result of the end of the Cold War, of the dramatic victory of Western democracy over the Communist dictatorship that tyrannized its own people for 70 years, and threatened the free world with aggression and destruction for more than 40 years. Today we celebrate not a conquest won on the battlefield, but a triumph of Western spirit and ideals. Without the fanfare and parades that marked the end of the World Wars, we are celebrating the collapse of an evil and godless political system whose villainy rivaled that of Hitler and his Nazi thugs.

The Communists' record of brutal repression and terror spans the entire seven decades of their rule. In the 1930s, at least 20 million people were executed or died of starvation during Stalin's violent repression of political dissent, collectivization of the peasant farmers, and purges of the military and civil leadership. As World War II opened, Stalin divided hapless Poland with Hitler and absorbed the three small Baltic countries into the Soviet Union. At the war's end, Stalin moved quickly to establish Soviet dominance of the countries of Eastern Europe; as Winston Churchill lamented in his famous 1946 speech in Fulton, Missouri, "From Stettin in the Baltic, to Trieste in the Atlantic, an iron curtain has descended across the Continent. Behind that line lie all the capitals of the ancient states of Central and Eastern Europe."

To one whose entire adult life and professional career were influenced greatly by the Cold War, the world events that have transpired since Mikhail Gorbachev came to power in March 1985 have been nothing short of astonishing. Once General Secretary Gorbachev cracked open the Iron Curtain with his introduction of glasnost, perestroika and democratization, there was no restraining the nearly explosive rush for personal freedom and national independence that followed; first in Eastern Europe, then in the Baltic states, and finally within the republics of the Soviet Union itself. We witnessed on television the total rejection of the Communist philosophy, and of the system of government its masters had imposed by force upon the millions of people imprisoned behind the Iron Curtain. In November 1989, we watched as the Berlin Wall—that ugly symbol of a corrupt government that walled its people in—came down stone by stone; and I'm

sure that each of us offered a silent prayer of thanksgiving, along with tears of joy and relief. And finally on Christmas night, 1991, as the red hammer and sickle flag was lowered from a Kremlin tower for the last time, and was replaced with the white-blue-and-red flag of the Russian Republic, I think that we all began to believe, for the first time, that the Cold War was truly at an end; at an end without the cataclysmic World War III that we had prepared for, feared, and labored so hard to prevent. This was our victory—our *Silent Victory*—a victory over an evil regime that had enslaved nearly half of the world—and a victory over war itself.

For those of us who built and sailed BATON ROUGE there is a twinge of sadness as our ship is retired at mid-life, with many a nautical mile left in her. At the same time, we can rejoice that BATON ROUGE is no longer required on the front lines of freedom. As we bid farewell to a ship that represents a bit of each of us who went to sea in her, it is important to remember that **we have much to celebrate and to give thanks for:**

- The Cold War's end
- The greatly diminished threat of a nuclear holocaust
- The restoration of liberty and freedom to the people of Eastern Europe and the former Soviet Union
- A growing quest for peace among the world's nations no longer captive to the deadly struggle between East and West
- And finally, the years of dedicated service and sacrifice given by the men of BATON ROUGE and their loved ones.

May God bless the United States of America and keep her strong in peace. God bless the United States Navy and all who serve and support it. And may God bless each member of the BATON ROUGE crew, past and present, their families and loved ones. Thank you all.

<u>USS SILVERSIDES (SSN 679)</u> Remarks by Captain John E. Allen, USN(Ret.), 17 December 1993.

Thank you all for allowing me to return and stand one more time on the deck of this splendid ship that I once knew so well. It is a thrill and a great honor for me to speak to you on this sad but proud occasion.

I'd like to begin by recalling another day when I also stood here. The date was 4 June 1971. Before the beautiful but as yet

inert hull of SILVERSIDES slid down the ways into the Thames River, Senator John Chafee, then the Secretary of the Navy, gave us some words to remember—words that in retrospect capture precisely the essence of the mission and service that were to follow. After recalling the indomitable spirit and magnificent wartime service of our namesake, the first SILVERSIDES, Secretary Chafee said this:

> "Our highest hope for SILVERSIDES is that she lives to retire in peace with her tubes unused except for the practice required to keep her sharp and credible. And if those hopes are realized, SILVERSIDES by her mere existence as a fully ready warship will have done the job she was born to here, today. She will have kept the peace. We launch her today with the hope and the prayer that she will be successful in that truly noble task."

During the past week I've read with fascination, satisfaction and respect the official command history of SILVERSIDES as she ran up a 22 year record of achievement. Even in the dry understatement of an unclassified summary, the diversity of her accomplishments and the sustained professional excellence of her long line of officers and crew shines out unmistakably. For those of us who have had the privilege of actually taking these marvelous ships to sea, the dedication and skill that went into making those achievements happen is unwritten but also clear.

By my count, SILVERSIDES has successfully completed 17 major operational deployments, the last ending only weeks ago. They spanned the whole range of attack submarine missions. She has been repeatedly honored with commendations and awards, at all levels and covering all the many functions and skills that come together in their maturity to make a great ship. She has demonstrated her mission effectiveness across a remarkable range of warfare and support tasks—a range that even today is, in my opinion, unexcelled by even our newest attack submarines. (We aging retired types are entitled to a little bias, and mine says that the long hull 637 class SSN is still the most ideally balanced design and most versatile submarine that ever put to sea!)

Adding to her long record of success in more traditional SSN missions, SILVERSIDES' recent innovative accomplishments represent a real head start on today's essential business of integrating SSNs into a new naval strategy built on the precepts of the white paper "...From the Sea". Your ship's motto, "If you

have a mission, we have a submarine", is highly apropos to the future direction of our Submarine Force. It not only captures your range of demonstrated multi-mission capabilities, it shows that today's innovative submarine people are in fact able to envision and master a broader spectrum of warfare skills than their predecessors of the Cold War era. In particular, your pioneering work in developing, executing, and training combined forces in naval special warfare concepts and techniques sets you among a small group of leaders in the vital process of once again validating the versatility and unmatched operational value of attack submarines.

