THE SUBMARINE REVIEW

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FROM THE PRESIDENT

Communications .... We live in a world that has become increasingly dependent on communications, most in capsule form, to inform us of world events, technology applications, economic vicissitudes and just plain news. The founders of the NAVAL SUBMARINE LEAGUE recognized the need for a communication vehicle early on and published a submarine oriented magazine, THE SUBMARINE REVIEW. In time, the NSL was financially able to offer a modest stipend to the contributing authors as a recognition of our appreciation. This stipend has now grown to be competitive with those paid by major trade magazines and journals. Currently a $200.00 stipend is paid for major articles (short story length -- 2,500 words) and three published articles are annually selected for special recognition and an honorarium of up to $400.00.

To foster the idea of writing as a desirable and rewarding effort, the NSL has established programs at the U.S. Naval Academy and NROTC Units to encourage forward-thinking future naval officers to accept writing as a career enhancing and satisfying effort. This issue of the REVIEW contains the first of many such articles. The pay-off for the submarine force of the future should be immense. The top three entries each from USNA and the NROTC Units will receive a cash prize and recognition in the REVIEW. The submarine communication seed has been planted and the first harvest reaped. What next .....?

The NSL Editorial Review Board has long been concerned about the reticence of active duty members to write about submarine matters. There are an abundance of submarine issues that can be opened to debate and consensus, far removed from the specter of security clearances. To encourage our submariners to write and foster the exchange of thoughts and ideas, the NSL is establishing an annual program that will recognize a prize essay from each of two categories based on rank. Contrary to some belief, the encouragement and stimulation of informed debate will strengthen the submarine force. There is sufficient opportunity to classify those aspects which have that need, as programs and ideas

mature. The haunting thought is that, without a communication medium, significant ideas and thoughts will never reach the nurturing stage. There is no autocratic dispenser of creative ideas. To stay at the technological and operational forefront of its adversaries, the submarine force can benefit from debate and debate requires communication. As a side benefit, our more creative submarine thinkers will be furnished a means of early recognition and hopefully their service will be channeled into productive arenas. The NSL Prize Essay Program will be described elsewhere in this issue. I encourage every senior submariner to encourage our future leaders to get involved.

Finally, I hope to see many of you at the 13-14 June Annual NSL Symposium. These are exciting yet difficult times. Our submarine force success will be a function of teamwork and an integrated and focussed effort, encouraged and supported by all NSL members. Our speakers at the Symposium are recognized authorities and our new 2-day agenda will be worth your time and support.

Al Kelln

MEMBERSHIP STATUS

	Current	Last Review	Year Ago
Active Duty	956	911	901
Others	2875	2819	2741
Life	174	172	161
Student	28	25	21
Foreign	62	54	45
Honorary	20	20	10
Total	4115	4001	3879

HAVE YOU GOTTEN 2 NEW MEMBERS FOR 1990?

THE INFLUENCE OF THE SUBMARINE UPON SEA POWER

By Edward L. Beach

For centuries men have tried to construct special vehicles to sustain them in the hostile environment beneath the sea. Of these most were tethered, or merely suspended like the early diving bells. A few were mobile, but there was no power for submerged locomotion other than human muscle. Hence such craft were tiny, and extremely limited in speed, range, and endurance. Even more than the air above, the undersea has been fraught with difficulty and danger.

A century ago, Captain Alfred Thayer Mahan, U.S. Navy, professor at the U.S. Naval War College, electrified Europe by publishing his lectures in a book entitled *"The Influence of Sea Power Upon History."* Never had the historical importance of England's centuries old navy been so clearly articulated. Neither had Germany's opportunity at the beginning of the twentieth century ever been stated so well. Kaiser Wilhelm II, seeing a powerful navy as exactly what he needed to consummate his long felt rivalry with his cousin George V of England, required Mahan's book to be read by the entire German naval officer corps. Sea Power was the key, and Control of the Sea the means. A fleet of powerful battleships would be the instrument. This was Mahan's lesson, as the Kaiser understood it.

Through a whole sequence of fortuitous circumstances, beginning with his ability to state complex considerations in simple language, Mahan became the naval guru of his age. He greatly influenced Theodore Roosevelt, who was already very navy-minded, and most of the crowned heads of Europe as well. Moreover, Germany's interpretation of his thesis was accurate enough for the time, and Mahan may therefore be held at least partly responsible for the naval rivalry that presaged the first World War.

The central message of Mahan's work was that during the previous three centuries, command of the sea had historically determined the outcome of international war. What sea power could accomplish, how to attain it, how it had been exercised by the sailing navies of the past particularly that of Great

Britain, constituted his theme. Control of the sea was essential, he held, attainable only by possession of a more powerful fleet than that of an opponent and using it to destroy the enemy's fleet. Ideally, this would take place in a titanic naval battle, like Trafalgar, but it could also be done in a series of smaller battles. Elimination of an enemy's ability to contest use of the sea in support of the war was the objective -- precisely what England had done as she built her empire.

The epitome of sea power in the early days was a fleet of wooden sailing battleships, the most powerful and best protected warships that could be built. The effect of the industrial revolution was to convert the "ship-of-the-(battle)-line," into a steam-powered warship mounting the heaviest possible armament and the strongest most impenetrable armor that could be devised. Appropriately, this new ship was also called a "battleship." In the Kaiser's day, the size and power of a navy was estimated simply by counting its battleships.

Beginning with the ironclads of the U.S. Civil War period, by 1913 the battleship had developed into an awesome steel monster, possessed of a certain austere majesty that enthralled men of the sea (who, despite military training and touted practicality, were largely romanticists at heart). Some of the "cult of the battleship" that so heavily influenced naval thinking during the years before WWII was undoubtedly due to this deep-seated sentiment for ships.

During the two decades between World Wars I and II, however, the potential of sea-based aircraft was becoming evident to forward-looking naval officers of Japan and the United States. The debacle of Pearl Harbor solidified the change, and the result was ascendancy of an entirely new class of warship. Rifled cannon of huge size, able to shoot twenty miles, were supplanted by aircraft, carrying bombs ten times as far -- and with greater accuracy. The aircraft carrier became the battleships' direct descendant for sea combat, and as it turned out, did much more fighting than battleships ever did. For World War Two and afterward it held -- and still holds -- undisputed sway as the premier vehicle by which American policy can be projected anywhere in the world.

Carriers with their air wings represent however, only half of the naval three-dimensional revolution. As with the battleship

before them, their prospects depend on the developments of science. But, like the battleship, and in a comparable number of years, they see an unthought of rival in the wings. Today, the most likely scenario is that the future of navies rests with the submarine, which can use both sides of the sea-surface membrane from what has been so far a safe underwater sanctuary.

Mahan was familiar with the concept and design of the submarine that fought the two world wars. He did not live to address its success at commerce raiding, however, because his death, in 1914, took place prior to full development of Germany's U-boat threat to England. His thesis about control of the sea did indeed hold true during both World Wars but with great difficulty, and only then because of the great logistic support of the undamaged United States, combined with the extraordinary naval and air effort she was able to bring to bear against a relatively small group of men, the German U-boaters.

Submarines have always seemed attractive to the weaker naval power. In the early days, U.S. inventors built three operationally successful underwater craft: Bushnell's TURTLE in 1776, Fulton's NAUTILUS in 1801, and Hunley's diving boat, in 1864. Fulton tried for years to interest France in his "diving boat," and it can be said that a badly advised Napoleon lost one of his big opportunities when he turned Fulton down. All three boats were hand-driven by propellers, (only FULTON provided a mast and sails for surface propulsion), and all three worked. The TURTLE nearly succeeded in sinking a British warship, and 88 years later the HUNLEY actually sank the blockading Union HOUSATONIC. For this feat HUNLEY will live in history even though she sank also, with all hands.

All nations with navies had experimented with submarines by the time of World War I. All had created small submarine forces with crude boats and minimum crews. At the very outset of that war, the giant capabilities of underwater combat vessels burst upon a startled world when the tiny 500-ton German U-9, with a crew of 29, sank three British armored cruisers totalling 36,000 tons in a couple of hours, suffering no damage and with very little danger to herself. British casualties in the three big ships were about 1,500 men -- some

50 times the U-9's whole crew.

In the aftermath of World War I, it was clear that an extraordinarily small group of dedicated German submariners had very nearly defeated Great Britain and her navy. But what this meant to naval warfare was not fully appreciated. Britain still held control of the sea in the sense envisaged by Mahan, and that was all that mattered to that beleaguered nation. Almost entirely lost was the understanding that traditional sea power, in this emergency, had not been enough. England had been saved only by timely all-out industrial assistance from her erstwhile colony, the United States.

Twenty years later, in World War II, there were essentially three submarine campaigns with three very different outcomes. The German submarines, manned as before by only a handful of men (some 50,000 overall, an inconsequential number compared with the size of the rest of the Nazi war machine), nearly beat England again. For the second time in about twenty years, the massive intervention of America's industrial power was all that allowed England to survive.

On the other side of the world, however, and in spite of brilliant early successes, Japan's submarines made no significant impact in their campaign against the United States. They could not have changed the outcome of the war, but they could have been far better employed than they were. The assessment today is that their overall ineffectiveness was largely due to poor strategic management by the Japanese high command, not to any deficiency in weapons or their tactical use.

The third submarine campaign was that waged by the United States against Japan -- and it must be stated flatly that U.S. submariners were initially the least effective of the three undersea services. This was partly because of years of the wrong kind of training, but mostly because of their defective torpedoes. Total loss of the Philippines was directly attributable to this unfortunate situation. The U.S. subs were better designed than those of the other navies, however, and they were, at least, properly utilized. When U.S. weapon difficulties were finally resolved, Japanese maritime and naval losses began to mount. In contrast to England, Japan had no powerful industrial ally to make up her losses, and American

submarines thereby became one of the primary decisive factors that forced Japan to surrender.

Today we simplistically divide submarines into "pre-nuke" (before nuclear propulsion) and "post-nuke" classes -- with concentration on the present nuclear-power era. To the dedicated submariner this somewhat neglects the period before nuclear power, when submarines demonstrated so conclusively what they could do. The pre-nuke period, slightly longer than the first half of the twentieth century, was the growing time, and also the testing time of war. Massive improvements in diesel engines, electric storage batteries, electric motors, hydraulic systems, and all sorts of important internal mechanisms finally produced the outstandingly successful Fleet submarine of World War II -- and similar boats in the other navies, friendly or not.

Twice in the first half of this century, submarines conclusively demonstrated the new element of sea power that nations are wrestling with today. Prior to outbreak of war in 1939, Hitler promised his subordinates they would have adequate time to prepare the forces they would need. To Admiral Doenitz, this meant 300 to 400 operational submarine boats and the necessary well-trained crews. What would it have meant to England had this been the force with which Doenitz began the war, instead of the 39 or so he actually had? In the Pacific, U.S. subs share major credit for victory over Japan. The enormous damage inflicted by submarines on both sides, roughly between a quarter to a half of all the maritime damage, was done by less than one percent of the forces under arms; this, against opposition specifically directed at them that amounted to about half the total naval strength of the opposing side. And it should be noted that the submarines of all the nations involved incurred the highest percentage of losses of any engaged force.

With the second half of the century came the nuclear power plant, permitting submarines to remain submerged indefinitely by removing their dependence on air, and simultaneously greatly increasing their power and thereby their speed. To these "true submarines" have been grafted the world's most sophisticated missile systems, with guidance, range and destructive power undreamed of during the first half of the

century. These ships (they are no longer "boats") inhabit the trackless fluid covering most of the globe, but little has been thought about them because, except when in harbor, they cannot be seen.

We should think about them. At this very moment U.S. nuclear submarines carrying more than 100 ballistic missiles meticulously serviced by a few hundred highly trained young men, are on submerged station. Another hundred ballistic missiles (the numbers are symbolic) in Soviet submarines are likewise hidden in the ocean. These are essential elements of today's sea power, to which the events of the first half of the twentieth century have led.

World War Two was the greatest conflict yet waged by man. Unfortunately, we are still preoccupied by the mode of thought bred by that titanic conflict and have not yet separated its lessons from its dramatic story. In a sense, the nuclear submarine came too soon -- opening new horizons of capabilities before there had been adequate contemplation of how the world reached the point where we now stand.

Nor has the human mind been able to focus rigorously on the fantastic capabilities of the nuclear submarine. We go into lengthy technical descriptions, but such considerations quickly become classified. On the public affairs level we say, "Picture a submarine, the tiny underwater boats of the first two World Wars, suddenly grown to the size of the battleships sunk at Pearl Harbor!" But few individuals, even if they grasp its technological points, will understand what may be the most important thing of all. Eminent British historian John Keegan, for example, predicts in his newest book, ***The Price of Admiralty***, that future Battles of Jutland will be fought underwater. On the contrary, in spite of the greatly increased importance of nuclear submarines there will be no submerged battle even remotely similar to that or any other great sea fight of days of yore. The onrush of sophisticated technology negates any prospect of repetition, even by analogy, of naval battles of ages past, anymore than jet aircraft armed with heat-seeking missiles would wish to reproduce the aerial dogfights between the Spads and Fokkers of World War I.

