THE SUBMARINE REVIEW

APRIL 1984

A QUARTERLY PUBLICATION OF THE NAVAL SUBMARINE LEAGUE

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OF
THE NAVAL SUBMARINE LEAGUE

FROM THE PRESIDENT

This issue of the Submarine Review should reach you prior to our Second Annual Submarine League Symposium on 1 May 1984. In this issue, as with previous issues, there are questions raised about the directions being taken by today's submarine force as well as how the Submarine League might be of benefit in helping to realize the submarine goals being pursued by the Navy. To this end, this symposium will again provide briefings from leading submariners of major commands--in an attempt to provide detailed insight into the problems of today's submarine force. It is hoped that these briefings will provide a closer working relationship between League members and the active duty Navy as well as develop an understanding of areas of mutual interest where the expertise and influence of Submarine League members may be usefully applied to today's submarine problems.

The growth of our League membership has not been as fast as was optimistically predicted last year. We are still not at the "1984 by '84" mark. More effort is needed to get the word around that the League has more than sociability goals and that through the Review and the Symposium the League is accelerating its potential for usefulness. A broader membership, including submariners of foreign navies and now several Naval Academy midshipmen, is ensuring the diversity to make our League a must for those who believe in the future of submarines and who have great affection for the submarine past.

I am pleased to announce that John Drain has accepted the chairmanship of the Fact Book Committee and Dori Williams the chairmanship of the Speaker's Package Committee. Both will need help so it is hoped that we can draw on our volunteer bank of names to not only help staff these committees but also other activity committees which are developing as the League

increases its scope of interests.

The Naval Submarine Directory is being issued and will help you identify friends who are not listed and who may not have heard about the League, and who are basically submariners at heart, and who would want to join and participate in League activities.

I'm looking forward to seeing you at the May 1st meeting at the Sheraton-National, near good old BUPERS. Don't forget the warmup session on Monday evening preceding the Symposium.

SHANNON

FROM THE EDITOR

It would seem that, particularly now, there is a need for informing the public about submarine matters. Four nuclear attack submarines and one Trident are in the FY 85 Budget. But with an election year push to reduce the national deficit--some of it through cutbacks in defense programs--the FY 85 submarine program might be cut, through sheer lack of public understanding of why the United States needs even more submarines than have been budgeted.

The Soviet build-up in nuclear submarines is increasingly alarming. The new classes of submarines they are putting into the water are alarming for their advanced characteristics and the mission they imply. And, the preponderant part of the Soviet's naval budget, which this new construction represents, alerts one to the Soviet singleness of purpose for making their fleet predominantly one of submarines. U.S. Navy thinking--concerning 100 attack submarines of a single type being adequate to meet this

threat--seems rooted in an earlier period of Soviet submarine design, production and operations. It has been argued that the Soviets could not adequately man the great numbers of nuclear submarines which they would attain if they continued at their rate of eight a year. But then it appears that automation, along with simplification of functions for individual Soviet submarines, are being incorporated as the way to answer the manning problem. It is also argued that U.S. submarines can stay ahead of the game using their superior technology, despite having only one third as many submarines. But this argument relies on a superiority centered around a single area of submarine technologies--those used to produce submarine quietness and a related passive acoustic acquisition superiority . This raises the question of how the Soviets intend to capitalize on their areas of superiority to win a war at sea. The argument that the Soviets have incompetently lagged the U.S., in developing the most effective kind of submarines, may be true. But the United States is faced with the reality of Soviet submarines which are going to be used differently to take advantage of the superior characteristics they possess as well as the superiority of numbers they enjoy.

One can argue for maintaining the "silent service" policy to best meet this growing and changing threat. But--borrowing from George Reedy's recent lecture on free speech at Marquette University--"We forget that there are disadvantages to secrecy...." Then he says, "1. Secrecy limits the number of minds that can be brought to bear on a problem...Men thinking in a closed circle can arrive at some extraordinarily stupid conclusions... 2. Secrecy has a tendency to break down the confidence of our people in government.... 3. Secrecy has a tendency to place us at a disadvantage in our dealings with....(here Reedy used the words "other nations", but the Silent Service would use

"others", implying the public, other government activities, etc.).... 4. To the extent that we hamper publication, we hamper the advancement of knowledge."

Published ideas involve risk since there are always some who don't agree with what is proposed. Yet, the advancement of submarine knowledge can be served by those who will express their thoughts and concerns despite the promise of little or no personal reward for their efforts. Those with this interest in submarines and submarining--the hard core of the Submarine League--can benefit the United States well through what they write for the Submarine Review.

WHITHER THE LEAGUE

No weapon system in modern warfare has given such consistent, devastating performance in combat and yet been so inadequately factored into Naval planning than the submarine.

A spectacular inauguration of submarine warfare occurred in August 1914. Then a lone U-boat shocked the world's Naval community by sinking the British Cruisers Aboukir, Hogue and Cressy in a single action that lasted less than an hour and took the lives of 1459 seamen. Shortly thereafter HMS Goliath was destroyed by a lone Turkish submarine in the Aegean Sea--precipitating a timidity on the part of the Royal Navy which led ultimately to loss of initiative in the Dardanelles campaign. Victory there would have shortened the war by years and prevented the loss of a million troops in the trenches of Western Europe. German U-boats went on to reach a pinnacle of 875,576 tons of bottomed merchant ships in one month. They also took a toll of British warships that outperformed the Kaiser's

Imperial Battle Fleet in every respect.

It was not the successes of the U-boat arm but rather the humiliations suffered at Jutland which influenced subsequent deliberations by Nazi Navy planners. They wasted a lion's share of available production resources on battleships, pocket battleships and cruisers--whose contributions in WWII proved of no consequence. For the most part, the German capital ships passed their careers bottled up in port where they required substantial antiair and harbor defenses.

By the eve of World War II, then Capt. Karl Doenitz was able to acquire only 56 of a requested 300 U-boat force level. This was fortunate for the Allied Nations since, from this austere beginning, German U-boats destroyed 13.5 million tons of merchant shipping and 175 Naval vessels. Consider the consequences had Doenitz's 300-submarine force been available at the start--with 100 in port, 100 enroute and 100 dispersed about sea lanes in the North Atlantic.

The impact of WWI submarine warfare results was not apparent in U.S. Naval planning before WWII. Naval warfare continued to be regarded as a surface force activity. Despite the great ship losses sustained, the popular British notion that submarines were weapons of a second rate sea power apparently had caught on. There was little realization that regardless of a ship's size and armament, a big hole in its side will cause it to sink.

The U.S. entered WWII with only 50 "fleet" boats. Seven "Os", 18 "Rs" and 32 "S" boats rounded out the remainder of the U.S. submarine force. These latter relics were totally inadequate however to deal with the wide expanses of the Western pacific. But two strokes of good fortune helped the Americans. There was a readiness to produce more fleet boats and the

Japanese failed to concentrate on U.S. submarines and their facilities during the initial phases of the war. At Pearl Harbor, the submarine base was overflown by Japanese airmen who were only eager to attack a row of obsolete battleships. Thereby, they achieved little more than the fulfillment of Admiral Yamamoto's prophecy of "awakening a sleeping giant and filling him with a terrible resolve." Moreover, the overlooked submarine base helped sustain an effort that cost Hirohito eight carriers, 43 destroyers, 23 submarines, nine cruisers, a battleship and 189 assorted combat vessels of lesser capability. Before war's end, submarines had lined the Pacific sea bed with 63 percent of Japan's Merchant Marine.

Armed with lessons from two major wars and the fact that submariners had destroyed about twice as many ships as all other naval forces, one would think that submarine warfare had finally "emerged from the closet." But had it?

Submarines were not an issue in the "Revolt of the Admirals" 1948-49, during the so-called "Louis Johnson Era" of defense cutbacks. The Admirals who resigned were frustrated over their failure to get a super carrier. No careers moreover were sacrificed on the altar of greater submarine emphasis. The "Silent Service" seemed content to subsist upon the fallout from the vicious in-fighting over appropriations for the more traditional heavy combatants. Submarine fleet modernization meant only the adding of snorkels, increasing battery capacity and streamlining of the old fleet boats. Post-WWII construction of diesel-electric submarines in the U.S. resulted in a questionable product that did not approach the reliability or efficiency of Germany's Type XXI, which was in mass production at the close of the War. The incorporation of modular assembly, perfected in German Shipyards by 1943, for mass production, was not implemented in the U.S. until TRIDENT. It is ironic that the introduction of

nuclear propulsion and ballistic missiles into submarines drew their principal impetus from a maverick submariner who never commanded a submarine, and a Naval aviator.

What does all this mean to the Naval Submarine League? Isn't our rallying cry "The Silent Service should remain silent no longer?" Do U.S. Navy planners better understand the full impact of submarine warfare in relation to the many tasks which must be undertaken in the projection of sea power? What evidence is there that suitable portions of available resources are being directed into exploring the advantages of submarines?

Apparently, funding for U.S. submarines is much less than that of our principal competitor. Soviet submarines outnumber the U.S. three to one. They dive deeper, run faster and are tougher boats than ours. Soviets give priority to a strong submarine arm--ahead of all other Naval Forces--yet the USSR is far from being a second-rate sea power. While U.S. submariners dallied in the Arctic, wrote books about it and presented slide shows, Soviet Admiral Gorshkov developed the Artic as a sanctuary for SSBNs. There, inaccessible to most U.S. ASW forces, the Soviet Deltas and Typhoons now enjoy all the advantages of TRIDENT for only a fraction of the cost. Although U.S. SSN Arctic experiments date from the late fifties, no substantive ASW capability has yet been produced. Fortunately the diligent efforts of Dr. Waldo K. Lyon, of NOSC San Diego, have given continuity to our SSN Arctic program. With a miniscule budget but tremendous determination, Dr. Lyon has kept U.S. interest in Arctic submarine matters alive. When an effective U.S. Arctic ASW capability is achieved, it will be due in large part to his dogged persistence.

The League can be an important factor in turning these circumstances around. Its membership includes a vast reservoir of experience, insight,

and most importantly, creativity in the discipline of submarine warfare--a true "submarine resource." The task then is to apply this resource in a manner that will permit our country to best exploit submarines in its defense.

"Breaking of silence" is not merely important; it is necessary to meet the naval challenges which confront our country. Communications to all decision making levels, ranging from the general public to those individuals who make final resolution in defense procurement matters, must be initiated. This can be done only through a well-conceived plan formulated by media specialists among the league membership. Piecemeal, sporadic pronouncements by individuals wishing to "air a beef" makes entertaining reading but will not produce a desired result. In effect, the League, in "breaking the silence" must talk to other than just itself and with a strong voice.

Credibility is important. Those who listen to the League's messages will be influenced in direct relation to the confidence they have that such messages are a product of the "submarine resource" and not a reverberation of "City Hall's" submarine party lines. Therefore, ties with the active duty community will best consist of channels for exchange of information and social amenities. Today's submariner is heavily preoccupied with other matters. He must be free to concentrate on ways and means of fighting wars which may occur in the near term--wars in which he is out-numbered three to one by an enemy with an excellent repertoire of weapons. Additionally, the regular Navy is bound by a myriad of directives and policies from which League members are able to enjoy complete freedom. Most League members have completed their runs through gauntlets of selections boards, plucking boards and flag officer assignment boards and need no longer permit such boards to be a factor. Additionally, today's service politics may drive submariners to

options less than optimum for the best interests of our country. Recognizably then, the League's position could run contrary to that currently expressed by the Navy. In view of the amassed experience, accrued under "Government" circumstances, exercise of the right to inform government decision makers on submarine matters is a League responsibility.

So then, whither the Submarine League? More than a year since commissioning, has a course been well charted? Do its achievements reach beyond attainment of membership goals, meetings and publication of quarterly bulletins? Have its resources been drawn upon in the course of resolving issues of national defense relating to submarine warfare? If so, what has been the outcome? Is the League prepared to own up to submarine mistakes of the past so that the wisdom gained from hard-earned experience can light the way ahead for those who follow? Has its Review contained articles which increase public awareness as to the significance of submarines in today's warfare? Can the League draw from its "submarine resource" and develop unbiased positions on current and prospective issues relating to U.S. seapower?

The League is certainly "able" but is it "ready and willing" to initiate and advance alternatives which will provide American Taxpayers with greater Naval protection for their investment? Or has the Silent Service broken its silence only to hear itself talk?

Capt. D. M. Ulmer, USN (Ret.)

The Soviets appear to have a radically different philosophy for the design of their submarines--in order to best function in a big seawar against the West. Specifically, their attack submarines are reflecting a specialization of design to meet the demands of a specific primary mission rather than being multi-purpose like the U.S. SSNs. At the same time, the Soviet emphasis on certain characteristics other than acoustic quietness is producing submarines which will necessarily fight in a different manner than the high performance U.S. nuclear submarines, whether SSNs or SSBNs. And most importantly, the Soviets consider their submarines to be the main and growing source of offensive strike power at sea--unlike the U.S. with its attack carrier oriented Navy.

The manner in which the Soviet submarine force is developing--its trends into the '90s--have allowed for a crude form of interpretation despite the very scanty amount of unclassified information presently available. Although the trends derived appear to be overly simplistic and based on too little data, it is felt that additional bits of information are not likely to radically change any of the trends shown. Comparison of these trends with similar U.S. submarine developments provides a good appreciation of not only the Soviet trends but also their relentless consistency.

The direction of certain Soviet submarine R&D programs which are examined herein should also be seriously regarded for the possible impact they may have on the balance of seapower in the next decade.