Whether operating alone where others cannot or best not go, or integrated tightly with multi-service operational elements who until recently couldn't imagine what a submarine could do for them but are learning fast to insist upon having SSNs on their team—whatever the scenario, our SSNs can make a unique and critical difference in resolving the inevitable situations of tension and conflict that we know the United States will confront in the years to come. But the job of going forward with this enduring but under appreciated truth, and pressing it home to our military and civilian leaders, will be largely up to people like you, the active professional submariners. You alone can combine the lessons learned from decades of Cold War experience with the vision you have already shown into the potential value of exploiting inherent, unique SSN capabilities in many roles across the redefined spectrum of conflict.

Despite the bittersweet feelings I have today as this beautiful ship is prematurely retired from a career she surely could have continued with distinction, I am filled with satisfaction and pride as I reflect on what she has contributed to our Submarine Force, our Navy and our Nation. The credit goes to you and all your predecessors—with the essential support of your loyal families and friends—for keeping your ship, and mine, among the best of the best over these eventful years. I'm fully satisfied that you fulfilled that challenge that Secretary John Chafee laid down on June 5, 1972—you have in fact "provided the inspiration, deserved the gratitude, and earned the respect" that he foresaw. And I'm confident that you've felt that "excitement of excellence", that "proud joy that comes from a job well done".

Yes, SILVERSIDES—our ship and all her family—has accomplished her mission with honor. Now you can, and I'm sure

you will, move on to accept new challenges, those *new*, yet timeless, submarine roles and missions that will lead the force and our Navy to distinction and honor in the 21st century. Thank you all very, very much.

<u>USS STONEWALL JACKSON (SSBN 634)</u> Remarks by Vice Admiral John H. Nicholson, USN(Ret.) 10 June 1994

It's an honor and a privilege to celebrate our ship's honorable retirement and her contributions, which with other SSBNs, were largely responsible for the prevention of nuclear war and for the end of the Cold War.

I'm delighted to see Mrs. Julia Cissel, a direct descendant of Stonewall Jackson, here at the decommissioning, as she was the sponsor at the launching ceremony over 30 years ago and I have not seen her since. Her grandmother, Mrs. Randolph Preston, had been asked to be the sponsor but she wanted Julia to break the champagne bottle so she could enjoy the relationship with the ship for many years. Welcome Julia—what a thoughtful and perceptive grandmother you had. You honor us with your presence and we're proud our ship bears the name Stonewall Jackson.

Participation in a decommissioning ceremony is one of the most difficult things for Navy men and women to do. Each ship and each crew has been an important part of our lives and continues to be even after we retire and after the ships are decommissioned. There's nothing like it in the other services and there surely is nothing like it in industry, believe me. That feeling and bonding is particularly strong for those who were plankowners and who had the responsibility and privilege to help give birth to a ship.

For plankowners who arrive early it is normally a particular treat and thrill to be able to ride the ship down the ways at launching and to participate in the celebrations immediately following.

Alas, such was not the case at the launching of STONEWALL JACKSON since President Kennedy had been assassinated only eight days prior to the launching. Accordingly the launching ceremony was somber. The programs carried twin ribbons of black and the post-launching ceremonies were cancelled.

Despite the difficult beginning however, STONEWALL JACKSON proceeded to excel. Nine months after launching she was delivered a month early at a savings to the Navy of $1 million and

both crews as well as the shipyard were praised for their performances. After successful shakedown cruises and missile firings by both crews, she proceeded to conduct 82 successful deterrent patrols.

Many of us here today were part of the rapid expansion of the Submarine Force following the successful operations of NAUTILUS over 39 years ago. We saw ever increasing capabilities of classes of submarines and missiles, and we saw the universal recognition that the attack submarine is the most effective weapons systems to detect and kill an enemy submarine, and that the SSBN is the backbone of the nation's deterrent. Then, largely due to the success of these submarine systems, came the end of the Cold War and the supposed end of the Soviet submarine threat. Suddenly the Administration and Congress have drastically cut back the submarine building program. There is a real concern that we could lose the industrial capability to build submarines in the future.

All of you here today are well aware of the stringent requirements to ensure safety and reliability of the submarines and power plants. Loss of the highly trained, experienced engineering staffs at the nuclear building yards, EB and Newport News, and loss of second and third tier suppliers and subcontractors would be extremely difficult to reestablish and would, in fact, place us in danger of losing a national asset.

So, what does the future look like for submarines? As Yogi Berra said, "It's hard to make predictions, especially of the future", but I'll try. Fortunately the Navy with assistance of the Naval Submarine League, the shipyards and others have strongly expressed the need to retain a nuclear building capability and these efforts are beginning to pay off, at least so far. The recent Bottom-up Review of defense programs by former Secretary Aspin called for a third SEAWOLF submarine and the remaining four Trident submarines to be completed at EB and a new class SSN to be commenced in FY 98. Newport News will be building a nuclear carrier to retain its capability. The review states that about 45 to 55 SSNs will be needed in the post-Cold War environment necessitating the decommissioning of many SSNs from the current force level of 85. It is absolutely vital that we continue to build submarines even at a slow construction rate. We must maintain the capability and experience to build in the future.

In the strategic area, the current plans are to build up to an all

Trident Submarine Force based at two excellent bases—Bangor, Washington and Kings Bay, Georgia. All other SSBNs, including STONEWALL JACKSON, will be decommissioned except for two which have been modified to carry special forces. Many changes have been made in the strategic triad and more are planned to adapt to the New World order. For example, the U.S. and Russia no longer target their missiles at each other. Most notably a new command has been established, the U.S. Strategic Command which controls all of our strategic forces. This force is to be alternately commanded by a 4 star Air Force General and a 4 star Submarine Admiral. This force is now commanded by a submariner, Admiral Hank Chiles. As one who spent his last tour of active duty in Omaha working for the Air Force commander of SAC, I can assure you that this is a significant change and a significant improvement.

In the New World order experts including Ambassadors Linton Brooks and Paul Nitze believe that nuclear weapons are likely to become more, rather than less, important to the Navy in the coming decade and that we must maintain overwhelming nuclear strategic capabilities. No one is advocating that the U.S. nuclear arsenal be scrapped. Even William Arkin, a weapons analyst for Greenpeace, concedes that the situation in the former Soviet Union is uncertain and that Washington needs some nuclear forces as defenses. Whatever changes are made, you can be certain that the Trident submarines will be the most important part of the forces. By 1997 half of the U.S. nuclear warheads will be carried in submarines. As General Colin Powell summed it up just before being relieved as Chairman of the JCS, "So, however warm our relations might grow with the new former Soviet Republics—however close our friendships become—we will always, always place our faith in our boomers and not in anyone else".