The new battleship-sized strategic submarines carrying weapons tens of thousands of times the destructive power of

the old "battlewagons," are not intended to fight other submerged battleships. Their targets are whole nations. Submarine destroyers will of course be sent to find them, and other submarine destroyers ("attack" submarines) will protect the submerged weapons-carriers. Finding the latter will be the principal problem, even before attack can be contemplated. This is not easily done -- their invisibility exists until the moment when their rockets fly out of a peaceful sea.

One OHIO-class SSBN can shoot in a single salvo 24 missiles carrying in all about 200 "MIRVed" atom bombs -- each bomb far more powerful than the one that obliterated Hiroshima. We have to assume that the USSR's TYPHOON- and DELTA-class subs can launch approximately the equivalent. No country on earth can recover from even one of these dreadful salvoes. Yet, these "obliterator-ships" -- to coin a term intended to infer much more than "battleship" -- have one twentieth the crew of the greatest battleship ever built, a fortieth that of a new aircraft carrier.

No one has yet dealt with the fundamental question: "does all this change sea power as we have thought of it during the past hundred years?" More specifically, what is sea power today?

As the twentieth century nears its end, the submarine has come of age. In a very few years it has become one of the most absolutely terrifying ocean-going vehicles of all time, armed with the most fearsome, most easily concealable, most readily usable weapons ever conceived by an uneasy mankind.

The submarine, nuclear power and the nuclear weapon were combined to form this remarkable weapons system. Its immediate predecessor, a relatively tiny boat with only pinpricks for weapons, nevertheless possessed lethality out of all proportion to its cost in lives and money. To neutralize the conventional submarine took an effort on the order of 100 to one, and despite optimistic predictions, research since has done more for submarines than against them. The result of it all is that subs are today much harder to detect and counterattack than ever before. How much greater than ever before, then, is the dimension of the submarine threat!

We need to think of sea power in an entirely new way, for the world ocean is now a haven for surprise attack. Sea power

has gone the other way from Mahan's early concept. It is less controllable than ever before. Recent history shows that formulas for the use of arms are dividing into two types. The first amounts to implementation of national policy, and the means employed may range from simple visible presence, in itself expressive of the national will, to direct use of conventional arms in a "limited war." The other use of arms amounts to instant destruction, visited upon huge areas of an enemy heartland in retaliation for (or perhaps in anticipation of) a similar attack by the enemy. Actual use of such destructive capability by either side is manifestly unacceptable, even though the threat of it, under the name of deterrence, has been in place for years.

It follows that the ultimate warship, the missile-firing submarine, by its very impregnability and tremendous destructive power is right now helping to make unlimited, all-out war a thing of the past. Disagreements will not disappear overnight, but the first thing to go will be nuclear weapons. When it comes time to retire the extraordinary submarines we have developed to carry the outlaw nuclear weapons, the boast will be that they were never used.

So be it. Sea Power now refers to the possibility of irresistible onslaught from the deep of the sea, capable of producing the effect of a whole war in a single day, and visiting unimaginable destruction upon innocent people (whatever the sins of their leaders). From this the world recoils. World War II is likely to be the last all-out general war. World War III will probably never take place, though "limited" wars, carefully circumscribed as to purpose and means employed may, for a time. Even the meaning of the word "war" will become more carefully defined. The world is going through one if its most significant changes, for one of the instinctive purposes of man is to avoid the final demonstration of the cataclysmic capabilities of the doomsday weapon he has made.

The influence of the submarine on sea power has been, from the deep of the sea, to give new meanings to "war" and "peace," and man has entered a new age.

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AN IRISH INVENTION

By Richard Compton-Hall

[CDR Richard Compton-Hall MBE, RN(Ret) is Director of the Royal Navy Submarine Museum overlooking Portsmouth Harbour in the U.K., where, fully restored, HOLLAND I (as the Royal Navy knew her) is the only surviving example of the very first of the Holland 'submarine boats'. (Another slightly later design is preserved in Sweden.) Medallions struck from the battery lead and souvenirs carved from surplus internal teak fittings are available from the Museum at Haslar Jetty Road, Gosport, Hampshire, PO12 2AS, U.K.]

Just ninety years ago, on 11 April 1900, the United States purchased HOLLAND (SS-1) from the J. P. Holland Boat Company for $150,000. (This date was designated Submarine Day by a Directive issued by Secretary of the Navy, James Forrestal, in April 1947.) The little egg-shaped craft, formally known as HOLLAND VI, was commissioned on 12 October, Lieutenant Harry H. Caldwell commanding, and the crew consisted of nine brave men in all.

Thus, after France, the United States became the second power to adopt the submarine as a fighting unit of its fleet. Britain, with the greatest navy in the world at the time, launched HM Submarine Torpedo Boat No. 1, built to a similar pattern, a year later on 2 October 1901; and a good many other navies speedily followed along the same underwater path. All must surely acknowledge, on this ninetieth anniversary of the U.S. Submarine Service, the quirky, professorial, shy, prophetic, brilliant but commercially naive little Irish-American John Philip Holland.

Holland was born in a single-story cottage off Castle Street, Liscannor, on the windy Atlantic coast of County Clare, Ireland, on 24 February 1841.

Physically weak and suffering continually from ill health in youth, he saw poverty and disease all round him. Landlords were always ready to evict defaulting tenants from their cottages and strip off the thatch to prevent them coming back. It was a process known as "levelling" and young John saw plenty of it. Levelling symbolized the effect of English rule

for him; and Holland believed, like so many of his countrymen, that England was entirely to blame for Ireland's pitiable condition. All true Irishmen sought some means of throwing off the intolerable yoke which, in Holland's view, was largely imposed by the background presence of the powerful British Fleet. He was, of course, debating the same problem that had concerned David Bushnell during the American war of Independence.

The Civil War in America and rumblings of war in Europe encouraged submarine plans. Rumours of several reached Holland who concluded that submarines could be Ireland's answer to England's might. There were certainly no facilities for building them in his native land. So in 1872 he sailed from Liverpool, as a steerage passenger, bound for Boston. Amongst his few personal possessions were drawings of a submarine.

There was plenty of Irish fervour in America to encourage revolutionary designs. The secret Irish societies of the Fenian Brotherhood welcomed Holland's submarine proposal. It was just what they were looking for -- wild enough for the headiest imagination. The Irish World newspaper launched an appeal for funds; and money from Irish-Americans quickly started to roll in.

In 1876 Holland built a 33-inch model and demonstrated it to prospective Fenian supporters at Coney Island. It was enough to convince them that a full-sized 'Wrecking Boat' should be built.

Holland's first proper submarine was 14 feet six inches long and two feet six inches high with a squat turret-like attachment at the top. She was completed at Paterson, NJ, in 1878 at a cost of $4,000 funded by Jacobs & Co. -- a code name for the leading Fenian, Jeremiah O'Donovan Rossa. On 22 May, the dwarfish boat was winched onto a wagon and drawn, reportedly by "eight pairs of stallions," to the water's edge close by the Spruce Street Bridge on the right bank of the Passaic River. When tipped off the wagon, the two-and-a-quarter tons of iron settled rapidly into the water and, in a moment, sank out of sight. Nobody was on board.

Almost certainly, the inventor had calculated the buoyancy for salt water. But, the upper reaches of the Passaic River

were nearly fresh. It was a trimming mistake of the kind to be repeated quite frequently by some of us down the ages.

Undismayed, Holland hauled up the recalcitrant craft and made adjustments. the two-cylinder gasoline engine no longer worked. Ingenious as ever, however, he adapted the engine to steam power. Steam was passed through a rubber hose from a hired launch alongside: the female end was then forced onto a male connection when Holland was ready to go. Alone in "the Coffin" (as a spectator called it), he dived and then surfaced the cramped vehicle, safely.

Trustees of the Fenian "Skirmishing Fund" were thereby convinced that more money was justified to pursue their "salt water enterprise." So $20,000 was provided for a warlike submarine for use against the British.

What came to be called the FENIAN RAM started to take shape at the Delamater Ironworks on West 13th Street, New York City on 3 May 1879. Construction was slow. The trouble amongst the Delamater engineers was, according to Holland, the same as he later encountered amongst Staff Officers of the United States Navy: "they were, almost without exception, of English, Welsh or Scottish descent ...." Holland further complained that "they appeared to know by intuition that the project was absurd" -- a reaction not unknown to modern submariners.

The RAM was launched in May 1881 and towed across the Hudson River to Jersey City. The three-man, nineteen-ton boat was 31 feet long, six feet broad and was propelled by a Brayton twin-cylinder, double-acting 15 hp engine. The gasoline engine was used both on the surface and submerged. Air was bled from reservoirs when surfacing.

Trials were surprisingly successful. But a passing tug washed water over and down the conning tower during an unauthorized trip by the Engineer, and the RAM sank, but the Engineer escaped -- " a bit pale." The boat had to be raised and dried out at a cost of $3,000 to the Fenians.

As for a weapon system, Robert Whitehead's torpedoes were quite well proven, yet there was not any way of discharging them underwater. So Holland devised an underwater gun which fired a six-foot projectile by high-pressure air at six hundred pounds per square inch. With the

muzzle only three feet six inches below the surface, the shell travelled a dozen feet through the water and then "rose fifteen feet into the air ... striking a pile .... and frightening a fisherman ..."

Unfortunately, Irish impetuosity, "palaver" in barrooms and the refreshments consumed therein made the Fenians impatient. A few resolved to take matters into their own hands. Forging Holland's name on a pass, they towed the craft up Long Island Sound towards New Haven where they made such a hash of things that the Harbourmaster declared her a menace to navigation. Frustrated, they beached the boat and endeavoured, but failed, to sell her to Russia. Holland was furious: "I'll let her rot on their hands" he said. In fact, the RAM did not rot. She is now alongside craft No. 1 at the Paterson Museum.

That was the end of the "salt water enterprise." But Holland would never have gotten started without Fenian money. It could be said that our Submarine Services owe their beginnings to what today would be called the IRA -- an ironic consideration for at least the Royal Navy.

Holland now turned his attention from Irish problems to the United States Navy -- despite the advice offered five years earlier by Captain Edward Simpson of the Naval Torpedo Station, Newport, who bitterly remarked that "to put anything through in Washington is uphill work." Simpson was correct.

There is no doubt that Holland's ideas about hydrodynamics were right, and far ahead of his time. In particular, he was alone in insisting that a submarine should "not descend and rise on an even keel." It should be steered down by horizontal planes affixed to the stern -- diving and rising like a porpoise." But only one naval officer, Lieutenant William W. Kimball, was sympathetic.

Holland befriended Kimball at the Brooklyn Navy Yard in 1883. The young lieutenant was not in a position to do much immediately; but, through him, Holland met Captain Edmund L. Zalinski of the U.S. Army who was anxious to promote a new "dynamite gun." He thought a submarine boat was the best vehicle in which to mount it. And so the elongated, wooden Zalinski Boat (Holland's No. IV) was launched in September 1885. Holland embarked on this misguided project

against his better judgement. It failed completely and set him back years. Nevertheless, the fiasco provided the inventor with material for a provocative article entitled "Can New York be Bombarded?"

The article, circulated by Kimball, struck a chord somewhere deep inside the Navy Department. In 1888, two years after its publication, an open competition for a "Submarine Torpedo Boat" was announced. Competing against Nordenfelt, Baker and Tuck, Holland won. But the Navy's unrealistic requirements for 15 knots on the surface and eight knots submerged -- the latter speed for two hours on the battery -- could not possibly by met. Indeed, those capabilities were not achieved until the German Type VII U-boat emerged shortly before World War II. A fresh competition was announced in the following year and again Holland's design was selected. But then the U.S. Administration changed and the appropriation was shifted to surface vessels.

Holland was now flat broke. Fortunately his old friend Charles A. Morris found employment for him in his Dredging Company at the modest wage of $4 a day.

A third competition was announced in 1893. Capital ships, advocated by Captain Alfred T. Mahan, would be needed for outward American expansion, but submarines appeared to be the answer for coastal protection. Holland once more won with the design for his fifth boat, and an appropriation of $200,000, passed by Congress on 3 March 1893, enabled him to establish the John P. Holland Boat Company. The contract for the 5th boat was finally signed on 13 March 1895. William T. Malster at Baltimore -- already building Simon Lake's ARGONAUT as a private experimental venture -- undertook to construct Holland's steam-driven PLUNGER. The PLUNGER, 80 feet long and displacing 168 tons submerged, had a huge Mosher boiler amidships which made the submarine much larger than Holland wanted.

The PLUNGER (no relation to SS-2 of the same name which came later) was launched in 1897 but Holland had no faith in her. His fears were justified: trials were never completed.

