THE SUBMARINE REVIEW

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A QUARTERLY PUBLICATION OF THE NAVAL SUBMARINE LEAGUE

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FROM THE PRESIDENT

It has been the aim of the Submarine League to offer an informative educational dialogue within the pages of the Submarine Review -- and it is gratifying to see this as an improving thing with each issue. Exceedingly astute material on submarine matters as well as good positive suggestions for improvement of the League have been made in the Review, making the League more dynamic and useful to the submarine service.

Consistent with the League's objectives which your Board of Directors is actively promoting, the League is developing at a pace which is even more rapid than its growth rate. Still, the Board would like more ideas and suggestions as to the future course of the Submarine League. Letters or articles for the Submarine Review will certainly get the Board's attention.

With 1915 members at present, it is evident that a large number of would-be members are still not aware of the Submarine League's activities. Hence, it is desirable that League members canvass their friends and encourage them to join this brotherhood -- whose basic interest is submarine matters. The value to our country of an informed articulate Submarine League can be great -- particularly as to the lead role of submarines in strategic deterrence and in the control of the seas.

The response to the Submarine League's Life Membership program has been good. Ken Highfill was our first life member, followed by nine more true believers in the long term future and importance of submarines -- not that saving money over the long haul isn't important!

Chuck Griffiths

FROM THE EDITOR

In thinking about the role the Submarine Review can play for the submarine profession, I recall my early reading of the Journal of The American Medical Association, (JAMA). In my youth, I was exposed to the Medical Journal on a monthly basis, perhaps because it was hoped I'd later be a doctor. But in retrospect, although the profession of medicine was considered to be the most highly regarded of professions, I subsequently came to believe that I had wisely chosen as highly regarded a profession -- by being a naval officer in the submarine service.

What I came to admire about the articles in the Medical Journal was the open discussion of how practicing doctors were using their tools -- medicines, trained diagnostic skills, new kinds (then) of instruments and equipment -- to heal their patients. It was evident that the art of healing was taking great strides forward because of this sharing of ideas.

A recent review of a few of today's Medical Journals shows some marked differences in the medical profession. There are a far greater number and variety of medicines to choose from. Research is uncovering a startling number of new healing techniques. This explosion of medical know-how has forced specialization in many fields, yet the "family doctor" -- the generalist, or general practitioner -- can keep pace with the changes through the aid of computers. Computers are now being used to store and digest medical knowledge and relate it to vast numbers of case histories, thus providing inestimable help in the diagnosis of patients. In addition, there is much advanced on-going research, directed toward areas in the medical field which can hold great pay-offs in licking diseases as well as other medical problems.

What I would observe from a reading of Medical Journals is that the medical profession has greatly improved the art of healing in only a short period of about fifty years. This progress is certainly evident in the increased longevity of peoples' lives. And it appears to result from the uninhibited dynamic dialogue within the medical profession -- and which is being carried on in the pages of JAMA.

Perhaps the art of submarining can enjoy the same sort of progress and success, if a free dynamic dialogue is carried within the pages of the Submarine Review?

The analogy between the JAMA and the Submarine Review might sound far fetched, yet there are so many similarities, as to how one or the other increases the degree of professionalism of its individuals, that a few parallelisms might be drawn to better understand the importance of the new-born Submarine Review to today's submariners.

Past submarine experiences (like patient histories) and historical submarine successes in combat (like old cures) can be profitably used in the Submarine Review to show the immutability of the principles of war. The new equipment and techniques (like new medical and new medical equipment), available to submariners, can be related to better ways of fighting (like healing) with submarines. The training necessary to develop tactical skills (like diagnostic skills) can be usefully analyzed. How the great amounts of available information, today, can through computers be used for decision making -- by the generalist, the practicing strategist/tactician -- needs discussion, both as to its validity as well as to the alternatives of action which might be derived from such information. And, where research can and should be directed to maximize the payoffs for improvements to the art of

submarining should be delineated.

In short, the dialogue in the Submarine Review, if generated in great part by active duty submariners (like the practicing doctors), will tend to insure a development of the art of submarining to a high degree - despite an over abundance of good and bad information and an overwhelming burden of technical detail, which must be absorbed and treated in the course of a submariner's duties.

I would hope that the Submarine Review's aspirations to emulate JAMA are evident to the submarine profession from this as well as past editions.

STRATEGIC EMPLOYMENT CONCEPTS

For many years it was the good fortune of the U.S. to possess a strategic deterrent capability whose competence could be assured well into the future. Each new system -- strategic bombers, ICBMs and SLBMs -- was significantly more capable than the forces available to the Soviet Union with which to counter it. In the past, the U.S. was always a technological generation ahead of the Soviet Union. Moreover, throughout the 1960s and most of the 1970s, our ballistic missile submarine force was confident of the future effectiveness of its deterrent posture, measurednot in years, but in decades. Unhappily, those days are gone.

For the future, our strategic submarine force has to recognize that the best that can be hoped is a deterrent posture based on a number of partial solutions. No single solution will ensure a force invulnerable to all threats. But taken in

aggregate, it is believed that the elements of a credible and survivable deterrence have been assembled. The strategic modernization program which was begun in October 1981 is designed to preserve the effectiveness and flexibility required in order to continue to deter Soviet aggression successfully. In essence, the program is designed to accomplish two general goals: first, to improve the survivability of present and planned submarine forces, and secondly, to sustain the credibility of our deterrence policy by developing a hard-target-kill capability -- the ability to retaliate against the growing numbers of hardened Soviet silos and command centers -- which our forces are not able to do with confidence today. This combination of improved survivability and military capability will assure that the Soviet leadership continues to recognize that they can realize no conceivable benefit from initiating aggression.

The President's strategic modernization program includes the construction of at least one Trident SSBN a year, and the development of the Trident II (D-5) missile with an initial operational capability no later than 1989. It also includes the deployment of sea launched cruise missiles as part of a nuclear reserve force. It is the significantly improved accuracy and yield combination of the Trident II (D-5) missile which fulfills the presidential mandate for a hard-target-kill capability in the most survivable leg of our strategic triad. The capability of the strategic submarine force to fulfill national policy will continue to grow. Despite the fact that our Poseidon SSBNs will retire due to age in the 1990s.

Let me review the advantages of the SLBM leg of Triad.

First, it is the most survivable and endurable leg of the Triad.

Second, it permits rapid retargeting. This feature is inherent in the design of the missile fire control system and changes in individual targets or entire target packages can be accomplished on board the ship very rapidly.

Third, it offers exceptional reliability.

Fourth, it offers a hedge against Soviet expansion of an ABM system. The high number of warheads on each missile create an ability to exhaust an ABM defense. In addition, the mobility of an SSBN provides a multiazimuth attack capability, which complicates the Soviet ABM defense.

While all of these attributes are important, survivability is the most significant strength of the SLBM force.

Survivable strategic deterrent systems accomplish several things. Perhaps the most important is the stabilizing influence they exert in a crisis. Since they cannot be attacked successfully, no rational enemy is likely to expend a large portion of his nuclear offensive capability in some futile attack on the system itself -- an attack futile in the sense that it cannot deny the capability to retaliate effectively. In this sense, survivable means non-targetable, and such systems remove or significantly reduce any temptation for a first strike, particularly during a crisis. That's theory, in the practical sense our non-targetable sea-based systems limit the extortion value of the Soviets' large ICBM force.

Additionally, with survivable, non-targetable forces, one does not have to procure forces to hedge against their potential loss. Thus forces can be sized, based on military need, and the incentive for arms build-up is reduced. What is termed "arms contol stability" is enhanced by

survivability.

The inherent endurance of the SSBN force, time-tested in over 2220 deterrent patrols since USS George Washington sailed in 1960, also contributes greatly to deterrence. Valuing endurance in our strategic forces does not translate to our trying to fight a protracted war. But to deter the Soviets, we have to understand how the Soviets think. They value nuclear forces held in reserve. We must project a force structure which also can be seen to have the capability of being held in reserve. It is vital that a U.S. reserve force, as well as its supporting command, control, and communications, be enduring.

The importance of a reserve brings us to the second sea-based component of the President's strategic modernization program -- the deployment of sea launched cruise missiles. While these weapons will be on SSNs rather that SSBNs they will still make a major contribution to our deterrent posture. Deployment of the Tomahawk nuclear land attack cruise missile began this summer. Its value lies both in greatly expanding the Navy's offensive capability and in providing a survivable and potent reserve threat. It will have superior military utility, achieving a hard target kill with limited collateral damage. The range and flexibility of this system make it attractive for holding at risk Soviet targets not currently ranged by any non-strategic nuclear system.

Nuclear Land Attack Tomahawk is an effective deterrent because it provides a survivable and enduring nuclear strike capability throughout the military spectrum. Its shipboard deployment will make a significant contribution to our policy of deterrence by providing visible evidence of a widely dispersed, survivable and effective nuclear presence at sea.

Should deterrence fail, the U.S. must be prepared to engage in combat across the full spectrum of possible conflicts. A credible nonstrategic capability and a surivable and enduring nuclear reserve force are integral to this total military capability. Nuclear Land Attack Tomahawk's survivability, flexibility, and endurance make it uniquely suited for theater and reserve force roles. Its deployment adds a new dimension to the variety of response options available to the national command authority and consequently to the unified commanders. In a post-exchange reserve role, it supports the strategy of maintaining a capability to terminate conflict at the lowest possible level of damage. Thus, while we think of it primarily as a theater weapon, it will make a major contribution to strategic deterrence as well.

Returning to the SSBN force, there are significant challenges as well.

First: There is greater and greater need to be able to engage targets across the entire spectrum, from soft area targets to hard point targets. The existing Poseidon and -- to a lesser extent -- Trident I missiles have only a limited capability against hard targets. These problems will be largely overcome with the deployment of the Trident II (D-5) missile.

Second: The nature of SSBN operations poses some unique command, control, and communications problems that land based forces face to a lesser degree. As our weapons grow more capable, our traditional stress on the viability of communications might have to be expanded to include rapid and flexible command and control.

Third: We will never be free of the traditional challenge posed by limited resources. Like all complex systems, SSBNs are expensive, both in dollars and in the requirements for

skilled manpower.

Fourth: In our stress on SSBNs we must not forget the challenges that come with the immense capabilities of Tomahawk. The Navy as a whole and the submarine force face a unique challenge in attempting to balance the nuclear and conventional roles of Tomahawk equipped ships.

And Fifth: There is the challenge of preserving both the fact and the perception of SSBN invulnerability. Further, we also must preserve the deterrent value that resides in the enemy's perception of that survivability.

Despite what one may have read, no one in the Defense or State Department or the White House, is unaware of the horrible consequences of any use of nuclear weapons. As a result, the United States does not seek -- in any way or form -- to wage a nuclear war. Rather, all efforts are directed toward ensuring that nuclear weapons will never be used and that a nuclear war -- or a major conventional war -- will never be fought.

Commodore R. F. Bacon, USN

THE POTENTIAL OF THE NUCLEAR SUBMARINE?

There has been a consistent failure in the past to recognize the actual potential of the submarine. When it has been used in war the results achieved by the submarine have far exceeded planned expectations. This makes one suspect that what the role of the nuclear submarine -- the true submarine -- should be in tomorrow's sea warfare is similarly not well appreciated. Thus to comprehend what realizing the full potential of the nuclear submarine might offer to naval warfare -- and its possibly revolutionizing effects -- needs to be examined,

not only to see if the U.S., is missing a good bet but also to evaluate the success of the Soviet's thrust toward gaining command of the seas with a Navy whose major ships -- their "ships-of-the-line" -- are nuclear submarines.

At the start of World War I, the submarine was considered to be a low cost, submersible torpedo-boat with very limited capability due to its low surface and submerged mobility. That it was a serious threat to big, heavily armed warships was claimed by only a few optimistic military analysts of that day. The Germans, consequently, entered the war with only 18 operational boats, of 300 to 500 tons and with only a few torpedoes on board. When, then, in the opening moments of the War, a German submarine sank 3 British cruisers in a single operation, the high command of the British Navy -- and probably other major navies of the world -- overreacted and took unnecessary, inhibiting actions in their warship operations when the near presence of enemy submarines was even suspected. This caution continued through the war despite subsequent evidence that submarines were not efficient in anti-warship warfare. Against merchant ships, however, German submarine results exceeded all expectations.

Yet, at the start of World War II, the Germans had far too few boats operational (only 57) to fully realize the great potential of the submarine in an anti-shipping attrition campaign. Other navies seemed to better comprehend the submarine's potential, and had more submarines, but quickly discovered they needed even more. The U.S. started the war with 95 operational boats, the Russians with 218, the Japanese with 65 and, surprisingly, the Italians had 84 ready for sea -- out of 150 in commission. Again, the sinking of ships in WW II by submarines exceeded all expectations.

Today, as Navies consider the possibility of a World War III, there is predominant evidence that the full potential of the submarine is still not being recognized -- except possibly by the Soviets. Moreover, the highest potential of the submarine lies in nuclear submarines that are heavily armed, highly mobile, of long submerged endurance, tough and almost unsinkable. Today's nuclear submarines of the Soviet navy seem to meet all these specifications. Hence, only the Soviets at present seem best able to use their nuclear submarine fleet to gain command of the seas. The U.S. with its goal of only 100 nuclear attack submarines, however, apparently sees the capability to command the seas as vested in fleets which are centered around attack carriers. The 100 U.S. nuclear attack submarines thus seem designed to merely deny the Soviet submarine-oriented navy a capability to command the seas.

The "submarine" discussed here as to its potential to command the seas, is a collective term and implies the use of submarines not just as "ships-of-the-line", in the Mahan sense, but also submarines for anti-surface, anti-air, anti-satellite, anti-mine, pro-amphibious, shore bombardment, etc., warfare.

"Command of the seas", in Mahan's words, derives from "a prolonged control of strategic areas of the oceans -- and that such control can be wrung from a powerful navy only in fighting and overcoming it." Mahan also notes that such control of the seas "does not imply that an enemy's single ships or small squadrons cannot steal out of port, cross less frequented tracts of the oceans, make harassing forays," etc, since history has shown that "such evasions are always possible, to some extent, however great the inequality of naval strength." Thus, in Napoleonic days, the naval power demonstrated by the British, through successful fleet engagements

in which sailing ships-of-the-line comprised the main battle line, made it clear to the French and Spanish fleets that to risk operations on the high seas around Europe with major naval units promised only their destruction. Nelson at Trafalger literally drove the fleets of the Allies from the seas in the local theater of naval operations, by destruction of enemy's ships.

In World War I, command of the seas was contested by fleets with battleships comprising the battle line.

The ships-of-the-line in WW II proved to be attack carriers.

In any case, "ships-of-the-line" of the past have contained the greatest weapon power of all units afloat while being hardened to withstand great punishment -- making them highly survivable.

Now, Admiral Gorshkov with a fleet whose "ships-of-the-line" are nuclear submarines, has noted that in today's naval environment, control of limited areas of the seas for short periods of time sufficient to carry out certain naval missions -- a low level of command of the seas -- is possible even for weak navies because of the considerable destructive power that all naval units, even small ones, now possess.

In our time, we have seen nuclear submarines demonstrate a command of the seas in warfare. Hence this capability is more than a remote dream. In the Falkland Islands War, the sinking of the Argentine cruiser Belgrano by the British nuclear submarine CONQUEROR, convinced the Argentines that the risk to the Argentine fleet was too high to attempt to operate in waters infested with British nuclear submarines. The Argentine fleet was therefore held in port for the remainder of the war. A similar kind of command of the seas by submarines was reported in World War II when

conventional submarines -- primarily Sam Dealey's HARDER -- operating in Sibutu Passage, sank five Japanese destroyers. This caused the Japanese Admiral in command of the fleet operating out of Tawi Tawi Bay, to sortie his fleet and clear the area because of the great hazard posed to his carriers by the presence of U.S. submarines in the Sibutu Passage area of the seas.

Still, it is assumed that today command of the seas is vested in a navy which can control the air over the seas. Dominant air power, it is felt, assures the destruction of enemy threats in the air, on the surface of the oceans and underseas as well. Moreover it is seriously questioned whether the Soviet Navy, with submarines as their "ships-of-the-line" could, in this decade, gain command of the seas in war. It is felt that the command and control of a navy, so oriented, is still sufficiently impractical so that other navies whose fleets have air dominance over the oceans cannot be seriously threatened. But, if the Soviets tried a shoot-out with their "fleets," which are composed of mainly submarines and land based air, against those of the U.S. -- which are primarily attack carrier battle groups -- "command of the seas" would stem from the control "wrung from a powerful navy which had been fought and overcome."

It does seem evident, however, that the naval power projection capability for strategic nuclear war is eminently achieved by the ballistic missile nuclear submarine, the SSBN — so well in fact that this submarine capability has supplanted that of carrier-based, nuclear armed aircraft. Consequently, for strategic nuclear war the potential of the nuclear submarine seems to have been fully realized. But for limited naval wars, including those using tactical nuclear weapons, the potential of the nuclear submarine appears to be only partially exploited. U.S. nuclear submarines, for example, have been well designed

to realize their potential for anti-submarine warfare. But for other missions, achieving the nuclear submarine's full potential appears to be for the most part neglected.

In realizing the nuclear submarine's potential to command the seas, consideration must be taken of the advantages from operating in the water medium as opposed to the surface, in the air, or in space far removed from the sea's surface. The water medium provides the greatest protection and concealment. It has the least ranges for detection. It offers the greatest shielding of radiations. And it causes the greatest span of time for tactical actions. In today's environment of electronics, very high speed systems, and precision weaponry of great damaging power, the need for covert operations and surprise in attack become paramount, and submarines offer a high degree of both. Submarines also enjoy more opportunities to concentrate forces and mass their weapon power than other types of naval forces -- while still achieving a high element of surprise in attack. The principles of war are thus readily realized by submarine forces.