I believe it is vital that all of us continue to provide the capabilities of our submarines. Despite the end of the Cold War, the submarine threat throughout the world is significant. The Russian submarine fleet is huge—some 273 submarines and they are still building new, more capable ones as well as aggressively selling them to Third World countries. Additionally, there are some 39 other countries operating more than 400 submarines, many of them very modern with sophisticated sensors and platforms. U.S. submarines offer the best defense against these potential threats, yet there are those in the press and in Congress

who call for even more cuts in the Submarine Force.

In conclusion, it remains to be seen what the new Administration and Congress will do to defense and the Submarine Force. I sincerely pray that we will not go through another fiasco such as Secretary of Defense Louis Johnson took us through after WWII only to have the Korean War find us ill prepared. Isn't it ironic that once again with defense forces being cut back Korea is one of the most serious problems facing the U.S.? I hope that restructuring will be well thought out, retaining the significant capabilities we have built up and I hope that submarines which were so instrumental in causing the end of the Cold War will be included in adequate numbers as a vital part of the restructuring. As Secretary of the Navy Dalton said in a recent speech "I know that the importance of the Submarine Force to our nation is at least as great today as it has ever been since the Second World War". And finally I concur with General Colin Powell who said at the ceremony in Kings Bay for the 3000th SSBN patrol, "No one has done more to prevent conflict—no one has made a greater sacrifice for the cause of peace—than you, America's proud submarine family, you stand tall among all our heroes of the Cold War".

God bless you and the United States of America.

■

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METAMORPHOSIS

by Steve Collier, EMCM(SS), USN(Ret.)

The submarine piers at the Norfolk, Virginia Naval Base are about 1200 feet long from foot to head. Before leaving on a submarine patrol or deployment, I always hoped that the boat I was serving on would be out at the far end of the pier, particularly the more deployments I had under my belt. The reason is that, with the boat farther away from the foot of the pier where my wife dropped me off, I had farther to walk, and thus more time for what I term *metamorphosis*.

This is a process that I believe most submariners must have learned and undergone in some form, though it was not a subject I ever talked about with any of my shipmates.

You see, a submarine is a large metal can, submerged in salt water, filled from one end to the other inside with 480 volts of electrical generators, equipment and wires, 4500 pound air pressure, 3000 pound hydraulic oil running throughout the interior. There is no place inside the ship where you can get more than a few feet away from these hazards, whether you are eating, sleeping, showering, or working.

Additionally, on the outside of this metal trap is the bottomless (for all intents and purposes) ocean full of crushing sea pressure continuously trying to get past the two inch thickness of the ship's metal skin and drown you. The very air a submariner breathes while the ship is submerged is manufactured by one of your shipmates on watch on the machines splitting water atoms into hydrogen and oxygen (both explosive gasses) at a pressure of 3000 pounds, and other machines to remove hydrogen (generated by the ship's gigantic battery), carbon dioxide and carbon monoxide.

Some of these ships carried even worse hazards in the form of the most powerful atomic bombs known to mankind—and the farthest you could get from these was less than the length of a football field.

And, of course, I haven't even mentioned working within mere yards of a very powerful, compact nuclear reactor generating deadly radiation (shielded, of course) and high pressure steam which was constantly trying to get out of its pipes and steam-cook those inside the engine room.

Those are the hazards that you carry with you while at sea, each minute of each hour of each day. As if all that weren't

enough, you occasionally had to take your ship into areas where there was the possibility of enemy Russian submarines locating you and pointing very large bullets at you, possibly with an itchy finger, depending on the politics of the moment.

While these machines were designed and manufactured to the best engineering standards and technology in the world, they suffered from one unavoidable weakness—like even the world's best computer, they are only as good as the operator. And that guy was you, and your shipmates.

Most people with a job know that sometimes their everyday home and family life problems occasionally affect their performance at work. This can work both ways—when things at home are very good, work can be an unusually easy breeze. And when things at home go sour, whether problems with the kids, an argument with the wife, or an unexpected or prolonged visit from an in-law, it can be very difficult to focus on the task at hand on the job.

When your job happens to be in the deadly environment of a submerged nuclear submarine, the price for a mistake can be high—the highest. And not only for you but for 130 of your closest friends who were all doing their jobs properly.

For me, leaving home for an extended deployment was always one of the hardest things I ever had to do in my life, because of leaving the loved ones behind to handle more than they should have to handle on their own. After all, that's one of the reasons for getting married; to share the problems and work, right? But the nature of the job required leaving for extended time periods with no ability to telephone home once a week, or even to send off a letter. Completely cut off until the next port visit.

The last week prior to a deployment was particularly difficult because of the clock ticking down to zero hour, when you must leave her and the kids, sometimes for as much as half a year. It was only an item on a calendar a year ago (if you were lucky enough to have that much warning), and thus, easy to put off as something merely unpleasant, like a dentist appointment. But in the final week, it became real. Tension built between you and your wife because neither wanted the separation, but both knew it was unavoidable. And with building tension came minor, occasionally major, arguments that both regretted almost immediately.

Finally, zero hour arrived, with emotions at their highest. If

I was lucky, I was able to hold my tears in check. If I was luckier still, she was too. For if she let go, it was sheer agony for me, for I knew that I, through having chosen this profession, was the cause of her pain.

And thus, in such a state, it was time for the final hugs, kisses and goodbyes, and then turn away from them and walk down the pier. For god's sake, don't look back—what if they are waiting there, staring at you with teary eyes saying, "Please don't go?" If you did look back and made eye contact, you would have to go through another round of the same painful separation all over again. It would be unbearable. So just walk straight ahead and don't turn back.

Having accomplished such an emotionally charged separation, it was time to look forward to where you were going. It was not looking forward in the sense of looking forward to a vacation, but looking forward into the environment that awaits, your home for the next several months, one which required each man to do his job if all were to survive.

For me, I would not be able to function effectively in such an environment with my emotions in such a shambles from the unwanted separation from loved ones. Accordingly, I somehow developed an ability to undergo a metamorphosis (were you beginning to think we'd never get back to that?) when required. It was not a split personality, though I knew some men who developed that as their tool to cope—one personality at home, and a totally different one at sea. For me, I was able, because my survival depended on it, to lock away my family and home life, in a special room in my heart.