Fleet Compositions

The greater emphasis which the Soviets place on submarines is evident from the makeup of their

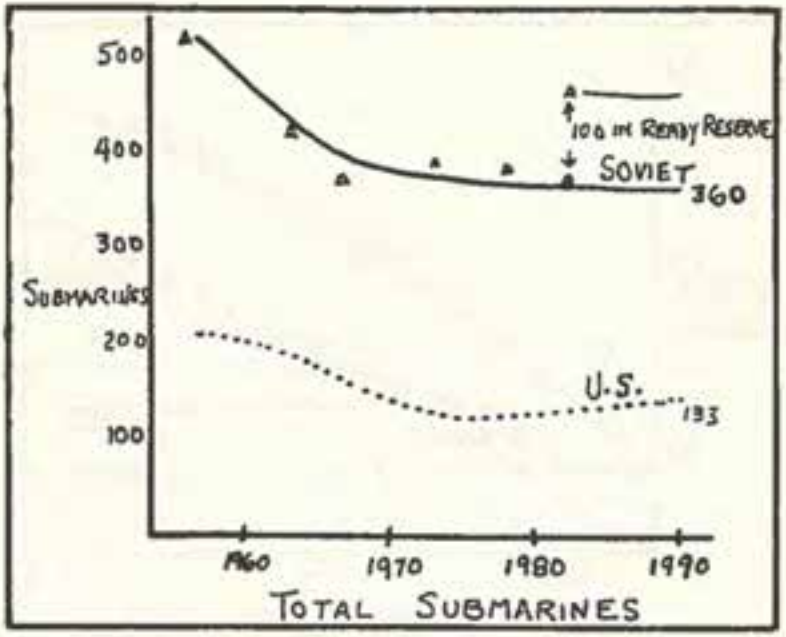
Fleet--a fleet of about 250 major surface combatants of over 1000 tons, some 350 land based aircraft and about 375 operational submarines (of which 180 are nuclear powered) plus another estimated 100 submarines in a ready reserve. Maintaining this fleet orientation towards a predominance of submarines is indicated by the steady building program shown below--which is apparently being continued through the 80's.

Submarine Force Levels

USSR Submarine Construction

	1976	1977	1978	1979	1980
Submarines	10	13	12	12	11

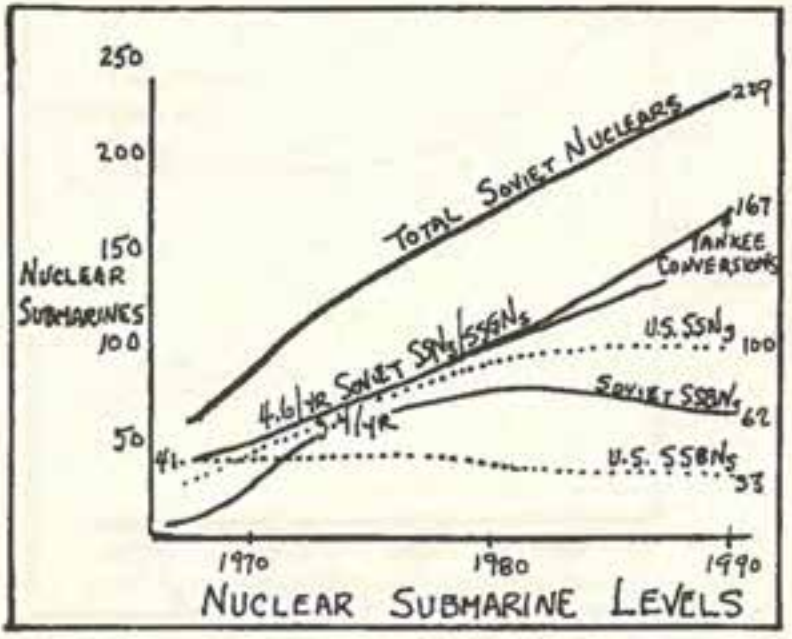
Of these yearly totals, about 8 are nuclear powered and the remainder conventional submarines.



This construction program is apparently being balanced by retirements of obsolete conventional submarines. Thus an almost level force of strategic and attack submarines is being maintained out into the '90s as shown.

By comparison the U.S. is building only 3-4 submarines per year and with retirements should achieve by 1990 a force goal of 100 attack submarines and about 34 strategic submarines.

The nuclear submarine construction programs of the Soviets equate to about 4.6 attack submarines and 3.4 SSBNs per year for a total of 8 nuclear submarines annually. With six Soviet nuclear submarine construction yards providing some 24 construction positions, about half of the building potential is being utilized. On the other hand, the U.S. presently has a maximum building potential of only about 5 nuclear submarines per year--in two private shipyards, Newport News and



Electric Boat. The graph of how nuclear submarine force levels are changing, as shown , needs some explanation. Because of the SALT I agreement Retirement of nuclear submarines due to old age is unlikely until late in the '90s, since keeping their submarines in commission for 30 years or more is consistent with past Soviet policies for retaining very old-age military units. Significantly, the Soviets latest SSBNs--her Deltas and now the Typhoons--appear to be configured for under ice operations. This capability coupled with the great range of their SLBMs (over 4,000 miles) and the expressed intent to operate their SSBNs in "bastions" close to the homeland and "in the Arctic environment", indicates a relatively new strategy for their employment. It also lends credibility to the concept of a survivable fleet-in-being in an extended war which can decisively influence the political outcome of the war through the threat it poses to an enemy's homeland.

By comparison, U.S. submarine programs call for a ceiling of 100 SSNs and a force of 31 SSBNs since the eventual force of all Trident submarines would provide 644 launch tubes--within the SALT I limit of 656 tubes for U.S. strategic submarines.

Submarine Design Trends

o Hull Design of Nuclears--As shown, the Soviets have steadily reduced the length to beam ratios of their nuclear submarine hulls, whereas the U.S., to date, has had successively greater ratios--after starting with the Skipjack class which was developed from the lessons learned from the Albacore.

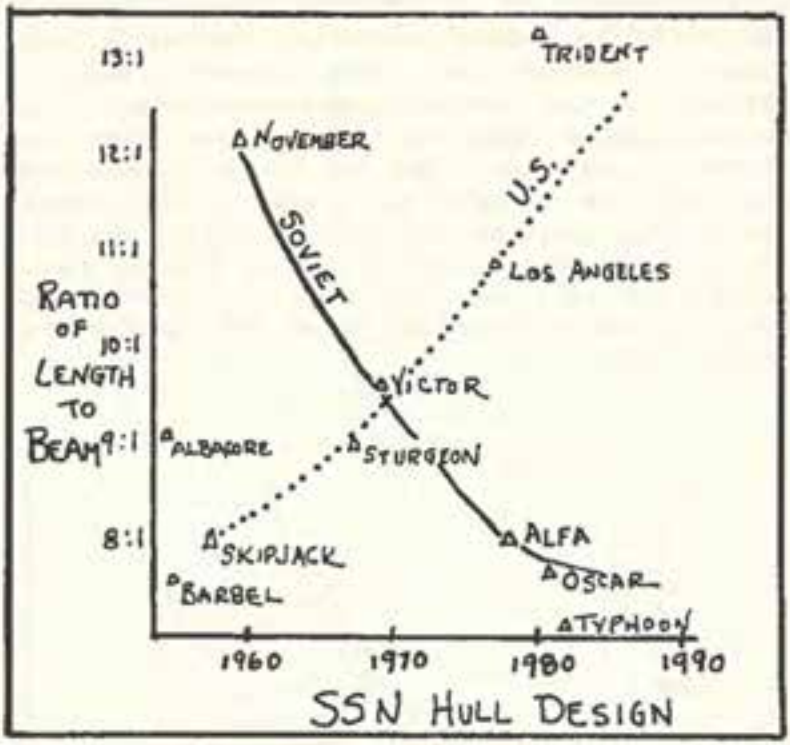
o Size of Nuclear Submarines--The Soviets nuclear strategic submarines have progressed from the 5600-ton, 3-6 missile tube Hotels in 1958 through the 9,300-ton Yankees in 1967, the 16 missile tube 11,750-ton Deltas of the mid'70s and finally

today's Typhoon of 25,000 tons with 20 missile tubes. On the other hand, the Soviets nuclear attack submarines respond to a philosophy of designing various types of submarines--each for a specific primary mission. It is a single purpose approach as opposed to the U.S. design philosophy which has reproduced, since Nautilus, a similar kind of multi-purpose but basically ASW submarine. Thus for the Soviets, there are a variety of trends created by specialization of their nuclear attack submarines--which they distinguish as torpedo-submarines (SSNs) and missile-submarines (SSGNs). As shown, Soviet torpedo attack submarines or (SSNs) respond, displacement wise, to two different basic missions. The increasingly smaller SSNs, best characterized by the titanium-hulled, 43 + knot Alfas are probably designed for the anti U.S. SSBN mission, whereas the increasingly bigger SSNs characterized by the Victor IIIs and now probably including the new Sierra class appear to be well suited for the protection of the Soviet SSBN force.

Significantly, the Alfa needs only an anti submarine weapon to carry out its mission of destroying U.S. SSBNs whereas the Victor III would need anti sub, anti surface ship and even anti air weapon systems to protect Soviet SSBNs, plus an under ice capability--resulting in a larger submarine.

By comparison, U.S. SSNs show a single growth trend in displacement tonnage while increasing their various weapon capabilities.

The other type of Soviet nuclear attack submarines, the SSGNs, also appear to respond to two different kinds of basic missions. The early Echos with their 250-mile 2200-pound warhead Shaddock missiles were undoubtedly designed for the anti attack carrier mission. And now the Oscar with its 24 tubes for the SS-N -19 is seemingly an updated SSGN for the same mission.


13:1
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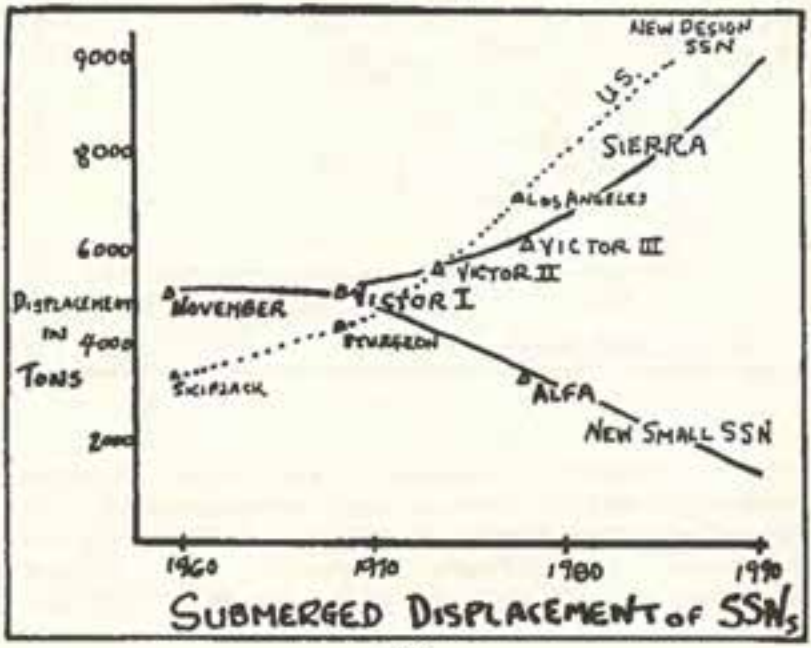
RATIO OF LENGTH TO BEAM
TRIDENT
NOVEMBER
SOVIET
U.S.
LOS ANGELES
VICTOR
ALBACORE
STURGEON
SKIPJACK
BARBEL
ALFA
OSCAR
TYPHOON
1960
1970
1980
1990
SSN HULL DESIGN


9000
8000
6000
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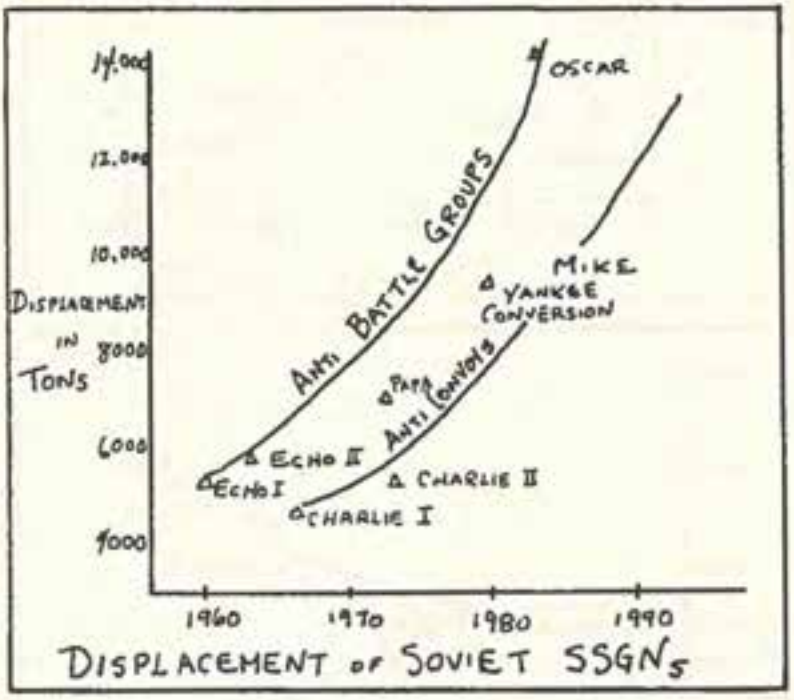
DISPLACEMENT IN TONS
NEW DESIGN SSN
U.S.
SIERRA
LOS ANGELES
VICTOR III
VICTOR II
VICTOR I
NOVEMBER
STURGEON
SKIPJACK
ALFA
NEW SMALL SSN
1960
1970
1980
1990
SUBMERGED DISPLACEMENT OF SSNs

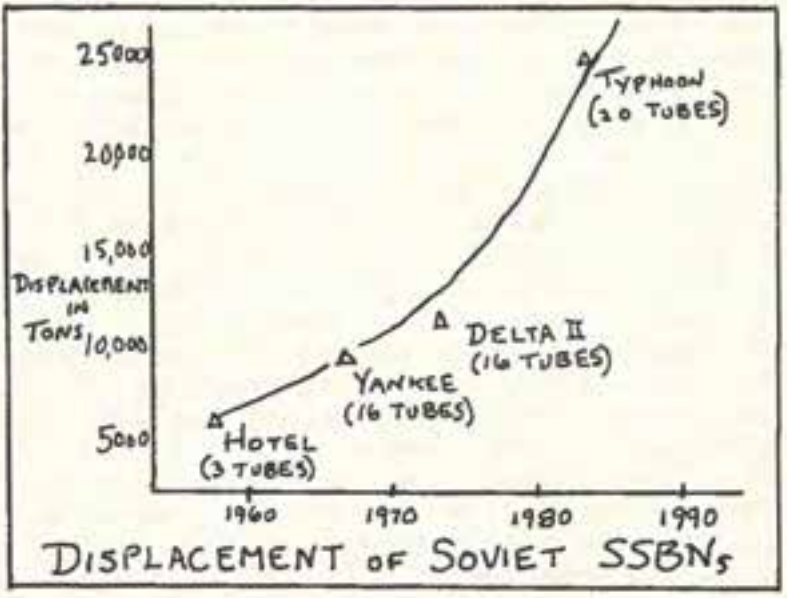
It was thought that the Charlies with their 30-60 mile antiship missiles were a reasonable step backward because of long range targeting difficulties for the anti carrier mission. But the subsequent Papa and what looks like its follow-on, the Mike, plus the Yankee conversions which might be oriented for either mission, would indicate that this type of SSGN is better designed for the anti convoy mission--the medium range missiles to take out the escorting screens and their big load of torpedoes to be used against the merchant ships.