The assumed shortcomings in command and control of submarine forces stem from a surface ship oriented view of what it takes to coordinate forces for battle -- both strategically and tactically. Since submarines today are likely to be armed with long range anti-ship missiles which are targeted by third party information, such strike submarines can deliver their attacks from widely diverse positions as regards to range to target and sectors from which their weapons are delivered. Consequently, critical communications to and between submarines prior to engagement will normally take place several hundred miles away from the enemy forces. This allows methods of communication which should not be readily compromised by an enemy. Then when battle is

joined, tactical communications to and between submarines will be of the simplest nature. Even two-letter coded instructions (as possibly used by ELF communication systems), in many circumstances should be adequate. Submarines today need not be operated in tactical formations in battle. This tends to minimize tactical communications. And the supposed danger of collisions, which would require some communications concerning other submarine whereabouts, should be virtually non-existent. Like aircraft, submarines can be operated in stratums. But unlike aircraft in low visibility conditions, today's submarines with their excellent passive detection capability can be passively warned of the near presence of another submarine in time to take avoiding action. As to being hit by another sub's torpedoes, wire guidance directs torpedoes to "identified" enemy targets and can prevent straying to other targets.

Command and control of submarine forces armed with today's weapons is far simpler than that for surface fleets. This was evidenced by the Soviet's central, land-based control of submarine forces in Okean '70 and Okean '75. Thus, what little and occasional command and control is actually necessary for fleet engagements -- where submarines play the role of modern ships-of-the-line -- should be recognized when evaluating the submarine's potential to command the seas.

The conventional wisdom of today's submariners is that nuclear attack submarines must first and foremost emphasize quietness and long range passive acoustic detection capability. Hence U.S. submarines are necessarily single hull boats which minimize hull-created noise both radiated and self. The former prevents being heard by an enemy, the latter ensures a least hindrance to listening capability.

In the process of emphasizing single hull

design to achieve what is considered a best warfighting capabiltiy, U.S. submariners also recognize the considerable volume, buoyancy and payload limitations inherent to single hull submarines. These are limitations which dictate against the submarine developing sufficient capability to be a ship-of-the-line of the future.

Thus, if the full potential of the attack submarine is to be realized, some compromise with the elements of stealth and quietness appears necessary. Inasmuch as the Soviets are credited with greatly quieting their third generation submarines while still retaining hardness and great weapon payload in their double-hull designs, it would seem that their realization of a ship-of-the-line capability may be imminent.

But of what value are submarines -- like the Soviet's OSCAR -- which can mass 24 big-warhead missiles on a ship target from 150 miles away, and later at closer range deliver 32 torpedoes into enemy fleet units while being able to absorb hits from light-warhead aircraft-delivered conventional weapons without being diverted from their attack? For such ships-of-the-line, air control over the oceans is of questionable significance if today's sea-based aircraft, armed with today's antisubmarine conventional ordinance are used. Hence, the use of air-delivered tactical nuclear ASW weapons seems more appropriate. But in tactical nuclear war the submarine holds most of the advantages. It is shielded from electromagnetic propagation. Blast and radiation effects are minimized. Locating submarines is most difficult. Attacks can be made with a higher element of surprise, etc. In fact, a few submarine fleet units armed with nuclear anti-air weapons should discourage enemy attempts at holding air control over an area of submarine operations.

But even if a submarine-oriented fleet gained

command of a sea area which was critical to the success of shore operations -- as with the sea lanes of the North Atlantic where convoys would carry logistic resupply for embattled NATO forces in Europe -- could properly developed nuclear submarines destroy sufficient shipping to seriously affect the land battle outcome? The success of the convoy system versus conventional submarines in WW II has been dredged up as a valid argument against the potential of today's nuclear submarine to efficiently carry out the antishipping mission -- "an important secondary operation of naval war", in Mahan's terms. Whereas single-hulled submarines would be hard put to carry a sufficient payload of antiship weapons to critically affect the massive movement of heavily loaded merchantmen, submarines with double hulls might carry far greater numbers of weapons -- but many of them externally. This would include mines in external mine belts. Attriting convoys near their destinations is an equally useful way to destroy shipping as on the high seas. Additionally, due to the precision of today's submarine weapons, fewer should produce more sinkings than in WWII. The potential of submarines which can carry a great load of relatively low-cost, anti-shipping weapons -- simple torpedoes, with big warheads and mines with great destructive force -- is great.

It may be argued that air delivered attacks on convoyed shipping should be more efficient than submarine torpedo attacks. But again, WWII experience is deceptive since today's merchantmen can be readily armed with simple short-range anti-air missiles, like the Stinger or Grail. These would force aircraft into a standoff delivery of weapons. This makes the use of bombs inefficient and necessitates the use of costly precision weapons, which are normally not as destructive.

In short, the submarine's considerable

potential against warships and shipping is still not apparently being emphasized -- if not being neglected. The Soviet's "fleet" of "mainly submarines" appears to be insufficiently evaluated as to its imminenence of achieving a capability to "command the seas" through the defeat of an enemy's "powerful fleet." And, the U.S. might be missing one of the best bets of history through a lack of vision as to what the nuclear submarine can offer to naval warfare. arming the new attack submarine, the SSN 21, with 50 weapons comprising advanced torpedoes and long range antiship and land attack missiles is a major step forward, but seemingly only a partial effort towards realizing the full potential of the nuclear submarine.

Phoenix

THE SUBMARINE IN WORLD WAR I

The following article retraces the conventional wisdom about the "submarine torpedo-boat" that prevailed 70 years ago. It tells of the shock that the craft caused when it was put to use in a way and with an effectiveness that was not expected and the return to "business as usual" once the war was over.

All of the major naval powers on the eve of the First World War had their "submarine flotillas." France, with 76 units, had the most powerful fleet. The Royal Navy had 66 active units, Germany had 18 boats at sea and 12 more being readied, Austro-Hungary had eight, Italy 17, Russia 30 and the U.S. Navy's 28 boats comprised the world's fourth largest active "underwater" fleet. The typical submarine of 1917 displaced about 500 tons, had a surface speed of 15 knots and submerged speed of 8, two to four torpedo tubes and a three or four inch gun. The cruising radius on the surface was only 1,000 to 2,000

nautical miles.

The submarine of the first decade of the twentieth century was neither designed nor intended to fight underwater. It was a torpedo boat first of all, and a divable vessel secondly. The ability to submerge beneath the waves was viewed mainly as an operational expedient that would - hopefully - allow the tiny vessel to make its final approach to within 1,000 yards of the target surreptitiously and, if detected, make good its escape from its much faster and better armed surface oponent.

A few far-sighted submarine enthusiasts at the time promoted the idea of the true (all-electric) underwater vessel, but the general consensus among submariners and non-submariners alike was that designs ought to stress operations on the surface first as "submersibles" and the ability to move underwater as secondly. The advantages of a double-hulled submersible were clearcut:

a) Vision was better due to high freeboard.

b) The favorable lines of the submersible increased her surface stability and improved her sea-keeping qualities.

c) Habitability was better.

d) Submersibles would be armed more haeavily with additional torpedo tubes located inside the outer hull.

e) The fuel placed between the two hulls, made it possible to carry more fuel and to increase radius of action.

Each decade experiences its own debate over the vulnerability and future of the large surface warship. The years before the First World War

were no different in that sense than the 1920's furor between battleship and bomber proponents. Admirals and journalists exchanged heated arguments over the cost effectiveness of the all-big-gun battleship, whose era had been inaugurated with the commissioning of H.M.S. DREADNOUGHT in 1906. No one denied that the submarine armed with torpedoess had made the operations of capital vessels more perilous -- the issue turned on how perilous, and whether existing defensive measures would stymie the danger of the submarine. The opinion among most submarine proponents was that, if the submarine were lucky enough to get within striking range, one or a few torpedo hits probably would not be fatal. The indifferent results of the Japanese torpedo attacks against Admiral Makaroff's Imperial Russian squadron in April of 1905, compared with the spectacular efficiency of sea mines, appeared to underscore the submarine's doubtful value as a torpedo-firing weapon.

Irrespective of the debatable lethality of the torpedo-firing submarine per se, there was no disagreement that a battlefleet was too valuable to risk deliberate operations in sea areas known to be within reach of submarines. "Close blockades" of enemy ports and harbors, a favorite strategy of the Royal Navy against a Continental enemy, became the first traditional "battle fleet" mission to be ruled as henceforth impractical. Alfred Thayer Mahan had noted, however, that the submarine's probable use would be "to blockade ports." Coastal seas and "chokepoints" were the next domains that many observers of the naval scene prior to the First World War believed would also be off-limits to battle fleets -- because of submarines.

Raider warfare or guerre de course with the aim of avoiding the enemy's battle strength and instead attacking his seagoing commerce directly, was a popular alternative among some Continental

naval strategists, but they were in a minority. "The sea can no better be kept with submarines than with torpedo-boats, no more than it was formerly kept with fire ships," insisted a naval writer in 1908. "To command the sea, fleets are necessary." Rear Admiral Fletcher, then the commander-in-chief of the United States Atlantic Fleet, told a congressional committee on the eve of the German U-boat onslaught that the submarine was "a weapon of opportunity" that owed most of its success to its novelty. He labeled the submarine simply another "new and disconcerting weapon" on a par with fire-ships, spar-torpedoes, and automobile torpedoes." "None of these arms," the Admiral asserted, "has ever won battles that finally decided the war." Instead, the "only thing that weapons of this kind do is to delay or obstruct the movement of the main force of the battleships. But eventually the final clash is decided when the battleships come together."

Neither side in the First World War was prepared for either the way or the effectiveness to which Germany's U-boats were put to use. The German naval high command began the conflict by using its submarines in accordance with expected and "legitimate" rules -- against the warships of the Royal Navy. The essence of German naval strenth in 1914, like that of its more powerful British enemy, were the battleships of the High Seas Fleet and the German admiralty shared the view of its opponents across the North Sea that the issue at sea would be decided in a "decisive fleet battle." It similarly was agreed that the submarine would be employed mainly as an auxiliary for patrol and reconnaissance on behalf of the battle fleet. Some optimistic thinkers on the German naval staff thought that the U-boat might whittle down British naval strength enough for the High Seas Fleet to sally forth and give battle on even terms.

Those hopes seemed well-founded initially,

especially with the sinking of three older British cruisers on the same day, September 22, 1914. It was then asked, "Why were the ill-fated ships that were known to lack proper underwater protection, permitted to patrol an area known to be frequented by the underwater enemy?" Submarines were not yet thought of as an oceanic threat; their menace was only perceived when the heavy ships were in exposed anchorages or navigating in confined waters. U-boat attacks on the open sea seems to have been imcomprehensible to many of the Royal Navy's senior officers.

German submarine successes against warships declined rapidly thereafter. Unrestricted submarine warfare, "even at the risk of war with America," was then Germany's only option for "a victorious conclusion of the war within measurable time." Thus, U-boats struck with a vengeance on February 1, 1917. During the year, the Allies lost over eight million tons of merchant shipping of which only one-fourth could be replaced by new-construction.

Great Britain was almost brought to her knees by the submarine. As an instrument in battle, or as an instrument to be used against the principal battle units, the submarine had failed almost completely. But the most conspicuous of its disappointments was its total inability to prevent invasion by a power possessing superiority of surface craft. It had lost the one role universally assigned to it in pre-war days -- that of being a cheap substitute warship of weak navies. The submarine continued to be considered as a mere numerical adjunct to the "essential" measure of sea power -- the battleships. Battleships remained the sine qua non for the avowed purpose of naval power -- command of the sea via a decisive battle. Despite the First World War, considered naval opinion refused to see the submarine for what it really was -- not a torpedo boat that periodically vanished beneath

the waves, but something that produced a qualitatively different form of warfare. A minority view indicated that, contrary to the judgement of virtually every naval officer before the First World War, the submarine had demonstrated that a war against commerce could influence a naval campaign decisively. A British writer said, "The fact remains that had Germany been as ruthless in building submarines as she was in using them, we should probably have lost the war entirely through her successful warfare against our sea-borne commerce."

The defeated enemy, too, had learned its lessons. The German Admiral, Arno Spindler, summed up the Allied antisubmarine effort prophetically: "As long as submarines exist they will continue to be a threat to those nations which are unconditionally forced to rely upon overseas transportaiton."

The early "submarine boat" brought about unparallelled changes in the conduct and understanding of war at sea. Indeed, it may be speculated that, were it not for the near-coincident emergence of another revolutionary weapon -- the airplane -- surface fleets as they were known for centuries might have disappeared.

Jan Breemer

WHAT TO DO WITH THOSE BIG OLD POLARIS BOATS?

In late May 1984 the following news clip appeared:

> "The PATRICK HENRY, the second submarine in the Polaris fleet, will be decommissioned today and placed in the inactive fleet at the Puget Sound Naval Shipyard. Launched in 1959, the PATRICK HENRY logged more than 500,000

miles on submerged patrol. It was converted to non-missile status in 1981. Coming up: The decommissioning of GEORGE WASHINGTON, the oldest of the 41 Polarlis subs."

Thus, a quiet end after 25 years for these magnificent machines which have contributed so much to over 2000 successful deterrent patrols, generated scores of highly successful flag officers and magnificent crews, and been part of the U.S. Navy's most outstanding program -- both operationally and logistically.

As the Polaris boats arrived on the scene, there was a similar quiet demise of the Regulus boats. Their contribution to deterrence along with their "Black and Blue Crews" proved of considerable importance to the early Polaris effort.

In either situation, submarines have become available for other possible missions -- each mission of which requires a very large compartment.

Variety of design, Polaris budget pressures, and the fact that Regulus boats were no longer top-notch submarines resulted in little use made of their unique large compartments. Perhaps, with a larger number of old Polaris-Poseidon boats being made available, along with the demands of arms control, we can get smarter. Most of these boats are still very effective submarines -- even though probably not up to the latest in ASW capability. But that should not be their mission. It is felt that many of these boats, when they are taken out of the strategic deterrent system, should be placed for some years into a reserve status pending the approach of a war. With war, there should be a rapid expansion of necessary submarine missions. Such missions are not being seriously considered for the next war because of

lengthy new submarine construction times. Such missions might, however, be met within the time limits for altering of these old-age boats.

With imperfect foresight, some possible future missions are suggested which changing technology and naval challenge may make important and for which the old Polaris-Poseidon boats could be adapted:

-- Carrying massive numbers of cruise missiles for launch against ships, especially those in port. In most naval history, ports have been used as havens for ships and thus used to control the schedule of a war. (See the following addendum written in expansion of this mission.)

-- Covert laying of mines in large numbers. Many mine barrages in history have failed because they failed to reach saturation strength before being discovered -- and hence with countermeasures initiated.

-- Covert laying of sensor systems. U.S. SOSUS systems are not actually secure: their positions are known; their shore sides are subject to a variety of attack; and their arrays are destructable. The ability to covertly and rapidly lay replacement systems, perhaps with glass fiber leads to CONUS, could prove critical for U.S. ASW.

-- Covert laying of net systems, either anchored or towed. As the potential enemy becomes more adept at avoiding SOSUS, such a "zero range" detection system could prove important and might include a kill system.

-- Launching of massive numbers of long range torpedoes against large naval forces, e.g. 1000 torpedoes against a force of 50 ships. New torpedoes would have to be designed for this purpose.

-- Launching, towing, and monitoring of sonic arrays for the detection of aircraft and missiles. Surely the U.S. can find a way to detect sonically the loudest machines man has developed. Early warning especially against low-flyers could be vital.

-- Launching of missiles against aircraft or missiles detected by various means such as sonic, infra-red, radar, satellite, or bistatic radar. This might be a most important mission in protection of strike forces -- a means to fight the outer air battle.

-- Launching and controlling reconnaissance drone aircraft. These drones could be handled in large numbers and either expended or recovered in a variety of ways. They could also be used for control of an attack on ships in port, for relaying of information and control orders, as well as for reconnaissance.

-- Covert support for beleaguered garrisons by transport of personnel, material, POL, ammo. Almost every war develops this need at some time.

-- Covert refueling of short-legged vessels such as hovercraft, ground effect machines, hydrofoils.

-- Rescue of submarine crews with DSRV, or of surface crews subject to air attack.

-- Provision of a relatively invulnerable command center for naval operations -- where marginal communications are tolerable.

-- Intelligence gathering, using new methods.

-- Use of high power radiation weapons from a thermally protected environment. The submarine could have critically important advantages in this developing field.

-- Covert carrying, supporting and controlling of small X-craft submarines. Many real-war situations have shown the great value of such craft. The X-1 developments of over 20 years ago and the DSRV have shown that small submarines can be developed to enter ports, thus imposing expensive defense requirements on an enemy. Use of a large mother ship to provide the necessary operational range for such a scheme is indicated.

A reserve supply of about 30 submarines with large compartments would seem to be a prudent way to approach the 21st Century. It is also worth considering what the possible effects may be of a potential enemy using his old age submarines in similar fashion.

- AN ADDENDUM -

Attack On The Ships In Port With Cruise Missiles

The densest concentrations of ships, even in the middle of a war, are apt to be found in port. Since most ports are poorly defended against a weapon like Tomahawk and most ships in port are in reduced states of readiness, it seems only sensible to plan for saturation conventional attacks against ships in the naval and commercial ports of the enemy. Such attacks from long range would hold the element of surprise by very nature of the sea-hugging characteristics of a weapon like Tomahawk. Saturation at port facilities might be enhanced by combining submarine missile attacks with B-52's launching air to surface cruise missiles.