I locked them away, and my emotions related to them, so that they could not affect my actions in the new environment. They were by no means forgotten—I knew they were there all the time. I checked in on them from time to time. But they, and the associated emotions, were thoroughly isolated from the outward me. They had no impact on my thinking, emotions or actions. That is why I say a metamorphosis—a change or evolution in my being, for, before the metamorphosis, my family was always in my thoughts and heart and soul, for better or worse. Before, they were an integral part of me. Now, and until I returned, they would not, could not, be an integral part, but rather more like a cherished possession brought out occasionally to remember fondly in quiet moments when a shipmate was minding the dangers.

I had the walking distance from the car to the brow of the submarine to undergo this transmutation in my soul. As the length of my service in the Submarine Force grew, so did the walking distance required to complete the inner change.

This was my way of dealing with this lifestyle, which has been described by many as an impossible lifestyle for a family to survive. It allowed me to be at my peak most of the time while at sea, at least to the extent that missing the family and home life did not impair my judgement.

A final warning: Having developed the ability to undergo this metamorphosis, there remains the task of reversing the process upon return home. This is perhaps one of the most serious challenges. For me, it was not easy to develop the ability, and once developed, it became difficult to reverse the process and completely open up with the family. I believe today's submariners need to be very cautious, if they desire to reserve a good home life after submarine service, to ensure a complete reversal of whatever process they use to prepare themselves for their lives while deployed. Perhaps a simple awareness of the possibilities will be enough to some. ■

NAVY LEAGUE EXPOSITION

The Navy League of the United States will once again hold the Sea-Air-Space Exposition, the largest of its kind in the world, in Washington, DC, April 11-13, 1995 at the Sheraton Washington Hotel. This year's event, with the theme *Sea Power for the 21st Century*, will feature approximately 150 exhibits of defense-related technology, education seminars, and special programs. The 1994 Sea-Air-Space Exposition, held in late March, attracted more than 10,000 attendees.

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The Office of the Undersecretary of Defense for Acquisition and Technology, supported by Carson Associates, is conducting and integrating process improvements in eight functional areas. These process improvements include changing the business processes, automating work flows, defining information system requirements, and evaluating, selecting, and implementing automated information systems. Using an Enterprise framework, Carson Associates is identifying cross-functional interfaces, standardizing data elements, and integrating common processes across all these A&T functions.

The **Continuous Acquisition and Life Cycle Support (CALS) Initiatives** has been supported by Carson Associates since 1986. The company has developed strategic business plans and tactical plans for implementation of the strategy; developed and maintained military standards and implementing instructions, and coordinated weapon system demonstration projects.

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HONOR ROLL

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ON PATROL FIFTY YEARS AGO

by Dr. Gary Weir

[Editor's Note: BARB's Eleventh War Patrol is justifiably listed as the most successful ever conducted. Behind the recitation of attacks and number of Japanese ships sunk or damaged, however, one can see a strong foundation of professional competence, innovative tactics and forward-thinking situational analysis. The Patrol Report is particularly recommended for the insights about World War II U.S. submarine support in the Wolf Pack.]

USS BARB - Report of Eleventh War Patrol
Period 19 December 1944 to 15 February 1945

PROLOGUE
Arrived Midway from 10th war patrol 25 November 1944 for second successive advanced base refit.

NARRATIVE:
19 December 1944
Departed Midway. Enroute Guam or Saipan.

27 December 1944
Arrived Guam. Received an excellent welcome and voyage repair from Sperry and Sub Div 101.

29 December 1944
Underway in company with QUEENFISH and PICUDA. ComWolfPack, Commanding Officer QUEENFISH.

3 January 1945
Passed through Tokara Kaikyo. Decided to run surface patrol through Area Nine, since we were astern of rest of pack who had submerged.

7 January 1945
0540 Surface patrolling off Tungyung Tao. Radar contact at 20,000 yards.
0601 Finally established contact as a definite convoy of seven ships. Sent out contact report. Commencing end around at full speed. Dawn has arrived. Sky is heavily overcast. Horizon hazy

with about 12,000 yards visibility, varying. Ending around at 15,000 yards. Enemy appears to be enroute Keelung at 11 knots. Sea state 5.
0746 Ahead of convoy. Contact reports going out every 20 minutes. PICUDA will be able to get in; QUEENFISH probably not.
0803 Submerged 14,000 yards ahead of convoy.
0829 Commencing approach. Nothing in sight.
0845 Rain squall has reduced visibility to about 4000 yards. Making continuous periscope exposure at 59 feet with over 10 feet of scope out half the time.
0902 Haze lifting. Sighted a large tanker broad on starboard bow, range 850 yards with 130 starboard angle on bow. Made ready bow tubes. Nearly whole formation is now in sight. A large freighter is about 1500 yards beyond the tanker. Escorts are five destroyers, two stack, with white bands around stacks.
0905 Tubes are ready. Tanker is zigging away. Definitely a poor shot which would not be worth the value of an unalerted convoy to the PICUDA.
0941 Surfaced. Convoy at 12,000 yards. Commenced end around at 10-14,000 yards depending on the visibility of the port screen. Base course 110°T.
1115 Convoy changed base course to 150°T. Visibility increasing. Destroyers in sight. Secured end around. Impossible to beat them to Formosa now that haze has cleared. Heading back to China Coast.

<u>8 January 1945</u>
Patrolling in wolf pack along convoy routes.
0600 Eased in towards coast in event convoy hugged coast.
1300 Sighted smoke of convoy towards the coast. Commenced closing. At least five ships.
1312 Sent out contact report to pack.
1350 Sent out contact report of convoy course 140. Seven or more large ships.
1415 Commencing end around on port flank of convoy at 22,000 yards. Visibility excellent. Sent out contact report of enemy base course 160, speed 12. The pack is closing.
1549 In position ahead of convoy. Sent out contact report giving enemy zig plan. Have been ending around at 20-23,000 yards with funnels and masts of most ships clearly in view from bridge,

some of escorts masts tops barely visibly. If we had not been in wolf pack, end around would have been made at greater range. However I estimate the situation as follows:

(a) Convoy is evidently heading for Takao which will allow the pack only the early evening for attack, at best, before getting too deep in blind bombing zone and too close to minefields.

(b) Our job is to bring pack into contact as expeditiously as possible, then make a daylight submerged attack from coastal flank and slow or turn the convoy into the QUEENFISH and PICUDA.