The PLUNGER's failure cost the Holland Boat Company dearly. But the inventor was thankfully able to turn his full

attention to HOLLAND VI. As Lt.Col Alan H. Burgoyne MP remarked later in his classical history: "Of this vessel perhaps more has been heard than of any other ship or boat in the world. She is the prototype of the latest submarine ordered by Great Britain and the American Government and is also, without doubt, the commencement of the 'really successful' submarine."

The sixth Holland boat displaced 63.3 tons on the surface and 74 tons submerged. It was almost the ideal shape with a length-to-breadth ratio of 5.25. A 45 bhp Otto gasoline engine drove the boat at close to eight knots on the surface; and the battery supplied power for a maximum 5 knots submerged. In addition to a single 18-inch torpedo tube forward -- with two reload torpedoes -- HOLLAND VI had an inclined "Dynamite" or Pneumatic gun above the torpedo tube forward and initially one aft as well.

Appropriately, on St. Patrick's Day, Thursday 17 March 1898, HOLLAND VI made her first successful dive off Staten Island; and ten days later the Navy Department sent observers to witness formal trials. Captain John Lowe, USN, Chief Engineer of the Navy, was well pleased. His opinion carried weight.

Kimball, now a Commander, was present on at least one submerged run. Two years earlier, anticipating the success of Holland's latest boat, he had made his famous boast before the Senate Committee on Naval Affairs: "Give me six Holland boats, the officers and crew to be selected by me, and I will pledge my life to stand off the entire British Squadron ten miles off Sandy Hook without any aid from a Fleet."

On 10 April 1898, Assistant Secretary of the Navy, Theodore Roosevelt, wrote to Secretary of the Navy John D. Long: "... I think that the Holland Submarine Boat should be purchased ... I don't think that in the present emergency we can afford to let her slip ..." Roosevelt was, of course, referring to Spain's declaration of war against the United States over Cuba. Holland himself declared his willingness to take the HOLLAND VI to Santiago and sink the Spanish Fleet if it were still there. The offer was not taken up.

The Navy Department sought to criticize everything it could, after its purchase of the HOLLAND VI; while the naval

personnel who replaced Holland's team were slow and inept. It is difficult to understand how the Navy expected untrained men to put the submarine through her paces and arrive at sound conclusions. However, some of the modifications they demanded were sensible: the after Dynamite gun was removed as redundant; controls were improved; and very handy small trimming tanks were added.

Meanwhile, the Electric Boat Company, with Isaac Rice as President, had absorbed the Holland Torpedo Boat Company. The Rice empire rapidly expanded at the expense of Holland's personal influence and fortune. The Irish inventor was no match for the acumen of American businessmen like Isaac Rice. Holland, who died in August 1914, just eight days after the declaration of war, never reaped the financial rewards due to his genius.

Whether he foresaw the devastation that submarines -- specifically German U-boats -- would cause in the First Great War is problematical. He envisaged his invention in a quite different light, as evidenced by his declaration to Clara Barton, first President of the American Red Cross. The 78-year old lady went out for a trip in HOLLAND VI which the inventor thought would give her pleasure. It did not. At the end of the day, which was cold and rainy, she sharply reprimanded Holland for developing "a dreadful weapon of war." He reiterated that, on the contrary, he saw the submarine "as a deterrent to war;" but he failed to pacify her -- and it would be a very long time before its deterrent value was recognized. In fact, even today, the role of "ordinary" non-missile submarines in deterrence is poorly understood by politicians.

Kimball, Morris, Lowe, Theodore Roosevelt and others played important parts in the submarine story. But, with St. Patrick's Day just past, let us remember that the submarine as we know it today was an Irish invention. *Eireann gu brath.* Those of us with forebears in the Emerald Isle will take a shillelagh to anyone who says otherwise!

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SUBMARINE WEAPONS OF THE '90s

By RADM M. H. Rindskopf, USN(Ret.)
and CAPT William J. Ruhe, USN(Ret.)

The changes in the world situation in the past few months have been electrifying. The collapse of Soviet power has greatly alleviated the Soviet threat to Western Europe and, because of announced military force reductions, the Soviet threat on land and sea is seemingly diminished. The cold war is at an end? But at the same time, the instability in many countries of the world, created by the decrease of Soviet military and political influence, may result in Third World upheavals, such as: insurgencies, revolutions, and attempts, through armed conflict, to settle long-standing disputes between rival countries. Thus, for the next decade at least, it seems reasonable for the United States to plan for military involvement in some of these Third World crisis situations -- while still recognizing that Soviet military forces may also be protecting Soviet interests in a contraposition.

Under these circumstances, weapons for U.S. submarines must have the capability to fight in conflicts which involve mainly third world nations, while at the same time being able to handle Soviet submarines and their supporting elements when encountered as an opposing threat, independently or with the Third World.

U.S. submarines continue to be able to respond effectively to Soviet threats, even if the Soviets are not actually crippled by declared drawdowns of military forces or peaceful overtures. But, to fight effectively in this developing environment of Third World wars, the U.S. submarine community must now focus some of its efforts on weapons which are unlike those aboard our submarines for use against the Soviets -- ones which should be effective under a different set of conditions. Our submarines' targets will be different: they will have to fight in shallow water; their rules of engagement are likely to be different and the political objectives fought over will be at great variance with those to be achieved in the potential conflicts which in the past have been planned against the Soviet Union. The character of U.S. submarine weapons will

be based upon different philosophy of development.

The submarine community is indeed conducting research into many aspects of weapons improvements, many of which are applicable to today's unstable world situation. But still it seems useful to think about the kinds of weapons which are effective under evolving world conditions.

Does it make any sense, however, to consider acquiring new or improved weapons for the submarine fleet in light of expected reductions in military budgets? It does -- from a requirements viewpoint and from the cost effectiveness aspects. One can't forget the dictum of Karl von Clausewitz that "the conduct of war is determined by the nature of weapons available," while also recognizing that relatively low-cost, state-of-the-art weapons can be produced to meet the expected new set of conflict circumstances -- even during this period of austerity.

The nuclear submarine provides the best and most rapid response to crisis situations in all areas of the World Ocean. It can be on station, ready to take appropriate action well ahead of surface forces and even land based air forces -- which in most situations are so hampered by overflight and basing rights as to be impractical for remote areas of the world where no treaty rights exist for the basing of U.S. aircraft. It can remain on station without third party support for long periods of time. This, particularly, enhances the submarine's ubiquitous quality which produces a psychological effect on opposing forces that can be decisive in effecting a political settlement.

The several weapons which should be attractive to U.S. submarines to meet the revised challenges of the '90s are examined below.

For Nuclear Threats

The growing number of countries having a nuclear weapons capability suggests that it might be advantageous to have a nuclear, single-warhead ballistic missile capability in U.S. strategic submarines. Having a very long-range, highly accurate weapon of this sort could deter the use of nuclear weapons in third power conflicts. A single warhead on a D-5 missile would promise a surgical, discriminating accuracy, necessary to

fit the crime of nuclear weapon use. This may seem an outlandish solution to a third world nuclear aggression, but it may be the only way to bring some sanity to limited wars where at least one of the antagonists has nuclear weapons. Moreover, detection and follow-up action against a firing submarine employing this weapon in limited war is so improbable as to pose no significant risk. (The use of a nuclear warhead on a long range cruise missile is likely to be ruled out by START agreements early in this decade.)

For Antisubmarine Efforts

While accepting the more than satisfactory present U.S. weapon blue water capability against Soviet submarines -- nuclear as well as conventional -- it still should be recognized that, in third power conflicts, a U.S. submarine's weapon system will have to function efficiently in geographic areas which are unfavorable for the use of existing weapons systems. Shallow water, high ambient noise, heavy reverberations, omnipresent coastal anomalies, a high density of surveillance efforts, and far more rapid response to a submarine's overt actions, are some of the factors which must be reckoned with.

World War II experience showed that a noisy torpedo with a heavy bubble-wake was too often easily spotted and avoided by warships. Furthermore, the wake so accurately revealed the submarine's firing position that "the dogs" frequently meted out a merciless beating of the submarine. In fact, using a noisy, wake-making ASW torpedo in shallow waters seems out of the question today because of the virtually assured consequences. Additionally, using a shallow running torpedo with a hot wake -- generated by a thermal power plant in the torpedo -- seems illogical. Observation of the infrared scar produced on the sea's surface, is likely, by airborne or shipborne means, during darkness as well as in daylight, with today's IR surveillance technology. Compromising a submarine's firing position in shallow waters, by using a "hot" torpedo is just as risky as using a wake-maker. Similarly, firing a noisy torpedo -- with the shortened sonar ranges inherent in shallow waters -- at a conventional submarine using a quiet torpedo reactively, is also asking for great trouble. Such an ASW attack equalizes the contest. (Moreover, because of the

greatly reduced sonar detection ranges experienced in shallow waters, the use of a long-range ASW weapon like the cancelled SEA LANCE appears to be impractical.)

The German 12,000 meter SUT, a wakeless, cool, quiet electric torpedo is a natural for U.S. use in third power conflicts. (A closed-cycle thermal powered ASW torpedo might also be applicable, but the development costs for such a torpedo in this budget environment seem to rule it out now as a candidate for ASW.) Electric torpedoes are objected to mainly on the basis that they lack sufficient speed. Significantly, third party conflicts are unlikely to see enemy submarines of high sustained speed. But drag reduction measures, if used on today's electric torpedoes to increase speed, are feasible. They also have the bonus of reducing self noise -- from skin cavitation and vortex production -- so that they function far better in a passive sonar listening mode. Use of improved higher energy density batteries can significantly increase torpedo speed. Finally, a panoramic sonar for both passive and active detection -- to solve the depth problem -- is indicated.

It should be emphasized that the torpedo employed in third world conflicts should be as covert in its trajectory as its firing platform is in gaining an attack position and in moving clear after firing. When attacking an enemy conventional submarine, although it may have been detected due to its overt actions, a note of caution must be injected. There might be another "quiet" conventional submarine acting in concert with the targeted submarine and in close proximity to it, and it might take a deadly countering action by firing a quiet homing torpedo at the firing submarine's compromised location.

Antiship Weapons

For the destruction of surface ships, both merchant and warships, a low-cost relatively simple, quiet, cool, medium range, big-warhead homing torpedo which capitalizes on the nuclear submarine's stealth and great mobility -- to attack with a high degree of surprise -- is appropriate. The recent program to buy Whitehead A 184 electric torpedoes for antiship use takes on added significance. The reported cost of $200 K for an A 184 with its wire guidance and passive and

active homing makes it an attractive candidate for U.S. submarine employment in the '90s and beyond. It is a here-and-now weapon that should be promoted to a high priority status. Fired from a 21-inch torpedo tube, it is readily made compatible with U.S. nuclear submarine fire control systems. In a pinch, it might also function as an antisubmarine weapon. It is, however, a seemingly poor candidate for backfitted improvements to make it a truly good ASW torpedo for shallow water use.

A second antiship option is the 1470-lb HARPOON cruise missile as presently configured. HARPOON is a 35-mile, high subsonic speed, "hot" weapon with a sea-skimming trajectory, active radar homing and a 570 lb warhead. In coastal waters it is likely to lack attack-surprise because of its detectability by shore-based radars, infrared detection and other surveillance systems, particularly the human eyeball. It is also likely to disclose the submarine's firing position, greatly increasing counter-attack risk for the submarine. Very importantly, the nuclear submarine represents such a costly investment that putting it at unnecessary risk is foolhardy. (This tends to eliminate the nuclear submarine's mine-laying mission, even if the 12,000-yard, mobile Mk-27 mine were resurrected.)

For Attack Against Shore Objectives

Conceivably, the most effective weapon in a limited conflict may be the submarine-launched land attack cruise missile. Fired from a submerged nuclear submarine far at sea and distant from a land battle, it can be safely employed with a considerable degree of surprise. It can also be so accurate in hitting land targets that decisive political effects may be derived from the destruction of high-value land objectives. Manned aircraft attacks against similar targets run the political risk of losing military personnel. The adverse repercussions from the loss of a single F-111 in the Libyan raid and the loss of several manned aircraft over Lebanon illustrate the political hazards of using manned aircraft in low intensity conflicts. Additionally, the reduction in manned aircraft domination of a battlefield when confronted by insurgents using shoulder-held, simple STINGER missiles, as in Afghanistan, emphasizes the desirability of using unmanned aircraft -- cruise missiles

-- in low-key conflicts. The psychological effects produced by cruise missile attacks need to be stressed. Again, Clausewitz in his book *On War* is worth quoting. "All military action is intertwined with psychological forces and effects," and historically, "what mattered (in battles) was the vital but incalculable factor of morale. In the last analysis, it was at morale, not physical strength that all military action was (best) directed."