DISPLACEMENT OF SOVIET SSGNS

Various basic missions evidently create substantial differences in the characteristics of nuclear attack submarines. Thus, since mining is considered a "primary mission" for Soviet submarines, according to Capt. Thomas

Brooks--writing in the January 1984 Proceedings, there should be this type of Soviet submarine evolving through several generations. But perhaps it is a conventional one which to date may have been disregarded because of its non-nuclear character. It would also seem that basically logistics submarines should also be evolving, consistent with the Soviet's development of single purpose submarines. The submarine for reconnaissance of amphibious landing areas and destruction of inshore underwater obstacles is evidently (from the recent submarine intrusions into Swedish coastal waters) the mini-submarine operating from another submarine. Capt. Brooks also gives a good rationale for the Soviet's continuing construction program of new types of diesel-electric submarines--which are reportedly showing increasingly greater submerged endurance on the battery with as high as 10 days suspected. "Arrayed in barriers", Brooks writes, "where she



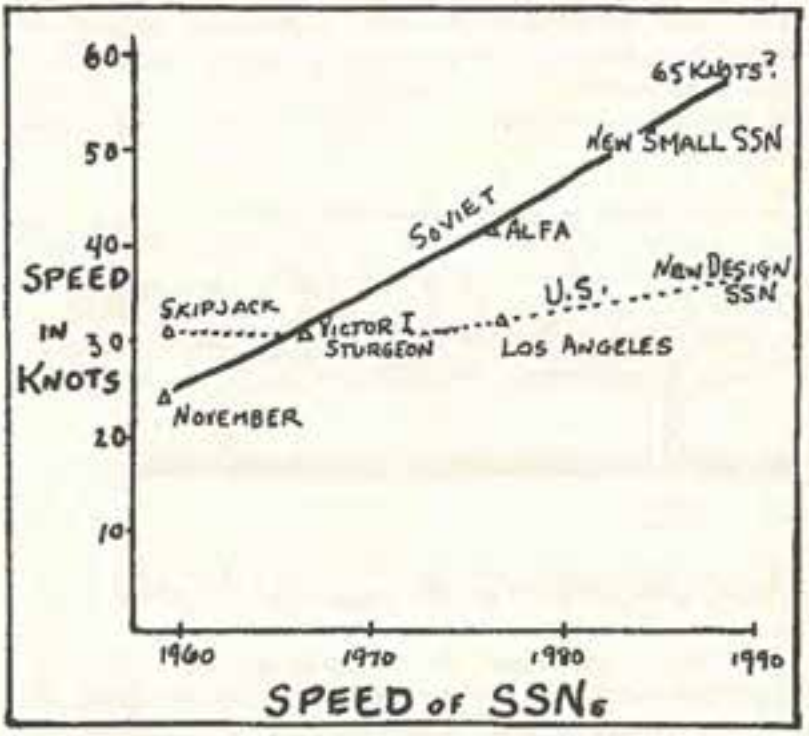
can take advantage of her quiet battery mode of operation, the diesel need not compete with the speed and endurance advantages of the SSN. A U.S. nuclear-powered submarine venturing into waters adjacent to the Soviet Union had better take into account the diesel barrier threat."

The increase in size of Soviet SSBNs shown here reflects not only the increasing number of missile tubes installed, but also the progressively larger weapons carried in the tubes, to gain increased range and carry a greater number of MIRVed warheads.

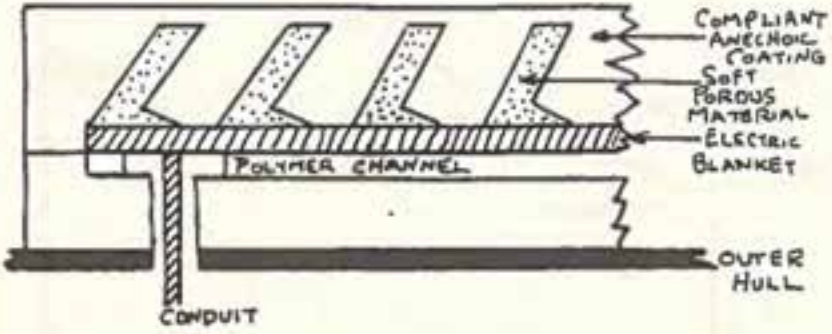
o Speed of Nuclear Submarines - High speed in a Soviet torpedo attack submarine is apparently at a premium, both to quickly close a distant datum, determined by a third party observation, as well as to attack, using active sonar derived fire control information, and to evade enemy counterattacks. It seems imperative that very high closing speeds be used in order to reduce the area of uncertainty of target location, if active sonar is to be then employed as a localizing means. In addition, very high speed lends itself well to Admiral Gorshkov's philosophy of having "quickly developing operations" in order to surprise an enemy--where "surprise" can mean not only catching an enemy unaware but also preventing an enemy from organizing his adequate and timely defense. As shown, the Alfa is credited with a 43 knot speed and according to Capt. John E. Moore, USN (Ret.) the Editor of Jane's Fighting Ships, "The probability of the successor to Alfa, a comparatively small, deep diving and very fast submarine being in commission by late 1984, is high." This seems to be the reported "new small nuclear submarine" of the Soviets. Capt. Moore also reports a Morskoi Sbornik forecast of a 23,000 ton submarine of very high speed that may use unconventional power sources." The Soviets indicate a belief that a hybrid type of submarine, one which uses a nuclear power plant to steadily

charge a fuel cell or battery or heat sink--which acts like a capacitor--can provide a great surge of power for short bursts of speed. Thus, speeds of over 60 knots do not appear unreasonable in the possible time frame shown. By comparison, U.S. SSNs have increased in speed only slightly over more than two decades. But for the U.S., speed is subordinated to quietness.

The use of very high speed along with difficulties in producing sufficient numbers of skilled personnel to man their submarines seem to be driving the Soviets towards a high degree of automation in their nuclear submarines. One Soviet designer sees as reasonable "a completely automated missile submarine with a crew of 25-30 and a crew of 10-12 for a torpedo submarine."



Not only are the Soviets pursuing new power sources for propulsion to produce higher speeds, but there is also a continued effort to achieve significant hull drag reduction through boundary layer control techniques. The Soviets indicate that the secret of drag reduction lies in imitating the bionic principles used by underwater speedsters--dolphins, sailfish, squid, etc. To this end, a series of Soviet patents starting in about 1972 show the practical application of these bionic principles to hull coatings. The 1981 patent shown here seems likely to be in use today. It consists of: a compliant coating with anechoic qualities; soft porous material embedded in it to respond to boundary layer pressures; an electric blanket for heating control of the boundary layer; and a means to feed a polymer to the surface of the coating. Such a coating may produce up to 60 percent reduction in frictional drag on the outer hull. And it should provide a damping effect on active acoustic sound waves hitting the hull, while producing a decoupling effect on noise transmitted through the outer hull of the submarine.



A SUBMARINE HULL COATING

Following through on applying the bionic principles which allow squids to go at a speed of up to 75 knots, the addition of a cybernetic boundary layer pressure - sensing system with such

a compliant coating, as shown, plus the use of a hydro-pulse propulsion system to allow the cybernetic system to better react to pressure changes and control polymer ejection, are possible next steps for achieving speeds in the 60-knot regime.

However, improved methods of drag reduction are insufficient to provide such speeds.

o Propulsion - Not only is hydro pulse propulsion likely to be utilized, but other forms of propulsion with higher efficiencies should be evidenced as the Soviets "depart from the traditional scheme of large-bladed, extermal propellers in favor of new methods." Super-cavitating or ventilated propellers, ram jet propulsion and even magnetohydrodynamic (MHD) driven flow of water are techniques being suggested, while the pump jet has apparently been already utilized.

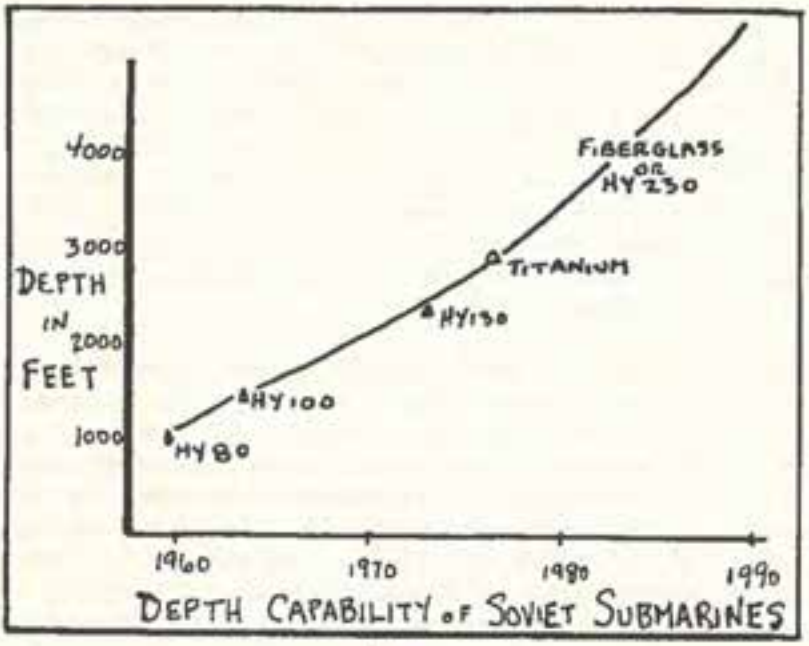
o Power plants - In addition to the hybrid idea noted earlier, which could be less costly than present "atomic powered submarines" and use a simplified nuclear power plant, other power plants with an increased horsepower-to-weight ratio appear to be under development. Reactors using gas or liquid metal are listed, as well as an MHD system which uses a heated plasma to provide, magnetically, a direct conversion to electricity.

Depth

Increased depth in Soviet submarines is evidently of great importance. One Soviet Submarine designer notes that "increased depth capability allows for a full utilization of high submerged speed." Another says, "a deep-diving submarine becomes invisible to the sonar gear carried by the ASW surface forces." Getting down into the deep sound channel--3000 feet or more "to significantly increase the operating range of

sonar gear," is also of great importance.

The graph shown is an indication of Soviet interest in hull materials for increasing submarine depth. It also shows what is considered to be logical development of these capabilities--the application of titanium being quite consistant, with the introduction of the 3000-foot depth Alfa. The U.S. by comparison is still in the HY80-100 regime.



Survivability/Unsinkability

The Soviets regard the submarine characteristic of survivability as one which they term to be its "unsinkable" quality. This approach, in effect, focusses on making their submarines capable of withstanding the damage from an enemy weapon hit,

or nearby nuclear explosion. The U.S., on the other hand, sees the problem of survivability as one of submarine vulnerability to enemy attack and presupposes that the best way to make a submarine survivable is to insure that it is never hit--or be close enough to a nuclear explosion to sustain fatal damage.

Soviet submarines are all double-hulled, with an increased spacing between hulls in newer classes to improve their unsinkable quality. The reported 4-meter separation for the new Oscar and up to 5 meters for the Typhoon indicate the extremes to which the Soviets are being driven to minimize damage from torpedoes with high explosive warheads. The effort towards deeper diving submarines is also indicative of Soviet emphasis on tougher hulls which can, when operated shallow, better withstand the effects of nearby underwater nuclear explosions. The use of two reactors and multi propellers or propulsion systems are Soviet means to insure against the kind of crippling damange which inexorably leads to being sunk by subsequent enemy attacks. Internal compartmentation obeying the "two-compartment rule" which calls for the capability to withstand the flooding of two non-adjacent compartments and still get the boat back to the surface is evidently being practiced. Greater inherent reserve buoyancy in Soviet boats (the Soviets indicate about 20 percent as compared to U.S. boats with about 12.5 percent) plus multi hard tanks, forward and aft as well as midships, for buoyancy control, are implied in Soviet descriptions of how, not only is unsinkability achieved with the "flooding of a compartment" but, the submarine is likely to also maintain a capability to continue fighting.

Like the U.S., moreover, the Soviets see unsinkability as reducing the chances of getting hit. The reduction of submarine signatures, non-acoustic as well as acoustic is stressed--to

minimize detection by the enemy, with subsequent weapon attack. The magnetic signature of Soviet submarines is minimized through use of degaussing coils between the outer and inner hulls, the use of the non-magnetic titanium alloy in the Alfa and the expected use of fiberglass in hull construction. Hudrodynamic and infrared signatures are being markedly reduced with the use of better hull and conning tower shapes, compliant hull coatings, uses of polymers, etc. Wake disturbances as well as acoustic signatures are being reduced with improved methods and propulsion. In fact, acoustic signatures created by any means are apparently being reduced as the newer submarines are reported to be considerably quieter than earlier classes of submarines. The addition of an anti-air weapon capability to Soviet submarines, the emphasis on countermeasures against enemy sensors and weapons and the heavy stress on electronic warfare efforts to reduce an enemy's ASW attack potential, all serve to prevent weapon delivery on target.

Summary

The Soviet submarine trends and techologies described can only lead one to recognize that the Soviets are building tough boats of increasingly higher performance for their own style of waging war. The dominant role played by submarines in the Soviet Navy and the evident massive R&D effort in progress as well as the past successes in meeting scheduled milestones, force one to contemplate how the U.S. must change many of its ideas about ASW to meet such a growing naval threat.

PHOENIX

SSN FIRE CONTROL:
THE NEED FOR SYSTEMATIC TRAINING

A major problem in today's submarine community is the blind faith of its people in machines and their search for a panacea made of blinking lights and electronic wizardry. Humans are felt to be fallible. Therefore glorious testaments to mechnical and computer ingenuity are fabricated and expected to not only replace the human mind but perform minor miracles. Machines are presumed to automatically produce perfect solutions and perform flawless weapon presets. All this is expected--without human intervention. The MK 117 fire control system, for example, was envisioned by some as a complex machine that could do any thing.