(c) The above will require an accurate flow of information. This can only be obtained by close-in tracking.

1612 PICUDA has contact.

1616 Informed pack we were diving to attack starboard flank. We are now well into blind bombing zone.

1618 Submerged. Sea force 5; making attack at 60 feet.

1655 Echo ranging. A plump convoy of eight good sized ships. All better than 6500 tons and many of those coal burners. Ships are in several echelon groups. The leading echelon to port consisting of a KAGA MARU class freighter with a destroyer about 1500 yards ahead. About 500 yards on the starboard quarter of this freighter is a transport surrounded by four spit-kit escorts. A large freighter straggles about 1200 yards astern of the transport. The starboard echelon is about 1000 yards on the starboard quarter of the above echelon. It consists of three brand new large engine-aft freighters or tankers. A small escort is close on each bow of the leading ship in the starboard echelon. Two escorts are about 3000 yards out on the starboard flank. Between the two echelons and straggling about 3500 yards astern are two more large freighters. There seems to be escorts everywhere. All ships are painted grey and are heavily laden.

It would be a snap to get in the center of this outfit. However it is imperative that we bend them to port, and prevent them from heading towards the shallow China Coast. Holding off on starboard bow. Plan to smack the transport with the four escorts in the port echelon since she is probably the most important ship, then use the other three bow tubes on the leading engines-aft job.

1718 Coming in nicely. Made ready all tubes.

1723 Fired tubes 1, 2, 3 at the large transport on a 70 starboard track, range 2700 yards, gyros zero. Can see KAGA MARU class ship exposing itself from superstructure forward in a bow overlap. Shifted targets to engines aft ship.

1724 Fired tubes 4, 5, 6 at the engines aft ship on an 80 starboard track, range 1700 yards, gyros 5° left.
1725 Left full rudder. All ahead standard. Swinging for stern shot.
1726 Four torpedo hits close together, the third of which was a tremendous explosion. The ship had been forced sideways and down, personnel had grabbed the nearest support to keep from being thrown off their feet, and cases of canned goods had burst open in the forward torpedo room. QUEENFISH later told us this last ship hit blew up and was obviously an AE.
1728 Sound reporting high speed screws all around. Rig ship for depth charge. Steadying up and attempting to climb back to periscope depth at 2/3 speed. A look at our results is paramount. Breaking up noises.
1737 Periscope depth. A smoke cloud where the engines aft had been. The stern of the transport sticking up at a 30° angle with two escorts close aboard. Her bow is evidently resting in the mud. Depth of water 30 fathoms. The KAGA MARU class ship is on fire amidships just above the water line. The whole formation has turned away and appears to be stopped. All escorts have scampered over to the unattacked side of the formation. The destroyer has reversed course, and now has a 90 port angle on the bow.
1747 Can feel aggressiveness surging through my veins, since the escorts are more scared than we are. Commence reload forward. Heading towards convoy with another engines-aft in our sights. Destroyer suddenly turned toward and shifted to short scale.
1748 Maximum relative movement between destroyer and BARB. Nice spot for a down the throat shot, but no torpedoes forward.
1749 Aggressiveness evaporated. Assumed deep submergence of 140 feet, mud below.
1815 Completed evasion. No depth charges. Reloaded forward.
1856 Surfaced with breaking up noises still being clearly heard. No contact.
1914 QUEENFISH reported attacking.
1934 PICUDA reported attacking. Reported six ships in convoy. That checks, unfortunately, with KAGA MARU still afloat.
1945 Reported having contact and taking position on starboard flank.
1956 Two explosions. PICUDA has probably attacked. We are now about 8000 yards abeam of last ship. Inasmuch as QUEEN-

FISH would be anxiously awaiting completion of our attack so she could get in again, decided to try our radical new system of continuous attack. Commencing our normal screaming surface approach on last ship in the formation from the starboard flank. Another ship about 600 yards on his port bow overlapping. Two more ships about 3000 yards ahead. Formation plot indicates five escorts around this tail group. One forward, one on his starboard bow, one on starboard beam and two astern. Since we intend attack from starboard quarter these will not bother us (we pray). Night is very dark and visibility poor. Sea state 4.

2012 Fired tubes 1, 2, 3 at trailing large AK on a 145 starboard track, range 2180 yards, gyros zero, own ship speed 16.5 knots, torpedoes sounded like motor torpedo boats going out. Overlapping ship is a large AO or AK. All ahead full, right rudder, swinging out to commence approach on the next ship up the line.

2015 Two hits observed and timed.

2016 One hit observed and timed in overlapping ship. First ship disappeared from view and radar—sunk.

2025 Remaining two targets maintained formation but increased speed. These two ships were in column about 2000 yards apart. Making approach on starboard flank of trailing ship. Formation plot showed nine escorts within 5000 yards. One about 1000 yards on starboard beam, two close aboard, others scattered with apparent confusion. Having only eased out to 4000 yards abeam for a setup this would be quick.

2033 Fired torpedoes 4, 5, 6 on a 127 starboard track, gyros 1 right, range 1590 yards.

2034 Swinging right to ease out and then attack target ahead with stern tubes.

2035 Three hits timed and observed followed by a stupendous, earth shaking eruption. This far surpassed Hollywood and was one of the biggest explosions of the war. The rarefaction following the first pressure wave was breathtaking. A high vacuum resulted in the boat. The target now resembled a gigantic phosphorous bomb. In the first flash as the torpedoes hit, all we could ascertain was that the target had a long superstructure and a funnel amidships. The volcanic spectacle was awe inspiring. None of the escorts close to the ammunition ship could be seen. Those were probably blown up and we would claim them as probably sunk except that I figure that four ships sunk, one probably sunk and one damaged is about all the traffic will bear from

a 12 torpedo expenditure.

At this point of the game I was ready to haul ashes. However, the new TBT operator (the Engineer Officer who had never seen a shot fired or a ship sunk in five runs from his diving station) really had his guns out. Frantically he pleaded that we couldn't let the last ship go. Good sales talk. Commenced the approach for a stern tube attack on the ship ahead. No pip from our probably sunk ship on radar. From this and information from rest of pack, her classification is now SUNK.