The TOMAHAWK conventional land attack cruise missile with a 1,000-lb warhead and a range of about 800 miles seems well designed to play an essential role in the projection of power against shore objectives. With an accurate terminal-homing feature using scene-matching correlation, it is particularly useful for airfield and port-area interdiction. It does have the drawback of using a TERCOM terrain matching mid-course guidance system -- the data for which may be lacking for those areas of the world where third world conflicts are likely to be prosecuted. To make TOMAHAWK more flexible for conflicts of the '90s, a mid-course guidance system with inertial guidance and a continuous, accurate-position supplied by two-satellite fixes derived from Navstar global positioning satellites, is presently being developed by Collins Radio Co.

The land attack cruise missile also needs to be less costly than the present $2 million for a single copy of TOMAHAWK. Compromise in the features of TOMAHAWK's design which might make it more applicable for a third world conflict might be: a one-time expendable engine; less "gold plating"; simplified trajectory control; less counter-countermeasures; reduced range -- all are suggested as possibilities to bring down unit cost.

It should also be recognized that a submarine-launched land attack cruise missile can provide a necessary assist to carrier aircraft strikes on coastal installations. Preceding sea-based air attacks, this missile can suppress enemy air defenses and disorganize an enemy's command and control functions so as to reduce the hazard to follow-on manned aircraft and the adverse political implications from loss of personnel.

One other submarine weapon that should be considered for the '90s is one for use in an ASW "melee" -- where the

detection range of the submarines involved is under 6,000 yards. A new sort of very high speed torpedo with a short arming range (the Germans in WW II developed a 192 knot rocket propelled torpedo which was stable in its trajectory) may be the answer, or a battery of rapidly dischargeable underwater rockets -- like a Phalanx gun -- may be required to meet the challenge of modern submarines if they become so quiet that long range acoustic detections are virtually eliminated. (The proliferation of quiet closed-cycle, non-nuclear power plants in fuel cells in third world submarines can be expected soon.)

Funding limitations preclude an all-new submarine weapons mix. We suggest a priority approach: the land attack cruise missile should have first priority; the wakeless, quiet, cool antiship torpedo, second; the quiet ASW torpedo, third; the single-warhead nuclear ballistic missile, fourth; and not to be forgotten is the ASW "melee" weapon and other discussed weapons at some lesser priority.

In summary; in today's peacetime end of cold war environment, the submarine warrior -- faced with a likely slowdown in building programs -- should profitably use these "hard times" to (in the words of the 17th century samurai Musashi), "sharpen" his weapons and produce weapons which "cut well" in the battles ahead. Such a demonstrated interest in a submarine's weapons is a best argument for a submariner's belief that the nuclear submarine through the next decade and beyond is the essential element in a U.S. Maritime Strategy which is adapted for third world conflicts.

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THE SUBMARINE BIRTHDAY BALL

The submarine force celebrates it's 90th Birthday this year. If you have not received an invitation to your local area birthday ball, and you wish to attend, we suggest you call one the local Submarine Force Staffs listed in your 1988 *Fact Book*. To get invited to the Washington Metro area birthday ball on 21 April 1990, call LCDR Steve Weilbacher at (202) 697-1565.

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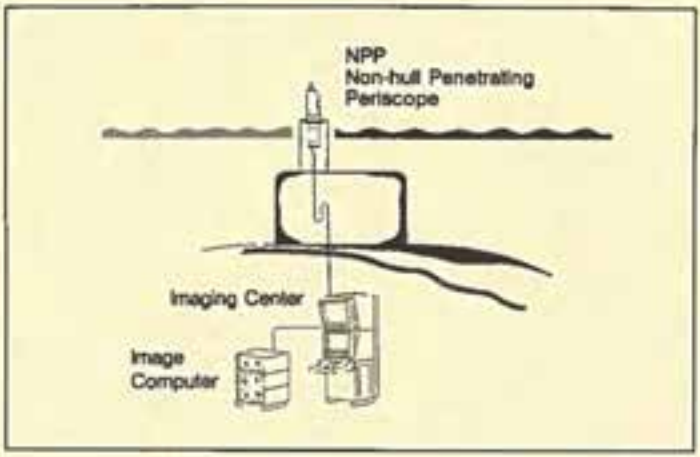
Extending the Submarine Commander's Vision



Kollmorgen continues to extend the mission of submarines. As part of the Advanced Submarine Imaging Systems program, Kollmorgen is offering the Non-hull Penetrating Periscope (NPP):

- Complete, 24-Hour Threat Detection and Surveillance, Television/Thermal Imaging/ESM without a Major Hull Penetration.
- Enhanced Performance and Improved Command and Control Operations.
- Flexibility in Ship Arrangements and CIC Design.

KOLLMORGEN

"ASW: THE NAVY'S TOP WARFIGHTING PRIORITY?"

An address by VADM Dan Cooper, USN (Op-02)
to a U.S. Naval Institute Seminar -- 27 February 1990

I appreciate this opportunity to address the Naval Institute membership and its distinguished guests.

I am reminded of Augustine's law XLVIII --

The more time you spend talking about what you have been doing, the less time you have to do what you have been talking about. Eventually, you spend more and more time talking about less and less. Until finally, you spend all your time talking about nothing.

It is fairly appropriate, however, that, in my somewhat "august" position as ACNO (Undersea Warfare), I participate here. My billet, of course, oversees the interesting broad spectrum ranging from Strategic Deterrence, to Integrated Undersea Surveillance Systems, to Attack Submarines. My people are intimately involved, or maybe I should say submerged in the subject of this meeting.

A second reason for me to participate is that of the seven panel participants, only Admiral Coward (Flag Officer Submarines, Royal Navy) and I are submariners. However, without the type of platform we support, this whole ASW question becomes moot. (Both Admiral Coward and I increased our expertise just last night -- at the premiere of "Hunt for Red October.")

(I will tell you, with no hesitation, that both Admiral Coward and I are biased; but I prefer to think it is because we firmly believe in the potential of these platforms and the threat they represent when their full capability is used by an enemy.)

I would like to diverge a second, if I may. Barbara Tuchman has written several books, one of which was recommended to me by a friend several years ago. The title is ***The March of Folly (from Troy to Vietnam)***, and it talks to governments which through history have pursued "policies contrary to their own interests."

In a particularly cogent section in chapter one, she defines one major factor of such folly as wooden-headedness.

Wooden-headedness is "acting according to wishes not deflected by facts." It is the refusal to benefit from experience.

The title of this seminar, phrased as a question, is interesting and may be a little presumptuous since both the Secretary of the Navy and the Chief of Naval Operations have stated that the Navy's number one program is ASW. This position has been repeated unequivocally in speeches, editorials and statements to Congress. The CNO designate, Admiral Kelso, has also strongly endorsed the subject in his most recent testimony.

On a different plane, just the fact that ASW is discussed or questioned in so many forms, means that it is exceedingly important -- submarines are the major threat.

It should not surprise you that I shall not deviate from the Navy's position that ASW remains the top warfighting priority! Detecting modern quiet submarines is the most difficult task in modern warfare. And we do not have a fool-proof system for all oceans under all conditions.

Defense Secretary Cheney stated recently:

I don't think there is any question that the U.S. is now and will want to continue to be the preeminent naval power in the world.

- The primary unit of a maritime power is the SSN, the attack nuclear submarine. The Soviets, despite Perestroika, Glasnost or the status of the Berlin Wall, clearly understand this; consequently, their leaders have stated that the principal ship in their navy is the submarine. My compatriot, Admiral Brooks, has stated that they continue to build several modern classes of submarines at rates which have not slowed down regardless of words about arms reductions. As previously mentioned, nine submarines were commissioned by the Soviets; our authorized number of SSNs in the budget of 1989 was three, and in 1990 is one. In 1991 we are requesting two. That is an average of two over a three-year period.
- The SSN will determine the maritime battlefield. (Note, I don't say the U.S. SSN will -- the SSN of any country can.) Through its inherent stealth, mobility and endurance, the SSN is the one platform which can determine where, when and if the engagement will occur. This forces the opposition into a

defensive posture. The SSN can operate anywhere in the world remaining virtually undetected until the commanding officer chooses to attack. The SSN can operate independently, remotely and covertly, without replenishment for extended periods, up to several months.

- Until there are no submarines, there must be effective ASW. As long as a submarine threat exists, we have to be able to counter that threat. Admiral Brooks discussed the numbers and condition of the Soviet submarine force. Currently, 43 countries in the world are operating submarines. Of those, a majority is fully capable of pursuing anti-U.S., anti-NATO or anti-Allied activities. The ASW problem not only applies to the Soviet threat but also to quiet diesel submarines of third world adversaries which could be used in low intensity conflicts.

We must remember that the attack submarine's tremendous capabilities go well beyond ASW; SSNs are, in fact, multi-purpose platforms. The SSN has crucially important missions in strike warfare with land attack cruise missiles, special warfare, surveillance, and mining. Even for U.S. forces, as the submarine threat changes on a day-to-day basis from theater to theater, the force and battle group commanders suddenly realize the potential his own submarines have for many missions (while held in reserve for their ASW potential). That same ability to do many missions is present in all submarines, thus making ASW paramount.

- The submarine is absolutely necessary for effective ASW. Obviously, it is not the only effective ASW weapons system we have, and great improvements have been made in all platforms over the last decade. Similarly, the submarines of other countries, including potential enemies, have improved.

Combined arms is a viable and proven concept which takes advantage of the synergism of the several types of platforms involved. But the opposing submariner chooses his battleground and may not choose to operate in an area convenient to combined arms or convenient to any platform which does not have the inherent stealth or covertness and mobility of the submarine. He may choose to operate in an area where air superiority, if not in his favor, was neutral. There are areas of the world where only the submarine can be

used for ASW.

- Genuine ASW is directly coupled with Anti-Surface Ship Warfare (ASUW). The submarine was originally designed to sink surface ships.

The advent of submarine launched anti-ship missiles has added tremendous ASUW capability to submarines. The Soviet OSCAR-class SSGN is armed with 24 SS-N-19 cruise missiles with a range in excess of 300 nautical miles. As mentioned earlier, they are building at least one of this modern, quiet class of submarine each year. The formidable threat posed by the OSCAR certainly accentuates the need for ASW to protect the battle groups.

The SSN's effectiveness in ASUW was dramatically evident in the Falkland Islands War. The sinking of the GENERAL BELGRANO by HMS CONQUEROR virtually eliminated further participation by the Argentine surface fleet in the conflict. The Argentineans could neither measure nor oppose the threat of the British SSNs and subsequently operated their surface fleet in home waters far from the campaign.

On the flip side, the Argentineans deployed two diesel submarines during the conflict which the British correctly perceived as a real threat. Consequently, the British had to devote a significant amount of their attention and assets to a submarine threat. In subsequent reports, we know about 150 ASW weapons were used to attack suspected submarines which were not there.

- As a maritime nation, we are dependent on the seas for our economic health, and we have critical alliances across both oceans. U.S. world trade routes are the overseas lifeline to Allies in Europe and other trading nations. We must be able to protect our sea lanes of communication (SLOC). The submarine threat can interdict and sever the SLOCs. In World War II, the submarine was incredibly effective in disrupting trade and resupply. In the Atlantic, German U-boats sank over 2,700 ships (14.5 million tons) -- until the Allies solved the problem. In the Pacific, U.S. submarines sank about 55 percent of all the Japanese shipping. That country's strong reliance on oil and supplies from Southeast Asia was severed.

The submarine today is a major threat as long as a potential

enemy has even a single one -- because we frequently will not know where it is. If he has a force of them, we may not know how many submarines might be in the vicinity of our objective. The knowledge that a submarine is near makes that threat multiplicative; if we know several are there -- do we know where each is? How will we know what it will do or where it may be on the next day? The CNO's posture statement states: Detecting and killing modern quiet submarines (nuclear or diesel) is the most difficult task in modern warfare. That sentence is underlined.

CONCLUSION

ASW must be the United States Navy's top priority because:

- We are a maritime nation
- Submarines are the major threat
- We do not have the answer to ASW
- We cannot depend on Soviet restraint while their submarine potential continues to increase and improve.

To fall off that #1 priority is to do so at our own peril!

I repeat Barbara Tuchman's definition of Woodenheadedness: "Acting according to wishes not deflected by facts."

I realize I may have been fairly muted and subtle in my statement, but ASW is the Navy's number one priority!

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NAVAL UNDERSEA MUSEUM NEARING COMPLETION

Construction of the Naval Undersea Museum is 95% complete. While the first role of the museum was envisioned as a place to chronicle undersea warfare and its applications, the Navy in 1987 enlarged its mission to represent all undersea activities for the Navy and all aspects of the technology and phenomena used to explore the oceans.

The museum is the only one of its kind in the nation and houses artifacts related to all aspects of undersea exploration, including commercial and military applications. It is much more than a collection site for relics. It will serve as a national repository for technological advances in the field of undersea technology and will be a viable resource for

researchers and scientists, and educational institutions, including elementary through high school classes. The museum of 68,000 sq. ft. houses an extensive library, orientation theatre, a 450 seat auditorium, an 18,000 sq. ft. Exhibit Hall and an 18,000 sq. ft. Repository.