Obviously this is an exaggeration. But the point is that this type of thinking--the worship of machines--overlooks the human element. Machines alone will not sink ships. High technology has not yet replaced training. If anything, the advent of the MK 117 has increased the training requirement for people involved in the fire control problem.

The October 1983 edition of Submarine Review carried a significant comment regarding the introduction of the MK 117 fire control system: "A widespread conviction grew that training facilities would not be required and that adequate training could be achieved on the job--but cooler heads prevailed." The controversy over training required for the MK 117 thus reflects a general and still unresolved problem in SSN fire control training: the lack of a coherent, systematic approach to training. There are those who tend to ignore the need for training--the believers in the "spontaneous training" theory. (This theory holds that a sailor, when placed within five feet of a weapon control console, will form a symbiotic relationship with the machine--resulting in

instantaneous training through electromagnetic osmosis.)

Even among those who acknowledge the need for training, however, there appears to be little consensus regarding the type and depth of training required. The current status of SSN fire control training is reminiscent of a huge jigsaw puzzle with missing pieces. It is a fragmentation of training efforts. Land-based training, on-board training, and implementation training all occur, but with little integration and little coherence. There may be a "quickie" crash introduction to new software with the introduction of changes to equipment on board; classroom training may or may not be adequate or timely; on-board training may be extensive or nominal. Because of this training hodgepodge, the difference in relative level of fire control expertise among submarines can be significant. There is nothing to ensure uniformity.

Fragmented training is not necessarily a shipboard phenomenon, however. Thanks to Admiral Rickover, personnel involved with the nuclear propulsion plant receive systematic, rigorous training and assessment both on land and at sea.

An emphasis on performance assurance is a matter of common sense. The engineering readiness of an SSN must be high in order to support the ship's mission and ensure its safety. It is ironic, however, that while enormous effort is expended to ensure that personnel are capable of operating and maintaining the equipment needed for SSNs to operate, we do not place equal emphasis on whether or not these submarines can perform the major task for which they exist--to destroy the enemy.

School Training

Fire control training at the classroom level faces several obstacles. First there is the

problem of scheduling classes to coincide with hardware and software. Fire control training may consequently occur much later or much earlier than practical. Second, school training results in a reduction of available fleet manpower along with signifiant dollar costs. Costs in turn mean constraint on the time used for schooling. With time a scarce commodity, there is a continuing trade-off between the amount of knowledge to be taught and the time available to teach it. It is possible then for enlisted personnel to emerge from a fire control course twirling encoders on the fire control console to create a perfect dot stack of estimated position dots producing a solution involving target course, speed and range, yet not grasp the relationship between the dot stack and the reality it represents. Similarly, an officer who has completed a MK 117 training program may understand the theory behind the machine yet not be able to efficiently use the encoders--since adequate training time was not available.

Adequate training encompasses far more than familiarizing an individual with concepts and equipment. It includes the time spent reinforcing that training, applying the knowledge and skills derived from different types of scenarios. Reinforcement training requires time, but unfortunately this type of training must often be sacrified in order to first develop basic skills.

None of this is an indictment of the instructors nor the training methods used at the schools. It is merely a recognition of time constraints. Schools alone cannot be held totally responsible for meeting the needs of fire control training. Rather, there must be a coordination of land and sea training efforts through a systematic approach to integrating these two types of training.

On-board Training

The SSN community has an on-board fire control training package SORAT (Submarine Operational Readiness Assessment and Training) which addresses individual through team training on the plots and the MK 81 console. This program, however, is used at the discretion of the individual submarine CO. The wardroom's dedication to training governs the level of training effort. The SORAT fire control package may lie dormant in the bowels of some submarines for years, its existence acknowledged only by the fire control technician who brushes the dust off long enough to insert material changes.

A multitude of reasons are given for shunning structured fire control training. Such reasons range from "It's too difficult to set up a team exercise" to "We don't have time." In fact, the "We don't have time" chant is heard so often that one begins to wonder if its memorizing is required. It indeed may be a true statement; but then something is definitely wrong. A serious distortion of priorities has taken place if requirements for supporting the ship's mission (administrative duties, engineering, etc.) have been allowed to overwhelm requirements for performing that mission. What good is an attack submarine that can't track and destroy the enemy? The fact remains that a high training priority and effective training system are required. There should be no waiting until a war is threatened before priorities are restructured.

Of course, it may be felt that the operational experience and training gained in at sea exercises sufficiently fill a submarine's training needs and consequently a structured training program is not required. This assumption however has several shortfalls. First, operational experience is a matter of opportunity; with the acquisition of critical knowledge and skills fragmented and

likely to be deficient. Further, this approach relies heavily on the training expertise and knowledge level of the crew members who happen to be available. In short, operational experience alone lacks a systematic approach as well as control required to ensure that adequate training occurs and that a submarine reaches a satisfactory level of combat readiness. Periodic operational training also has limitations. There are the constraints imposed by artificial exercise conditions and limited geography for the exercises. Budgetary considerations and scheduling problems also enter the picture. Further, operational training involves the participation of the entire submarine. It does not lend itself to the careful training of an individual crew member nor does it account for the training of all members of a particular team.

Sometimes, fire control training on board is inadequate because the wardroom believes that its crew has had adequate classroom training. "They spent two months at the trainer." "My men have been to MK 117 school." This is all too often a faulty assumption. First, classroom training cannot be expected to completely fill the training requirement. Second, even if sufficient time and resources existed for thorough classroom training, refresher training would still be a necessity. Skills are lost when not used regularly. Training is an on-going process and skills require constant practice. For example, the officer who mans the MK 81 console only at times when his ship goes to battle stations will not be able to maintain a high skill level without regular refresher training.

Submarines where relevant regular fire control training is conducted can be easily distinguished from their counterparts which satisfy a requirement for fire control training through having occasional lectures. Such disparity in training effort can be attributed to many causes

ranging from ingrained philosophies to a lack of accountability. But the net effect is the same--a lack of uniform fire control expertise among submarines.

A key component of the problem lies in the isolation of the various training elements. Each of the training areas--classroom training, on-board structured training, operational training--exist as separate entities. There has been no systematic attempt to integrate the training elements. Hence, this lack of integration means that the role of on-board training is ill-defined in relation to the large training effort. How can on-board training meet the fleet's training needs unless coordination of efforts between the training communities occur?

These obvious problems in achieving adequate training also suffer from subtle obstacles grounded in human perception and attitudes.

Equipment versus Training

Consider that famous line muttered by all self-respecting submariners: "In my day, all we needed for a fire control solution was an angle on the bow, a bearing, and bearing rate." Today, however, the Mk 117 has made the fire control problem significantly more complex than that. The Mk 81 operator is now inundated with hundreds of pieces of data to sift through, multiple modes to consult, and numerous weapon presets to be made. Does he understand how the data fits together? Does he know which pieces can be safely ignored or which are crucial? Does he know when or how to utilize data from a differenct mode? This is far more than his predecessors had to cope with. Not only has the equipment failed to replace the person, it has put significant new requirements on a person's skills.

The Navy spends billions on equipment, yet when

dollars are short, it is training that is sacrificed. Equipment is visible evidence of money spent; you can reach out and touch it. Equipment is exciting, impressive, something which is documented. Either it works or it doesn't and either the money was well-spent or the product is inferior. You can't do this with training, however. Training is an intangible that takes place over time. You cannot reach out and examine a man's brain to reveal where the money has gone. You have not exchanged dollars for something you can touch. Therein lies the rub.

But even when adequate training dollars have been budgeted, the nebulous nature of training makes it vulnerable to budget cuts with the rationalization that training can "always be conducted somewhere else." The "somewhere else", of course, rarely materializes.

Additionally, to ensure that training money has been well spent it is necessary to assess people. And this is another area of controversy. There are those who believe that assessment is required--that there must be some method of evaluating the current status of submarine combat readiness to ensure a preparedness for war. There are others who fear that the word "assess" is a six-letter word with a four-letter meaning. Without assessment, however, training dollars are difficult to justify. How then can the need and its outcome be documented?

Complacency

There is an attitudinal problem which arises from an assumption of technological superiority. Such complacency adds to the problem of achieving an adequate training emphasis in fire control. There are at least two serious flaws with this assumption, however. First, as stated earlier, tehnological superiority ultimately relies on the humans who exploit it. The Mk 117, for example,

may have capabilities that exceed those of an enemy's fire control system. But without adequately trained personnel who can exploit the system's capabilities, the advantages of better technology are reduced if not eliminated. It can no longer be assumed that the U.S. has marked technological superioity in submarines. To do so in dangerous. The technological advantages previously enjoyed may be gradually diminishing. As the technological edge continues to narrow, the key to combat superiority will more and more result from training. Our submariners must be better trained than their adversary, better able to utilize equipment capability, and better able to collate information and then respond rapidly.

To accomplish this, a well-structured, cohesive training concept is necessary—with programs that ensure integrated, systematic training on land and at sea. Unless the required investments of time, money, and effort are made for training our fire control personnel, the millions spent on machines will have been squandered and our technological advantage seriously reduced, with our submarine force far less effective than supposed.

R. F. BAIRD

REPORT FROM THE FLEET

As I complete 3 years in command of one our finest nuclear attack submarines, I have many thoughts that seem important—a few of which may be of interest to the readers of the Submarine Review.

PEOPLE. People come first to mind. The people today are superb! ...both the officers and sailors. They seem to be a cut above the mold of the young men who entered the service in the

early-seventies. Recognizing that there are ne'er-do-wells in today's group, I think that today's young men as a group exhibit a degree of patriotism, personal pride, and enthusiasm that was notably and painfully lacking a half-generation ago. Whatever the causes for the changes, I know that the young men I am serving with are doing their country proud, day after day--and mission after mission they have proven themselves to be most deserving of our respect and support.

SENSORS. The AN/BQQ-5 series sonar is a quantum jump forward from previous sonars and has provided today's skippers with many tactical tools not readily available 10 years ago. Day-to-day tactical use of very long tracking ranges, very high speed tracking, and multiple contact tracking are but a few of these tools that have helped me to conduct missions that were both very successful and very exciting. On the other hand, I have noticed no great additions to my tactical tool bag from the changes in our ESM, RDF or radar sensors. True, the equipment has been updated, but the tactical impact of any increased equipment capabilities has not been significant in comparison to the sonar changes.

COMMUNICATIONS. The high-speed satellite communications systems have revolutionized the submarine radio room. We no longer have the small, cramped radio receiving room that was energized three times a day to receive the submarine broadcast at tens of words per minute. Now we have the small, cramped Communications Center that is nearly always in action, processing both incoming and outgoing traffic at many times the speed and volume of a few years ago. The satellite has made it possible for the force commander to exercise effective operational control of a tactical encounter thousands of miles away, and to smoothly coordinate several submarines in support of a single or associated

mission. The satellite has also made it possible for the force commander to talk to the skipper on scene, and it is pleasing that the boss has shown great restraint in this area. There has been no move in the direction of giving rudder orders from afar. Instead, the increased communications capabilities have been used to improve the support of the skipper on the scene.

WEAPONS. The MK-48 torpedo is a quantum jump forward from previous torpedoes. Its capabilities, and associated submarine tactics, are not adequately evaluated in fleet exercises because our firing signals would not be detected by the targets at normal firing ranges (they would, however, notice the torpedo in the real world). However, the MK-48 has been shown over the past few years to have shortcomings, and the skipper's choice of firing position has been one of them. The addition of the cruise missile (HARPOON) to the submarine arsenal over the past few years has been disappointing. Not only are we hampered by an apparent shortage of missiles, but the combination of small warhead and long range isn't what I've needed in my task force encounters. At any rate, with the existing limitations of both HARPOON and the MK-48, the weapons area is in need of another quantum jump forward.

RICKOVER. The departure of Admiral Rickover has not changed the operations or effectiveness of the Division of Naval Reactors as viewed from my boat. It is still impressively responsive with technical assistance, and the nature of the information which skippers must provide to the organization remains essentially unchanged. The Fleet Commander's Nuclear Propulsion Examining Board is still impressively effective in enforcing existing standards and in setting improved standards through the challenging annual examinations. The unique, direct communications between the 4-star boss and the 3-stripe skipper in the Naval

Reactors chain has also not changed. There is still immediate, personal feedback provided in this channel in response to shipboard performances, both good and bad.

OPPORTUNITIES. Submarining today still provides great opportunities for personal achievement just as it still provides strong challenges that always test and sometimes exceed the capabilities of even the best skippers. Each area of a submarine's operations--propulsion plant, tactics, food service, intelligence collection, etc--still requires the day to day dedication of many talented people to make things work. Nothing is in automatic! The people, from the skipper on down, need daily training and skilled coordination of their efforts if the ship is to succeed. And the fruits of success are surely as sweet as they've ever been. Today's submarine missions provide great levels of excitment and pride in success as a team working in a most demanding and hazardous environment. There is very much a feeling of service to country and of great challenge and opportunity evident in the crew of today's submarine.

CAPT. KEN LEE, USN

STEEP ANGLES AND HIGH SPEED

SHIPMATE'S recent cover showing USS PICKEREL surfacing at a 72-degree angle, and a later letter to the editor by a reader who thought it might instead be my old ship, AMBERJACK, impell this follow-on. As skipper of AMBERJACK in 1948-49, when we were developing high speed and steep angle tactics, I can testify the picture was not of her but of PICKEREL a year or so later. SHIPMATE'S picture was taken in March 1950, just before she began her epochal cruise on snorkel from Hong Kong

to Pearl. Paul Schratz was her skipper at the time, and both exploits made records which still stand.

AMBERJACK'S experiments with high speed and steep angles were begun in 1948. In those days combat tactics still had to be geared to the necessity of getting within close torpedo range of important targets, and this usually meant penetrating a screen of enemy ASW forces. Whether in peacetime exercise or actual war, this was always a matter of some risk. There was always the concern that the penetrating submarine might come up in just the wrong place; dead ahead and close aboard of a big ship making high speed. Because of the danger of broaching, approaching periscope depth took time, during the last phase of which the submarine would be vulnerable near the surface while still too deep to use the 'scope. Many otherwise successful screen penetrations failed to produce attacks because the submarine skipper could not be sure, in face of the noise of many sets of propellers nearby, that it was safe to come to periscope depth to aid his torpedoes. It seemed to us, reading reports of successful screen penetrations, that most of them involved a lot of good luck.