The fact that recent development of air to surface missiles for use against tanks -- which don't require a lock-on under pilot control -- suggest satellite observation and terminal control of missiles might be developed, as well as drone aircraft carrying out much the same function and

launched from a forward-positioned submarine.

To increase the potential volume of fire, conversion of a Polaris submarine to carry hundreds rather than tens of Tomahawks seems logical.

Strategically, such a need is driven by the continued Russian build-up of conventional forces which suggests that mutual nuclear deterrence is expected to be in effect. If this is the case, the speed with which U.S. forces might annihilate Russian sea forces becomes critical to those even more critical battles being fought on land. In an age when, through modern reconnaissance, two large navies tend to know where each unit of the other is, naval air will be converted from the opportunistic winning of sea encounters to the almost industrial perted-out process of destruction of ships wherever they may be. Speed of the process becomes the critical factor. Naval wars must be won in months instead of years, all other activities are happening too fast. The implications of this are profound in terms of weapons, tactics, weapon supplies, and defensive planning.

It is inevitable that too few carrier battle groups will have too many missions and that submarines must take on the destruction of shipping as described above. Should war break out along a central front, it further follows the U.S. strategy should provide for attacking peripheral interests of the enemy to stress his overall war-making potential. Thus, all of the enemy's commerce for SE Asia and NE Asia should be wiped out.

It is predictable that submarine launched cruise missiles will place U.S. and allied ports in jeopardy as well as ships at sea. The loss of industrial products on the scale experienced in

WWII would bankrupt the world. Thus, the naval effort must quickly produce a winning situation -- for the U.S.

Capt. R.B. Laning, USN (Ret.)

THE LAUNCHING OF THE PROVIDENCE

At a little past two on a hot, humid, hazy Saturday in Groton, the growing activity interrupts the weekend stillness. A DC-9 flies overhead and settles into the New London Airport. Black limousines roll down Poquonnock Road. A caravan of thirteen buses from Rhode Island are backed up on Clarence B. Sharp highway. Policemen stand on every corner. Crowds stream towards the gates of Electric Boat. It's launch day for the PROVIDENCE!

Astroturf covers the ground inside the Building Ways. Huge tarps, white ropes, patriotic bunting and bright lights help conceal the fact that this is an industrial work area. The many seated guests fan themselves with their programs and listen to the Northeast Navy Band.

The giant round bow of the submarine, draped with a bright and colorful skirt, protrudes into the ceremonial area and looms above and behind the podium.

Behind the drapes, where it is much darker, workers are busy with the final launch preparations. Instead of astroturf and bunting, there is scaffolding, staging, power cords and hose lines.

Workers in soiled clothes congratulate the crewmembers of the 719 boat, who are in full dress whites. One worker introduces himself to a sailor. "I'll be working on your boat after the

launch," he says proudly.

A steep ladder ascends from the floor, through a maze of scaffolding, to the submarine's brow. Capt. Emil D. Morrow, the boat's prospective commanding officer, stands next to his executive officer, Cmdr. Stanley R. Szemborski. The officers line up on the sail planes, while the crew mans the rails. Back aft, SUPSHIPS and contractor personnel wait for the big event.

The brow is withdrawn promptly at 3 p.m. A railing is then hammered into place where the brow had been.

"This is more than just a hulk," says one of the carpenters. "This boat is more complete than any they've ever launched." He looks over the side as his co-workers below wave to him. "After building 18 of the 688s, VLS added a new challenge," the Manager of the North yard says, referring to the Vertical Launch System for Tomahawk cruise missiles. (PROVIDENCE is the first sub to receive the system.) "This boat is 83 percent complete, including 95 percent of the weight." He adds, "When completed, with her liquid load the 719 will displace about 6,900 tons submerge. Today, she'll enter the water with a dryweight of 5150 tons." Although they don't measure launch velocity anymore, the manager guesses that "the boat will be moving between 16 to 17 knots when it hits the water."

Large anchor chains are fitted to the ship and secured to a pile out in the river. "When the chain reaches the end, the boat stops," one of the carpenters explains. "That's so we don't end up in New London," -- and "The cradle that the sub sits on goes down the ways with the boat. After the boat is in the water, the ropes holding the cradle will be cut free with an axe."

It is now 3:53. The speeches are heard by

those topside over loudspeakers. It is hot, but they're out of the sun. A flock of small craft herded by Coast Guard boats buzz around in the river below. A helicopter orbits above. Thick haze almost obscures the New London shore. Sponsor Jean Smith, wife of the U.S. Attorney General, approaches the bow. "In the name of the United States, I christen thee PROVIDENCE," she proclaims.

There is a metallic bang, and another -- and another -- as Mrs. Smith tries to break a bottle of champagne on the boat. Then the whistle sounds, the ship shudders, all hands salute, and at 4:06 the submarine begins to move. The many workers in the building wave to the people topside. The ship picks up speed, emerging 22 seconds later through the doors and into bright sunshine. The ship gently enters the water. Thousands and thousands of yard workers, their families and friends, watch from the land-level, facility dock, cheering wildly. There are countless small craft tooting their horns. Dozens more spectators watch from shore outside the yard. Then the whistle is silent. The crew cheers. The North Yard manager returns from up forward. He's outwardly expressionless, a veteran of many launchings. "I had to break my bottle," he says. "Mrs. Smith failed to break her bottle in two swings, so I took charge and broke the standby bottle."

"It's a great feeling" says a Chief -- riding the topside of the PROVIDENCE. You're hot, you've been standing there for over an hour, you're tired. And then the ship starts to move and you straighten right up. A lot of pride comes forth."

Tugs come alongside immediately. Navy tugs, EB tugs, Thames River tugs -- all are there. A

Navy tug takes off a large portion of the riders, bringing them back to EB. One of them, the Maintenance Painter Foreman, then walks through the yard to the street. He's seen every launch since the Nautilus, but PROVIDENCE is the first he's ever ridden. "This is my last launch before retirement" he says. "I wanted this to be my best, and I think it was!"

Lt. Edward Lundquist, USN

DEEP SEAFLOOR SUBMARINING

For many years, a submariner's principal interest in the deep seafloor environment was for its convenience as a repository for sunken ships. Seafloors, in general, were thought to be good places to avoid contact with, although some WWII boats found them useful when under depth charge attack.

Scientific interest in the ocean depths created the need for vehicles for seafloor exploration, and the deep submergence vessel era began shortly after WWII. U.S. Navy submariners have been active participants ever since, manning TRIESTE-I and II, SEACLIFF, TURTLE, AVALON, and MYSTIC, and providing trained pilots for civilian DSVs, including ALVIN.

We said farewell to TRIESTE-II in May, bringing to a close a quarter century of bathyscaph service to the U.S. Navy. It started in 1957, with the Office of Naval Research (Undersea Warfare Branch) evaluation of Jacques Picard's TRIESTE-I for oceanographic research, and continued through the years of dives to mind-boggling depths - from the 35,000 foot Marianas Trench to the searches for SSNs THRESHER and SCORPION in the Atlantic. It spawned Submarine Development Group ONE, the development

of DSVs and a cadre of dedicated submersible pilots and operational support personnel, afloat and ashore. TRIESTE-I and II will be long remembered, and are well-qualified to be part of the Submersible Pilot's insignia.

Since those early times, submersible operations have become familiar to the public. Commercial DSVs support the offshore oil industry, and the exploits of DSVs employed on research and exploration activities are well covered on TV and in the printed media. There is one aspect with which not many are familiar, however; that there are very few DSVs which can reach 20,000 feet, the depth which includes over 98% of the world's oceans. TRIESTE-II could, and she didn't depart until SEACLIFF had been given that capability. So the U.S. Navy can still operate on the deep seafloor to explore, to inspect, to sample, to measure, to learn about the benthic environment and how to accomplish useful tasks in that remote but extensive arena.

"Benthic" is a word that describes the deep ocean environment near the seafloor. Below about 4,000 feet depth, the temperature is a nearly constant 2°C. At 20,000 feet, the pressure is about 600 atmospheres - almost 9,000 psi. The currents are usually low, 0.25kt being a normal value, but they are affected by topography and have been measured as high as 2 kts. Water clarity is usually good, but not without scatterers, both sedimentary and biological, and subject to blackout when turbidity currents flow.

We are slowly learning more about the wildlife in the seabed environment, but we have a long way to go. Biofouling does not appear to be a major problem so far, and low oxygen content retards corrosion. But the environment is not uniform, nor has it been fully explored. We learn something new nearly every year that deep dives are made. Submersible operations in the deep

ocean are still fascinating and still contribute to the increase of our understanding of the oceans.

All very well, you say, but what's the connection with submarine warfare and national defense? With curent resources (one 20,000 ft. DSV, one 10,000 ft DSV and 24,000 ft DSRVs, and no dedicated support ship capable of long distance operations) deep seafloor operations are quite limited. However, there are influences which could generate considerable expansion. Among these are 1) the changing nature of naval warfare at the sea surface, 2) advance in technology, and 3) advances in the capabilities of other nations for operations on or near the deep seafloor.

As far back as 1969, forecasts were made that the combination of sea surveillance and long range weapon delivery could reduce the wartime effectiveness of surface forces to such an extent that major naval missions would require undersea platforms for their support. Fifteen years later we find that manned space stations and space shuttles have become commonplace, and the increased accuracy of ballistic missiles is being complemented by long range cruise missiles from several types of naval platforms. We observe that the techniques of surveilling and trailing surface ships have been developed to a high degree of reliability, thereby contributing greatly to the solution of targeting requirements for long-range weapons. Reliability and accuracy of satellite communications make it a key link in the growing threat to surface naval forces, giving opposing commanders a capability for rapid reaction to surveillance information. Weapons themselves, have greatly improved organic navigation, detection and CCM capabilities. The term "open sea" is taking on new meaning -- more "open" to detection and attack of surface forces.

In addition to the advances in technology

that are represented in this increasing threat, we find that new capabilities are becoming possible in the undersea environment. Cumbersome sensor packages are being replaced by miniaturized components, and their signal acquisition and processing potentials are expanding by orders of magnitude. Undersea cables of large diameter and heavy armor are being overtaken by the developments of Kevlar strength members and fiber optic transmission lines, whose large bandwidths make it possible to deploy networks of undersea sensors with much more signal-carrying capacity. Drifting surface buoys are now transmitting environmental data to shore stations via satellite. Since they are capable of being anchored in the deep ocean, they offer possibilities as relay stations for seafloor data collectors. Acoustic telemetry has the potential for providing the link to the surface relay station. Seafloor power sources remain a problem, but we have tested long-term undersea operation of small nuclear reactors and they offer definite promise for the future.

The improved strength-to-weight ratio of titanium has given designers of all undersea vehicles new options, from submarines to ROVs. Even Kevlar has made its appearance as a shallow-depth submarine hull material. With less weight required for structure, payload potential increases and with that, the flexibility and endurance of the undersea vehicle.

Communications from or near the surface to undersea vehicles near the deep seafloor will benefit from acoustic telemetry, making coordinated operations possible. Between vehicles at the seafloor, the effects of pressure on the acoustic ray paths will still limit the range of communications. Relay transponders properly placed above the seafloor, however, can make the connection between vehicles operating in a localized area.

Navigation at the seafloor within a few meters accuracy is possible now, using moored transponders for relative location, and conducting geographical grid-lock using satellite navigation at the surface. On-board navigational computers can give submersible pilots much greater capability and less dependence on directions from the surface.

When we look at the seafloor through the eyes of other nations, we see both economic and military opportunities. Offshore petroleum resource development has moved from the shallows of the Gulf of Mexico to mile-deep wellheads in the North Atlantic. Exploration is leading to deeper depths, and technology is being challenged to provide the new capabilities required. The ability to recover manganese nodules from the vast deposits on the deep Pacific seafloor has been demonstrated. The excitement of the discovery of polymetallic sulfides near several widely separated subseafloor fracture zones is magnified by the realization that similar geologic features are to be found worldwide along the undersea edges of the moving continental and oceanic plates. Control of seafloor resources could be a factor in future economic strength, and is consequently a key political item in the Law of the Sea deliberations.

The seafloor has been a military locale since mine warfare has existed, usually in shallow depths against surface targets. Antisubmarine mining drove the fields deeper, and now our CAPTOR weapon system has opened a new page in the mine warfare book. With the Soviets' extensive experience in mining, they can be expected to add some pages of their own. Mine warfare in the deep ocean can lead to mine counter-measures of a novel nature.

Tracked vehicles have been operating on the seafloor since the U.S. Navy's unmanned RUM-I in

1957. Recent press reports from Scandinavia and Japan indicate that the Soviets have developed seafloor vehicles for some form of covert activity. To determine the mission capabilities of such vehicles, we need to know whether they are manned or unmanned, autonomous or tethered. A new surveillance requirement could be developing.

What does it all add up to? Too early to tell, but look at the trends: a) more restrictions on the accomplishment of missions by surface forces -- particularly those involving surprise; b) increasing technical capabilities to operate on and near the seafloor, both by manned vehicles and remotely controlled systems; c) increasing pressures for discovery and exploitation of food, energy and mineral resources in the ocean; d) increasing pressures from under-developed countries to get their share of the world's wealth; e) new military involvements in the undersea environment, particularly at the seafloor. They may not add up to Captain Nemo and the Nautilus yet, but neither do they support continuation of a near surface "status quo". Our Navy has been a leader in developing undersea capabilities. Now other countries are pushing our lead. We need to take a look ahead at both offensive and defensive aspects of potential deep seafloor military capabilities, define our requirements and achieve the necessary levels of technical and operational performance.

Recent CNO and SECNAV ocean policy statements and requirements have created opportunities for advancement of the Navy's capabilities in the oceans. The deep sea environment should be a prime area for that effort, and the Submarine Forces are uniquely qualified to lead the way.

Charles B. Bishop

THE OFFICER STRUCTURE IN A ROYAL NAVY SSN

Although Royal Navy submarines have many similarities in operational performance and achievement with U.S. Navy submarines, the composition and structure of their ships company, and in particular the Wardroom, are quite different having historically evolved along separate lines. As an SSN Commanding Officer, I will, in the main, restrain my remarks to the SSN Wardroom, but many parallels can be drawn to the SSBN world as well.

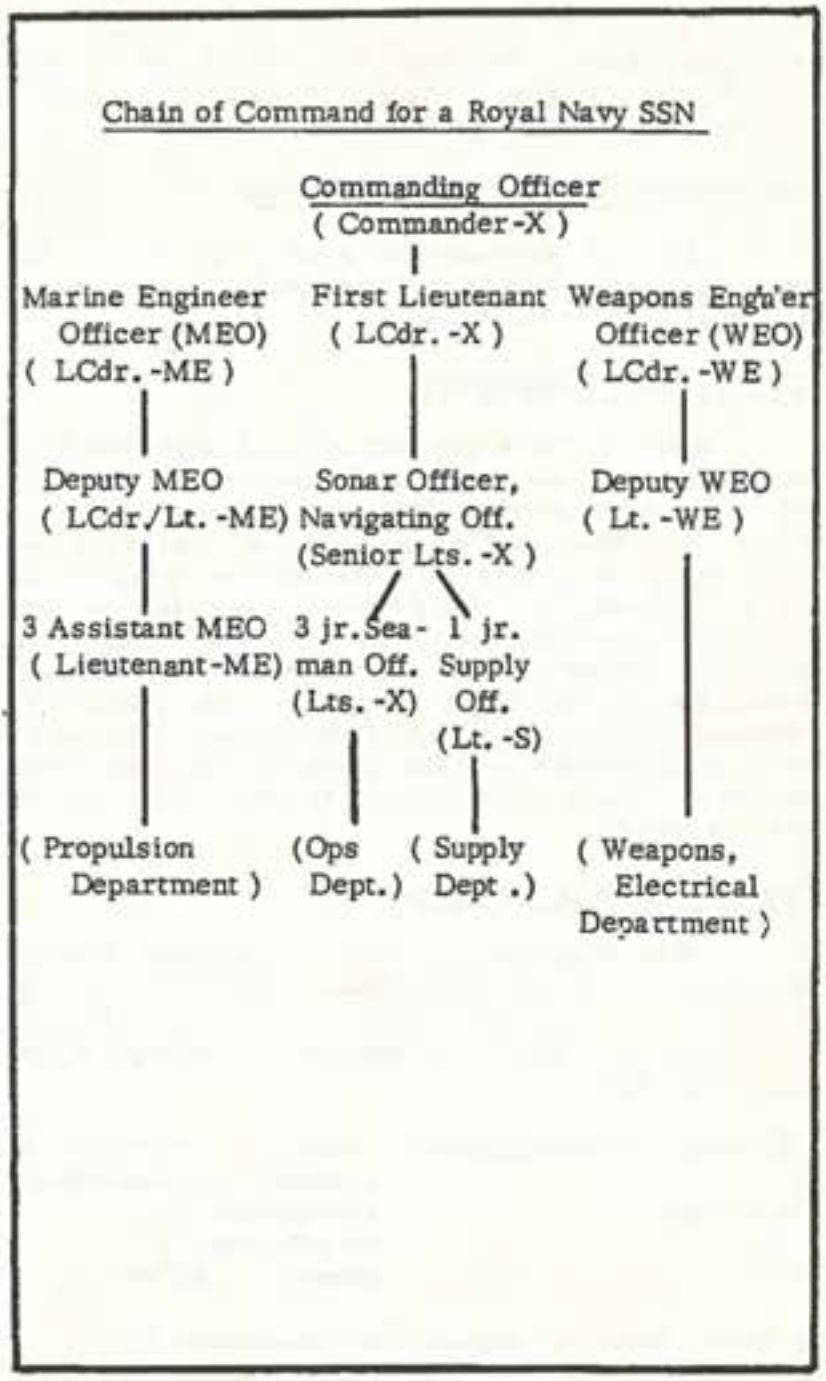
The Officer Structure of the Royal Navy

There are some fundamental differences in the officer structure of the Royal Navy to that of the U.S. Navy. The Royal Navy has no "Line Officer". Instead, a man before he ever enters Britannias Royal Naval College, Dartmouth, must have been selected for one of four streams: Seaman, Marine Engineer, Weapons Engineer or Supply/Secretariat. After a communal period of basic naval training consisting of 3 months at Dartmouth, 3 months at sea in a training ship, and one year at sea in the Fleet, the training for each type of officer varies:

Seaman Officer - Returns to Dartmouth or a University for further academic training, then completes eight months of professional Naval courses.