In July 1979, after a nationwide search, the museum was donated by the U.S. Navy -- adjacent to the Naval Base property at Keyport, WA. After its completion the Navy will maintain and operate this facility. There will be no general admission fee to tour the museum. Of the $9.1 million needed for the facility $7.3 million has been raised to date. If present fund raising efforts are successful the museum can be opened to the public this year.

Acquisition of remarkable artifacts continues. The museum was fortunate in obtaining the deep submergence vehicle TRIESTE II, a deep sea exploration and research craft, which is displayed on the museum grounds. It will join an impressive list of acquisitions including a KAITEN torpedo (a one-man submerged Japanese KAMIKAZE) and a World War II submarine 5"/25 wet mount gun.

Recently the museum welcomed a new addition to its historical collection with the arrival of the MAKAKAI, a manned submersible built by the Navy to study the use of new materials and devices underwater. It was used for two-man observation dives, marine ecology studies, observation of experimental work stations, study of oil leaks, and underwater photographic work.

This Museum facility will be a national asset and enable the Navy to preserve it's heritage and hard earned knowledge obtained through its efforts to utilize the ocean's depths both in peace and in defense of the nation.

Individuals who have artifacts, documents, appropriate undersea memorabilia to donate, or would like to become a member of the Foundation should contact the Naval Undersea Museum, Keyport, WA 98345. Phone (206) 396-6218.

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SUBMARINE WARFARE IN THE 1990'S
A NEW DIRECTION

By Midshipman 3rd Class Joseph S. Zurzolo
U.S. Naval Academy

[Ed. Note: This article was the winning essay in a recent NSL sponsored essay contest held at the U. S. Naval Academy.]

The ongoing battle to obtain funding for construction of the right ships has been a point of insistent debate in Congress as well as the Navy itself. Advances in technology have poised Submarines and Surface Warfare ships on the threshold of a much larger role in the use of America's naval forces. The submarine community is the vanguard in a fight that will shape the U.S. global naval power structure into the next century.

Since the early 1970's, Congress, with inputs from factions within the Navy, has focused a higher priority on attack carriers than on other facets of the Navy shipbuilding programs. A clear case of this was the budgetary yo-yo syndrome that hampered the development of the TRIDENT class and still plagues the D-5 missile. The Navy will operate thirteen aircraft carriers, if the CORAL SEA is retired as planned at the completion of her present Med cruise, but is unable to muster the ships needed to provide an adequate ASW screen.

Even in the most biased scenarios, the submarines end up with a draw and submariners glide silently away congratulating themselves on knowing they can pierce the swiss cheese shield which serves as a carrier battlegroup's ASW protection. In the past, competition raged between the Surface and Submarine communities over who should have the upper hand if the shooting became real. Unable to get a unified answer on that question from the Navy, Congress has continued to build carriers as the cornerstone of U.S. sea power. Its vital supporting ships received secondary priority. An operational imbalance in our fleet and our continuing inability to protect our carriers during conflict from a concerted and determined attack by Soviet submarine forces has been largely dismissed

outside Navy circles. Congress still has plans to build two more carriers at a projected combined cost of over 7 billion dollars (their aircraft add an approximate $5.3 billion) and to do this before the close of the century.

An initial reaction to this was that fifteen LOS ANGELES class, or seven SEAWOLF class submarines or thirteen TICONDEROGA class AEGIS cruisers could be built with that much money. A mix of these attack submarines and cruisers added to previously planned forces would greatly increase the Navy's ability to protect its carriers from all manner of threat.

The Submarine and Surface communities need to increase cooperative efforts to make Congress understand the balance between the aircraft carrier and the submarine, a balance which is changing with the next generation of weapons. This is not to say that carriers are obsolete, but recent history has shown that a carrier is valuable only if it can leave port safely. The Navy has not challenged strongly enough the belief that our present forces are adequate to protect our carriers. Successes against Libya and Syria on different occasions have been possible with only little carrier protection. The Navy is deluding itself. When our forces get involved in a fight with an effective submarine force we will suffer heavily in terms of lives and ships. When the Japanese refused to consider the submarine as an effective weapon for sea control, the Japanese merchant and combatant losses in World War Two were staggering, even by the standards of today.

The best example of modern offensive nuclear submarine tactics is the HMS CONQUEROR. She sank the Argentine cruiser GENERAL BELGRANO despite the BELGRANO's three destroyer escorts that were supposed to prevent a sub from getting to the cruiser. Consequently, the Argentine navy was afraid to let its aircraft carrier out of port despite the desperate need to stop the Royal Navy from pounding the Falklands into submission. The Argentines believed their carrier would be sunk due to inadequate ASW protection.

For those who think that our ASW screens are superior, I had the opportunity to see just how easily a single submarine penetrated the ASW screen of the CORAL SEA during an ASW exercise. The screening ships moreover were aware of

the submarine's presence and intentions. The Soviets, however, will be much less accommodating.

Consider for a moment the fertile hunting ground around the Chesapeake Bay entrance and the waters around Oahu, for a Soviet "wolfpack." Carrier ASW screens have a hard time stopping one submarine that is known to be there. What happens to a carrier when it is confronted by four or six submarines that it doesn't know about? Imagine the public uproar that the loss of a carrier would cause, and the morale booster it would be for the Soviet navy.

Cruise missiles have also drastically altered the modern naval battlefield. From these new weapons the Navy is learning something the Army has known for centuries -- never send a man where you can send a bullet. This lesson was graphically retaught when an Air Force F-111 and its two man crew were lost over Libya. It should not take the death of a Naval aviator to teach this lesson. Today that mission should clearly be carried out by a ship using a TOMAHAWK. This is more cost efficient than risking a two-man crew and a $30 million dollar aircraft (ordnance not included). Cruise missiles now provide both surface warships and submarines with the potential to play a leading role in strike warfare. This was previously the eminent domain of the carrier and its air wing. It is time that the Navy impress upon the Congress that the carrier is no longer the only tool of naval presence or power projection.

Cost, personnel and tactical requirements, have all been used as an excuse for neglecting production of desperately needed submarines to protect our present carrier force of thirteen, let alone a larger fleet of fifteen. In fact, the ten thousand men it would take to crew two additional carriers would be enough to crew all of the submarines proposed as options.

The Chief of Naval Operations must guide the Navy construction program in a new direction. This direction must stress the SEAWOLF and TICONDEROGA classes. Further, we must maintain this construction at a reasonable pace for at least fifteen years starting in FY 91. The results from this program would bring a total of twenty-five SEAWOLF subs and fifty-five TICONDEROGA class ships to the fleet. These

additions will be enough to stave off the impending losses due to age of much of our destroyer and cruiser forces.

The ARLEIGH BURKE destroyer is now projected to cost as much as a TICONDEROGA class cruiser and field twenty-five percent less firepower. Operation costs for each ship are about the same, eliminating every good point used to sell the ARLEIGH BURKE. New construction TICONDEROGAs could incorporate follow-on modifications such as the removal of the aft 5"/54 caliber mount and replacing it with a smaller twenty-nine cell VLS system. This type of follow-on modification would increase the firepower of new construction TICONDEROGAs by twenty-three percent. A sample load-out for deployment could consist of eight HARPOONs in quad canisters, or twenty assorted TOMAHAWK missiles, or one-hundred-ten standard missiles and twenty-one vertical launch ASROC. This is a significant amount of firepower by any standard.

The addition of the SEAWOLF class will allow the reassignment of two or three of the then aging LOS ANGELES attack submarine class from independent operations to full-time carrier battle group protection, allowing the submarine community to realize the full deep strike and offensive capabilities which SEAWOLF holds for a daring submariner cut from the mold of a Ramage or Fluckey.

Both of these changes in ship procurement will increase the ability of battlegroups to protect their high value units. This will mean a much more survivable carrier. In any future war the ability to build new ships and repair damaged ones will probably be limited due to Soviet conventional cruise missile strikes against our major shipyards. That makes limiting of damage from missiles a key to success.

Complaints about Research and Development costs in the SEAWOLF program should be put aside. SEAWOLF must be the epitome of submarine technology when she is commissioned. This submarine will have to be able to penetrate into the heart of Soviet waters, deliver a fleet crippling strike and then fight her way out. That is the ultimate goal of offensive submarine warfare.

To give future leaders the tools to win the battles of tomorrow, the battle in Congress must be won today. Rising

ship costs and budgetary restrictions coupled with long term maintenance costs on older vessels will increasingly limit any major new construction efforts.

The Submarine community does not have the influence to redirect ship building programs on its own. Hence the necessity of a strong alliance with the Surface community. Together these two communities must convince the Air community that unless priorities are changed soon, they had best look for some dry land to land their planes because there will be few if any sea platforms remaining. A guarantee is needed that after carrier aircraft take off from their flattop it will be there when they get back.

ASW forces have achieved top billing in the navy's budget in recent years, but programmed spending on carriers and Congressional indecision still leaves the Navy unable to fill gaps in requirements for underseas units. I alluded earlier to the yo-yo syndrome of funding for the TRIDENT. In the facets of this situation is a map of pitfalls for SEAWOLF's developers to avoid. In his recent book Unguided Missiles, Canadian author Fen Hampson plainly describes the wasteful way that some of our most expensive weapons systems have been developed and bought. This included a section on TRIDENT and its D-5, as well as the B-1 bomber, M-1A1 tank, SDI, and MX missile. Each case showed how gold-plating, mismanagement and poor performance by our elected civilians and military leaders caused monumental problems and occasionally turned out a weapon that couldn't do its job until an "improved" follow-on version was designed. That kind of time is no longer available! Each year sees greater innovation in the Soviet fleet and a continual erosion of U.S. ability to control the sea in the event of a war. U.S. potential for sea control has been as essential to our deterrence of conventional war as SLBM's have been to our nuclear deterrent.

The Navy will have to cajole Congress into changing its policies to allow professional Naval officers to determine the design of their ships. The disruption of Navy planning by politicians affects our future ability to obtain and maintain control of the world's oceans. More importantly, we must insure that the officers placed in charge always demand the highest product standards and not allow themselves to be

swayed into bad decisions by public opinion. There can be no second rate equipment for a force which beats the enemy by quality instead of sheer numbers. Further, we must keep in mind that numbers will still play a role regardless of how superior we build our equipment. The Navy learned that lesson in the early 1800's when the U.S. built some of the most powerful frigates -- but only six were built. The British accepted U.S. individual ship superiority and countered it by always engaging U.S. frigates with at least a two to one numerical superiority. The Soviets presently enjoy a three to one numerical advantage in submarine forces. History says that we are pushing our luck in this arena far more than is wise, given the Soviet penchant for submarine innovations.

If changes are not started now, the captains and crews of the U.S. Navy will suffer, but more importantly, the safety of our nation will be hazarded. If this is allowed to happen, history will judge us harshly, and rightly so.

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CORRECTION

In the January 1990 *Submarine Review*, the article on the GROWLER and the Regulus II missile, misidentifies it, on page 42, as "surface to air" rather than "surface to surface."

THE GREAT NSL MEMBERSHIP RACE

So far this year, Norman Polmar leads the pack for recruiting new NSL members with a dynamic 4. James Peirano is running a close second with 3. **If there are any sleepers out there, we caution you to run a smart race, but don't get too far behind!**

■

THE SOVIET SUBMARINE FORCE: GLASNOST'S REVELATIONS

By Lt. Paul W. Siegrist, USN

Glasnost is providing Soviet and Western readers with interesting glimpses inside the Soviet Navy. Captain H. J. Manthorpe provided a fascinating review of Soviet coverage of the MIKE sinking ("The Soviet View," U.S. Naval Institute Proceedings, August, September, November 1989) using Soviet media reports to examine the accident. While the Soviet willingness to discuss the tragedy in detail was unusual, it was not an isolated case of glasnost exposing problems within the Soviet Navy. Military problems that were not previously disclosed or discussed, have become subjects for open debate in the Soviet press. An observer can find many examples of problems in submarine units among the complaints being aired. Some interesting insights can thus be gathered from articles concerning the Soviet Navy's most formidable arm, the submarine force. This essay reviews recent Soviet media stories concerning the Soviet Navy. It focuses on the submarine force, and discusses the significance of problems revealed in such stories.

PROBLEM AREAS

Training is a recurring topic of complaints appearing in the Soviet media, with many aspects being criticized. The highest levels of fleet leadership acknowledge the deficiencies. The Northern Fleet Commander, Admiral Gromov, and his deputies are personally overseeing training in their fleet. In the fleet's submarine force, the Deputy Fleet Commander for Training has been assigned the task of teaching tactics and torpedo attack procedures to submarine commanding officers!