Every submarine skipper of that time asked himself what he should do if, when almost up to periscope depth, high speed screws were suddenly heard on a steady bearing and closing. At such moments the psychological tension is high. In peacetime exercises the pressure is for caution, not unnecessary risks. In war, aggressiveness is required as well. How, then, train for combat? The dilemma had major proportions. Clearly, we should train to use all our capabilities to the feasible maximum while still maintaining the necessary edge of safety. Since many attacks failed through inability to see at critical times, while others may have been pressed too far and resulted in sometimes serious training

accidents--not to mention disasters that may have occurred in war--how a skipper handled it was a direct measure of his effectiveness. The trouble was that the criteria in peace and war were opposites.

After the war, with the guppy submarine capable of 18 knots at the half-hour rate and 15 for a full hour--unheard of during the war years--we had a much more agile vessel than the great boats with which we had fought Japan. New combat tactics were needed for it, and many wardroom discussions ensued. It became a favorite topic. Rapid depth changes, to go along with our new speed submerged, seemed logical. But this was not achieved merely by recognizing its desirability. There were many unknowns in ship stability, internal security, control procedures and emergency situations that needed to be handled with assurance. BUSHIPS was already conducting experiments to determine control and stability, and it seemed only right to go on to evolve combat tactics.

It was an exhilarating time. We worked out our ideas slowly and steadily, and gradually increased the stresses we placed on our ship and ourselves. I should point out that most credit should go to AMBERJACK's engineer and diving officer, Allen J. ("Red") Gilmore, and his battle stations planesmen. Their confidence and abilities were infectious, and the entire crew, once briefed in what we were trying to accomplish, was with them. Our enthusiasm, parenthetically, caused us to become known in some quarters as "USS ANGLEJACK." However, Jimmy Fife, then ComSubLant, approved of what we were doing.

With ComsubLant's concurrence, 30 degrees was established as the operational limit. We never exceeded it except during emergency drills. Fifteen degrees was set as the limiting angle for normal dives. Beyond that we were always at battle stations, and no actual emergencies ever

occurred. Some special preventive procedures were needed; engine oil sumps were kept near their low points and checked constantly; generator oil seals were under continuous observation for the first sign of incipient leakage; special consideration was given to the cook; and a vendetta was waged against loose gear which could present a missile hazard (coffee mugs were the worst offenders, especially if not completely emptied). A few special preventers were devised, such as brackets welded to the control room deck to keep tool chest seats from sliding. Grab rails were installed, extra chains and turnbuckles were put on torpedo racks, and extra belly bands (thoroughly tested) secured the fish to the racks. Tail buffers were kept always rigorously snug on fish in tubes, as they should be anyway. The crew used to brag that AMBERJACK was "secured for sea like no boat had ever been secured before"--and this was good to hear.

The worst possible casualty was defined as a stern plane jammed at hard dive with the ship at 15 knots in a 30-degree dive. As may be imagined, this was one we worked up to with a great deal of respect for the forces we were dealing with, carefully staying at least even with the angles we were then working with. In fact, the emergency drill, initially at slow speed, always came first. Ultimately it became a thrilling demonstration. On order, with the boat at 30 degrees dive and speed 15, the stern planesman would put his planes on hard dive and hold them there. Conn would order full rudder, back emergency, blow forward group and blow bow buoyancy. The stern planesman had orders to reverse his planes if AMBERJACK passed 45 degrees or appeared about to exceed test depth, but the boat always stopped at exactly 47 degrees and after about 150 feet of depth increase. We would vent tanks and go ahead one third as she ballooned upward, and AMBERJACK always steadied out beautifully. A large bubble, which would not have been desirable in combat, of

course resulted, but this was better than the alternative, and anyway, it gave a false sonar target, and we would be long gone by the time it surfaced.

The result of our drills was the ability to go from periscope depth to test depth in a minute or less, starting with the scope up and speed two knots. From any speed in the surfaced condition we could get under in 25 seconds and be at 400 feet in 35 more. Coming up, we could change depth from 400 feet to periscope depth, and have the scope up for a fast observation, in 90 seconds. By actual test, a full look around could be underway within 30 seconds after passing 200 feet on the way up, and if necessary we could be back at 400 feet a minute later. We were blind and vulnerable to being rammed for only about fifteen seconds. Our sonar was good enough to ensure we could hear any underway ship within a couple of miles. We felt able to tackle a first class ASW outfit--penetrating a screen or coming up near an enemy main body, and having plenty of time to attack or evade. Our only concern was the possibility of a ship lying dead in the water, directly overhead, with all machinery stopped. The periscope was therefore always raised before it could break surface and a good underwater look taken for the dark shadows of big hulls dead ahead, as the boat planed upward. I have seen this once, and it is a sight never to be forgotten.

AMBERJACK was actually updating Holland's old "porpoising" maneuver for making observations before development of the periscope. One of Holland's major differences with Simon Lake, his chief rival in the early submarine days, was on this point. Lake held that submarines should dive and surface as nearly as possible on an even keel fore and aft. To expedite going deep he introducted a negative buoyancy tank into his design. In short, he wanted submarines to be

operated rather like a blimp or dirigible, while Holland argued for tactics more like those of heavier-than-aircraft. Strangely, considering Holland's preeminence in submarine matters, it was the Lake submarine design which the U.S. Navy took up and refined, not the Holland design. Boats of each type were built, up through the S-boat classes. Pre-war submarines can recall the arguments over the respective merits of "Holland" and "government" boats, as the two basic designs were known. Although, "Holland" boats, built by the Electric Boat company, were better liked by the operators, it was the "Government" boat which grew into the successive "T" and "V" classes and ultimately into the fleet boat with which we fought WWII.

So much for an abridged version of U.S. submarine design history. Basic to all navies between the wars was the the idea that subs were submersible surface ships whose best employment was in support of the battle fleet. Lake's double hull design may have seemed better suited to this concept. In any case, his tankage and machinery design concepts were favored by U.S. Navy designers, and almost automatically some of his tactical ideas were also. Before the war a three-degree diving or surfacing angle was considered normal. Anything more than ten degrees would cause general pandemonium throughout the boat, bringing skipper and cook roaring into the control room. Even in combat, when rapid depth change was sometimes clearly indicated, the "blimp" technique was all we knew. I have strong memories of an action when the old TRIGGER, in which I was serving, was nearly lost because we changed depth too slowly.

While AMBERJACK was working on this, a National Geographic photographic team in Key West, where we were based, evidently heard of what we were doing and requested an opportunity to get some pictures of us doing our stuff. I protested that our steep

angle work was being done underwater, was not photographable, and should remain classified. All the same, we were directed to make a surface demonstration for the camera crew, which would be embarked in a blimp from the nearby naval air station at Boca Chica. We made steep angle surfacings beneath the blimp for a couple of days, but the pictures were from too great a distance. A much closer range effort, with the camera in our squadron submarine rescue ship, was consequently decided on. With the ASR on steady course and speed and on our Torpedo Data Computer, and ourselves on parallel course, we dove off her quarter, passed under her at 150 feet and full speed, blew tanks and went to full rise just off her bow. We broke surface at a 38-degree angle, about 200 yards broad on the ASR's starboard bow.

AMBERJACK thereupon settled back down to some 75 feet, but of course bobbed immediately to the surface. As we did, I heard the Squadron commander's delighted "Return to the base!" on our voice radio. One partially expended roll of film was all they had, and without even looking they decided it was enough. The shot was later published in the National Geographic and some newspapers. The Geographic sent us enlargements of the picture, and some of them are still around.

Some time later, Joe Grenfell, Chief of Staff for ComSubPac and an old friend, wrote me that the Pacific submarines had "grown tired" of having an Atlantic submarine adorning their walls, wanted to replace it with one of their own, and asked for all the information I could send him. I sent back a long letter with all the details and copies of official reports to ComSubLant. After a while a photo of PICKEREL surfacing at a 48-degree angle came back from him. I later saw the same shot on television, and it is still shown from time to time. PICKEREL's skipper at this point was Hank Sweitzer, who had recently relieved Schratz.

Personally, I've always regretted the emphasis on the dramatics, for the next question is always, "What use is that?" The answer, of course, is that there is no use; steep angles are useful only for fast depth change, an ability we must have when needed. Whatever the rationale for publicizing what our submarines were doing in this regard, the long range effect was to make it seem like a stunt. We also thereby announced it to all potential enemies. In the U.S. Navy, however, I believe AMBERJACK's experiments increased the tactical abilities of our submarine forces, for we demonstrated the tactic's usefulness for both attack and evasion in fleet problems. But I sincerely wished we had kept it secret.

On the personal level, however, I always pay attention if a modern sub driver mentions diving angles, and am delighted to find that while today's submarine cooks still appreciate being forewarned of expected steep angle operations, they accept ten degrees with equanimity.

EDWARD L. BEACH

RECOLLECTIONS OF A DANGEROUS MISSION

It was a beautiful day for flying over the South Pacific in the month of July 1943. I was on my way to Guadalcanal under orders "as a volunteer" to inspect a beached Japanese two-man midget submarine. My job was to determine if it was safe to transport the sub back to the United States.

My boat, the USS S-31, had just returned from her 7th War Patrol--a reconnaisance mission of Aneityum Island in the New Hebrides group. We were refitting in Noumea, New Caledonia, prior to resuming our primary mission of training United States, Australian and British warships in

anti-submarine warfare tactics.

Admiral Halsey, Commander Southwest Pacific, learned that a small Japanese submarine had been abandoned on a beach at Guadalcanal. He believed that it might be in a good enough state of preservation for salvage, and possible return to the U.S. He requested ComSubPac to furnish a submariner to make this determination. I was the only available submarine skipper in the area so Vice Admiral Lockwood "volunteered" me for the job. Hand-written TAD orders sent me on to Guadalcanal.

I had no idea what I was getting into. I was not an ordnance expert. In fact, I was rather naive regarding most aspects of ordnance except for routine operations involving torpedoes. The staff gave me sketchy information indicating that the submarine had been ashore for some time, that no one was on board, and that all hatches were still closed. I was also told that abandoned Japanese installations were frequently booby-trapped. This gave me something to think about. However, my enthusiasm for a new angle on submarining offset any undue alarm I might have felt for this mission.

We took off early in the morning from Noumea in a J2F and flew 800 miles to Guadalcanal arriving just before noon.

We made no aircraft contacts during the flight, but on reaching the big island, several Navy planes escorted us to the site of the beached submarine. Our "old flying Duck" landed in calm blue water and taxied to the beach where a large number of Army personnel and natives were gathered near the submarine. I jumped ashore and told the pilot that while I was inspecting the submarine he could refuel and return in an hour to pick me up.

The senior Army non-com in charge was a Master

Sergeant who briefed me on the situation. He said that the sub had either been washed up on the beach or been driven ashore by its crew some time before he'd arrived in the area. And, that no one wanted to approach the sub since its two yellow torpedo warheads were exposed and were probably armed.

The submarine had grounded just above the water line. It was canted ten degrees to port, and there were no signs of damage. I was given a wooden ladder--a small tree trunk with hand-hewn crossbars--which I leaned against the hull alongside the conning tower. Then I advised all the observers to move about 200 yards off--just in case the sub blew up.

The small, two man mini-sub was about 80 feet long. It had a diameter of 8 feet, a small conning tower amidships, and displaced about 50 tons. Two vertical in-line muzzle loaded torpedoes with large warheads protruded from the bow. Control planes and rudder were located at the stern just forward of a five foot three-bladed propeller. The unpainted hull was in good condition except for a few rust spots here and there.

Having made these observations, I climbed the ladder to the top of the conning tower. By gently shifting my weight athwartships I was able to test the stability of the sub. But she was well anchored in the sand. Then I turned my attention to the small hatch, which was, surprisingly, cracked open about half an inch. The air coming out of the sub didn't smell too bad. I felt around the hatch-combing for wires which would indicate a trigger for an explosive device. But there were no wires. Then, I opened the hatch being very careful not to jar it when it reached the lock-open position. All went well. The air in the conning tower was musty, but breathable. The hatch into the sub was much smaller than our

30" S-boat hatches--probably less than 20" in diameter. After feeling around the internal edge of the hatch and down the first three rungs of the ladder for obstructions which would restrict my going below, I started down, wiggling back and forth in order to squeeze through the hatch. All the way down I looked for any gadgetry which might activate an anti-personnel device. At the bottom of the ladder, my flashlight disclosed no triggering devices, so I began to feel much better.

Looking forward from my badly cramped position, I realized that I couldn't stand erect in any part of this small sub. My flashlight illuminated a narrow corridor leading forward to the two torpedo tubes. Crawling forward, I noted that on either side of the passageway there were food storage spaces of shelves and small mesh baskets--some of which still held canned goods. Several cable runs leading forward were connected to brown metal boxes at the tubes. The boxes evidently held the launching circuits for the tubes. At this time I wondered how the Japanese C.O. controlled his depth and attitude after he got rid of either of these monstrous torpedoes. I hadn't seen any compressed air tanks for blowing water ballast to compensate for the discharged torpedoes. I felt certain that the battery powered electrical system had been dead for a long time. So the torpedoes even if armed weren't about to be accidentally launched. I finally turned myself around in the cramped quarters and started back to the midships section. The deck over which I crawled was damp and slimy from the tropical humidity and rotting of food. I also noticed that a duct in the overhead contained vent holes for recirculation of air through the sub. That didn't however reduce the foul odor stirred up by my passage through the compartment. When I returned to the conning tower hatch area where the controls and the periscope were located, I tried the driver's seat where the CO handled the boat. It was comfortable for a

five foot human, but I had to squeeze to get into the conning position. Facing forward my legs straddled the scope which looked like a German Kollmorgen periscope but on a smaller scale. Although I wanted to take a look, the periscope eye-pieces were too low to peer into, since the periscope was housed with no hoisting power. Several control devices and indicators were located around the base of the scope. These controls were so arranged that the CO could operate the scope, steer the boat, control the depth, change speed and determine the trim of the sub--all within arm's reach of the CO's seated position. I didn't dare touch any of the controls for fear of activating fluids or power which could disturb the neutral position of moveable parts.