Marine Engineer - Completes a three year degree-course at the Royal Naval Engineering College at Manadon, followed by a one-year Application course.

Weapons Engineer - Same as for Marine Engineer, but with weapon/electrical bias.


Chain of Command for a Royal Navy SSN
Commanding Officer
(Commander-X)
Marine Engineer Officer (MEO)
(LCdr.-ME)
First Lieutenant
(LCdr.-X)
Weapons Engineer Officer (WEO)
(LCdr.-WE)
Deputy MEO
(LCdr/Lt.-ME)
Sonar Officer, Navigating Off.
(Senior Lts.-X)
Deputy WEO
(Lt.-WE)
3 Assistant MEO
(Lieutenant-ME)
3 jr. Sea-man Off.
(Lts.-X)
1 jr. Supply Off.
(Lt.-S)
(Propulsion Department)
(Ops Dept.)
(Supply Dept .)
(Weapons, Electrical Department)

Supply Officer - The same for the Seaman Officer but his professional courses train him in supply and secretariat duties.

The Composition of the SSN Wardroom

The SSN Wardroom is also divided into the same four departments and the chain of command is as shown in illustration.

The Operations Department

This is the fighting/tactical department of the submarine and consists entirely of operators with no equipment maintenance responsibilities except for the traditional cleaning, painting and ship husbandry duties. The officers all have their watches in the control room and become tactical specialists. In order to fight the submarine effectively, they require a working knowledge of the whole submarine and therefore, although they are not qualified nuclear operators, they still require a firm grasp of the propulsion systems -- and this aspect is not forgotten in their training.

Seaman Officer's Training

The training of the Operations Branch Officers continues throughout their career in submarines. A typical career structure with the completion of basic professional courses might look like this:

Officers Training Class (4 months) - A basic introduction to a submarine, submarine systems and an introduction to submarine tactics.

Nuclear Greenwich Course - An introduction to reactor physics,

(7 weeks) reactor/propulsion systems and nuclear safety.

Joins the First Submarine

Part III Qualifications - On the job training. Consolidates all that has been taught. He will watchkeep in all positions in the submarine both forward and aft. On successful completion he is awarded his "Dolphins."

(4 months)

- Completes first tour at sea -
(Approx. One Year)

Submarine Warfare Course - Further tactical, weapons and sensor training enables officer to be competent Control Room Watchkeeper in a tactical environment.

(10 weeks)

- Second Tour at Sea -
(Approx. 18 months)

Submarine Specialist Course - Either Navigation or Sonar (ASW) Submarine

(10 weeks)

Advanced Warfare Course - Further tactical training. Enables officer to lead the Control Room Watch in advanced tactical situations.

- Third Tour at Sea -
(Approx. 2 Years)

Attack Coordinator Course - To teach the function of the First Lieutenant (4 weeks) in the Command Team.

- Fourth Tour at Sea as First Lieutenant of SSK (the Executive Officer) -

Commanding Officer's Qualifying Course - (5 months) All aspects of submarine tactics, attacks, and safety. Preparation for command of an SSK. A very testing course conducted ashore and at sea.

Commanding Officer of an SSK - (Approx. 2 Years) Promotion to Commander rank by selection

Nuclear Pre-Joining Training - (14 weeks) A full tactical refresher on all aspects of submarine operations and tactics -- including an introduction to surface ship tactics and strategic plans. This course also includes a refresher on Nuclear Safety and operations.

Commanding Officer of a Nuclear Submarine

Note:

(1) Any tour at sea may be in either an SSBN, SSN or SSK. The aim is to give most officers across-the-board training in all aspects of submarine operations during their careers.

(2) It can be seen that the Seaman Officer receives extensive tactical, sensor and weapon training throughout his career, giving him great

in-depth knowledge of all aspects of submarine operations by the time he aspires to command.

(3) The Seaman Officer, who can aspire to command, is not a nuclear operator. Thus, the CO of a nuclear submarine will have received no more than 9 weeks of nuclear courses -- where the emphasis is on nuclear safety.

(4) Marine Engineers and Weapons Engineers will never assume command of a seagoing ship of any type in the Royal Navy -- including submarines. Command at sea posts will always be filled by Seaman Officers.

The Weapon Engineers (WE) Department

This department is responsible for the maintenance and availability of all sonars, tactical data handling, fire control, weapons and navigation systems. The Royal Navy submarine service does not have an operator maintenance policy and the bulk of the ratings in the WE department will be artificers. The two officers in this department are fully qualified weapon engineers who on top of their detailed specialist knowledge obtain tactical experience by keeping watch in the Control Room. This mix of tactical and engineering knowledge is later in their careers used in the procurement and development of future sensors and weapons.

The Marine Engineers (ME) Department

This department under the MEO is responsible for all aspects of maintenance, operations and safety of primary and secondary propulsion systems and electrical power distribution throughout the submarine. All ME Officers have completed a post-graduate course in Nuclear Engineering and have had further training in applying that knowledge to submarines. They are all qualified Nuclear Plant Operators and regularly have to

requalify to satisfy the stringent requirements of the Nuclear Safety Directorate. Throughout their careers they keep watches in the Maneuvering Room although they do spend periods in the Control Room to enhance their ship and tactical knowledge to help them become more proficient in their understanding of the Command problems. The MEO is responsible to the Commanding Officer for all aspects of Nuclear Safety and advice on plant operation. There must be a regular dialogue between these two to ensure that the tactical and engineer's requirements do not clash. The MEO will be a very experienced Engineer and Nuclear Operator, having completed two or three tours at sea as well as shore appointments on Ministry of Defense/Flag Officers' Staffs or in Dockyard repair/refit duties.

Summary

The Royal Navy, as there is no line officer concept, splits its officer corps into four main specializations. This has the advantages of being able to train the officers to a great depth within their own departments and allows for the Seaman Officers to have great tactical experience in all aspects of submarine warfare. This split in specializations can lead to a split between forward (operations) and aft (propulsion). To avoid this, requires the Commanding Officer and the three main Heads of Departments, the First Lieutenant, MEO and WEO, to work together to ensure that all persons onboard understand what the submarine is trying to achieve and to plan their respective department's work and training to achieve it.

Commander James F. Perowne, OBE, RN

SOVIET DOUBLE-HULLED SUBMARINES

The Soviet Union is clearly the most active submarine producing nation in the world. It is building new submarines at a rate more than twice that of the United States. Moreover, the popular concept that the Soviet union is "technologically inferior" to the U.S. in submarine design is being challenged by many people, both inside and outside the Department of Defense. They cite improvements in the submerged speed, depth capability, maneuverability, and stealth of the latest Soviet submarines, as well as the innovative designs of the ALFA, OSCAR, UNIFORM, TYPHOON, MIKE and SIERRA Classes, as evidence that Soviet submarine design has come of age from a scientific and technical perspective.

Soviet submarines differ from their U.S. counterparts. One major difference is that the USSR continues to build submarines of double-hull construction, a practice abandoned by the U.S. in the mid-1960s. Critics of Soviet technical prowess and innovation cite this fact as evidence of extreme conservatism by Soviet submarine designers. Ironically, writings appearing in the Soviet technical and military literature explicitly challenge the wisdom of the U.S. practice of building single-hulled submarines.

A discussion of the Soviet rationale for building double-hulled submarines can determine whether the Soviet Union is bound by "design inheritance" as some critics maintain, or whether the USSR has developed a sound philosophy for continuing to use a traditional submarine design.

Combat Survivability: A Soviet Perspective

According to the American Heritage Dictionary, invulnerability has two definitions. The first listed is "immune to attack"; the second is "incapable of being damaged." The duality may

be seen in the usage made of the word by the U.S. and Soviet submarine communities. The U.S. relies upon the first definition to proclaim that its submarines are invulnerable; the Soviet Union applies the more stringent criterion dictated by the second definition.

From a U.S. perspective, an invulnerable submarine is undetectable and therefore "immune to attack" by enemy forces. If safety and reliability are also present, then the submarine is invulnerable to accidental damage caused by man and elements of nature. With these features in hand; i.e., stealth, safety, and reliability, the U.S. may be content to declare its submarines invulnerable.

The Soviets' view of invulnerability is different. It is dictated by the second definition. For the Soviet, it is inadequate merely to reduce the probability of attack through increased stealth, but the possibility of attack must be recognized and anticipated.

According to several Soviet authors, combat survivability, "the ability to withstand combat and accident damage and restore and maintain combat capability," is a basic characteristic of a submarine and must be provided for during the period "of a ship's construction, in the process of day-to-day operations, during repair, and even when in mothballs."[1]

Combat survivability, according to the Soviet philosophy, has two major aspects; defense of the submarine against the initial effect of weapons and munitions; and "staunchness" of the submarine to secondary damage caused by fires and flooding. This philosophical difference between the U.S. and Soviet submarine designers explains the rationale behind Soviet Rear Admiral-Engineer V. Droblenkov's claim that "foreign specialists fail to provide their new ships with adequate

survivability to withstand the harmful effects of contemporary and especially prospective weapons." He claims that foreign specialists "think that damage control should be provided only against accidental damage not associated with weapons effects," and that "they see no semantic difference in the concepts of reliability, safety and survivability."[2]

Admirals S. Gorshkov and V. Droblenkov, discuss in their writings the "eternal struggle" between trends in the means of destruction and trends in the protection of warships.[3] They argue for balance. Droblenkov is extremely critical of U.S. submarine design trends, noting that "the balance between the characteristics of survivability and performance, which had been achieved in the process of the century long evolution of submarines, have turned out to be disrupted."[4] He goes on to state that although the more recent U.S. nuclear-powered submarine classes have improved weapons systems, can dive deeper, and have higher submerged speeds, "no qualitiatively new, radical solutions in providing for the survivability of submarines have yet been made."[5]

According to Droblenkov, the U.S. in 1959 conducted a practical experiment to build a submarine with both surface and underwater survivability. He asserts that the double-hulled TRITON with its eleven compartments, and 36 percent reserve buoyancy represented the last U.S. attempt to build a highly survivable submarine.[6] While this interpretation of the rationale for the TRITON's design may not be correct, this example does highlight the overriding concern afforded submarine survivability by Soviet naval officers writing in the military and technical literature.

Soviet Rationale for Double-Hulled Submarines

Several reasons have been given for

abandoning double-hulled submarine construction in the U.S. The major argument is that for a given military capabiltiy, a double-hull design would result in a larger hull. This, in turn, would increase the drag of the platform, and thus require a larger power plant to maintain the same military capability. This argument is valid given the premise that combat survivability has only minimal military utility.

According to the Soviet literature, the benefits accompanying the use of a double hulls fall into the following categories: increased survivability, increased useful volume, reduced costs, and signature reduction.

Increased survivability occurs for many different reasons. First, the external hull will cause many weapons to be detonated away from the pressure hull, thereby reducing the impact of explosion. To complement this effect, it will also be possible to install special armor between the two hulls, which along with the equipment and various associated supply lines will further absorb the shock of an explosion. Increased survivability is also more available in a double-hulled submarine in that the added possibility for ballast tanks allows a damaged submarine to not only remain neutrally buoyant but also to maintain trim.

A double-hull design permits the use of external stiffeners for framing, rather than internal stiffeners used in a single-hull submarine. This leads to a space savings within the pressure hull and relaxes the requirement to smooth these frames, since they are external to the pressure hull. Air bottles, auxiliary propulsors, heat exchangers, and additional tankage can be stowed between the hulls, thereby freeing additional internal volume for other uses.

The Soviets also discuss placing highly

flammable materials between the hulls to avoid the secondary effect of explosions. They claim that weapons can also be placed external to the inner pressure hull. For example, torpedoes and mines can be launched silently by dropping them out of bomb-bay type hatches in a manner similar to that of bomber aircraft.

Double-hulled submarines also provide several opportunities to reduce costs. In the first place, the exterior hull, which is not a pressure hull, may be constructed of much thinner plates. Since shaping of the exterior hull is hydrodynamically important, the necessary shape can be more inexpensively formed in the thinner outer hull material of a double-hulled submarine. The inner hull or pressure hull can then be formed in the structurally desirable shape of a cylinder, which is also easier to achieve and better adapted to pressure deformation due to increased depth.

A further cost benefit occurs in that, if there is sufficient standoff distance between the two hulls, many future advances in technology may be simply retrofitted. Since many types of equipment may be located outside the pressure hull, the opportunities for retrofitting may occur several times during the useful life of the submarine.

Advanced technologies include various boundary layer control (BLC) schemes such as polymer ejection, suction, controlled heating of surface and gasification. The increased volume existant in a double-hull design affords the opportunity for the Soviets to incorporate and refine BLC systems on existing hulls. These BLC techniques have the potential of radically enhancing the military capability of the submarine at relatively low cost.

Signatures can be reduced through the installation of degaussing coils between the

hulls, baffling against radiated noise, the use of internal coatings on the exterior hulls, and by the use of BLC. These methods are most easily employed on a submarine of double-hull construction.

The Cost of Increased Survivability

The argument most frequently used to challenge the value of a double-hulled submarine is that a larger submarine must be built for a given military capability.

This need not necessarily be true. In a simplified case in which a submarine is approximated by a right circular cylinder, the volume (V) or displacement is given by $\pi r^2 L$. The wetted surface in terms of the volume of a submarine can be expressed as:

$$A = (16.\pi.\ V^2.\ \frac{L}{D})^{1/3}$$

where A is the wetted area
$\frac{L}{D}$ is the length-to-beam ratio

From the equation it is seen that a single-hulled submarine with a displacement of 3000 tons will have a wetted surface area of 1711 meters^2 if the length-to-beam ratio is 11. This ratio is generally representative of U.S. submarines.

From the same equation, a double-hulled submarine having exactly the same wetted surface area will have a 28 percent increase in submerged displacement over the single-hulled submarine discussed above if the L/D ratio is reduced to 7. Thus, in this case drag of a double-hulled submarine can be similar to that of a single-hulled version; and, in addition, have a standoff distance of about 0.4 meters to enhance

survivability.

Furthermore, the external non-pressure hull can be designed to optimize the hydrodynamic shape of the vehicle. It is more difficult to do this for a single-hulled submarine, since the thick pressure hull sections themselves would have to be shaped. A double-hull thus eases fabrication of the pressure hull, which can be simply a right-circular cylinder.

Furthermore, it can be shown that the cost in terms of speed, for example, for the ALFA to have a double vice single hull is modest.

The benefits afforded by a double hull accrue to the ALFA at a cost of approximately two knots. That is, a single-hulled ALFA could theoretically achieve speeds in excess of 44 knots given a single-hull design. In that at 42+ knots the ALFA is the fastest submarine in the world, there appears to be some wisdom on the part of Soviet submarine designers to trading off speed to enhance the combat survivability of this high value platform.

Observations

The longstanding and widespread Western perception that Soviet submarines are noisy and readily detectable may be due to the Soviet Navy emphasizing primarily combat survivability in their submarine designs. This insurance policy seems to have serendipitously provided Soviet submarines with a lengthy list of enhanced performance capabilities not enjoyed by their less survivable single-hulled counterparts.

M.W.

FOOTNOTES

1. Rear Admiral-Engineer V. Drolenkov, Candidate of Technical Sciences, and Capt. 1st Rank-Engineer

Yu Yakhaenko, "Has the Damage Control Problem Been Solved?" Morskoy Sbornik, No. 5, 1978, p. 80.

2. Ibid.

3. Ibid. Also see Soviet Union Flt. Adm. S. Gorshkov, "Certain Questions Concerning the Development of the Naval Art," Morskoy Sbornik, No. 12, December, 1974, pp. 24-32.

4. Ibid., p. 81. Also see Capt. 1st Rank-Engineer V. Droblenkov, Candidate of Technical Sciences, and Captain 1st Rank-Engineer Yu Yakhaenko, "The Survivability of Ships from the Ironclads to Our Day," Morskoy Sbornik, No. 2, 1977, p. 93.

5. Ibid., Droblenkov, 1978, p. 82.

6. Ibid., Droblenkov, 1978, p. 81.

SUBMARINE SCHOOL - A NOSTALGIA TRIP 1958 - 1984

This would have been written now whether or not Captain Bill Houley's summary of changes in the Submarine School curricula had appeared in the July 1984 issue of The Submarine Review. In fact, the idea of a return to my old command and after twenty-five years was germinated in a discussion with Bill at the 1983 Naval Submarine League Symposium. We didn't make it in 1983; we didn't make it on Bill's watch; but we did make it in August 1984. Captain Rich Enkeboll was an enthusiastic host.