Oversimplification of multi-unit exercises has been cited as another submarine training problem. One senior officer emphasized that the goal of multi-unit training was not to gain operational proficiency, but to avoid the unpleasant consequences of an unsatisfactory evaluation. This was accomplished by giving submarine captains "the places and courses in such a way that they can probably be met." Critics

claim that such artificialities lead to inaccurate indicators of force capability.

At the unit level, the Soviet Navy seems to organize its ship-board training on a standardized plan, but there is talk of granting a measure of independence to individual ships. Despite attempts to liberalize, one naval officer stated that "combat training still is closer in nature to a production cycle than a training cycle." Although his comments were directed at the Navy in general, the Soviet's centralized methods of control and execution imply the existence of such a situation in the submarine force as well.

At the individual submariner's level, there are significant problems. Soviet submarine crews are often prevented from attending planned training programs due to additional duty requirements levied upon them from higher commands. Many submarine crew members are diverted from training to stand guard duty, garrison patrol, or other projects requiring manpower that is in short supply. At one base last year, "hundreds of man-days were spent on economic projects." As a consequence, the level of training of Soviet submariners is probably not what their plans project. Other articles point out instances of submarine crews standing watch with insufficient training.

A related issue receiving attention in the Soviet media is the demonstrated inadequate level of initiative of officers in leadership positions -- particularly commanding officers. One observer noted that a common trait of Soviet naval commanders is their tendency toward cautious action which stifles initiative. He stated that although opportunities exist for ship's captains to be innovative, "inventing, creating, (or) testing something of one's own becomes very difficult, since one risks being put off the plan, and this is a mortal sin." As a result, many commanders eschew departure from "the plan."

Some articles blame the lack of Soviet officer initiative on the near-continuous presence of senior riders aboard submarines. A submarine unit's deputy commander, Captain 1st Rank Shvechkov, told the Soviet military newspaper Krasnaya Zvezda that regulations require a senior commander to be aboard "whenever a submarine puts to sea for combat training." For example, a Baltic Fleet submarine that lost its

commanding officer overboard while leaving port was reported to be carrying the submarine unit commander, the superior formation commander and his staff. Critics claim that senior riders often interfere with the operational control of the ship. The Baltic Fleet's deputy chief navigator, Captain 1st Rank D. Shtefanov, cited "a blurring of responsibility while senior commanders are present" as the cause, last year, of a disproportionately high number of navigational violations among vessels carrying senior officers. The presence of senior riders apparently causes a dilution of the commanding officer's authority and an avoidance of responsibility. As one officer explained, "they say there is a senior commander aboard, and he will be held responsible."

The MIKE-class submarine, KOMSOMOLETS, on its first operational cruise, carried a senior rider on its final voyage. The Chief of the Submarine Political Department, Captain 1st Rank T. A. Burkulakov, was the senior officer on board.

Another highly-publicized incident provides another data point: The Soviet diesel submarine that grounded off Sweden's Karlskrona naval base in late 1981, WHISKEY-137, carried an officer senior to the submarine's captain. That officer told a Swedish naval officer who boarded the submarine that the senior officer was in charge after the grounding. While WHISKEY-137's captain would only admit that his Kaliningrad-based boat was on a "mission," and that they had grounded due to a navigational error.

A potentially serious problem area was recently revealed in the Soviet press. It is the apparently poor material condition of many Soviet submarines. The recent primary coolant leak aboard an ECHO-class nuclear submarine, requiring it to be towed home, emphasizes the rapidly approaching age limit of some portion of the Soviet submarine fleet. The incident was followed by the Soviet announcement that they would retire their first-generation nuclear submarines ahead of schedule. Moreover, boats deemed suitable for repair, rather than retirement, are experiencing problems as to repair facility availability. One SSBN was recently moved from its garrison to a repair base, only to be told that there was no space available. Notably, Soviet submarine personnel do not exhibit confidence in their boat's nuclear safety. The ECHO's

accident caused considerable concern among inhabitants of the submarine's garrison, prompting rumors and questions about radioactive contamination which resulted in at least 86 personnel reporting to the garrison's clinic -- concerned about contamination. Officers of the SSBN's crew expressed concern that, "We have been living for almost a month on a ship with an atomic power generator, even though at the base it is not recommended that long periods of time be spent on it."

An area receiving much attention recently is equipment deficiencies. Emergency equipment deficiencies were highlighted by the April 1989 MIKE sinking. Several deficiencies that were brought to light are worth noting. MIKE's life rafts failed to function properly and problems developed with emergency breathing systems -- apparently costing many sailors their lives. One officer questioned why the amount of emergency equipment listed on the ship's emergency bill was insufficient for all hands. Yet, they are certainly not strangers to submarine accidents. Counting MIKE, they lost four nuclear submarines: a NOVEMBER in April 1970, a CHARLIE I in 1983, and a YANKEE in October 1986, and also lost the conventional GOLF in 1968. Additionally, several Soviet nuclear submarines have been so severely damaged in accidents that they have been scrapped rather than repaired.

Articles have also criticized equipment provided to the Soviet submarine force for routine duties. Critics have attacked not only its quality and availability, but its usefulness and safety in the submarine environment. A recent example is foul-weather gear for submarine bridge watchstanders when running on the surface -- an understandable concern for crews operating at high latitudes. The only protection afforded these exposed men, beyond layered clothing, is an insulated suit meant for the Army's chemical service. It is described as woefully inadequate for sea service and is so bulky that it is impossible to wear a life jacket over it and pass through the bridge access hatch, on some classes of Soviet submarines. The men consequently do not wear life jackets and take the risk of being swept overboard in protective gear offering no buoyancy. This was the case in the Baltic incident involving the loss of a submarine's captain. Soviet submariners complain

that their allies in the East German submarine force wear "orange-colored, impermeable, insulated coveralls, which inflate when a sailor enters the water" while they have no equivalent. Soviet Vice Admiral Igor Ryabinin commented as follows:

More than thirty years of my life is linked with submarine sailing..... But I have yet to see any significant improvement in the clothing worn for standing watch topside.

Topside clothing is not the only submarine hazard criticized in recent Soviet articles. According to Soviet accounts, they wear overalls that are probably similar in design to those worn by American submariners. However, an officer writes that "... the overalls of ... submariners ... in a fire ... go up like gunpowder." This can cause disastrous consequences during damage control efforts.

CONCLUSION:

The implications of the revelations concerning submarines presented in the Soviet media are:

Submarine crews are poorly trained. Men are diverted to other duties, and conduct training exercises under oversimplified conditions. Sizable gaps exist between the proficiency levels projected by plans and the actual proficiency aboard individual submarines.

Excessive oversight of commanding officers by senior commanders stifles the degree of initiative that some Soviet writers credit to submarine captains. The presence on board of senior officers may lower the sense of responsibility among submarine captains and even the perceived authority of the captain in the eyes of the crew. This has potentially disastrous consequences. In today's fast-paced underseas world, waiting for the approval of a senior commander and losing the crews' respect may be the factors that allows an opponent to win. Moreover, the oversight of the Northern Fleet leaders does not speak highly of the tactical ability of Soviet submarine commanders.

Material condition of submarines is low with those in poor repair likely to be incapable of executing wartime missions. A lack of adequate repair facilities exacerbates this problem.

Finally, the Soviets may not be learning from past accidents. Damage control efforts during the MIKE incident may have

been heroic, but reports reveal serious deficiencies in damage control gear and emergency equipment.

Not only is emergency and damage control equipment inadequate, but basic equipment such as foul-weather gear and work uniforms pose hazards to Soviet submariners. Poor equipment quality seems to be the fleet norm, rather than the exception.

In summary, the Soviet submarine fleet is experiencing many material, training and organizational problems. Recognition of these problems in the Soviet press will likely be followed by attempted solutions.

It is easy to sit back, observe the Soviet problems that glasnost is revealing, and assure ourselves that our forces are adequate to defeat the Soviet submarine fleet. However, we must not let revelations of Soviet problems lull us into a sense of complacency.

■

TRIDENT WARHEADS

By Dr. Edward J. Lacey

In the October 1989 *Submarine Review* article on "TRIDENTS," Dr. Jon Boyes and Captain William Ruhe note that a U.S.-Soviet START agreement, as currently envisioned, would limit each side to 6,000 strategic warheads. They make a convincing case that the majority of these warheads -- 3,456 -- should be allocated to the SLBM leg of the Triad and be deployed on 18 TRIDENT SSBNs (eight warheads per missile or 192 warheads per submarine). Boyes and Ruhe further note that 18 TRIDENT submarines would be "a minimum" and would represent "a dangerously low number" since a greater Soviet ASW effort could be focused upon each submarine at sea.

In my view, the actual situation under START could be even more pressing for the U.S. submarine force. In addition to the overall 6,000 warhead limit, the START agreement probably will incorporate a sublimit of 4,900 warheads on ballistic missiles. (The other 1,100 START-accountable warheads would consist of several hundred bombers and more numerous air-launched cruise missiles.) The U.S. ICBM force presently accounts for roughly 2,500 warheads. Boyes and Ruhe postulate a START ICBM force of 100 Peacekeepers (ten warheads each) and up to 500 small ICBMs (a single warhead weapon) for a total of 1,500 ICBM warheads. However, this assumes that the 950 currently deployed MINUTEMAN IIs and IIIs would be eliminated and their silo launch facilities destroyed. More likely, in my view, would be the elimination of the 450 single-warhead MINUTEMAN IIs and, perhaps, half of the 500 three-warhead MINUTEMAN IIIs. The retention of 250 MINUTEMAN IIIs would account for another 750 warheads, for a total of 2,250.

Such an ICBM force posture would permit the U.S. submarine force to deploy no more than 2,650 SLBM warheads. Under this scheme, only 13 of the 24 launch-tube OHIO-class TRIDENT SSBNs could be deployed -- fewer by five than the "minimum" 18 suggested by Boyes and Ruhe.

Several options would be available to increase the number of U.S. SSBNs under this approach. One would be to download missiles from the TRIDENT submarines. If each OHIO-class SSBN carried only 20 missiles vice 24 (160 warheads), 16 TRIDENTs could be deployed. If only 18 missiles were carried (144 warheads), the "minimum" 18 TRIDENT SSBNs could be deployed. Another option would be to deploy a mix of OHIO-class units with older 16 launch-tube LAFAYETTE-, MADISON-, and FRANKLIN-class submarines. A hybrid approach would involve an SSBN force of downloaded OHIO's and older 16 tube units. Yet another approach, suggested by Boyes and Ruhe, would be to craft a set of START counting rules that would facilitate deployment of a number of TRIDENT missiles with fewer than eight warheads.

None of these options is optimum from an operational or force structuring perspective. Nevertheless, a START agreement limiting both sides to 4,900 ballistic missile warheads is very much in the offing, and a means to maximize the number of U.S. SSBNs within the treaty regime should be sought.

■

THE REMARKABLE PAPA

[This description of the PAPA SSGN is extracted from Submarines of the Russian and Soviet Navies: 1718 to 1990, by Norman Polmar and Lt.Comdr. Jurrien Noot, Royal Netherlands Navy, to be published later this year by the U.S. Naval Institute.]

In the early 1970s the Soviet Navy sent to sea the PAPA and ALFA, the fastest and deepest-diving submarines ever built. These submarine designs were impressive examples of Soviet submarine technology and construction capabilities. While the ALFA has received considerable publicity in the West, little has been said about the equally remarkable PAPA.

A one-of-a-kind guided missile submarine (SSGN), the PAPA was completed at Shipyard No. 402 in Severodvinsk in 1971. She was produced in the yard's building hall No. 2, which was originally used to construct diesel-electric propelled

GOLF ballistic missile submarines in the late 1950s and early 1960s; the enclosed hall was then upgraded for the advanced-technology ALFA, PAPA,and MIKE programs.

The PAPA -- given the Soviet Navy project No. 661 -- appears to have been a prototype and test bed for both advanced hull material and propulsion plant. The single submarine of this design displaces an estimated 6,400 surfaced and 8,000 tons submerged, and with a large, two-reactor propulsion plant credited with between 60,000 to 80,000 horsepower by Western intelligence. Twin shafts can drive the submarine at a reported 42 knots -- significantly faster than any Western undersea craft. (U.S. officials have publicly attributed a top speed of 39 knots for the submarine.)

The submarine has an unusual hull design with the outer hull having an extensive circular cross section. Titanium was used for the inner pressure hull. As with all other Soviet combat submarines, the PAPA has a double hull configuration which, coupled with the use of titanium, provides a relatively high survivability against enemy weapons. The design also provides a long, low sail structure (the craft having bow planes and not sail-mounted planes). Another unusual feature is the "notched" vertical rudder fin.

Although the PAPA has a titanium hull like the ALFA, there are indications that she is not a deep-diving boat. Possibly because of the method used in welding, as well as other features, the PAPA appears to have a maximum operating depth of only some 1,300 feet (i.e., an "even" 400 meters).