Through the hatch leading to the after compartment, I observed about 100 small storage batteries lined up on either side of the narrow passageway which led to a centerline motor. It seemed similar to a 600 SHP induction type direct drive DC motor which uses a resistance type speed control. This compartment contained vented air ducts for air circulation plus lots of the cabling--necessary for propulsion, lighting and equipment operation. To satisfy my curiosity, I used the old submarine electrician's trick for testing DC grounds. Wetting my index and middle finger with saliva, I passed them lightly over the plus and minus battery connections, then over the main motor leads, and finally over the cable connectors leading forward. There was no shock or tingling in my fingers, indicating that the electrical power in this mini-sub was totally exhausted. After this test, I felt much safer. Retracing my way forward, I made a note to include in my report to ComSoWesPac that this Japanese mini-sub could be safely cleaned up but with some effort, and could be used as a display after the warheads were disarmed and the torpedoes removed.

My one last look at the Commanding Officer's

battle station, where all controls fitted together so neatly, was an envious one--for the efficiency with which he could operate his boat while his subordinate did all the checking, testing and upkeep of the sub's equipment. However, I wouldn't have enjoyed being cooped up in such a small space during a short patrol. When I finally climbed the conning tower ladder, closed the hatch and left the boat, it was only a little over an hour after I had gone aboard.

My "flying Duck" pilot was ready. I told the Army Sergeant that since the warheads were still probably armed, no one was to board the sub until I had arranged for an Explosive Ordnance Detachment to disarm the torpedoes. I also told him to put "restricted" signs around the area--which he passed on to the natives hanging around the sub. Dangerous mission completed!

On an uneventful flight back to Noumea, I observed a gorgeous sunset over the South Pacific, and resolved that never again would I be conned into such a risky situation over which I had so little control. A War Patrol was much preferred!

MIKE SELLARS

(Ed. Note: This mini-sub may be the one which is on display in front of the Submarine School at Groton, CT. It is expected that this Japanese two-man submarine will be moved to the Museum-Library area just inboard of the Nautilus when the Submarine Museum is inaugurated.)

SUBMARINE COMPRESSION RING HULL JOINT

In the 50s, as commissioning CO of HARDER (SS-568) and then of SEAWOLF (SSN-575), I watched with astonishment as some 600 workers poured

through the 26" hatches to finish construction or repair of these boats. No wonder EBCO had a large Physio-Therapy Lab for workers cramped from working in contorted positions. (Almost as in scenes from Dante's Inferno.) The analogy came to mind of a jeweler repairing a watch through the stem-hole rather than through the open back.

One knew that in WWII the Germans preassembled their submarine hull sections for later assembly at a launching yard. In the same fashion, torpeodes and missiles are constructed by hull section and later the sections are held together by locking rings. Why not use the same concept in submarine construction?

After discussions with Adm. Andrew McKee and Capt. Ralph Kissinger--although they thought problems of out of roundness would have to be solved--the idea seemed feasible. They also pointed out that no such requirement had ever been established. This highlighted an odd sort of logic: i.e. the feasibility had not been established because the requirement had not been established because there wasn't sufficient evidence of feasibilty. An estimate of value was evidently needed from someone outside the bureaucratic circle.

One opportunity came soon. The SEAWOLF had gone to sea in '56 with a two-year supply of fuel in its unique sodium-cooled reactor. Though SEAWOLF's system operated perfectly, sodium proved to be such a superb heat conductor that, unless the plant was carefully operated, the stainless steel in the primary loop could be thermally shocked by sharp temperature waves. This hazard gave the competing high pressure water plants a decisive advantage in the near term. Still, I felt that SEAWOLF's liquid metal reactor should not be prematurely abandoned, and SEAWOLF put out of commission with a year of reactor fuel still available.

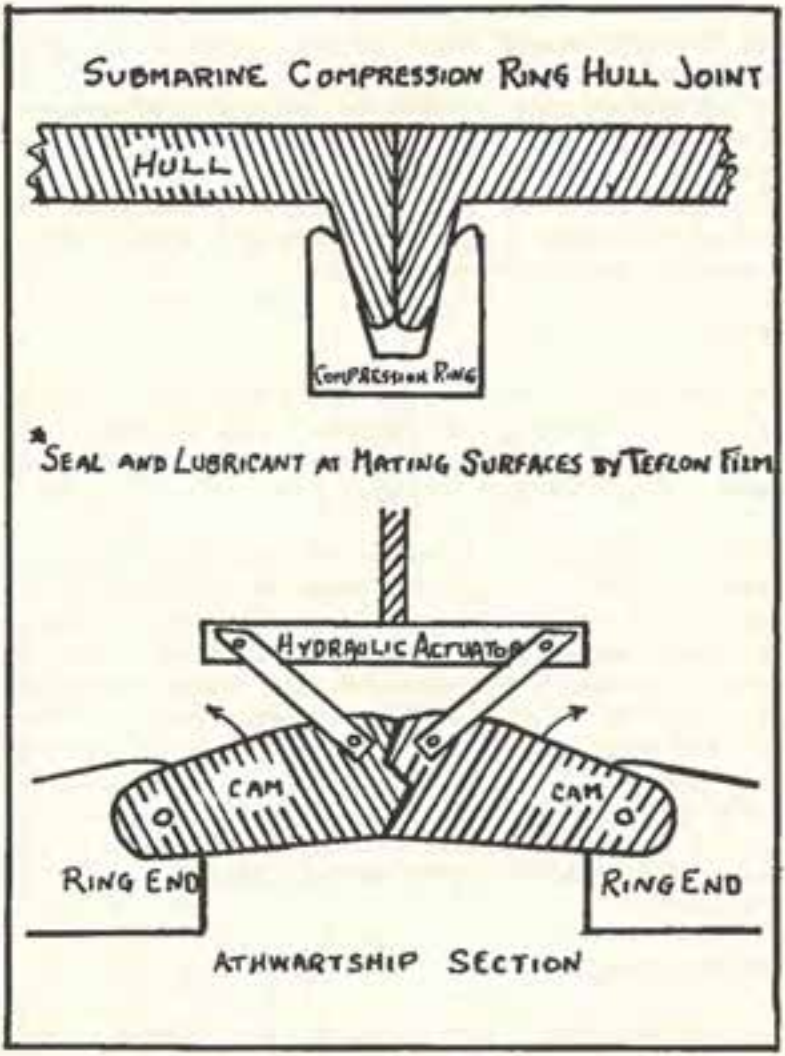
Thus, in '57 I tried to sell the idea that construction should be started on a water reactor compartment which could be used in SEAWOLF in '59 when SEAWOLF would have burned 3 years of fuel, including one partial refueling in between. It was estimated that a swap of reactor compartments could then be done in about 6 weeks. It was my hope that a very important principle of cost reduction could be demonstrated--preassemble the pressurized water reactor compartment then join it to SEAWOLF in such a manner that it could be later separated to facilitate repairs, refits and overhauls.

Unfortunately, my scheme was badly out of phase with the planning, budgeting, and advocacy in Washington, SEAWOLF entered EBCO in '58, and stayed 14 months for a normal kind of conversion.

Now, 25 years and many designs (successively larger) later, it may be time to establish the feasibility and the requirement to produce outfitted submarine compartments which can be joined together in production, and later separated and rejoined as needed for repairs, etc. In the last few years some use has been made of partial preassembly of hull sections, but full advantage of the principle is not reached until provision is made to separate compartments for repair. For this the SUBMARINE COMPRESSION RING HULL JOINT is an answer.

DESCRIPTION:

To envision this joint, think of a torpedo: its sections are held together by external locking rings. Under tension they compress the beveled machined surfaces near the end of each section of the torpedo. In such a system, the locking ring experiences external pressure--the same as the hull. Moreover, the ring is subjected to corrosion the same as the hull. If the ring is stiffer than the hull, the joint will tend to



Change in ring circumference equals cam spreading distance. Ring diameter should clear end lips and expand to seal in operation.

loosen. A best scheme for a submarine hull would be to place the ring inside the hull away from corrosion and hull compression. There it would tend to tighten the joint.

Now envision each submarine hull section with a thickened end-ring and machined face, behind which is a machined beveled surface designed to bear on a beveled compressing surface on the outside of an interior ring which forces the hull sections' ends together as it is expanded.

Control of the expansion of the interior locking ring would be by hydraulic locking into place cam sections within the circumference of the ring. In port for repair, the hydraulic cam would be retracted, disengaging the locking ring for separation of compartments.

Development and test of such a joint would not be cheap or easy; but the designs would probably be scalable for the thickness and diameter of a submarine hull. Ancillary development would be required for remotely operated electrical and pipe couplings, and for joints in the superstructure exterior to the pressure hull.

BENEFITS:

In construction, components could be more densely loaded into compartments through the ends, personnel access and rigging space could be sacrificed. The pressure hull could be made more dense with bouyancy provided by exterior non-compressible solids like syntatic foam. Such materials could serve also in sound absorbtion and reduction of weapon damage. Target size as seen by ASW weapons would be reduced. Compartments could be made in different specializing yards for later assembly. Change of submarine mission might be accomodated by change of compartments, i.e. for mining, anti-air, etc.

Relative to repair: who, among us submarine commanders has not spent hours in the mockups looking for interferences which would prevent strainer or zinc changes? The need for personnel access and work space within auxiliary or engine room spaces could be greatly reduced if the compartments could be separated in refit. In typical refits and overhauls, some compartments take much longer than others. The use then of spare compartments could greatly reduce tie-up of the whole investment. Submarine tenders might be designed to enclose the submarine and separate it for repair.

What seems needed is a means to provide joints in submarine pressure hulls which allow for preassembly of submarine compartments in construction and separation of them in repair. By so stating this requirement, this intuitive design solution may generate a superior solution by some brighter guy. Someday there might be a need for speedier production of many more submarines. Such a joint could then prove indispensable.

CAPT. R. B. LANING, USN (RET.)

NEW DESIGN ATTACK SUBMARINE ACQUISITION PROJECT

In order to meet the challenges facing us over the next few years, more effective management control of the Navy's submarine program management resources is considered necessary. The Naval Material Command has thus recently (Jan. 17, 1984) chartered a new Program Directorate, PDS-350, within the Naval Sea Systems Command, to prosecute all attack submarine programs of the Naval Sea Systems Command and the Naval Electronics Command. Consequently, PDS-350 becomes the focal point for the design and acquisition of attack submarines

and their combat systems — ensuring efficient management control of these activities.

The Director Attack Submarine Acquisition Programs PDS-350, Commodore Guy Curtis, has, as a result, overall management control of: attack submarine R&D programs and funds in NAVMAT except for those associated with nuclear reactor plants; PMS-409, the Submarine Combat Systems Project; PMS-393, the New Design Attack Submarine Acquisition Project. In addition, over the next few months PDS-350 will take over technical direction and funding of the Sea Nymph, masts, antennae and submarine communications programs currently controlled by various organizations within the Naval Material Command.

The new design Attack Submarine is projected to be introduced into the fleet in the mid-1990s and will bring with it many improvements over the current 688 Class submarine.

Concurrent with the establishment of PDS-350, a Technical Advisory Submarine Research and Development Panel has been established to develop a Coordinated Submarine Technology Base Plan for all attack submarines. Membership of the advisory panel includes representatives from the Office of the CNO, Naval Undersea Systems Command (NUSC), Office of Naval Technology, Naval Research Laboratory (NRL), Naval Ocean Systems Command (NOSC), Naval Electronics Systems Command (NAVELEX) and NAVSEA cognizant R&D offices.

In order to meet future threats while maintaining ship delivery schedules, concentrated action on the part of Navy management is considered essential. Through the centralization of control over the acquisition and design of our attack submarine fleet, it is expected that state of the art improvements in submarines and their combat systems will be realized. These systems will be delivered to the fleet on time and with

high quality in order to maintain our superiority in the undersea theatre.

COMMODORE GUY CURTIS III, USN

(Correction: Comdr. Tritten's article on Strategic ASW in the January Review suffered from a glaring typo error. The sentence: "The U.S. is obviously not adding defense to its well thought out strategic offense" should have read, "The U.S. is obviously now adding defense, etc.")

DISCUSSIONS

STEALTH versus SPEED

Stealth is the raison d'etre for submarines. Any other performance characteristic which might jeopardize stealth may rightfully be challenged. For this reason, submarine speed is not always considered to be a critical requirement. Indeed, the percentage of volume and weight allotted to sound quieting is likely to increase for future classes of Western submarines, while that dedicated to propulsive power is likely to decrease. Hence, advances in power density technology may be effectively cancelled by the ever increasing demand for sound quieting.

The advantages of speed, considered independently from stealth, are obvious and include rapid deployment, increased rate of area coverage, and tactical advantage in a melee. However, those advantages can be negated if stealth is sacrificed. It is apparent that there are trade-offs between speed and stealth. The question which must then be considered is whether

or not the relationship between speed and stealth is mutually exclusive.

It is possible that the conflicting goals of stealth and speed may be simultaneously achieved in some different technology regime.

U.S. submarines which emphasize stealth have a technology regime defined by steam generators, SSTGs, MPGs, reduction gears, and traditional screw propellers. In this regime, increases in propulsive power tend to generate higher noise levels. To suppress these noise levels, higher quality equipment must be developed or greater volumes be allocated to facilitate quieting. Thus, a significant increase in power may result in little increase in speed. However, other power technologies may exist outside this regime in which increases in power are not necessarily accompanied by increases in cost or in acoustic detectability.

Are there technologies where the functions of heavy reduction gears, large rotating electrical machines; and steam generators are eliminated or can be replaced by some low-noise or less costly system?

Fuel cells readily come to mind, particularly if they can be recharged with radiation or heat from a nuclear reactor. Another option is magnetohydrodynamic (MHD) technology which can provide silent thrust as well as power generation. If U.S. submarines are to move into the speed range of Soviet submarines without sacrificing stealth, alternative cost effective regimes of technologies--regimes in which improvements in speed and stealth could be achieved simultaneously may hold the answer.

K.J.M.

The Promise of Technology—What Went Wrong?

The article "After SUBACS" in the October 1983 Submarine Review caused me to reflect back on the experience of over 25 years involvement in the "digital revolution" of the U.S. Navy and to ask the question, "What went wrong?".

Certainly the promise of great benefits was there. The concepts which we tagged with such impressive names as "Central Computer Complex" and "graceful degradation" were not mere marketing buzz words but were firmly based on what could be achieved through digital technology. The potential benefits they would bring to the Fleet were recognized at the time but somehow got lost between exuberance for the design phase and the realities of the Product.

As a result, we found ourselves going through a series of designs, each one promising more through technology, each falling short in delivering that promise. Is SUBACS another in that series? I think not.