Bill's article takes a load off me. I can concentrate on the things that intrigued me, and comment on a few things no one else can.

Item: The Basic submarine course is about three months. I was in the first three months, pre-WWII shortened course -- the one which introduced Reserves to the Force. (They were recruited for "a summer in New England", and some did not get back home for 30 years). The principal problem of that short course was what to eliminate from the previous six months course, what to save. When I returned as Officer-in-Charge in 1958, another policy question was before us. The nuclear course was in full swing but integration with the basic officer's course was not considered desirable. In fact, it was not until 1979 that the diesel course was eliminated; and the nuclear course subsequently polished to its present 3-month Basic and 5-month Advanced Configuration.

Item: School boats. There aren't any. There is neither time in the course nor force levels sufficient to permit daily or weekly school operations. Instead, alongside indoctrination is offered, but one of the unique features of Sub School is gone forever. No longer will the CO be able to assure the young wives that that diesel smell after a week underway is to be savored, not to be put instantly into the washing machine. (See N.L. Day, 20 June 1959).

Item: Trainers, and that's what I really went to see. They are miles ahead of 1960. The best advertisement of their worth is the fact that they are fully committed all the time on into the night. Back "then" we could not get the FC teams to use the attack teachers because they were too unlike the boats.

The present Navy trainer with its representation of Charleston approaches and channel, or New London or elsewhere, (in daylight or dark) provides better training than you could get at sea. It's realistic, it's quick, it's safe.

The venerable Port Washington Training Device Center won the battle to design a Polaris launcher trainer. It was not what the SSBN people or the school wanted, and it did not do the job. Witness today's four-floor launcher. That's a trainer!

Sonar trainer -- BQQ-5 or 6 just like the sonar room on board. Historic comparisons are unfair because there is no contest. However, integration of the BQQ-5 into the FCS MK 117 isn't complete, so there is still a way to go. Nonetheless, it was impressive to watch TREPANG's attack center and sonar teams engrossed in an ASW attack.

Diving trainers look the same although they are configured and programmed for the latest classes. Yet, the Chief-in-Charge says upgrading of all trainers is delayed by lack of funds. So what's new?

Item: Gilmore Hall decor has changed.

The big WWII German paintings are gone and replaced by a collection of nuclear submarine photos. Not wrong, perhaps, but the staircase is no longer unique. There are lots of places with SSN/SSBN pictures. There was only one with those paintings.

Class photos are reduced from all to three because wall space ran out. Rich Enkeboll selected the first class of ten stalwarts 1917-18, his class 107 -- in which I am front and center as the Officer-in-Charge -- and Jimmy Carter's class! But the model of the Holland is still on display. It was presented to the school by Mr. Floyd Houston of the Goldsmith and Tuttle Shipyard of Orient Point, Long Island on 9 June 1959, the day GEORGE WASHINGTON (SSBN 598) was launched. RAdm. Freddie Warder and Judge Eller, the Navy historian, and I were at the ceremony. It is not well known that John Holland did some of his

construction work at a predecessor shipyard on Long Island. (To prove that this was an event of importance to Naval History, I report a recent meeting with Judge Eller at the Naval Academy. I mentioned the presentation in 1959. Not only did he recall the day; he instantly added that Mr. Houston was the model-maker!)

Item: The Officer-in-charge is now the CO. This change was suggested during my tenure but did not take place until Captain Lee Rathbun had the job in 1969. (In fact, his is the last name on the O in C plaque, and the first on the CO plaque). There are myriad advantages of an independent command for the school -- policy, different chain of command, discipline, budget, and on and on. But there is a unique story about O in C/CO Submarine base relationship.

In 1959, the school ran a contest amongst staff and students for a design of a school plaque (everyone else had one). After a spirited competition, the winner was the wife of a Basic Oficer student,. We presented our fait accompli to CO Subase, Captain Weaver Garnett, only to be rebuffed. His rationale, fair enough, was "one Base plaque is enough". So, we waited three months until Captain George Lautrup took command, carefully hiding recent records did the trick, and the school plaque was launched. It depicted a WWII submarine as shown in Sketch A below, (or maybe it was NAUTILUS?) In any event, it has been modernized as in Sketch B. but, it's encouraging to see that tradition, even twenty-five year tradition, is real.

Item: Another tradition. In 1960 as I prepared to move down river to command FULTON, my son was graduating from New London High School. I decided the school could publicize its mission, and recruiting and emphasize the importance of education by awarding annually math/science prizes to five local high schools. I was pleased to

SKETCH "A"

SKETCH "B"

learn that that tradition still lives -- and, in 1984, the prize was given in eight schools.

Item: Tradition abandoned. The Subase New London landmark has been the Diving Tank. Alas, when funds are available, it will be torn down to be replaced by a swimming pool type escape facility. That means there will never again be an OMNIBUS TV documentary on the Sub school. Never again will Esther Williams have a chance to swim in the tank as she overplayed her starring role as hostess for the 1958 show (See TIME; 17 November 1958). Never again will Alistair Cooke, of current Masterpiece Theater TV fame, write to commend the school for its masterful handling of a major crisis by stating that "The School Staff performed above and beyond the call of duty in defending against a double-breasted attack".

It is exhilarating to see a former command vibrant and moving forward successfully in an era of increasing complexity in submarines and submarining. What I saw made me both proud and pleased. In contrast, a visit to my WWII command, DRUM (SS228), at Mobile's Battleship Park, left me with empty feeling that a fighting ship should not end its days like that!

M.H. Rindskopf
O in C Submarine School
June 1958 - 1960

DISCUSSIONS

A HYBRID SUBMARINE?

There have been many challenges to our nuclear submarine program, along with the recommendation to go back to building diesel submarines. Having commanded a diesel boat and two nuclear submarines, building diesels could never by my choice.

It is, however, suggested that a hybrid might be developed which is basically a battery boat with a constant charge from a smaller than a peak-load reactor. The load profile would be an erratic one but the reactor need only be sized to provide an average load. The battery should be big and should be sized with the main motor for peak loads. In this manner the peak average is accommodated by the battery using only a moderately sized reactor, which can be of more simple design because of its constant load operations. By decoupling the hull and propeller from any reduction gear, a super-quiet boat can be built.

This is suggested in lieu of going back to diesel boats. This kind of submarine could not transit as fast as the 688s but it could provide a quiet, effective submarine for appropriate missions. High speed transits make for maximum vulnerability.

One of our biggest problems in the utility nuclear industry is energy storage. Our nuclear generators produce energy at least cost. But, without adequate energy storage arrangements we have to design for peak loads. I believe a load averaging such as described above would be great for us in the utility business except that we could not economically afford the size and capacity of battery to do the job.

I learned a lot in Tullibee*; transit was the only place I needed more speed. Once on station it was the detection capability and the weapon capability that became my limits. I never felt that I had to run like blazes and bite the opponent. In World War II, I was fighter director on an aircraft carrier where we always brought the fighter to the point where his machine guns could do the job. But with our current weapons there is no use in reverting to a fighter concept like that. We should let our weapons do the work and

not jeopardize a whole boat and its people when it is not necessary.

Dick Jortberg

(*Ed. Note: Tullibee is a small, low-speed nuclear submarine of 2500 shaft horse power.)

A PSYCHOLOGICAL WEAPON -- THE MINE

An enemy mine is basically a psychological weapon. Amid an atmosphere of billion dollar high tech weaponry the underrated or ignored mine can wreak havoc with ship deployment options. The psychological potential of the underwater mine, whether it is a moored, bottom, contact, magnetic, acoustic, pressure or other type, is enormous. Thus, the ability to project a mining threat into enemy waters may be critical. Recent deployment of mines in Nicaraguan harbors have emphasized a single fact: a shipping area is literally paralyzed if the possibility of it being mined exists.

Psychological pressure on an enemy can be applied by the mere suggestion that an enemy aircraft, a surface ship, or submarine might have been engaged in mining. It is easy to visualize naval ports being effectively bottled up by the faked use of this psychological ploy. Moreover, current mine-sweeping assets would be severely taxed to meet any large scale mine scare -- one carried out in several port areas, and which would result in a paralyzed fleet or an overly cautious deployment of fleet units.

We should seriously consider the potential of quality mining by submarines. We should demonstrate this submarine "ability" to project sea power. We must realize that the enemy's

assets in this area surpass ours. We know that he sincerely believes in mining as a principal method of projecting force, as is evidenced by the size of his mine stockpiles. It is equally obvious that the enemy respects the potential of the tactical and psychological warfare resulting from use of this weapon. His superior mine sweeping assets are evidence of this.

As a submariner, thoughts of conducting a minelaying operation never engender a feeling of pleasure or confidence. The mission will always be conducted in hazardous waters at slow speeds and noisily -- all detrimental factors. The navigational problem is also a concern, since an improperly placed minefield becomes hazardous to all forces including our own.

Setting aside the operational aspects of submarine mining, there are still psychological aspects at play for the submariner assigned this mission.

Since the dedicated schooling and allotted at-sea training time for mining is minimal, the importance of mining is downplayed in one's mind. Lack of high level concern with this training deficiency is also disconcerting. The "mind-set" against mining -- at all levels -- needs correction.

Another adverse psychological reaction is that since submariners are basically trained to shoot torpedoes, there is a resentment to filling valuable skids with mines. Torpedoes are more exciting and more easily understood. Reviewing the historic record of World War II, the most vital of all statistics in the submarining trade, was "TONNAGE SUNK". The mark of a submariner's success was tonnage. Good torpedo placement was the only acceptable gauge of a submariner's expertise.

These two factors, lack of mining training and the fact that mines are passive weapons which reflect little on the quality of professionalism, cause submariners to respond with limited enthusiasm or even disinterest to a mining assignment. Although these factors are usable to justify an attitude, submariners slight an invaluable tactical and psychological tool which can be used to project sea power in modern naval warfare.

The time has come for a reconsidering of submarine mining capabilities and an overcoming of a generally unfavorable attitude towards this mission.

James R. Kennish

IS IT TIME FOR THE ONBOARD SURVIVAL CHAMBER?

Man has established anniversaries to remind us of things past both good and bad. Through this method we can celebrate the good and recall the unpleasant insuring that if mistakes were made they will not be repeated.

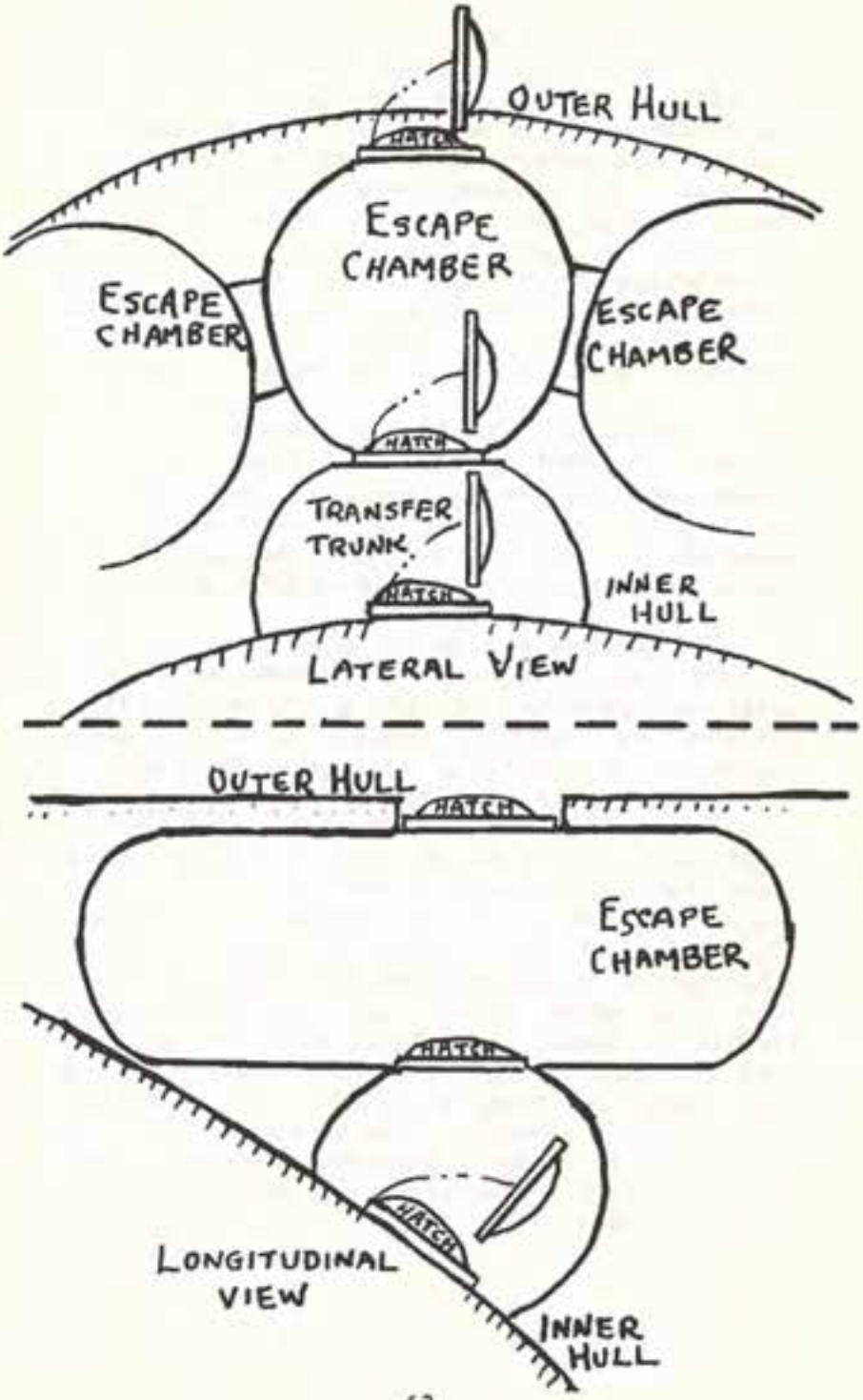
Rear Admiral J.B. Mooney, Jr., recalled his personal memories on the 20th anniversary of the Thresher's loss ("The Submarine Review" of July 1983) and concluded by saying "....between then and now our Navy and our Nation were moved to action not only to make our submarines safer, but also to develop the ocean science and technology which offers far better opportunities to find and rescue submariners in peril."

The most significant contribution to improved rescue methods since the disaster was the development and activation (approximately 15 years after the Thresher loss) of two Deep Submergence Rescue Vehicles (DSRVs). It would seem that the

DSRV, with an operating depth of 5,000 feet, is the ultimate system for rescuing crew members trapped in a submarine on the ocean floor when onboard conditions permit waiting for its arrival. Other rescue methods with considerable less operating depth include the McCann chamber with operational requirements similar to the DSKV, and free ascent, which involves some risk to personnel at shallow depths and affords no protection from exposure once the surface is reached.

The only significant factor challenging any remote system and the men who may be trapped is....time. Time to locate the casualty, time to alert the system, time to transport the system and time, weather permitting, to mate with the stricken submarine. Time is the enemy, especially when onboard conditions may involve toxic gases, limited life support systems, cold temperature, or flooding. If a survival chamber were installed onboard, the crew of the distressed submarine could, after accurately evaluating the conditions onboard, decide to reach the surface at any time without the aid of remote systems. Life support on the surface (protection from exposure and predators) would depend on the equipment cycled to the surface and the use of the chamber itself. Once the surface has been reached, the crew could radio their location for rescue by aircraft or by ship of opportunity, while pinpointing the exact location of the submarine for possible salvage operations. Simply stated, the onboard chamber would give the crew a highly reliable alternative to waiting for the DSRV system to arrive.

The concept of a submarine onboard chamber is far from new. Several patents have been granted dating back to 1926. All such devices use a cable and winch to raise and/or lower the chamber. The Federal German Navy has recently installed an on board capsule on their Type 2000 submarine. Because of the Type 2000's small size of 2370 tons, its entire crew of twenty four can be


OUTER HULL
HATCH
ESCAPE CHAMBER
ESCAPE CHAMBER
ESCAPE CHAMBER
HATCH
TRANSFER TRUNK
HATCH
INNER HULL
LATERAL VIEW
OUTER HULL
HATCH
ESCAPE CHAMBER
HATCH
HATCH
LONGITUDINAL VIEW
INNER HULL

evacuated at one time. In addition to small chambers requiring repeated trips to the surface, preliminary designs are also presently available for escape chambers capable of transporting entire crews of approximately one hundred crewmen to the surface. The chambers whatever their size or number onboard the submarine, should be designed to serve as part of a ship's access. The illustration shown suggests the use of a 3-part chamber to carry an entire crew to the surface. This onboard chamber system would fit in the superstructure above an escape hatch.

Obviously an onboard chamber could not replace the DSRV system until such time as all submarines have onboard chambers. This could take as long as twenty years. Backfitting is a possibility however on FBMs because of the chambers' adaptability to the superstructure.

The primary reason for considering a chamber at this time is because a new submarine design is under consideration, affording the opportunity to evaluate and shortly install such an onboard system — or something similar. Naturally the reliability of the onboard chamber would have to be proven. Noise, vibration and hydrodynamic requirements would be critical if the chamber was to be installed forward of the sail. (The onboard chambers shown could be carried in a flooded condition and then blown when put to use -- compensation being effected by flooding into the room from which escape was made.) Problems similar to those encountered with the no longer used messenger buoys would have to be resolved. But taken in today's context of significant technological advances, there should be little doubt that an onboard personnel survival chamber can be designed, installed and working within a relatively short time.

Paul Andino

A FABLE FOR THE SUBMARINE REVIEW?