2055 QUEENFISH said she wanted to attack. PICUDA said she would follow the QUEENFISH. The BARB could continue her attack as long as there were ships and torpedoes left. However we have our share, so gave them the green light. Passed our new target abeam to port at 2160 yards, (what a temptation) and headed down towards pass between Formosa and minefield to make sure nothing escaped.

16 January 1945

Surface patrolling approaches to Formosa Straits.

1355 Cruising among large junk fishing fleet closing coast for night traffic search.

19 January 1945

Surface patrolling Formosa Straits. PICUDA and BARB decided to blockade the Straits. BARB covering to east; PICUDA to west.

20 January 1945

1802 Have searched for all aircraft-reported ships covering all possible speeds and courses. Since nearly all are reported from Lam Yit, and we are positive they do not pass Turnabout Light, these ships must go by an unknown route. Study of charts indicates that the passage of these ships could be effected without sighting by pack, if the Japs have dredged the long 1-1/2 fathom stretch through Haitan Straits. Requested China Air Group obtain information on Haitan Straits.

21 January 1945

1900-2400 Received information from China *[Editor's Note: Naval Group China, commanded by Commodore Milton E. Miles,*

USN. See Every Man a Tiger, Naval History, December 1994.] that large ships are using Haitan Straits. From Lam Yit to Formosa ships pass through blind bombing zone. This completes our analysis of shipping. While our own forces are hammering Formosa no shipping is moving around Keelung. All traffic is now running the inshore route along the China Coast. No lights have been observed burning along the coast. Consequently the Japs are running only in the day time, when it is impossible to make a submarine attack with their now close coast route. Anchorages being used are probably Shanghai, Wenchow, Samsa Inlet, Foochow, and Lam Yit, all of which are well mined and a day's run apart. Seas are continually state 5-7. In conclusion, our prospectus appears poor, unless we can find a suitable opportunity at night to resort to torpedo boat tactics.

Basing the remainder of our patrol on the latter assumption, made a complete study of the China Coast from Wenchow south to Lam Yit. Recent unknown mining has taken place north of Wenchow. If our assumptions are correct, the present convoy, for which we are searching, is anchored at Foochow tonight and will be enroute to Wenchow tomorrow. To substantiate our conclusions, plan to mingle with the junk fleet north of Seven Stars tomorrow afternoon at a point 10 miles inside the 20 fathom curve and 15 miles from the coast where we can observe the passage of our convoy.

22 January 1945

1203 Maneuvering among junk fleet. Crossed 20 fathom curve.
1900 Passed edge of junk fleet. Approaching 10 fathom curve. Sorry to clear the junks even though they provide an obstacle race, for we depend upon their routes to keep us clear of minefields.
2100 Still no coast lights burning and no ships. Requested PICUDA by radar to patrol off Tungyung Island in event ships had departed coast north of Piseange Islands. Informed her that convoy had not passed our position.
2120 Have now covered route for convoy speeds 13-16 knots. Ships must have anchored. Decided to search coast.
2257 PICUDA reported negative contact.

23 January 1945

Conducting inshore surface search for convoy anchorage. Maneuvering constantly to avoid collision with junks. Present

entourage consists of several hundred darkened junks.
0112 Chart plot matching showed an uncharted smear northwest of Incog Light. Checked this on A-scope with showed saturation pips at 29,800 yards.
0240 Cleared junks. None ahead. Much prefer to have them, or know the reason for their absence.
0300 Rounded Incog Islands and had radar contact on a very large group of anchored ships in the lower reaches of Namkwan *[Editor's Note: Current name is Shacheng Gang.]* Harbor. Slowed to take stock of the situation.

Fully realize our critical position and the potential dangers involved. Estimate the situation as follows:

(a) Recent uncharted mining in this vicinity is a known fact. Mines could be laid from Incog Island to Tam Island. However, a more effective minefield would be from Incog Island to Pinc-fong, the eastern entrance to Namkwan Harbor, which would provide a protected anchorage behind it. Since the position of the anchored convoys is too close to this line, assume the latter minefield does not exist. The former though doubtful, must remain a possibility, particularly in view of the absence of junks.

(b) Jap radar interference is showing up on the A-scope and PPI, sweeping. One escort appears to be patrolling several thousand yards northeast and a second escort to the east of the anchored ships covering the most logical position for entry and attack. A third escort is working close to Incog Light apparently more concerned with using his radar to keep himself off the rocks. Visibility is very poor.

(c) Assumed the closely anchored columns would be heading about 050°T heading into the wind and seas with a current of 1 knot. Plotted the navigational position from which we would attack, making our approach from the southeast. The attack would be made on approximately a 60° track so that our stern tubes would be fired with zero gyros on our selected retirement course.

(d) Elected to retire through an area marked *unexplored* on our large scale chart which contained sufficient *rocks awash* and *rocks, position doubtful* to make any overambitious escorts think twice before risking a chase. This course would also cross the mass of junks which would be a definite and final barrier to all pursuit. While retiring radar will only be used sweeping quickly from broad on one bow to broad on the other. All damage must be assessed without it.

(e) Countermeasures expected will be searchlights, gunfire, and hot pursuit. Against this we will have a stern tube salvo, 40mm and automatic weapons.

(f) Inasmuch as our attack position will be six miles inside the 10 fathom curve and 19 miles inside the 20 fathom curve, we will require an hour's run before being forced down. Consequently our attack must be a complete surprise and the force of our attack must be sufficient to completely throw the enemy off balance. We have four torpedoes forward and eight aft. No time will be available for reload; for a speedy, darting, knife thrust attack will increase the probability of success.

0320 Figure the odds are 10 to 1 in our favor. Man battlestations torpedoes.

0325 Fortunately we have a flexible control party and at this point we flexed it. CO secured the bridge and took over the conning tower; target plot was secured and the Assistant Approach Officer was shifted to navigational plot; Plotting Officer was shifted to PPI; and another officer was shifted to the bridge.

Seriously considering placing crew in life jackets, but the atmosphere throughout the boat is electric. The men are more tense than I've ever seen them. Save for an occasional report of "single ping sounding, 6 fathoms," the control room is so quiet the proverbial pin would have sounded like a depth charge. Discarded the idea of life jackets as definitely alarmist, with so many hearts doing flip flops.

Do not consider it advisable in our present precarious position to send a contact report to PICUDA. She could not possibly attack before dawn and get out. Will send one after the attack when our presence is known.