In going back to the early days of NTDS and continuing through the various evolutions of combat systems that occurred first in the surface fleet and later in the submarine fleet, an explanation can be found for what went wrong.

From the perspective of a developer, the evolution of digital combat systems can be divided into three phases. The first phase, beginning with NTDS, was characterized as a learning process or proving ground. The major concern on the part of system developers was how to implement an emerging digital technology into an existing analog combat system. Certainly the potential benefits of digital combat systems over their analog counterparts were recognized at this time. However, the real concern and effort on the part of digital system developers was just to make it

work!

The early digital systems did work and much was learned. They also provided certain advantages inherent to digital technology. However, in the final analysis, it is questionable if the benefit to the operating forces was any greater than could have been obtained with an analog approach.

The second phase in the evolution of digital Combat Systems for submarines started about the time of the SSN 688 development. This phase was characterized by a widespread application of digital technology--in the BQQ-5 Sonar, the all digital Attack Center, Ship Control Subsystems, Integrated Radio Room, and others. Virtually every area of the Combat System was converted to digital technology.

Simple control routines gave way to complex operating systems. A host of software development tools were developed--compilers, simulation routines, high order languages. The system design process was formalized through a hierarchy of specifications and design documents.

During this period of progress and maturing, the submarine community developed and deployed a number of sophisticated digital combat systems. Impressive gains in performance and overall system reliability were achieved. In spite of these successes, overall the system fell short of design expectations.

In a shipboard environment they proved to be cumbersome and unfriendly to the user. Maintenance, both afloat and ashore, was time consuming, costly, and frequently required special expertise to resolve. The purported ease of accommodating system growth and incorporating new functions had not been realized. The result was that in the few short years since the SSN 688 Class and the TRIDENT Class were deployed, the

submarine community has been embarked upon the largest effort yet to build a "final" digital combat system. What went wrong?

It would be easy to argue that nothing went wrong; that the events and experience of the past 25 years are a necessary part of progress. Such an argument is probably wrong for it leads to the conclusion that as long as some progress is being made the ways of the past are sufficient for the future.

In the first and second phase of digital Combat System evolution two fundamental mistakes were made by those involved in its development. The first mistake was a failure to recognize that the sole objective of a Combat System was to provide submarines with the ability to conduct war. All too often, the means became the end. The challenge of technological innovation justified the effort to produce it. Consideration of mission objectives, if considered at all, were typically dismissed on the grounds that technology need not become involved in tactics. The second mistake was that there was no proper assessment of the true state of digital technology which was available at the time, in terms of its ability to fully support the design objectives of the then developing Combat System. The tendency was to assume that what was achievable in principle or had been implemented in certain cases could be applied to the System as a whole.

The net result of these mistakes was a cycle of high expectation followed by limited success. This, in turn, generated an attempt to provide a solution through ad hoc fixes. Ultimately, this led to the realization that a total new design was necessary.

The challenge to SUBACS is to not repeat this cycle.

The third phase of the evolution of digital Combat Systems is in progress. Phase three is characterized by a digital technology that has reached maturity in a number of areas.

In the area of hardware, performance has increased while costs have decreased. Reliability is greater, size is less. And this is by several orders of magnitude over the earlier phases.

Software development has progressed from the status of being a black art--practiced by a few specialists--to the point where it is a highly defined, highly automated practice and this practice can be subjected to the same disciplines of management as any other product development.

Significant changes have also occurred in the area of personnel. In the earlier phases, personnel involved with the application of digital technology learned their trade through individual experience and practice as they learned. Now a significant and increasing number of people have been formally educated in the theory and application of digital technology. They are well equipped to address the technical issues of evolving systems.

This maturity of the technological base goes a long way towards alleviating the technical problems experienced in the earlier phases, many of which can be attributed to attempting things which at the time were beyond the state of the art.

This is not to say that SUBACS does not contain elements of technical risk. They do exist. The ADA language, for instance, presents a set of new problems. Distributed Processing and Bus architecture have not been implemented in a real time Combat System to the extent contemplated in SUBACS. Also, the structure and management of the data base necessary to support a distributed

environment presents a technical challenge. The point is, that because of the maturity of the technological base, the SUBACS program is in a much better position to address these technical issues and to provide solutions that are general in nature and thus will provide a system design that will accommodate the requirements of the future.

The key then to avoiding mistakes in the application of digital technology is to clearly identify and recognize those areas of risk--areas where there are uncertainties in design, and areas where we are assuming that a technical solution will be available when we need it. These areas must necessarily be addressed and fully resolved before committing the design of the system to development. Only in this way can we avoid the fundamental mistakes that will result in a compromise of the original concept and design of the system.

J. A. PETERSON

LETTERS

o Brooks Harral's book review on German submarine losses in WWII -- "630 at sea (generally with the entire crew)" -- makes one wonder whether the German boats weren't faultily designed. The Germans lost more that 10 times as many subs operationally than the U.S. while only sinking a little over double the tonnage. Were the Allied ASW forces so much better than the Japanese ASW forces? I don't think so. And don't forget that the four German ace submariners were lost with their boats in a single convoy engagement in March 1941 -- before the allied ASW forces in the Atlantic approximated 25 warships and 100 aircraft

for every Nazi submarine at sea.

The movie Das Boot would indicate that the German submarine pressure hulls could withstand even greater depths than ours. That would make the Germans' inner hulls tougher. So a best guess is that it was the double hulls of our boats that made them a lot tougher than the single hulled German Boats.

The Soviets build exclusively double hulled boats. We build single hull ones. Did the Soviets learn something from WWII experience which we have failed to take account of?

R.T.C.

Sir:

I have read with great interest the January 1984 edition of the "Submarine Review" and wholeheartedly support a broadening of discussion on submarine matters to the widest possible audience. I certainly feel that the experience gained by those who have fought a war in submarines should be passed on to the present generation of peacetime submariners. Two articles in this edition of the Review caught my imagination. The first was "RAY's Fifth War Patrol" and the second was the review of the book "Submarine".

Since the advent of the Nuclear Submarine, there is danger of the modern Submariner becoming so embroiled in the daily business of operating and running this complex machine that the basic principles of submarine warfare are pushed into second place. It is self evident that safety, especially Nuclear safety, is vital but it is only

a means to an end, not an end in its own right. Likewise, although computers can do much to assist in calculating the fire control solution of a target, they are only an "aid". The instinctive tactical knowledge of the Commanding Officer and his Command team is still going to prove the deciding factor between success and failure in war. This point was well illustrated in the stirring and well written account of USS RAY's Fifth War Parol where, as the Commanding Officer and his team gained experience, so the success on patrol increased, making it "outstanding" despite "the shaky start".

In the book review on "Submarine", the author asks whether tactics involving a combination of diesel and Nuclear submarines are sound. The main advantage of the diesel boat is that when searching on main motors it is very quiet, making it virtually undetectable by a Nuclear submarine and also making it a very good listening platform especially when fitted with modern highly sophisticated sonars. Its disadvantage is its "short legs" and its limited ability to attack the long range contact using its own weapons. It does though, have the ability to operate in shallow water, making it ideal to place at choke points and port exits. The Nuclear submarine, in contrast, does radiate a detectable noise signature hampering its effective sonar search but does have "long legs", and is fast and maneuverable making it an ideal vessel from which to attack enemy submarines. Therefore, a tactic of using a diesel boat to "vector" a Nuclear submarine onto contacts would seem to be both feasible and effective, making best use of the attributes of the two types of submarine. Modern communications certainly make the interchange required perfectly possible. "Submarine" suggests a good example of such coordination proving successful, albeit in a very particular environment.

May I take this opportunity of wishing "The Submarine League" all the best for the future. To be entitled to wear "Dolphins" signifies membership of a great international club.

COMMANDER J. F. PEROWNE OBE RN

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o It has become a cliche to hail the ascendancy of the submarine as the decisive new determinant of seapower. And so it is. But that simple assertion masks many dangers of complacency. Superiority is not automatically given nor indefinitely conferred; beneath our feet there is a dynamism at work that continually threatens to undermine the status quo.

The U.S. Navy's current generation of nuclear submariners have had greatness, as it were, thrust upon them; they have not seized it themselves. Had comparable leadership been manifest in regard to weapons, hull characteristics, and tactical understanding to that degree which their great and enduring mentor achieved in regard to propulsion, likely the Submarine Force would have run away with the world. Whether that necessary degree of professional independence was ever truly possible over those years-given circumstances is, of course, highly debatable. In any event, the Admiral was indeed the great banyan tree in whose shade little grew. And the result has been only a few classes of submarines, an absence of imaginative prototyping, and the creation of a curious hybrid bird of war, powerful in the thighs and skinny in the beak and talons. As one formidable submariner, Vice Admiral Eli T. Reich USN (Ret.), has put, "there is a tendency to forget that, in the end, it all comes down to placing an ordnance package alongside the other fellow... and making sure that it explodes!"

News appearing elsewhere indicates that the Navy's submarine community is henceforth going to be speaking out more publicly on its needs and challenges. Wisely done, this has to be to the good. The submariner's silence, born of tradition and security, has not always served the best interests either of the Navy or the nation. As only one example-and there are many-it is to me a recurrent source of wonder that the submariners are so reticent in articulating the manifold advantages of putting a much greater percentage of U.S. strategic deterrent power to sea. No one knows better than the submariner that indeed he is, for practical purposes, invulnerable out in the oceans and, given the wish, can hide forever.

You would not know this from the stunning lack of public debate. Instead, the only sound we hear is of giant shovels out west digging holes in which to place more land-based missiles... all precisely located and each one another target amidst our homeland.

If The Submarine Review can create the dialogue and foster the knowledge that will enable the U.S. Navy to move faster towards realization of the full potential of the submarine, it will be fulfilling a needed and admirable function.

R. H. SMITH

IN THE NEWS

o An article in the Washington Times of 15 February 1984 reports that the Cuban Navy has been augmented by the delivery of a Foxtrot diesel electric submarine, from the Soviet Union. This brings to 3 the force of Cuban Foxtrots. It is further surmised that these submarines will be based at the Cienfiegos naval base which has

become a semipermanent Soviet base and where the submarine pens have been "hardened" against attack, with layers of reinforced concrete.

o An AP wire-note of 15 February 1984 said that the Swedish Navy was again on a search for a submarine intruder into Swedish waters and was "using depth charges powerful enough to cripple a conventional submarine." The new depth charges "which are twice as powerful as those dropped in previous submarine searches..were dropped about four miles from where a Soviet submarine (a Whiskey-class) went aground in 1982, on the doorstep of Sweden's largest naval base," near the town of Karlskrona. "Tens of depth charges" were reported to have been dropped. In addition to new depth charges for use against intruders, an article in Military Technology of November 1983 reveals that FFV of Sweden has developed a so-called "incident torpedo" in order to attack submarines in peacetime. This torpedo "has a small warhead which will destroy the propeller of the attacked submarine which will force it to the surface." Also, "Sweden has developed a submarine reporting system MALIN which is magnetically fastened to a submarine's hull and transmits a revealing signal. The submarine has to surface in order to remove MALIN from the hull."

o An AP wire-note of 14 February 1984 reports that there has been a substantial surge in the number of Soviet strategic submarines cruising off the east coast of the U.S.. Secretary of the Navy John Lehman is quoted as saying that the Soviet activity is part of the long-promised Soviet reaction to the U.S. deployment of nuclear tipped Pershing 2s and cruise missiles in NATO nations. He also noted that "there are now 3 Delta-class boats off the American coast in addition to 2 or 3 Yankee-class missile-firing subs the Soviets normally have in the Western Atlantic."

o As reported in Defense Week of 3 January

1984, the Spanish Foreign Minister Fernando Moran announced that Spain was ready to request from the Spanish Parliament the funding necessary for the construction of a new class of nuclear-powered attack submarines. And, that because of this plan, Spain has refused to ratify the Nuclear Non-Proliferation Treaty.

o Aerospace Daily of 23 February 1984, reports that a British Defense Committee is examining the performance of Royal Navy weapons systems in the Falklands War and expects to hear the sort of criticism voiced by Adm. Sir James Eberle, a former commander in chief of the RN's home command. He was quoted as saying the reliability of these systems was not "nearly good enough, and some obviously didn't work..The Navy allowed itself to be taken in by sophistication. We sacrificed reliability and simplicity for highly complex weapons that were highly unreliable." (Ed. Note: The choice of the old MK VIII torpedoes by Conqueror's skipper in preference to the new Tigerfish aboard might be relevant.)

o A Navy release says that the New Design Attack Submarine will support "a 100 SSN force level." And, "The FY 85 budget contains $174 million to focus and accelerate a number of submarine R&D program elements in order to support a 1989 authorization for a fleet introduction in 1995."

o An AP wire-note of 29 February 1984 reports that the Navy's Intelligence Chief, RAdm. John Butts, USN, acknowledges the Soviet development of two new submarine launched cruise missiles for land attack missions. "The Soviet SS-NX-21 cruise missile, which can be fired from submarine torpedo tubes at targets nearly 1,900 miles away, could be deployed for the first time as early as this year." Rear Admiral Butts also notes that, "a second land-attack cruise missile with a potentially greater range is being tested. Much

larger than the SS-NX-21, this missile is expected to be placed aboard a new class of submarine in mid-decade."

o An article in The Baltimore Sun of 1 March 1984 says that a Soviet defector, Arkody Shevenko, revealed that "Moscow had plans to hide its nuclear submarines in the fjords of Norway and Sweden in an international crisis." Shevenko also told a news conference, "the ruling Politburo had empowered the Soviet military in the early 1970s systematically to survey the Scandinavian coastline." (Ed. Note: The submarine intrusions into Swedish waters mentioned in the January Submarine Review seem consistent with this article and the Soviet deployments into fjords for the purposes of hiding during a crisis pose a seemingly new problem for controlling Soviet submarines through forward deployed U.S. ASW submarines.)

o The U.S. Navy Submarine Force completed its 2,200th strategic deterrent patrol on 18 December 1983, when the fleet ballistic missile submarine USS BENJAMIN FRANKLIN (SSBN 640), with the Blue crew embarked, returned to its homeport of Kings Bay, Georgia, following 68 days at Sea. The first strategic deterrent patrol was completed by USS GEORGE WASHINGTON (SSBN 598) in January 1961. The 2,200 patrols have involved 43 fleet ballistic missile submarines and more than 400 ship-years of submerged operations.