John Keegan in his book Face of Battle describes the preparation for and the initial results achieved by the British in the Battle of the Somme in World War I. He noted that the most expert British Army analysts and planners applied their best knowledge of artillery fire and infantry tactics to ensure the British occupation of the forward German trenches -- which were only 4000 yards away from the British trench positions.

An "elaborate artillery fire plan was developed along with a very simple infantry tactical scheme." The British analysts figured that about a million and a half shells (only 20,000 were used by Napolean at Waterloo) fired over a week-long period and directed at the German trenches and some of the approach routes to those trenches, should "scythe flat" the enemy's barbed wire protection, "batter the German's artillery batteries into silence", and "entomb the enemy's trench garrisons in their dug-outs". Keegan notes that this army optimism was due to the fact that "it was a trusting army" which "believed in the superiority of its own equipment over the Germans".

Then, after the week-long bombardment, a "barrage" consisting of a curtain of exploding shells preceding the infantry -- with carefully timed "lifts" -- could take the body of infantry it was protecting through the enemy positions in the forward trenches "without suffering a single loss from enemy infantry fire."

Although the initial bombardment plus the "barrage" -- some 2,960,000 artillery rounds -- were analytically shown to cut big holes through the German barbed wire implacements, bury the German infantry in their deep dug-outs and allow the British infantry to get to the German trenches

unharmed, the assault by the British infantry across "no man's land" on July 1, 1916, found most of the barbed wire as well as the Germans in their trenches still intact, and the German counter-fire devastating. The shrapnal shell of that period with its slow acting fuse tended to waste itself in the ground under the wire entanglements and the trench bombardment shells, although creating devastation and chaos on the surface, failed to bury the German troops. Keegan notes that, "The shell which the British guns fired at the German trenches, like those which a month earlier had broken up on the armoured skins of the German battleships at Jutland were the wrong set of projectile for the job."

The great slaughter of British troops for the very little gained in occupying German trenches made this one of the greatest fiascos of warfare. Yet, the British systems analysts had done a tremendous analytical job on the artillery plan -- which was then accepted with considerable optimism by the British Army's high command.

This is a fable of weapons -- weapons which were overrated as to their effects, and the systems analysis which proved the effectiveness of the weapons. One might only wonder if our submarine weapons -- the antiship Tomahawk with an armour piercing warhead, the MK 48 with only about 600 pounds of high explosives, the stand-off ASW weapon with an even lighter warhead -- aren't causing similar delusions of effectiveness?

R.R.R.F.

NEW IDEAS CORNER

DYNAMIC CONCENTRATION

The "Laws of Lanchester" state that the power of combat force varies with the square of the

number of units in the force. This is true if the force has the "power of concentration." The power of a non-concentrating force however varies directly with the number of units. Most importantly, victory of a concentrating force tends to be fast and total.

Lanchester analysed a large number of land and sea battles to derive his laws and predicted their importance in air war as well. Various battles of WWII have seemed to confirm his "Laws." In WWII, well-run surface escort forces occasionally approached the level of "concentrating forces." So did submarine wolf packs on both sides, as long as they were able to make the necessary speed in night surface attacks. At the height of the "Battle of the Atlantic," Admiral Doenitz, although lacking adequate air reconnaissance support, used submarine contact reports on convoys, despite the danger to his submarines from their DF'd transmissions. Concentration to Doenitz was more important than U-boat safety. And their safety would involve the possibility of collision as well.

When submerged, WWII boats were too slow, their weapon ranges were too short and they lacked communications to be "concentrating forces." Since WWII, however, these restrictions have been removed and modern submarines now have every characteristic required for concentration. This is especially true if backed by air and satellite reconnaissance.

The questions are: Do we know how to run a campaign of concentrating submarines? Have we practiced this in peacetime? Is additional equipment required?

I can recall two past occasions where concentration of submarines was needed and it was not achieved. On the first, I was Exec of the SALMON on her last patrol and in a Wolf Pack off

the east coast of Formosa. It was evident from intercepted radio traffic that a hell of a battle was being waged by the U.S. carrier forces near the Phillippines. There were several dozen submarines full of torpedoes between the battle area and Japan. Yet no effort was made for days to get them into the fray. Finally our Wolf Pack was directed east to intercept any ships headed toward Japan which were fleeing from the "Second Battle of the Philippines." The TRIGGER, the lead ship in our Wolf Pack column, soon spotted the tops of a battleship headed north. None of our submarines could catch it. But SALMON did later get a Japanese tanker which had fueled the battleships at Okinawa.

At a party in San Francisco some time later, I met Admiral Mark Mitscher and his new Chief of Staff, Capt. Arleigh Burke. Mitscher had been my skipper in HORNET a couple of years earlier, so I made bold to ask why had the Japanese battleships gotten away? He gruffly said, "You ask too many damn questions." With an embarassed, "Sorry, Sir," I backed off, repenting my gaffe. Later in the evening, Admiral Mitscher motioned me into a room where we were alone. Then he said, "Our bombs bounced off the battleships and we had run out of torpedoes. And if you are wondering why your submarines weren't in the battle, things were happening fast and we didn't know how to bring them into action."

In 1951 I was CO of TRUTTA, one of four fleet boats in a fleet exercise off Greenland. The submarines were to oppose a southbound surface task force making about 15 knots. The Officer in Tactical Command disposed his submarines in a patrol line perpendicular to the intended path of the target force. Because of reduced material readiness due to years out of overhaul, CROAKER was put into the center of the line, where she would probably require the least running. Her skipper was a canny, poker playing, lobster-loving

tactician. He was credited, as I remember, with 8 successful attacks during the war games. I think one other boat got in one. The rest of our submarines ended up running on the surface at high speed in lanes parallel to the target's line of movement with no hope of getting in attacks under the exercise rules. Safety and frustration were mutually guaranteed. But a lot was learned about surface operations in heavy icing conditions.

It is highly probable that in the next war merchant ships will continue to be concentrated into convoys and naval ships into task forces. Even nuclear submarines are likely to be concentrated for mutual defense. It will then be necessary to concentrate submarines against these concentrated targets. In doing so, the need for submarine radio transmissions should be eliminated since they are probably more of a hazard than ever before. Collisions and the danger from friendly weapons must be minimized, and maximum tactical flexibility must be provided to each CO — including reduced speed of advance for his submarine when searching for the enemy.

A system of equipment should be developed to prevent collisions mainly for peacetime. This system should be designed to reduce vulnerability to friendly weapons in war as well. It could be an all around, high power, coded, very high frequency sound beacon system with an assured short range for collision avoidance and weapon IFF. With such a system, exercises involving the tactics of concentration needed in war could be conducted safely in peacetime.

Then, a system of submarine control could be refined today, using computers.

The objectives of such a system design would be:

- To enable the Oficer in Tactical Command in one

transmission to order any number of submarines into a coordinated attack against a target force, surfaced or submerged without his detailed knowledge of the submarines' positions.

- To enable each available submarine to proceed with search, approach, attack, and evasion without making any transmissions -- unless important to the attacks of other submarines.

- To maximize the concentration in time and space of the submarine attacks without risking collision or weapon interference.

- To make attacks as early as possible consistent with the above.

- To provide for near simultaniety of attack by long ranged and short ranged weapons.

- To provide for depth separations in case of probable melee.

- To provide for a reorientation in case the enemy changes his PIM -- path of intended movement.

The format for this coordinated attack doctrine could be a large set of transparent chart overlays. Each would be a family of colored-coded curves of relative movement of attacking submarines relative to a target force. The Commander's order would give an attack-time and position as well as a PIM of the potential targets, plus a specified overlay to be used. Each submariner would then find his sub on the overlay and know what courses to steer and the speed to be made as well as other items of doctrine.

The curves on each overlay would vary with the size, speed, disposition of target force, approximate number of attacking submarines, weapons to be used, expected detection range of

target, and the expected counter detection range by target.

One of the main advantages to a stored doctrine of this kind is that it can be tested in peacetime and altered with lessons learned.

Since the curves envisioned would be computer generated, it probably makes more sense to store the information in a computer with updating/programming from the Commander's attack message. It is likely that the whole doctrine could be stored on a 10 megabyte Winchester disc, usable with many of today's micro computers. It might even be piggybacked onto the Mk117 Fire Control System.

As doctrine is changed with experience, the changes would simply be entered as messaged patches.

It seems probable that after the above doctrine had provided an initial attack, a melee would develop -- with the target forces in close contact with the attacking submarines. When this happens, a whole new situation would apply. Then, close cooperation between submarines requiring overt communications by UT (underwater telephone) or active sonar would normally be required. In the melee, the above mentioned sound beacon should prove invaluable as the attacking submarines are forced to adopt tactics more like those of fighter planes than submarines -- and short range weapons become decisive. Again, peacetime practice is likely to determine who wins in war.

If the next war develops with the speed anticipated, there will be insufficient time to evolve tactics by individual submarine experience followed by the slow process of critique and distribution of patrol reports.

We'd better get it right the first time.

R.B.L.

GATO-A SUBMARINE SIMULATION FOR MICROCOMPUTERS

What can the microcomputer, sometimes called the personal computer or table-top computer, do for the advancement of submarining in today's Navy? Since the middle 1970's when the "personal computer" first appeared in the market place, this marvelous invention has swept into our culture with no apparent constraints. A variety of new programs for these computers are being developed by very creative people. One such program recently packaged for public use provides one way these computers might help the aspiring submariner.

GATO is a submarine simulation program, in full color, written for the IBM Personal Computer. It has been produced by Spectrum Holobyte, Inc., 2006 Broadway, Suite 301, Boulder, CO 80302, and sells for $39.95. It is a fairly realistic simulation of a WWII GATO-Class Submarine operating in the Pacific Theater.

This program has vivid graphics that display the essential instruments for navigation and attack of enemy shipping, as well as remarkably good simulations of periscope, radar and visual images of the environment. The program provides command directives for classified patrols in areas viewed on a patrol chart. Enemy movements are conveyed to the submarine command. The time frame for patrolling has been compressed somewhat, but when the enemy is engaged the rapid sequence of events tests the tactical skills of the participant in a most realistic way. The consequences of poor judgement, sloppy decision-making, or over cautiousness are

impersonally penalized, while increased quality of performance shows up graphically with hits and ships sunk.

There are several ways this program and the personal computer should be an important adjunct to the development of submarine skills. This writer has been using the "personal computer" for the past five years. The variety of things it will do is awe inspiring. As a former submariner I can visualize many ways it could have helped while at Submarine School, qualifying at sea and for command, and at sea in command. It is a tool that amplifies what ever it is that one does creatively with the mind.

The interactive aspects of the GATO program introduces one to the immediate feedback feature of the computer. While the key commands are not complicated, they do give the user a feel for the way the computer accepts information and operates on it. The GATO program does lack the realities of submarining at sea...the salt spray, the roll and pitch of th deck, the dripping of water over one's face at the periscope, or the full impact of the depth charge attack. But the dynamics and mental gymnastics of the problem facing the patrolling submariner are there in full and moving color.

While this edition of GATO uses a World War II diesel submarine as its model, there is no reason why it could not be upgraded to the characteristics of the state-of-the-art SSN or SSBN submarine, with the parameters of the expected adversaries. As an aid to the newly arriving officer at Submarine School who lacks the experience of several years at sea in surface ships, this GATO program would provide a valuable self-paced introduction to the basic submarine problem. In addition to this capability, it would provide a way for showing the curious submariner the marvelous flexibility and versatility of the

personal computer, and perhaps speed the day when all submariners aspiring to command will have as part of their gear, a personal computer as essential to them as the ISWAS was to WW II submariners.

Capt. Charles H. Hoke, USN (Ret.)

(Editor's Note: I played this computer wargame with Charley one Saturday afternoon. It was a truly enjoyable experience -- with a lot of nostalgia mixed in for my WWII diesel-boat experiences recalled by the computer's actions. Starting with a 2 level of difficulty, I went after a seven-ship convoy which seemed about forty miles away at the start of the problem. On the surface, at night, and at 18 knots, I was able to close two big merchantmen that had quickly dispersed and fled as my sub was apparently spotted charging into the convoy. Torpedo shots up the kilt were hits and the ships were scratched. Then I foolishly chased the lead ship which, when I got too close, turned out to be a destroyer. (I should have guessed that.) Down we went and the sounds of his pinging (which you can hear) were right on my sub. Too late I told Charley to "take her deep." Before we passed 100 feet, the screen showed us breaking up from a successful depth charge attack, and the water on the screen rose over the instruments as well as us. At this, the computer asked, "Do you wish to play another game." We did!

Next game, I took only single radar sweeps, and when at periscope depth exposed my scope only briefly. This time we nailed a destroyer broadside to, and later got one of the ships he was escorting.

Below level 5 of difficulty, it was easy to mentally play out the relative movements of the ships involved and to gain excellent shooting positions. This was so, because good tracks of

our own sub as well as for the enemy ships -- even at long ranges -- were available from an area readout and could be used to check the progress of an attack. But above level 5 -- and we finally tried the highest level, 9 -- the tracks of the enemy were not available except at very close ranges. This made the game really tough -- but very realistic from what I remembered about WW II attacks. It took lots of conceptualizing as to where the enemy might be going, when to risk a radar sweep or a periscope look, what closing speed to use, how to navigate to clear some intervening islands, etc. Then, at level 9 the enemy had cracked our code and could spoof our messages, and wolf pack quack quack in the clear could get one suckered into accepting some bad dope cooked up by the enemy.

I felt that at level 9, I could only do a good job on the mission assigned by knowing the time constant involved....20 to 1 ?....40 to 1 ?....and the dimensions in miles of the quadrants where the action was taking place. Although in the GATO game these two factors are only relative because, according to Charley, various computers have various operating times, it does seem possible to establish both parameters for the particular computer in use by a test run. Then, unlike the computer chess game I have at home where Black at level 8 always beats me, this GATO game at 9 might be mastered with a good deal of practice.)

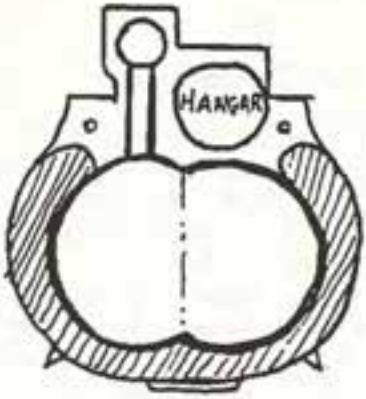
AN AIRCRAFT-CARRYING SUBMARINE?

A newly awakened interest in aircraft - carrying submarines has been generated by the article "Sink The Navy" by Charles Pease. The Japanese I-400 is an example of such a sub from WW II. The I-400 was one of four 5,223-ton, diesel

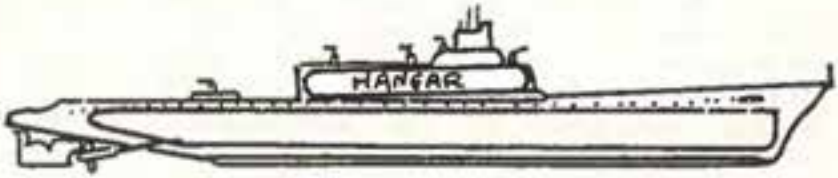
electric submarines which were completed during the war for bombing missions at great ranges away from their home base. These subs were 400 feet long with 39 foot width, provided by a double hull construction -- the inner hull consisting of two cylinders side by side, making a figure eight configuration, as shown in the illustration. These aircraft carriers had a surfaced endurance of 37,500 miles at 14 knots and carried three small Seiran-type aircraft each of which could carry an 800 Kg bomb to its objective after the planes were catapulted out of the main deck hangar -- which was 34 meters long and positioned at the side of the conning tower as shown. The planes could be fitted with floats if it was desirable to retrieve them after a mission.

Near the end of World War II, plans were laid by the Japanese to have aircraft carrying submarines conduct a bombing raid on the locks of the Panama Canal. But this mission was aborted in favor of bombing the gathering of U.S. ships at Ulithi Atoll. However, this mission also never came to fruition as the War suddenly ended after the nuclear bombing of Hiroshima and Nagasaki.

Although antiship and land attack missiles, launched from today's submarines, can accomplish much of what was expected by the Japanese in the way of surprise bombing of shore targets, there are missions today for which it would be highly advantageous to have manned aircraft of high performance operated from a submarine. Certain shore targets can be so camouflaged against the homing seekers of missiles as to necessitate a manned aircraft application -- where a human being on-the-spot can do intelligent bombing. And, a submarine lauching manned aircraft may be necessary to neutralize AEW aircraft and destroy manned bombers in the outer air battle. Hence, how a submarine like the I-400 might be updated with nuclear power and Harrier-type VSTOLS, can be readily imagined. Perhaps a VSTOL study of the



CROSS SECTION
of
I-400 CLASS



OUTBOARD PROFILE

character and applicability of an aircraft-carrying submarine is now in order?

This material was digested from SUBMARINES OF WWII, by Erminio Bagnasco, Naval Institute Press, 1973.