While definite information on the PAPA's armament has not been made public, she was designed to carry ten anti-ship missiles, launched from fixed tubes near the bow. The tubes are located between the inner and outer hull structures, and are covered by large, rectangular hatches. There was to have been a missile named "Amethyst," developed by the missile design bureau headed by V. N. Chelomei. But it is unclear whether a new missile was actually provided or if the PAPA carries the SS-N-9 anti-ship missiles found in the subsequent CHARLIE II-class SSGN. As with many other aspects of the PAPA, definite public information on this issue is lacking. The missile launch tubes appear to be housed in the bow, five

on either side of the "neck down" pressure hull. The submarine also appears to be armed with at least six 21-inch (533-mm) bow torpedo tubes. A large bow sonar dome, similar to the U.S. Navy's AN/BQQ-5 spherical transducers, is fitted in the PAPA.

The design, the propulsion plant, the fact that only one PAPA was built raise speculation about her relationship to the high-performance ALFA. While no official statements have been forthcoming from Western naval officials, one could postulate that the PAPA may have been intended as the SSGN "running mate" for the ALFA SSN. But high costs or technical problems -- or a combination of both -- led to only the single PAPA being constructed.

During her career the PAPA has seen relatively little operational service, having been engaged in lengthy trials and having undergone at least two lengthy overhauls. Unlike the later titanium-hull MIKE, the PAPA is not believed to have undertaken a forward deployment.

The ALFA and PAPA are said to be called *zolotaya ryba* -- "golden fish" -- by the Soviets because of their high cost. But the ALFA and PAPA opened new horizons for submarine development in the Soviet Union and may prove to have been a major stepping stone to the next generation of Soviet submarines.

■

SURFACE TENSION AND THE DETECTION OF SUBMARINES

By Paul Crutchfield

The introduction of aircraft and submarines with unique weapons and sensor technologies into the fields of war in the early 1900's changed regional land and sea warfare to one of a global, three dimensional context.

Since this introduction, nations have spent billions of dollars, rubles and pounds to develop air and ocean systems to detect and localize submarine platforms. The task continues to be difficult, for the ocean is nearly opaque and filled with anomalies which limit finding submarines. These warships are

in turn making their detection a more complex art as their envelope of operations grows with their greater submerged speed, depth, endurance, maneuverability and sound quieting systems. Nevertheless, today's sophisticated sensor technologies coupled with high speed, large capacity signal processing systems offer to enhance the probability of quick and accurate detection, especially if every ocean phenomenon is fully exploited. Even old concepts must be looked at again and again to discover their golden kernel. One, for example, is the detection of effects on the ocean's surface generated by submarines.

Can such an effect be detected, let alone measured quickly with assurance? The answer seems to be yes -- more specifically a "suprasurface" effect, stemming from some recent discoveries made about the phenomenon called surface tension or capillarity.

We know that atmospheric pressure on the water exists because of the weight and impinging of air (and water vapor) molecules upon the surface of the water. Molecules penetrate the water surface to varying degrees depending upon collision parameters of the colliding particles. For saturated conditions (100% humidity), the rate of entry of water molecules equals the rate of departure. Within the liquid, pressure is effected by a combination of intermolecular forces and collision forces.

A common manifestation of the surface tension phenomenon is provided by capillary tubes. Consider a circular capillary tube with a radius of one tenth of a millimeter partially filled with water having a surface tension of 75 dynes/cm and a zero wetting angle hemispheric surface. In this state the water would rise slightly over 15 centimeters (5.9 inches) at sea level. From the macroscopic viewpoint, there would be a pressure discontinuity of 15,000 dynes/cm^2 at the surface (atmospheric pressure being slightly over one million dynes/cm^2) of the water.

What of molecular dimensions and spacing? The spacing of water molecules in the sea is of the order of one or two Angstroms (A) (one ten-billionth of a meter). The mean free path between collisions in the vapor region is of the order of 1000A. With this curved capillary surface there is a "spread loss" situation for the rate of molecules crossing per unit area

in going from the vapor region into the liquid; a gain for molecules going from the sea water into the vapor.

This "spread loss" it was felt, could be equated with surface tension. Using the Equation of State provided in the revision to Keenan & Keyes "Steam Tables," I developed a computer program which, in a lengthy manner, calculated the "spread loss" rate. The operative distance across which the spread losses developed was one-third a mean free path. This distance coincides with the one-third mean free path encountered in the theory of gas viscosities. Here, the geometry of curved surfaces replaces the motion in viscosity theory. Furthermore, there is a small, but significant, contribution derived in the vapor region, across one-third a mean free path.

Analysis of the results of these calculations showed a very close correlation with long-established values of surface tension throughout the entire range of liquid water temperatures and pressures.

In addition to this analytical correlation with established values, I developed a "quick and dirty" home experiment to provide further verification. Smaller particles would travel further between collisions, thus yielding a greater mean free path. The helium molecule has a collision diameter, determined from viscosity measurements, of 2.45A compared with 3.5A for nitrogen and 3.4A for oxygen. I then predicted an increase in the surface tension of water of approximately 30% in a helium atmosphere based on these diameters, and marked with fingernail polish the rise in a capillary tube in this atmosphere. I inverted a 3-liter beaker in a water-filled laundry tub, released commercial grade helium from a balloon into the beaker, and noted the capillary rise. It increased approximately 30% as predicted. A crude experiment, but it worked.

While these discoveries may be of scientific interest, what are the naval applications? Firstly, the theory suggests the small droplets in the upper atmosphere are liquid in sub-freezing ambient conditions. This theory also provides insights into the formation of larger and larger raindrops and energy exchanges such as in hurricanes. I will not go into these matters in this article, but will address ASW applications.

Over a century ago, Lord Kelvin in England determined a relationship between sea wave velocities and surface tension. The velocity equates to the square root of the sum of two terms. One is proportional to the product of the wavelength and the gravity constant; the other is proportional to the surface tension divided by the product of density and wavelength. When the wavelength appears as a term in both the numerator and the denominator term, a minimum velocity wave occurs which is of calculable velocity and wavelength. Water, for surface tension of 75 dynes/cm, would provide a minimum velocity wave of about 1.7 cm wavelength and a velocity of approximately 23 cm/sec. (One knot is approximately 51 cm/sec.).

Previous approaches to surface tension has presumed an imbalance of intermolecular forces between liquid molecules at and near the liquid surface while treating the vapor space above the liquid as essentially a void. But my theory not only produces a vapor contribution to surface tension, it also measures it -- about 3 1/2 dynes/cm at 20 degrees Celsius, compared with the about 69 1/2 dynes/cm liquid contribution. When Lord Kelvin's wave velocity relationship is used -- where the surface tension term is proportional to the surface tension divided by the product of the density and wavelength -- low air density compared with that of liquid water nevertheless markedly changes the minimum velocity wave characteristics, producing a minimum velocity "wave" of velocity of about one knot, and wavelength of about 10 1/2 cm.

A surface ship of sufficient speed leaves a visible set of wake streaks on both sides of the stern which diverge according to Lord Kelvin's surface tension/gravity relationship. Nature processes the array of waves, moving those faster than the minimum velocity waves on out and leaving visible waves of calculable speed and wavelength. Because of this vapor contribution to surface tension, I propose that above a certain minimum speed a ship would also generate "vapor wakes" of predictable velocity and wavelength, and a wind shear abaft the ship. Moving in the horizontal direction there would be compressions and expansions, producing non-visible waves.

We would hope that radar detection of the phenomenon just described would be feasible at a frequency related to the

vapor wake wavelength. A mechanism for a detection system appears to be achievable, but would such a system operate above the threshold of detectability with today's technology? Initial experimental verification should be feasible with small surface craft and state-of-the-art radar. Signal processing may be necessary in addition to the signal processing done by Nature in producing minimum velocity vapor wakes.

An explanation of step changes in pressure across curved surfaces certainly derives from "surface tension", considering the centuries-old development of such theory by very eminent workers. An assumed variation in tension at such surfaces will, indeed, explain the pressure differential. But, could not the reverse be true? A pressure differential, however produced, would translate to a change in surface tension. The question becomes, "Which is cause; which is effect?" Begging the precise answer to that question, let us note there is no inconsistency with surface tension theory and my theory. After all, the Equation of State I used incorporates the effects of intermolecular forces. Furthermore, inasmuch as the pressure generated by the air and vapor equals in magnitude the water pressure, should not a perturbation of the interface, such as curving the surface, involve both media?

There are two primary bases which support my theory of capillarity produced by water vapor:

a. With only minor discrepancies, my calculated surface tension values are consistent throughout the entire range of temperatures from freezing to the critical temperature.

b. The predicted increase in surface tension of water in a helium atmosphere was qualitatively verified by me.

I believe that a measurement system can be developed for this concept. Risks are evident, though not of a significant financial nature. The payoff could be significant.

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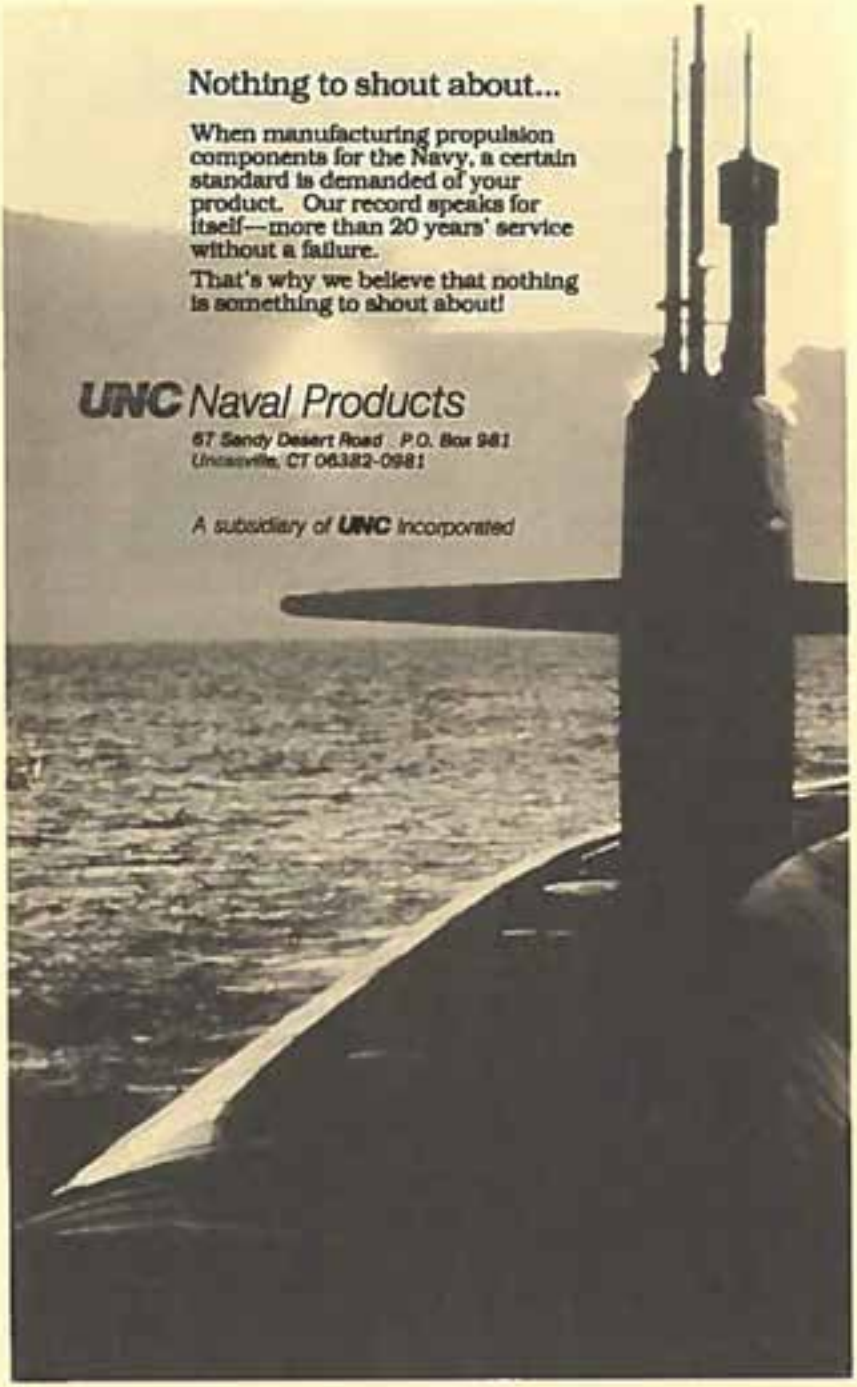
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INCREASED MORTALITY FROM SUBMARINE DUTY?

MAKE A COMMITMENT

[An editorial in the New London Day of 11 Feb. 1990]

The Navy says it has done enough. The Navy is wrong.

The Navy says its Yale University study of submariners' health shows there is no additional risk from serving on submarines. The Navy says there's no need for further study.