PERSONNEL NOTES

o In 1946, Dr. Waldo K. Lyon formed the Arctic Submarine Laboratory at the Naval Oceans Systems Center, San Diego and was its first Director. In 1947, he was aboard Boarfish (SS-327) for the first Arctic effort under ice. 37 years and 27

Arctic SUBICEXs later--on 22 January 1984--Dr. Lyon, the Technical Director and Coordinator for those exercises, turned over the directorship of the Arctic Sub Lab to Captain E. J. Sabol Jr., USN. Dr. Lyon through these many years has participated in most of the Arctic submarine deployments and has been a major force in the development of hardware and techniques for submarine Arctic under-ice operations. Dr. Lyon stays on at NOSC as Chief Engineer so his Arctic expertise remains for use by the Submarine Service. At the same time, the "fleet connection" which Dr. Lyon established between his Artic Lab and the Submarine Force, has been formalized so that Capt. Sabol will now report to both ComSubLant and ComSubPac regarding Arctic readiness and operational support.

o A 10 February 1984 ALNAV notes the selection of seven submarine Captains for promotion to the grade of Commodore:

Thomas Robert Fox - OP21B, OPNAV
Ralph Whitaker West, Jr. - Chief of Staff, ComSubPac
John McKay Kersh - Chief of Staff, ComSubLant
Michael Christian Colley - ComSubRon Two
James D. Cossey - Director, Middle East/African Div. J-5, JCS
Stanley E. Bump - Executive Assistant to CHNAVMAT
John W. Koenig - Director of Submarine Distribution NAVMILPERSCOMD

o In Admiral Watkins' 7 February 1984 statement before the Senate Armed Services Committee on the FY 85 military posture, it was pointed out that overall nuclear submarine officer retention had risen to 46.4 percent by FY 83. However, he noted that the "most serious problem" was the shortage of midgrade nuclear qualified officers. This deficit equated to 26 percent in the ranks of Lieutenant Commander through Captain, and is

projected to increase to 32 percent by FY 86.

o Added to the list of new Commodores is the former skipper of the Dolphin and now a designated surface officer, Captain John Richard Seesholtz, USN, presently the Oceanographer of the Navy.

o The following submarine major command assignments have been announced: ComSubRon 1, Capt. Alfred Cheaure; ComSubRon 7, Capt. William Hicks; ComSubRon 17, Capt. Jon Barr; ComSubRon 2, Capt. Richard Riddell; ComSubRon 4, Capt. William Owen; ComSubRon 6, Capt. Edgar Hux; ComSubRon 8, Capt. Thomas Meinicke; ComSubRon 18, Capt. Karl Kaup and ComSubDev Group 1, Capt. John Maurer, Jr.

BOOK REVIEWS

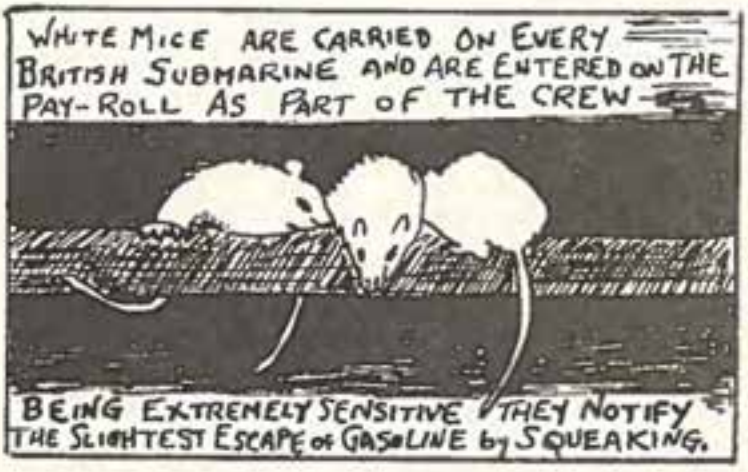
Submarine Boats -
The Beginnings of Underwater Warfare
Richard Compton-Hall: London 1983; Windward Distributors London, 192 pp. illus.

Richard Compton-Hall is the Director of the Royal Navy Submarine Museum, Gosport and the author of several books on the history of Naval Warfare. His style is unique in that it blends factual accuracy and technical descriptions with understated British wit. This alone makes his book a joy to read. The result is that every submariner will finish this book with a feeling of nostalgia and a warm recall of comparable experiences. The reader will also take comfort in the thought that the U.S. Navy Submarine Force is not alone in its problems of dealing with the frustrations of inadequate weapons and the difficulties of improving its lot in the hierarchy of a sluggish bureacracy.

Submarine Boats covers the period of 1900 through World War II. Included are many heretofore unpublished photos and sketches of the earliest submarines of all major countries. The book is well annotated and the citations are precise enough to enable the interested researcher to delve deeply into a great variety of submarine-related subjects such as weapons, power plants, medical problems, training, rescue, and early concepts of how to build submarines.

To the reviewer, the style of Compton-Hall in tracing the history of the submarine makes the book fascinating and sets it apart from the ordinary historical developmental chronology.

Submarine Boats is replete with firsts in the development of the complex systems now required in the modern submarine. And a few examples should serve to give some of the flavor of this book.



A first kind of environmental monitoring system was provided for the gasoline driven submarines of the early 1900s. Because gasoline fumes proved highly intoxicating, much inhalation of the fumes made the submariners slap happy, irresponsible and a total hazard to submarine operations. Consequently, three white mice, Compton-Hall relates, were used to give warning of leaking gasoline. See illustration. And they were also invaluable for indicating the presence of chlorine or carbon monoxide gas -- by turning their little feet up as they expired. Compton-Hall doesn't explain why white mice were chosen in preference to brown ones. But they were evidently allowed to run loose as bona fide crew members -- which they were, as verified by an account telling of the visit by the Prince of Wales to a submarine in 1904. When the Prince came aboard the A-1, "three white mice were standing by in the engine room ready to die for King and Country". Being white in color probably gave the mice a better chance of not being ground underfoot by the heavy booted submariners of that day, who according to doctor's reports were quite torpid after prolonged operations at sea because of the prime malady of all submariners, then, i.e. constipation. Several doctors' reports included in the book state that due to the totally inadequate toilet facilities on board the submarines, most members of the crew went many days without a bowel movement.

Another first for submarines -- an escape from a sunken submarine -- "was made a quarter of a century before Holland set about constructing submersible men-of-war". A Bavarian, Wilhelm Bauer, built two subs at St. Petersburg and made 134 dives with the second before it foundered. But with his first, Le Plongeur Marin (and this name is significant to many WWII submariners who took part in a dive-the-boat routine in French, at their drinking parties. A self-styled Diving Officer would shout, "Plonge, Plonge" while others rattled whiskey and beer bottles to approximate a

diving alarm, etc.). But to get back to Compton-Hall's story about the first escape from a bottomed submarine. "The iron ballast having slipped forward, they (the 3 men in Le Plongeur Marin) went down in a vertical position....in 18 meters of water. The situation seemed desperate but Bauer ordered the two crewmen (by means of "gestures with a large, serviceable spanner") to flood the whole interior so that as the water entered it would become equal to the exterior pressure on the hatches which could then be opened." Then, Bauer and his two crewmen came up in the first free ascent after using a basically sound method of getting the hatches opened when on the bottom.

The first escape from a U.S. submarine followed by a few weeks the sinking of the A-1, the first British sub to go down -- with eleven men aboard. In the U.S. escape experiment, two dogs were ejected through the 18-inch torpedo tube of USS Shark. "It was reported that they swam around on the surface unconcerned", and a newspaper over-optimistically then published an article headlined "Submarine Boats Safe". But not until five years later in 1909 did Ensign Kenneth Whiting, USN, Commanding Officer of the Porpoise make the first U.S. human escape. The boat was on the surface when Whiting crawled into a torpedo tube. He had the tube flooded, then, when the bow cap swung upward and open, Whiting pulled himself clear and emerged safely. Compton-Hall says that "the Porpoise's Log recorded the incident with a single throw away line: 'Whiting went through torpedo tube.'" Also, "Whiting's experiment was not much acclaimed. He was immediately rebuked by the hierarchy and by the Chairman of Electric Boat Company, Mr. L. Y. Spear who declared flatly that the venture was foolhardy" because "American submarines were already fitted with means of escape effective in all conceivable circumstances. It was an unwarranted claim." Bauer's second submarine, Le Diable-Marin, the Sea Devil,

embarked "some unusually patriotic Kronstadt musicians to play the Russian National Anthem at the coronation of Tsar Alexander II. The tones, although clearly audible on the surface, were said to be lugubrious in quality" -- mournful for good reasons.

That's a bit of the flavor of this book which is great fun to read because Compton-Hall's writings embody the best of dry British humor with the early history of "the boats" providing a vast reservoir of anecdotes.

But some of the stories which Compton-Hall relates are apparently selected to make important points relative to today's submarine world -- lessons which might be learned from history. It is as though he is saying that in the perception of the past lies the future of submarines. He quotes RAdm. Charles O'Neill, USN, Chief of the Bureau of Ordnance in 1900 as saying: "The only use of the Holland is to discharge torpedoes and no weapon is more erratic." Then Compton-Hall notes that "there are plenty of submariners even today who would gloomily agree with the tenor of his remark. Underwater weapons, until the advent of ballistic missiles, always lagged well astern of the vehicles that carried them, simply because designers consistently devised submarines and then decided what torpedoes they would carry rather then selecting a complete weapon-system and building the best underwater vehicle to accomodate it. Compton-Hall philosophizes that it wasn't the torpedo mechanisms that justified Admiral O'Neill's remarks as much as it was "a lack of adequate fire-control and discharge arrangements" -- which were apt "to upset a torpedo's depth keeping device as well as pushing it off course when it left the tubes". To which one might wonder why swim-out versus hydraulic ejection is being debated in today's environment.

In summary, the reviewer would like to use the

author's last paragraph in the hope that the U.S. Navy's 1985 budget justifications can utilize the prophecy of the Commander-in-Chief of the Royal Navy, Adm. Sir Jackie Fisher, of Edwardian days: "My beloved submarines are not only going to make it damned hot for the enemy....but they are going to bring the income tax down to three pence on the pound."

In many ways this book appears to be a labor of love on the part of a dyed-in-the-wool submariner who evidently sees in the many early happenings in "the boats" valuable lessons which might be applied to the problems in today's submarine service. As such, Compton-Hall's book is particularly worthwhile reading.

CAPT. ROBERT C. GILLETTE, USN (RET.)

The Submariner's World 1
Edited By Commander P. R. Compton-Hall MBE RN (Retired): Published in Great Britain by Kenneth Mason, The old harbourmaster's, Ensworth, Hampshire.

The editor of this book, Commander Compton-Hall, RN (Ret.), has made many official visits to the United States and also served a two year tour of duty at the DEVGROUP in New London. He is, therefore, a familiar figure to many U.S. submariners. The book he has put together is an interesting effort to provide a thumbnail sketch of the role submarines play in many of the navies of the world. His book particularly emphasizes, as the title suggests, life aboard these ships. While admirably achieving the goals which Compton-Hall has evidently set, by necessity the scope of the many aspects of submarining examined is limited.

Extremely well qualified contributors have provided the major sections of this book, ranging from analyses of the submarines of the British, American, Soviet, and Netherlands navies, to descriptions of submarine weapons, equipment (such as persicopes), escape procedures, new developments, old experiments, and many other diversified topics. But perhaps the most interesting profiles are those provided of the life aboard submarines. Though these sketches have been written about mainly British submariners and apparently by officers of the Royal Navy, it is easy to see that submariners the world over have similar reactions to this demanding way-of-life.

Spliced among the many articles relating to submarine matters are anecdotes related by Comdr. Compton-Hall -- so he is a most important and major contributor to his own book. His stories are about the British enlisted men who man the Royal Navy submarines and are related using their cockney language where appropriate. While showing the best of British wit, at the same time these anecdotes show the intense loyalty and dedication of the ratings to their submarine duties along with their unpolished but polite respect for their officers. One can easily realize from these stories why the enlisted men play a major role in making the British submarine service an elite one.

The articles on ASW highlight the importance of submariners understanding the threat they might face in war -- and possibly even in peacetime operations. Submarine life is so affected by the possible ASW response that might be encountered -- with its consequences -- that "the submariner's world" is only truly appreciated if the menace of ASW is recognized for its impact on the individual submariner.

The idea of a submarine aircraft carrier and the article dealing with experiments in the early '60s

on submarine propulsion systems using gas turbines show the wide diversity -- if not a hodgepodge -- of submarine interests collected in this book. It's like the Submarine Review -- but in an annual edition.

I found most intriguing the sections of the book that examined the role of diesel-electric submarines. The author provides a clear and concise rationale for their continuing development by the British Navy. In the process, he describes the new type 2400 patrol-class submarine that the British are building. And this description raises nostalgia in anyone who served in diesels. Perhaps this book provides the answer as to why the U.S. can rely on our allies to carry out some important shallow water operations using their conventional submarines.

THE SUBMARINER'S WORLD 1 is an extremely interesting book for all readers who are drawn to the study of these weapons of war. It is particularly useful for those people who are interested in receiving a rapid course in just what it means to be a submariner. At the same time it is a fascinating book for the old hands.

This is apparently the first of a series of such publications since Compton-Hall suggests that a SUBMARINER'S WORLD 2 should be due about two years after this book -- presenting an updated review of submarine matters.

CAPT. JIM BUSH

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

Articles for this publication will be accepted on any subject closely related to submarine matters. Their length should be a maximum of about 2500 words. The content of articles is of first importance in their selection for the Review. Editing of articles for clarity may be necessary, since important ideas should be readily understood by the readers of the Review. Initially there can be no payment for articles submitted to the Review. But as membership in the Submarine League expands, the Review will be produced on a financial basis that should allow for special awards for outstanding articles when printed.

Articles should be submitted to the Editor, W.J. Ruhe, 1310 Macbeth Street, McLean, VA 22102. Discussion of ideas for articles are encouraged, phone: 703-356-3503, after office hours.

Comments on articles and brief discussion items are welcomed to make the Submarine Review a dynamic reflection of the League's interest in submarines.

The success of this magazine is up to those persons who have such a dedicated interest in submarines that they want to keep alive the submarine past, help with present submarine problems and be influential in guiding the future of submarines in the U.S. Navy.

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