IN THE NEWS

o On Bill Buckley's TV Program "Firing Line," 24 June, the Science Advisor to the President Dr. George Keyworth, noted that the Soviets also had supersonic nuclear land attack cruise missiles on their attack submarines. (The U.S. announced the deployment at about the same time of the Tomahawk nuclear land attack missile on "at least two U.S. attack submarines.") When Buckley questioned the speed of the Soviet missiles, Dr. Keyworth reassured Buckley that they were supersonic "of almost mach 3 speed."

o Relative to the above item, a Washington Post article by Walter Pincus on June 26, 1984 notes that "The House last month attached an amendment to next year's defense spending bill banning deployment of the sea-launched cruise missile until the Soviet Union deploys a similar weapons system."

o Sea Power magazine of July 1984 notes that the Senate Armed Services Committee has directed the Secretary of Defense to report back on the pros and cons of building diesel-electric submarines in U.S. shipyards for friendly nations. This directive apparently stems from reports that the U.S. Navy has "frustrated attempts by the Israeli Navy to contract with U.S. builders for non-nuclear submarines." The Committee at the same time cautioned that such submarine construction, "Shall be limited to foreign designs

only, and is not to be undertaken by the Navy's own shipyards or in private yards presently engaged in building nuclear submarines for the U.S. Navy."

o A major naval munitions storage depot at the Severomorsk naval base adjacent to Murmansk, is reported by Jane's Defense Weekly to have exploded on 13 May with the loss of some 200 people. With destruction of this ammunition depot, the Soviet Northern Fleet reportedly lost two thirds of its stockpile of antiship and antiair missiles, torpedoes, and ASW ordinance. The effect of this disaster is believed to have crippled the Northern Fleet's operation for the next six months and is "the greatest disaster to occur in the Soviet navy since the Second World War." A later edition of Jane's Defense Weekly listed six other major explosions at other Soviet bases in the last seven months, including one at the Severomorsk Naval Air Station and one at Wismar, East Germany on the Baltic Sea. The New York Times of July 11 additionally lists some of the weapon losses in the May 13th explosion at the Severomorsk base, as derived from Jane's Defense Weekly -- "About 320 of 400 SSN-3 and SS-N-12 long range antiship missiles" used by Echo submarines, "nearly all of about 80 SS-N-22 submarine-launched antiship missiles which are capable of carrying nuclear warheads" and "an undetermined number of SS-N-19 missiles -- used by the Oscar Submarine."

o An article by Richard Barnard in Defense Week of Monday, July 23rd lists nine new classes of attack, cruise missile and ballistic missile submarines which are expected to be produced by the Soviets by the year 2000. Barnard says, "According to Pentagon experts, these advances threaten to slash the U.S. Navy's existing advantage in the combat effectiveness of attack subs." The new classes comprise (1) an improved Typhoon with a 6000 mile missile; (2) a cruise missile firing submarine of a third less tonnage

than the Oscar and of 40 knots speed; (3) another SSGN with two nuclear reactors and "armed with land attack and antiship missiles and SS-NP-X homing torpedoes,"; (4) a 4000 ton diesel-electric sub with top speed of 20 knots and 1300 ft. operating depth and armed with "existing missiles and wake following torpedoes,"; (5) a diesel-electric with submerged speed of 24 knots and a new SS-NP-X missile; (6) a nuclear attack sub, possibly the Sierra recently "identified by the Pentagon," of 7200 tons and armed with the SS-N-21 cruise missile; (7) a 5000 ton nuclear attack boat with titanium double hulls, of over 49 knots, and operable at depths greater than 2000 feet, with tube-launched cruise missiles; (8) a 6900 ton, steel double hulled, nuclear attack boat with speed of 45 to 50 knots. (Ed. Note: these nine new classes represent only evolutionary changes to existing Soviet submarines and scarcely reflect the trends in Soviet submarines suggested by the Soviet Submarine Trends article in the April edition of the Submarine Review. For example: by the early '90s, a projection of attack submarine trends would show a new small Soviet, SSN class of possibly a fiberglass hull, of about 2000 tons, with speed of about 60 knots and depth of about 4000 feet. Also, the follow-on to the Typhoon would have considerably more than 20 launch tubes. By the year 2000 such trends would lead to scarcely predictable, radical new classes -- which if reflecting developments over the past sixteen years, would have little resemblance to an evolution of present submarines.)

o The New York Times of August 15 reports that an unidentified submarine dragged a British trawler around the English Channel after getting entangled in its nets. The Royal Navy guessed it was a Soviet sub or one from another Warsaw Pact country. The 34 ton trawler was dragged backward in various directions at speeds of up to three knots, despite the trawler making full speed ahead

on her screws. After three hours of being towed, the crew was ordered to cut loose the trawler's net. (Ed Note: See Dick Laning's thoughts on how old Polaris boats might be used to deliberately net enemy submarines -- in this issue.)

o The House Armed Services Committee in its committee report expressed concern that "The Soviet Union has demonstrated more capability in deploying new generation submarines within the past decade than the U.S."..."and has requested assurances from the U.S. Navy that its attack submarine development program will maintain a technological lead over similar Soviet submarines." To this end, the committee has added $30 million to the '85 budget "to advance the state of submarine technology in coatings, propulsion, hull design, construction, and new techniques to ensure that the new design attack submarine would maintain currency as the threat matures."

o An article by Walter Andrews in the Washington Times of 16 August claims that the Soviets are able to detect U.S. subs by means of space-based radars. This new detection capability, the author claims, has been documented in reports from the Defense Intelligence Agency, US Air Force Intelligence and the National Security Agency. "For more than a year the Soviets have been conducting experiments -- using synthetic aperture radars aboard the Salyut manned space station and special aircraft OO to locate and track their own Delta-class ballistic missile submarines operating at depths of 200 to 300 feet off the coast of the Soviet Union." Unidentified government sources are quoted as saying that "the advanced radar has the ability to detect surface 'signatures' caused by moving submerged structures or the currents moving over them." One source said that the National Security Agency reports that "the U.S.S.R. has an operational space-based ASW detection capability," despite other

intelligence agency evaluations that an operational deployment of a space-based radar capability to detect deeply submerged submarines could still be a decade away. It is futher noted that the synthetic aperture radar demands a great deal of power which must necessarly be supplied by an onboard nuclear reactor.

o An article in the Wall Street Journal by Staff Reporter Gerald F. Seib, notes that the Navy expects to receive competitive proposals around the end of the year from General Dynamic's Electric Boat Division and Tenneco's Newport News Shipbuilding for the design of the new attack submarine -- the SSN 21. This new submarine, to be first produced in 1989, "will be designed to operate more quietly than any submarine in the world and will carry twice as many weapons as the Los Angeles class submarines" -- the 688s. The first unit is planned for completion in 1995 with 12 built by the turn of the century. The first SSN 21 will have 8 torpedo tubes and is expected to cost $1.6 billion. After the production of a fifth submarine the cost should be about $1 billion per submarine.

o An AP wire note on 16 August says that Supreme Court Justice J.P. Stevens refused to block the Navy from building ELF (extremely low frequency) facilities in Wisconsin and Michigan, despite an emergency request by State and local official to stop the Navy's "Project ELF." These officials have claimed that the ELF System's electro-magnetic radiation could be harmful to humans and animals although studies of the system's effects have proved the contrary. The ELF system provides low data-rate communications with submarines at least 400 feet below the water's surface -- enhancing their survivability in war.

o Tables derived by the Defense Intelligence agency on soviet weapons production, as reprinted

in Aerospace Daily of August 31, 1984, show that between 1972 and 1983 the Soviets produced 2200 submarine launched ballistic missiles (SLBMs) and about 9500 antiship missiles for domestic use. And, that on a yearly basis, production of submarines and their weapons has been steady with only small fluctuations -- about 8 nuclear submarines, 200 SLBMs and 900 antiship missiles per year.

o Janes' Defense Weekly of January 1984 says that the U.S. has a sample of titanium hull from the Soviet's Alfa-type submarine and that "whereas Soviet technicians have managed to make a weld (on this sample) in five passes, their American counterparts need 200 passes to do the same job." A later Janes' Defense Weekly of 19 May, shows a photograph of a surfaced Soviet Oscar submarine with its missile hatches for the 24 SS-N-19 antiship missiles "of a reported 445 Km range" and "a feature at the top of the rudder which could be a housing for a towed array sonar."

o Defense Daily of August 23, notes that the U.S. Navy has a two-man underwater swimmer vehicle operational with Special Warfare Units in both fleets. The vehicle has the MK-35 torpedo. Rear Admiral Nyquist of the Navy's Combat Systems Division is quoted as saying "The special warfare people can get in close to the beach and take under attack shipping that might be in the harbor, from some reasonable range so that they don't hazard themselves (as underwater swimmers) in close." The MK-1X vehicle is carried by a mother submarine.

o Recent launchings of submarines are: the U.S.S. PROVIDENCE, SSN-719 on 4 August; and the U.S.S. CHICAGO, SSN-721 on 13 October. Recent commissionings are: the U.S.S. H.G. RICKOVER, SSN-709, on 21 July; the U.S.S. H.M. JACKSON, SSBN-730 on 6 October; and the U.S.S. OLYMPIA, SSN-717 on 10 November.

o The U.S.S. BONEFISH, SS-582, one of four remaining diesel submarines celebrated her 25th anniversary on 9 July. A Barbel class submarine, she is the only conventional submarine now operating on the East Coast and is homeported in Charleston, S.C. She is commanded by LCDR James F. Struble, USN.

o Launched from a submerged submarine off the coast of Southern California, on 25 July a Tomahawk conventional land attack missile with live warhead, for the first time flew more than 400 miles to an inshore target and impacted on a concrete structure with its 1,000 lb "Bull Pup" warhead.

LETTERS

UNIDENTIFIED AUTHORS OF SUBMARINE REVIEW ARTICLES

The Review's practice of disguising authors by initials or, worse, the antideluvian stunt of using mythical noms-de-plumes, which was fashionable in the 18th century when the authorities (the monarchy or the mob) weren't very concerned with protecting a dissident's "first amendment rights," but is now obsolete, denies the reader one of the best tools available to him in evaluating a thought or train of thought -- his appreciation of its source. If you want to argue that identifying the source could condition the reader to prejudge the credibility of the thesis, you are denying one of the essential elements of the "professional" system. Can you imagine an unsigned or anonymous article in the "Journal of the American Orthopedic Association?" The whole concept of anonymity in journals is to protect the life or reputation of the author against some form of revenge. Surely you're not suggesting that the author of an article in the Review is in danger?

The power of positive identification is worthwhile. When I see "MHR" at the end of a passage, I go back and reread it, because if Mike Rindskopf did write it, I sit up and take notice.

The Review needs to be professional and open -- particularly if we want it to be properly contentious.

(Ed. Note: Allowing anonymity in Review articles has several favorable aspects -- protecting writers from "revenge" is not one of them. The articles are not paid for and this has a considerable value. The authors are obviously contributing out of love for and dedication to the submarine service. To each author, having his ideas read is of first importance. This is unlike the academic community where it is reportedly necessary to "publish or perish," making identification of authorship a requirement. As can be noted, the format of the Review is designed to coax the reader into reading the next article after one has been completed. Without the authorship fo the article alongside its title, the reader is not faced with a decision as to whether he wants to read the article because of who authored it. For example: What submariner would read an article on shipboard problems with a woman's name attached to it? But coaxed into the article by its title, such an actual article in the Review was apparently read by most of the readership. When they discovered only initials at the end of the article there was expressed diappointment. But the lessons which the writer sketched out would, in her judgement, be better accepted if the reader remained unaware that a woman had written the article. I agreed to this and even encouraged her use of initials. It should also be recognized that readers have a lot of built in bisses about certain authors -- he's a "lightweight"; he's a "non-nuke", he's been plugging that old idea for twenty years; he's trying to sell his corporation's product; he's a

maverick; he never made Captain; no Admiral can make anything but a political statement. These are all good reasons why a specific reader might decide not to read some of the review's best articles? But if he didn't worry about who was writing the article he might go ahead and read the thing. If the reader is sufficiently interested in authorship, he can get in touch with me and I'll disclose the author and why it appeared useful to be anonymous in authorship. The article by a woman is a good case in point. Having the article cleared by those interested in submarines is of first importance as a review policy! It's the good ideas that the review emphasizes -- not name authors. Even if a submitted article is poorly written but the ideas are profound, the necessary editing will be done to make the article readable. Thus, in our opinion, our policy of coaxing the reader into the next article is not deception but a sincere belief the article is well worth reading and should be read.)

The Antiship Torpedo

On to the new antiship torpedo. As I understand the thrust of the article, the author (Phoenix) believes that the Mk 48 torpedo is too expensive and more sophisticated than needed to use on the ordinary surface ship. He proposes a cheaper solution, a covert weapon, 43 knots, noncavitationg, electric, 20,000 yard, 1,000 lb warhead, simple, passive (with contingency active backup) homing, no wire guidance, and offset to hit forward of the screws.

I'm not going to address the possibility of such a weapon -- whether the engineers can produce a torpedo that fits the criteria. But let me pick at some specifics:

First, why offset to hit forward of the screws? A hit in the screws would immobilize the target -- and that might pose as much or even more

of a problem for the enemy as a sinking.

Second, a 1,000 lb warhead sounds much like the Mk 16 -- which I was taught to spread because without a lot of luck, one Mk 16 wouldn't kill. Maybe new charges/explosives technology (or flimsier targets) overcome that.

Third, with the homing system the author proposes, a spread would be difficult.

Fourth, the homing system the author pro-posed implies a single, unaccompanied target. Is the probability of such a target good enough to build a weapon dependent on that scenario?

Fifth, a forty-three knot torpedo takes a long time to hit unless you are considering very short runs.

Finally, can we afford such specialization? We have the Mk 48. The ADCAP is coming. We have Harpoon and Tomahawk. The author is proposing an adequate, inexpensive, limited capability, single mission weapon. I question that we can afford that, philosophically or economically, any more than we can afford to divert our talents to developing an adequate, inexpensive, single mission, limited capability submarine. Our national policy is geared to defense, not aggression. Only an aggressor can afford to build, equip, and train forces to predicted scenarios. With our policy of not starting wars, our forces have to build, equip and train to counter enemy capabilities, not what we would like to predict he would do. As long as we are so limited in numbers of platforms, our weapons and weapons systems have to be competent to deal with the most pessimistic of scenarios which enemy capabilities project. Tailoring forces to what you would like to hope for doesn't make much sense.

Twenty years ago I had the ideal week of type training -- a load of exercise Mk 14s and Mk 37-Os, a target group of a heavy and 4 escorts, good retriever services and good weather. SCORPION was fast, maneuverable, and efficient at periscope depth, but limited by the BQR-2B/SQS-4 sonar suite. Our plan was to use Mk 37s to shoot a hole in the screen then use the 14s against the heavy. We learned how to do it, and it worked, but the amount of noise generated by the multiple targets taught me several things - (1) we had to get to periscope depth to positively identify targets and get ranges - (2) Mk 37-Os easily get confused unless they are given a discreet noise source - (3) extended ranges and torpedo runs further blur a torpedo's discriminatory powers - and (4) the time needed to slow and search, let alone safely get to periscope depth, was a real problem in dealing with a 20 knot target group. Maybe the new sonars would offset all this, but that week I would really have been able to use torpedoes with Mk 48 characteristics and to launch and guide 2 fish simultaneously.

Finally, until we can either dictate the scenarios in which we will wage war (which doesn't fit our national strategy of deterrence and defense rather than aggression) or enjoy force levels large enough that we can tailor weapons systems in adequate numbers to meet each enemy capability when it threatens, we cannot afford to specialize further. In fact, I suspect that submarines without vertical launchers are going to have enough problems deciding -- with the limited accomodations for tube launched weapons — the proper mix between Mk 48 torpedoes and missiles, let alone having to cope with a limited competence torpedo. I can't imagine a poorer use of force than a submarine on patrol with plenty of endurance remaining in every category except that its only remaining weapons were insufficiently competent to successfully attack opposing forces.

RAdm. Ralph M. Ghormley, USN (Ret.)

LIMBER HOLES?

I've studied the published pictures of the Soviet's Victor submarine which was on the surface near Bermuda with a wire wrapped around her screws. The numerous limber holes in her outer hull don't make much sense, unless they aren't limber holes at all but actually slots for boundary layer control -- as described in the "Slippery Skins for Speedier Subs" article in the last Submarine Review.

A nuclear sub doesn't have to dive or surface rapidly -- unlike a conventional sub. Thus a double-hulled nuclear sub like the Victor, could slowly flood its superstructure -- between the inner and the outer hull -- as it starts from port and then drain it slowly on return to port -- months later. This could be done through a few doors which would be well faired into the outer hull, and produce little extra hull noise -- unlike an outer hull with numerous holes in it.

To ascribe these limber holes to poor hull design practices seems to be wishful thinking, particularly when one can note that the Victor's outer hull is shaped like a coke bottle -- a laminar flow shape. Any hull designeers who would go to this trouble to reduce hull drag could hardly be accused of having unnecessary drainage limber holes which would create considerable hull noise.

D.E.K.

LEAGUE PLATFORMS

A platform for the Submarine League? Yes, provided that it be a statement that promotes

professional debate and enquiry. A platform that presumes a political consensus, or any other consensus for that matter, would serve to make the League an organized mouthpiece at the expense of its credibility as a professional forum.

Professionalism can survive only when there is a constant infusion of new ideas to be tested by professional peers in a forum of free inquiry. In the professional world truth is sought through ovjective enquiry and vigorous debate. In the political world truth is established by an organizational consensus.

The Naval Institue Proceedings is a professional forum. The Navy League's magazine Sea Power is a forum for the advocacy of a political consensus. The Navy has a need for each. Both of their values to the Navy would be lessened if each of them tried to take on the mission performed by the other.

The Submarine Review has made an excellent start as a forum for professional ideas. It would be most unfortunate if it were to become a political journal.

Frank Lynch

BOOK REVIEWS

THE HUNT FOR RED OCTOBER

By Tom Clancy, Naval Institute Press, Annapolis, October 1984 394pp illus.