0352 Range 6000 yards. Made ready all tubes. Ships are anchored in three columns about 500 yards apart with a few scattered ships farther inshore. This, frankly, must be the most beautiful target of the war. Actual measurement of target length is 4200 yards. Ships are banked three deep. Even an erratic torpedo can't miss. Radar Officer counts 12 ships on one bearing. Estimate at least 30 ships present. Our biggest job will be to prevent too many torpedoes from hitting one ship. For purposes of set up chose one of the large ships to left of center of the near column as target. Using TBT bearings.

0402 Fired tubes 1, 2, 3, 4 with 150 percent spread, track 65 starboard, gyros 30 left, torpedo run 3225 yards, depth set 6 feet,

target speed 1-1/4 knots, target course 040°T.

Right full rudder, all ahead standard. Sounding 5 fathoms. Shifted target to right for ships ahead in near column.

0404 Fired tubes 7, 8, 9, 10 with 300 percent spread, track 65 starboard, gyros 3 right, range 3020 yards, depth set 6 feet.

All ahead flank! Commanding Officer manned bridge.

0406-02 Torpedo #2 hit on target. Timed and observed.

0406-09 Torpedo #3 hit on target. Timed and observed.

0406-27 Torpedo #1 hit in 2nd column. Timed and heard on bridge.

0407-27 Torpedo #4 hit in 3rd column. Timed and observed.

0408-16 Torpedo #6 hit in 1st column. Timed and observed.

0408-31 Torpedo #8 hit in 1st column. Timed and observed.

0408-36 Torpedo #5 hit in 2nd column. Timed and observed.

0409-41 Torpedo #7 hit in 3rd column. Timed and observed.

Main target of attack, large AK in first column was hit by torpedoes #2 and #3. Target observed to settle and undoubtedly sink.

Unidentified ship in second column was hit by torpedo #1. This was not observed since shielded by main target after turn to right. Damaged.

Large AK, in third column, hit by torpedo #4, shortly thereafter caught on fire. Fire later flared up 5 or 6 times then went out in a manner similar to a sinking ship. Probably sunk.

Torpedo #6 hit in the first column. Believed to have hit in main target or ship close to this target. Observation not sufficiently accurate to enough to claim additional damage.

Large AK, in first column, to right of main target of attack hit by torpedo #8. Ship belched forth a huge cloud of smoke. Damaged.

Unidentified ship, in second column hit by torpedo #5. The whole side of this ship blew out in our direction in a manner similar to an AE or the magazine of a large warship. Ship sank.

Tracers of all descriptions flew out from the two ships which exploded. At the same time several large caliber projectiles, estimated 6-12 inches, with tracers hurtled through the air. A moment after this, searchlights were seen sweeping about for a short while.

0413 Smoke from the ships hit, on fire, and exploding completely obscured all ships and prevented any further observation of other damage.

The BARB is now high balling it for the 20 fathom curve at 21.6 knots, broken field running through the junk fleet, with the radar sweeping rapidly 30° either side of the bow, wildly maneuvering when some of the junks are inside the sea return. Expect to see a junk piled up on the bow at any second.
0436 Gun fire from well astern. Some poor junks getting it.
0438 Some form of navigational light lighted on Tae Island. Probably to aid the escorts' navigation.
0445 Sent contact report to PICUDA.
0511 The Galloping Ghost of the China Coast crossed the 20 fathom curve with a sigh. Never realized how much water that was before. However, life begins at 40 (fathoms). Kept going.
0512 Slowed to 10 knots.
0550 Dawn. Assume the Japs will expect us to submerge, so will stay on the surface.
0633 Aircraft contact. SJ radar picked up plane at 7 miles coming in fast. A CO's privilege to change his mind. Dived. Range closed to 2-1/2 miles.
1220 Surfaced. Retiring to east. Requested China Air Force obtain information as to damage inflicted in harbor.
1621 Periscope sighted. Maneuvered clear. Doubtful sighting.

28 January 1945
Surface patrolling off Lam Yit. Seas state 6.
1200 Invaded blind bombing zone during afternoon in hopes of picking up Amoy traffic.
2000 Investigating Lam Yit Harbor. Empty.

29 January 1945
Surface patrolling along coast off Lam Yit.
0345 China aircraft reported 1 AK, 1 AP, 1 escort leaving Amoy at 1750 headed northeast.
0450 SJ contact at 17,500 yards. Commenced approach. Convoy consists of 1 large AK, 1 medium transport in column with 1 escort on starboard flank of transport which is loading. Heavy rain. Visibility is poor. Sea in Lam Yit about state 4. Targets on steady course 060°T, speed 7.8 knots. Sent contact report to PICUDA.
0537 Range to large AK 1600 yards. Swinging right for stern tube shot. TBT bearings inside 3000 yards. Fired tubes 7, 8, 9, 10 on 118 starboard track, gyros 2° right, range 2010 yards,

torpedoes set at 8 feet. Spread coverage 200 percent.
0543 Convoy no longer visible in rain squalls.
0544-10 One timed hit. Not observed.
0544-35 Second timed hit. Not observed.
0555 CO in conning tower watching A-scope and PPI when target suddenly disappeared from A-scope and PPI at 8800 yards. At this time AP and escort pips were 4° to right of target.

Frankly, assessment of damage in this attack from our standpoint can only be classed as unknown. The timed hits were over one minute late which is incomprehensible unless those torpedoes run very slow up heavy sea. Tracking the target after the attack showed no apparent damage until the pip disappeared. Seas off the coast were state 7 and one hour after the attack we were forced to slow to 8 knots. Cannot understand how we could possibly miss. The approach on a steady course, steady speed target was the simplest we've ever been offered. Even my conscience bothered me with the thought that I was practically jettisoning our last four torpedoes on such a simple set up, when I could have fired a split salvo of two torpedoes at the AK and two at the AP. Hit times, however, do not jibe and yet are much too early for end of run. Analysis is a mystery.
1000 Departing area in heavy seas. Making good 2 knots. Inductions closed.

30 January 1945
Surface patrolling enroute Midway, seas state 6, decreasing.

9 February 1945
Arrived Midway, channel closed. Patrolled south during night.

10 February 1945
Commenced search for MIDWAY which had moved northward at 4 knots during night.

1130 Finally overtook MIDWAY and moored.

15 February 1945
Arrived Pearl.

■

SILENT SERVICE TV SERIES

At a recent Norfolk meeting of WWII SubVets, a number of us remembered a television series *The Silent Service* which appeared in the mid 50s. The Naval advisor was Rear Admiral Tommy Dyckers.