The novel, The Hunt for Red October is must reading for submariners. The Naval Institute has never published a novel before. They didn't choose this book by chance. It's a "ringer". A

new specially modified Soviet ballistic missile submarine of the Typhoon class is loose on the high seas. Its Captain -- a man named Ramius is the prima donna skipper of Soviet nuclear submarines. He decides to defect to the Americans and leaves a message to his Admiral brazenly stating his intent. So the Russians know; the Americans do not. The Soviet high command redeploys its fleet in an optimum way to intercept and destroy, but the RED OCTOBER escapes the Russian blockade in the Barents, and steams carefully but confidently out into the Atlantic. The Soviets send their SSNs ahead toward the American ports to intercept, some at speeds over forty knots. Deployed Soviet ballistic missile subs are recalled -- an indication to the Americans of the non-hostile intent of the exercise.

The Soviets deploy their surface fleet, so do the Americans and the British. The American intelligence community comes up with an accurate analysis of what is happening and confirms this with the American "mole" in the Soviet Union. Now both the Americans and the Soviets know. Disinformation is used by the Americans; perhaps the RED OCTOBER has not really defected, but has been ordered into "left field" by a clever third country who has gained access to the Soviet system. Now the Americans know, the Soviets aren't sure. Back and forth it goes, all the way to the top in both countries.

The highest drama is played on the ships at sea. The RED OCTOBER is unusually quieted by a two-tunnel, secondary propulsion system dubbed the "caterpillar." The tunnels extend the length of the ship and house impellers. The Soviet submariners may have been foiled, but not the ten feet tall American submariners. She is heard, with difficulty, but heard by the DALLAS, a U.S. 688. Eventually the DALLAS gets into trail position. DALLAS is commanded by the finest of

skippers. The story rings true; for example the "Crazy Ivan" maneuvers of the Russians to foil a sub in trail; the mad dash through the peaks of the Reykjanes Ridge; and the typical submariner dialogue between officers and crew. There is a special rapport between the DALLAS captain and his particularly talented but eccentric sonarman.

DALLAS reports her contact to COMSUBLANT and receives permission to stay in trail. The episode is far from over; how do the Americans keep the Russians from destroying their quarry and how do the Americans take custody of a foreign submarine safely? Should they do it?

The surface forces mix it up too, as do Navy and Air Force aircraft. The Russian task force which includes the carrier KIEV is being shadowed by an American E-3A Sentry AWACS. A YAK-36 Forger goes off to buzz the AWACS just to show that in a real war the AWACS would be shot down. The YAK comes in very low to avoid radar. To his dismay he's caught by a pair of F-15 Eagles. He's out of radar range of his Russian ship, yet not within his missile range of the Americans. What's more, the Americans taunt him in flawless Russian. Next, 14 B52s surprise the Russian ships by coming in from all directions simultaneously. Eventually a completely frustrated YAK-36 pilot fires missiles at a Navy F-14. The cool-headed Americans don't fire back and the F-14 limps home. As with the submarines, the American surface and air arms invariably work better than their Russian counterparts. The Yanks are more imaginative -- simply better all around. As a final stroke, four DC-9s flown by the Maryland Air National Guard take the KIROV by surprise and lay a "box" of flares around the Russian carrier. Finally the Soviet surface forces realize they are compromising all their electronics and tactics and not helping in the search for the RED OCTOBER so they assume a very non-belligerent pose.

Beneath the sea and at command posts ashore the game grows more tense as the run-away Russian ballistic missile submarine approaches. As usual the Americans have a plan and carry it out with flair. By story's end three submarines are lost, reactors have loss of coolant accidents as well as cold water accidents, torpedoes are fired, decoys are used, many lives are lost, and everyone ends up relatively happy and most everyone slightly deceived thanks to the sleight of hand of the intelligence communities.

From beginning to end the story seems plausible, as tension rises to a climax. The reason is the basic accuracy in treatment of the submarines, ships, aircraft and their functions, their weapons and their people right down to their dialogue. It is rather difficult to believe that the writer Tom Clancy had never set foot on a submarine until after the book was written. He never even served in the armed forces, as claimed in The Washington Post Book World of June 24. The book does occasionally stray from reality. On the American side, the CIA and Naval Intelligence are far more than analysts and advisors; they make most of the key operational decisions as well. Indeed the author seems hard put to find convincing things for the JCS to do. There is a James Bond like character with two years experience in the CIA who manages to be almost everywhere: in American planes, on British ships, and eventually operating the depth planes and rudder on the RED OCTOBER itself. He is also involved in an automatic pistol shootout in a Russian "Sherwood Forest". Now and then he briefs the President of the United States. Obviously this doesn't add to the book's credibility. And then near the book's end it is a CIA man not the State Department who offers American sanctuary to defecting Russians.

As a former skipper of a nuclear submarine, I found the book's description of nuclear reactor

operations erroneous and disconcerting. Contaminations by radioactive material was termed a "radiation leak". Indeed, radioactive dosage, clothing contamination, and radiation fields are all discussed in RADs. The author said that after a loss of coolant accident that there would be enough residual heat in the core to melt everything in the submarine compartment. That's an awful lot of decay heat for a water-cooled reactor.

By far the most impressive aspect of this book is the way a large volume of material, normally too classified to discuss, is bandied about. Frequently the detailed nomenclature is quite unnecessary for the story itself. For example, nearly every item in the submarine R&D budget of ten years ago is somewhere described in the book is in service use and working well. MOSS the Mobile Submarine Simulator, the wide aperture array, SSIXs, Mk 48 torpedo improvement program, and towed sonar arrays are all there. The book points out that the Mk 48 torpedo was modified with a shaped charge because Soviet double-hulled submarines were tough targets to sink. The nickel-cadmium batteries of the Soviet Typhoon class of submarine are outside the pressure hull, partly for added buffering. The author, Clancy, underscores this point by exploding the Soviet version of the MK48 torpedo against the RED OCTOBER. (The Soviet version has less sophisticated guidance.) The RED OCTOBER does not sink. (If the MK48 is in trouble because of explosive power, most of U.S. surface and air ASW ordinance is also in trouble.)

Clancy gives the top speeds of modern Soviet Subs. He discusses the use of the two doors on the Typhoon stern. He gives a reason for the device between the two doors. He identifies the sonar on ALPHA submarines as essentially a French DUUV-23. The ALPHA submarine's reactor is not sodium cooled as the Americans think, he says, but

water cooled with very high temperatures and pressure. Clancy describes a dual pendulum navigating device which measures the earth's gravitational field. Laser technology allows measurement accuracy of the space between the pendulum to within a fraction of an angstrom. The Soviets have surveyed and charted key areas, such as the Reykjanes Ridge, by gravitational field and hence are able to manuever in these areas close to the bottom and to pinnacles at high speeds.

Other American equipment thoroughly discussed are FLIR, SOSUS, LANTRN, and the A-10 Avenger's rotary cannon loaded with spent uranium slugs.

Clancy makes interesting observations about the "political officer's" position on Soviet ships. He is there, close to the right shoulder of the CO to ensure the ideological "purity" of the skipper's actions and to prevent his deviating from the best interests of "the Communist Party". When there is a particular "orders opening" on the RED OCTOBER, the political officer already knows what the orders say. The ship's captain does not. The political officer also has one of the keys necessary to fire a missile. It is clear that the Soviet highest authority trust their political officers more than they trust their commanding officers. Perhaps because of this, much very routine verbiage in the Soviet Navy is couched in political terms or at least garnished with some key political words. This book says that the main reason the Typhoon patrols are so short is that the Soviets don't trust their commanding officers to be far at sea too long with all his ballistic missiles, even though there is a political oficer to watch him. We should therefore not expect the Soviet command and control network to look like ours. They conceive the problem differently. This difference in concept rests on the vast differences in the political structure of the two nations.

One could go on. But its best to read the book and see for yourself. It is a very good book to stimulate discussion of tactics for submarines and other fighting units. If Tom Clancy is really an insurance agent with no military experience as is claimed by the Publishers, he must be quite precocious.

G.E. Synhorst

SUBMARINE DESIGN AND DEVELOPMENT

Norman Friedman: Annapolis, 1984; Naval Institute Press, 192 pp illus.

The concept of a book on submarine developments for the layman is exciting and timely. It is exciting because there is a need to inform an interested public on the important issues regarding submarine developments by the superpowers. The esoteric nature of submarine warfare has made it dificult to gain support for systems. While there is a general awareness of the importance of submarines, those outside a limited circle are neither strongly motivated nor sufficiently informed to make judgements with regard to the support of new submarine design initiatives. This informative text is timely in that a new U.S. attack submarine design is currently under consideration with the goal of the first unit being authorized in FY 1989.

The topic is right and the timing is right. Submarine Design and Development is loaded with useful data that may not be available elsewhere. The photographs, many of which have been previously published in the Warship series and other text, are clear and in themselves present a review of past developments. The history is interesting and well sketched, but except for the mention of new Soviet and British classes, there is little that addresses developments over the

last ten years.

There are some factual errors and there are over a dozen myths that are presented as truths by the author -- without reservations. For the most part, these myths are rooted in the past and should be reexamined in light of today's technology. The author evidently has not done that, perhaps inhibited by the difficulty in accessing much of today's submarine technology. Thus, the reader who is inexperienced in submarine matters is likely to accept unquestioningly these myths as facts. The discussion of design tradeoffs is limited and not easy to follow. And the editing of this book is spotty, indicating the great difficulty in finding reviewers who are sufficiently versed in submarine matters that they can totally cover the very broad spectrum of submarine technologies.

There are two general areas of the book through which the reader should proceed with caution. In the area of submarine systems, the author stumbles over the functioning of basic systems such as those involved with surfacing and submerging. His comprehension of the functional aspects of basic submarine systems is suspect. He has obviously conducted research, since he uses the right words, but often in the wrong context. It is apparent that he does not have any practical submarine experience. However, he does charge ahead in a fashion misleading to the layman and aggravating to the "qualified" in this area. His errors appear in both text and caption of photographs. For example, the caption of a submerging submarine reads, "....blows out her ballast while diving"--and this is not a one-time error. Other areas where the author didn't fully comprehend the working of systems described to him include watertight integrity and depth, the battery/generator/motor arrangement on the U.S. fleet-type submarine, and the advantages of external and internal hull framing.

In the area of submarine weapons, the author has similarly failed to properly interpret the material he has gathered. The submerged launched SS-N-7 cruise missile is improperly described as a standoff torpedo in one section and correctly as a submerged launched cruise missile in another section. Yet the more recent SS-N-19 is later described as the first Soviet submerged launched cruise missile. There is no explanation as to why the SS-N-7 is excluded from that category. The text gives the impression that torpedo accuracy is a function of torpedo tube length and that the CHARLIE Class (SSGN) rather than the VICTOR Class (SSN) is the successor to the NOVEMBER Class (SSN). It is also stated that early Soviet submarine launched ballistic missiles could be fired only to a fixed range. Thus the launch platform had to position itself relative to the target before launch. Since the Soviet missiles were liquid fueled, they were adjustable in range by simply varying the burn time -- an option not available to solid fuel systems.

Specific areas also to be regarded with caution are the author's descriptions of nonacoustic signatures, flow around a submarine hull, Soviet design goals, and the interrelationships among the various submarine design parameters. As to the myths that the author seems to accept in good faith, if perpetuated they only serve to mislead decision makers as well as interested observers.

One of the myths is that the Soviet Union has been building large attack submarines, and it is their great size that allows them to achieve the combination of depth, speed, signature reduction, and weapons. The "quiet" Soviet VICTOR-III, however, has a submerged displacement of about 1000 tons less than the U.S. 688 Class. Moreover, the submerged displacements of Soviet submarines

include over 35 percent* reserve buoyancy for the VICTOR, while for the 688 it is only about one-third as much buoyancy. People who understand submarines will recognize that much more of the submerged volume of Soviet submarines is allocated to seawater-filled ballast tanks rather than internal pressure hulls. Thus, a more realistic measure of the volume and weight allocated to achieving depth, speed, and signature reduction should be a submarine's surface displacement. The surface displacement for the VICTOR-III and U.S. 688 are about 4500 tons and 6000 tons, respectively. The VICTOR-I is less than 4000 tons and the ALFA is less than 2700 tons. The ability of the Soviets to produce a highly capable submarine in a small package continues in that the surface displacement of the new SIERRA Class (the purported follow-on to the VICTOR series) is still less than that of the 688. Only the new Soviet MIKE SSN appears to have a surface displacement larger than the 688.

Perpetuation of the "large Soviet submarine" myth misleads people into the belief that excess volume alone accounts for Soviet superiority in such characteristics as weapons load, number of torpedo tubes, depth capability, redundancy, compartmentation, and speed. When it is realized that these advantages have been achieved with significantly lesser internal volume, then the need to examine the differences between the Soviet and U.S. technology bases becomes more apparent. Furthermore, the extraordinary size of the OSCAR and TYPHOON are more likely to be overlooked if it is believed that all Soviet submarines are large. Since the Soviet Union can pack so much into small

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*Photography showing the relatively shallow immersion of VICTOR Class units at sea suggests that reserve buoyancy of Soviet submarines may be over 40 percent.hulls, the question of why those two classes are so large deserves more attention.

It is certainly a myth that "inertia" in the Soviet industry results in submarines being denied the necessary navigational equipment. Another myth is that production of one type of pressure hull section has dictated the configuration of three generations of Soviet ballistic missile submarines. In regard to navigational equipment, Soviet submarines are not tasked to perform identically to U.S. submarines. Therefore, Soviet navigational requirements also vary. The myth that external intelligence places a burden on navigation adds to the confusion. Soviet remote targeting, such as aircraft relayed video over a data link (VDL), presents the submarine with a relative targeting picture. That is, both the submarine and its target are shown in the video presentation. The need for precise navigation is thus reduced rather than compounded. The fact that Soviet missile submarines are not equipped with U.S. type navigational equipment basically reflects a difference in targeting philosophy rather than a limitation of industrial capacity.

That the TYPHOON is a simple evolution of the YANKEE and DELTA Classes is another misleading myth that should be replaced with a more credible, factual concept, as occurred with the "27-knot ALFA" when it was observed making more than 40 knots. The TYPHOON (great wind) represents a revolution in undersea warfare. A check of the measurements published in Soviet Military Power, 1984 indicates that its submerged displacement is closer to 45,000 tons than 25,000 tons. There is no magic in that calculation. Submerged dispacement is not the displacement of the pressure hull alone; it is the displacement of the entire double-hulled vehicle including its flooded tankage, unless there are open channels through the TYPHOON. To gain only four missiles over a 13,000-ton DELTA, which uses a missile of almost the same size, doesn't make too much sense, unless the TYPHOON has reloads a different power plant and power thrustor, or is built to be unsinkable.

There is much more to the TYPHOON than a simple evolution from the DELTA-type SSBN. Such apparent characteristics as the size, shape, and location of the sail, the size and location of the thrustors, the stern configuration, and the over 300 square-meter elliptical cross section attest to its being unique. If those important differences are not recognized but simply dismissed as an evolutionary development, we can be assured of catastrophic surprises in the future. The power plant, the propulsor, the survivability, and the very function of the TYPHOON are yet to be understood in the West. Because of these unknowns, it is imprudent to project that te TYPHOON will be constrained to operate within a local sanctuary.

Other myths presented in the book include: that high speed submarines, particularly nuclear submarines, can never be silent; the Soviets need to "hand make" quiet machinery and submarine electronics; the Soviet Union uses double-hull construction because they lack confidence in their power plants and are afraid of ice rupturing the pressure hull; that SOSUS should be a viable wartime asset against Soviet submarines; that surface ships are the only rational choices for exercising "presence."

The author does bring out the little appreciated fact that the massive launch of ballistic missiles should reveal the submarine's location — and it does very precisely in a matter of seconds. However, the author thus concludses that the SSBN's existence is no longer relevant after all missiles are launched. But this is a perpetuation of what the reviewer believes is one of the major myths today — that all strategic weapons will be dumped in an all-out strategic strike against an enemy's homeland. Far more likely is a discreet use of SLBMs — if they are ever used. The launch of less than a full salvo increases in likelihood when the number of

missiles on each boat is increased and the force levels are decreased. The launch then of nuclear ballistic missiles will most assuredly bring counterfire, against which means to survive become important to SSBNs. The strategy of counterfire against submarine launched missiles is an important measure addressed in the literature by high level Soviet planners. The Soviet penchant for very high speed, even in their SSBNs, is consistent with this perception, since "post-launch maneuver" as well as great resistance to nuclear blasts becomes a key to survival.

A most disappointing aspect of Submarine Design and Development was the omission of new technologies. Except for the names of new submarine classes, the technology cut-off seemed to be over a decade ago. Little was said about new power generation concepts, drag reduction, or more efficient propulsors. We are in the midst of a set of extraordinary developments in submarine technology, yet the author's addressal of "future possibilities" is limited to the relocation of forward planes, the change of length-to-beam ratios, and the potential of using HY-130 steel. In a period when technological change is so rampant, it is unfortunate that the author apparently was unaware of the unclassified literature available regarding these new technologies and had to give the impression submare regarding these new technologies and had to give the impression submarine technology has been nearly stagnant for the past 20 years. If the public and key decision makers believe this to be true, then the U.S. Submarine Force will have a great deal of difficulty in acquiring the systems and technology necessary to combat Soviet submarines with their many new technologies.

This review may sound less than enthusiastic because of the nit-picks cited. Yet it is apparent that the subject of submarine design and

development is so complex that a single individual's attempt to cover all areas comprehensively is bound to be flawed in some spots. The remarkable aspect of this book is that Norman Friedman has been able to include so much historical material.

K.J. Moore

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108

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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.

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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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