A number of us are collecting video tapes of stories about such ventures and would welcome a chance to purchase the above series.

The huge catalog at the Blockbuster Video store contains many tapes of interest but not *The Silent Service*. It's my hope that your printing in the **REVIEW** of this request for information will prompt someone expert in such matters to come forward with some useful information. I think there would be a large market, at least among the 3000 SubVets.

I remember one chapter was named *The Salmon Swims Upstream*. Hollywood called me for permission to have an actor play my part as Exec; I gave it, of course.

When the show aired, we all giggled; the actor was a tall dark handsome glib guy who had too many girlfriends.

Sincerely,
Dick Laning

SUBRON FOUR DEACTIVATION

Following 64 years of dedicated and devoted service to our nation, Submarine Squadron Four will deactivate in March 1995.

I anticipate that some Naval Submarine League members may be interested in attending the Squadron's deactivation ceremony. The ceremony is tentatively scheduled for 17 March 1995. I am also looking for a few stories, from former SUBRON FOUR staff members or from the SUBRON FOUR ships, either serious or humorous to provide a historical perspective during the ceremony.

I can be reached at the address below or via phone.

Sincerely,
CAPT Stanley R. Szemborski, USN
Commander
Submarine Squadron Four
FPO AA 34099-5205
(803) 743-6065

HOLLAND BOAT COMPANY ARTIFACTS

November 15, 1994

We have purchased the site of the Holland Boat Company at the Sub Base in New Suffolk, New York and would like to display any items that may originally have been on site, or are characteristic of the period.

If any members of the Submarine League have artifacts which could be displayed from the Holland Boat Company era (1888-1906), please do not hesitate to contact me at the address below.

Sincerely,

Henry E. Raynor
P.O. Box 1459
320 Love Lane
Mattituck, NY 11952
(516) 298-8420
(516) 298-2127 (FAX)

WORLD WAR II-PACIFIC THEATER

I am researching stories on World War II U.S. submarines, particularly those that served in the Pacific theater, and would like to correspond with any surviving ex-submariners of that era. I am particularly interested in career officers who continued to serve after the war. I know that several have published books of their experiences in the last few years, and I hope that some of them would be willing to respond to my questions.

Sincerely,

Tom McGourin
2636 Newhall Street #32
Santa Clara, CA 95050-6368
(408) 248-3461

HARD KILL ANTI-TORPEDO SYSTEMS

November 28, 1994

I read in the 1994-95 issue of Jane's Book of Fighting Ships that the NIMITZ class of aircraft carriers are now being equipped with Mk32 torpedoes for *anti-wake homer* torpedo *hard kill* countermeasures.

The French Navy has also produced a wake homer version of the F-17 torpedo. No doubt it won't be long before other navies purchase this weapon or the Russian competitor the Type 65 torpedo. The result is that many navies are looking at hard kill torpedo countermeasures.

When will the U.S. submarine community adopt a hard kill anti-torpedo for the SSN 21 and the 688I class submarines?

A reduced force of submarines needs every edge we can supply them with. The resources contained in each hull would make it a national tragedy to lose a single sub to a older system such as a captor mine or a KILO class sub laying at wait near a choke point.

Sincerely,

Adrian DeVoe
3160 Hostetter Road
San Jose, CA 95132-1733

THE LAST PATROL

by Harry Holmes
Airlife Publishing Ltd., England
Distributed in USA by Naval Institute Press
212 pages, ISBN 1-85310414-0

Reviewed by Larry Blair

On December 10, 1941, Japanese bombers plastered Manila, Philippine Islands in one of the most destructive air attacks of the early war in the Pacific. Bombs straddled the overhaul dock at the Cavite Naval Station, where the submarines SEALION and SEADRAGON were in various stages of repair. Gun crews from both subs didn't take long to get into battle with their .50 caliber machine guns, however, the attacking planes were too high for the angry submariners. On the second attack wave, Jap bombs slammed into SEALION's cigarette deck and after engine room hatch. Four men were killed there, while a fifth man aboard SEADRAGON was mortally wounded by shrapnel. These were the first fatalities of the submarine war, and SEALION became the first sub victim. With a starboard list, she sank by the stern, and was to be out of action permanently.

On August 6, 1945, just a few days before the war ended, fate closed in over BULLHEAD and her entire crew. Lieutenant Commander Edward R. Holt took the sub out on her third patrol, his first as skipper. Traveling close to shore off Bali, a Jap plane pounced on the boat scoring two direct hits with bombs. The pilot observed the sub sink with much debris and bubbles rising to the surface.

Between the above two dates, author Harry Holmes has covered in chronological order the mournful sagas of the other 50 submarines lost in the war. He has painted an endless surrealistic word picture. Men and their boats traveled far, far from home both on and under the water, to engage the enemy in this most unusual, sometimes bizarre form of warfare.

This must-read volume for naval historians and general public alike pays due respect to the gallant 374 officers and 3,131 enlisted men who volunteered for this duty, and were killed in the service of the silent service. The casualty rate was about 17

percent, the highest for any branch of the military. The Submarine Force represented only about two percent of Navy personnel, yet it accounted for 55 percent of Japanese maritime losses. Our losses when compared to Germany, however, were low. They lost 700 to 800 U-boats. Japan only had 58 subs remaining at the end of hostilities, loosing 128.

A breakdown of our losses shows DORADO and R-12 lost in the Atlantic. S-28 was an operational loss during training at Pearl Harbor, and S-26 was sunk in a collision off Panama. The other 48 boats were lost directly or indirectly by enemy action. S-39, S-36, S-27 and DARTER were lost due to stranding on reefs. All personnel were rescued in all of the strandings. Three officers and five men from FLIER were saved in the manner of John F. Kennedy. Some men from the following submarines were held prisoners until the war ended: GRENADIER, PERCH, SCULPIN, TANG, one survivor out of the entire crew of TULLIBEE, and two from the complement of S-44. Four survived ROBALO's sinking by a mine but died later while prisoners. All remaining submarines were lost with all hands.

Truth is indeed stranger than fiction as fearless, youthful heroes prepare to meet their maker. Their stories are brought forth in stark detail and serve to remind us—they are for all eternity on their last patrol. ■

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