Why is the Navy so reluctant to update, improve and expand on a Yale University study designed to measure cancer, heart disease and respiratory illnesses?

New studies released by the National Research Council in 1989 have shown that the danger of getting cancer from low-level radiation may be four times as great as previously estimated.

Surely a cost of $3 million, $5 million, even $10 million is a small price to pay for a health study when measured against the enormous investment the Navy has made in building the best submarines in the world and staffing them with the most technically competent, intelligent people it can find.

To put that submarine force at sea, the Navy invests billions of dollars in submarines, as much as $1 billion per boat, and annually spends hundreds of millions in payroll, training and transportation.

No submariner should go to sea without the knowledge the Navy cares for its servicemen enough to continue regular testing of the health of submariners present and past.

Scientific studies have proven that exposure to asbestos, such as that installed in submarines in the past has caused respiratory, cancer and other major health problems.

The Yale study done by the Navy simply did not work with a period long enough in the servicemen's lives to gauge the development of cancer. The Yale study, measuring a group of navy men whose health was substantially better than that of the overall U.S. population, found slightly higher cancer rates among submariners. Given that finding, the Navy should invest in tracking earlier nuclear submariners and examining their health status.

When the Navy's nuclear propulsion program was

established and the Nautilus was launched, the Navy fully understood the potential benefits and the risks of its history-making venture.

The Navy has always preached that safety is the number-one consideration in its nuclear submarine program. Why, then, were medical histories of nuclear submariners not tracked from the inception of their training throughout their lives?

Why, in the words of Capt. James Bush, a submarine veteran who has recovered from cancer, does the Navy have to go to the Veterans Administration and Social Security Administration to find out which members of its "elite" force have died and from what cause?

Submariners' service to this country is extraordinary. For that service, the nation owes them a great deal of appreciation. But the nation owes them more. It owes them a commitment to assuring that the duty aboard submarines is performed in as healthy an environment as possible.

That is why the Navy's recalcitrance at expanding its exploration into the health of its submarine force is difficult to comprehend. It is in the Navy's own long-range interest to promote the safety and health of its submariners.

More than that, the Navy has a moral obligation to the families of its submariners to monitor the health of its most effective force.

■

A LETTER TO THE EDITOR OF *THE DAY*

[From Vice Admiral Daniel L. Cooper, USN
Assistant Chief of Naval Operations for Submarine Warfare]

The Day's editorial ("Make a Commitment", Feb 11, 1990) implies that the Navy is not committed to the occupational health and the long-term well-being of its submariners. *The Day* is wrong. Since Navy people in the New London area read your paper, this letter is sent to publicly respond and to set the record straight.

The Navy made a commitment to the health of its nuclear submariners long ago. Since the early 1960's, the U.S. Naval Medical Command has maintained an ongoing interest in the health of the nuclear submarine population. Over the last 25

years, numerous studies have been conducted on various aspects of submariner health. Most of the early studies were conducted by the Naval Submarine Medical Research Laboratory, Groton, Connecticut, or in collaboration with a college or university. These studies have proven valuable, for example, in refining submarine atmosphere control systems. None of these studies has ever identified a significant adverse health impact from nuclear submarine duty.

The Yale study, challenged in *The Day*'s recent series of articles and in your editorial, was an extension of an existing Navy Study begun in 1967. Initially, the Navy concentrated on active duty submariners and catalogued the incidence of sickness, injury or disease in this group and found no unusual excesses.

In 1979, the Navy decided to extend the scope of this study to include long-term follow-up of submarine personnel who had been discharged, to determine whether such personnel were suffering from any unusual incidence of conditions such as cancer, heart disease, or respiratory disease. The Navy contracted with Yale University to perform such a study. Dr. A. M. Ostfeld, a nationally-recognized physician and epidemiologist, headed the study group.

The objective of the Yale study was to determine whether the enclosed environment of submarines has had any impact on the health of these personnel; whether there is any increased mortality associated with service in nuclear submarines; specifically, whether there are risks associated with exposure to the low-level gaseous contaminants or external exposures associated with certain occupations among the crew.

It searched for both acute and chronic affects. The analysis took over four years and the preparation of the report took three years. At no time was the group under any direction or pressure to produce "desirable" results. In April 1987, Dr. Ostfeld submitted his final report.

The study concluded that submarine duty has not adversely affected the health of crew members. This observation is based on comparison of death rates, among the approximately 86,000 officers and enlisted submariners studied, against the national average.

The observed cancer rate was not statistically greater than

the age-adjusted national average. In fact, fewer deaths from cancer were observed in the submarine population than expected. Overall, the combined active and discharged submarine population is a healthier population than their civilian counterparts and this trend continues after discharge from the Navy. Finally, the Navy Bureau of Medicine and Surgery reviewed the Yale study and found that there is no basis for a health concern.

The Navy's commitment to the occupational health of its submariners did not begin with the Yale study, nor does it end there. *The Day*'s editorial assertion that "The Navy says there's no need for further study" is incorrect. Since the completion of the Yale study, the Navy has not stopped monitoring the health of our submariners, nor has it stopped looking for ways to ensure that our submariners serve in a safe environment and ways to reduce any potential health or safety risk, however small. *The Day*'s editorial incorrectly implies otherwise.

The Navy is a responsible organization, manned by responsible people. If the results of the Yale study were at all questionable, the Navy would act to resolve the concerns. However, the results of the Yale study were not questionable.

Nothing is more important in the Navy than our people and the families who support them. While *The Day* appears to share the Navy's long-standing concern for the health of Navy people, *The Day* does not appear to understand much about the many existing programs and safeguards which are in place to ensure the health and safety of our people who go to sea.

The Navy's commitment to the occupational health of its people can be measured by the rigid standards under which our people and our submarines operate. The Navy's exacting standards for medical and environmental monitoring, atmospheric purification, nuclear propulsion plant certifications, submarine operations and inspections, and for individual training and qualification ensure that our submariners are able to go to sea safely. Our Navy professionals deserve -- and receive -- our fullest commitment.

The Day's editorial position that the Navy has failed to fulfill its "moral obligation to the families of its submariners" is unjustified and disingenuous. The Navy's long-standing and continuing commitment to the health of its submariners, the

key facts of the Navy (Yale) study on submarine health, and the Navy's exacting standards which have produced an outstanding submarine safely record indicate otherwise.

The Day is wrong.

■

SEAWOLF REUNION -- (SS-197), (SSN-575), (SSN-21)

Members of the commissioning crew of USS SEAWOLF (SSN-575) have organized a SEAWOLF Reunion-Reception to be held in conjunction with the 1990 NSL Annual Meeting and Symposium. Rear Admiral Frederick B. (Fearless Freddie) Warder, USN(Ret.), commissioning Command Officer of USS SEAWOLF (SS-197) will be the Guest of Honor for this occasion. Admiral Warder was awarded two Navy Crosses, four Legions of Merit, the Bronze Star Medal, two Navy Unit Commendations and the Combat Action Ribbon with 9 stars for five war patrols in SEAWOLF. Admiral Alfred J. (Al) Whittle, USN(Ret.), highest ranking ex-Commanding Officer of a SEAWOLF, Captain Richard B. (Dick) Laning, USN(Ret.), commissioning Commanding Officer of USS SEAWOLF (SSN-575), Vice Admiral Daniel L. Cooper, USN, OP-02, and Rear Admiral Millard S. Firebaugh, USN, PMS-350 (SEAWOLF Program Office) will be Special Guests.

The SEAWOLF Reunion-Reception will be held in the Upper Foyer of the Radisson Mark Plaza Hotel from 1700 to 2000 on 13 June. Questions concerning this activity should be addressed to Charles A. Orem, Bird-Johnson Company, 110 Norfolk Street, Walpole, MA, 02081;
Telephone (508) 668-9610.

■

DARPA'S UNMANNED UNDERWATER VEHICLE

[This digested article by Edward J. Walsh is reprinted by special permission from the Armed Forces JOURNAL International/February 1990.]

The Defense Advanced Research Projects Agency (DARPA) will begin tests in March of two prototype unmanned undersea vehicles (UUVs). The tests are expected to demonstrate the feasibility of a UUV design that could be used for a variety of classified, "high priority" naval missions.

Unlike several other autonomous undersea vehicles, the UUV is planned as a tactical system that would be deployed from submarines, surface ships, and beaches. A Tentative Operational Requirement for a UUV has been approved. A third prototype will be delivered for testing in mid-1991.

The UUV was one of the first prototype programs undertaken by DARPA to "stimulate a greater emphasis on prototyping" of systems before they transition to the Services for full-scale development. Captain Edward Craig, director of deep submergence systems in the Office of the Chief of Naval Operations, said the program entails putting together some prototypes of a "back of the envelope" concept to see if proven technologies can be integrated. "If it works when we put it in the water, we can develop it for specific missions."

The technologies being incorporated into the UUV have never before been employed as they will be in this Undersea Vehicle. The program is expected to transition to the Navy in about three years.

LIKE A SMALL SUB

The UUV prototype, which is 36 feet long and 44 inches in diameter, is considered a "large" UUV. It is similar in size to a Mobile Undersea Test vehicle that began operational testing off San Diego in late 1988.

Rear Admiral Thomas W. Evans, deputy chief engineer of the Navy and director of advanced submarine R&D at Naval Sea Systems Command said "the Navy would prefer to reduce the size of UUVs as much as possible by using advanced technology to cut the size and weight of the sensors and

computers, and most importantly by reducing the size of the power sources needed to drive the UUV."

Evans is directing the transition of a LOS ANGELES-class attack submarine, the USS MEMPHIS (SSN-691), from the tactical submarine fleet to a role as the Navy's at-sea test-bed for advanced submarine technology, including launch and recovery of both large and small UUVs.

The UUV prototype program is expected to demonstrate the capability to perform certain naval missions from an autonomous, unmanned vehicle that would be equipped with advanced acoustic detection, communications, and signal and data processing systems. UUV mission software, which will direct the vehicle on such missions as mine detection, undersea surveillance and communications, is expected to use "artificial intelligence" algorithms that function akin to human thought processes. Three mission packages will be prototyped: a tactical acoustic system; a mine search system; and a remote surveillance system.

Draper Labs, under a contract with DARPA, has completed assembly of the first UUV prototype and is continuing work on the second. The hull will be built of titanium, a material that provides a much higher strength-to-weight ratio than steel. Pressure testing of the first hull was performed in late December 1989.

An internal pressure hull will house the UUV mission payload, which will occupy a five-foot-long section, and the batteries, which will be located in two 52-inch compartments. System sensors will be housed in the forward six-foot compartment. Vehicle electronics will be located in a 52-inch midsection.

The propulsion system, consisting of a 12-horsepower electric motor, and a motor controller, will occupy the aft 12 feet of the vehicle. The motor is built to operate when completely flooded with seawater. Bearings are fabricated with a special non-corrosive alloy, and the copper windings that carry power to the motor are impervious to wear. During normal operations, the internal volume of the motor is filled with oil in order to equalize pressure between the inside and outside of the motor, permitting use of a thinner and lighter "soft" housing, instead of a traditional, bulkier housing.

The small motor -- 10 inches wide by 20 inches in diameter -- achieves an extremely high degree of power density by use of samarium cobalt or "rare earth" magnets mounted in the rotor shaft.

FAULT-TOLERANT COMPUTERS

Draper Lab's approach to the UUV design is based on a need to make it fully "fault tolerant." Since no man is in the loop, the UUV must be highly reliable and able to operate despite computer hardware failures. The vehicle will employ three fully redundant computer (fault-tolerant) processors. The processors employ a "voting" approach to UUV system management. All operational programs -- those that control guidance, navigation, and mechanical subsystems such as ballast pumps -- are run by all three computers, which must "agree" on how the subsystems are controlled. If only two agree, the ship is operated in a degraded mode.

Mission packages eventually will also be run on the Draper Lab's processors, although mission contractors are being required to provide computer hardware.

Specific mission plans remain classified. However, the UUV mission concept is basically the same as that of unmanned aerial vehicles being developed by the Services.

Although the program is "looking at the submarine side, UUVs can be launched from surface ships or ships of opportunity." It is conceivable that UUVs could be dropped from aircraft or helicopters.

UUVs equipped with tactical acoustic systems, if assigned to such missions as reconnaissance, surveillance, and target acquisition, presumably would be used for detection and tracking of hostile submarines and surface ships. Acoustic elements will likely include a sophisticated active sonar to detect quieter Soviet submarines.

The tactical acoustic system software will be integrated with the UUV following the operational testing that begins next month. Prior to delivery to the San Diego test site, mission software will run on a high-fidelity, real-time simulator at Draper Labs. Physical integration of the mission package into the UUV prototypes, actual testing, and test support will be performed. The acoustic system package will transition from

DARPA to the Navy in mid-1991.

Development of the mine search system mission package calls for mission software to be written by Lockheed. Raytheon will provide accessory acoustic components, such as depth sounders and altitude monitors. Bell Labs will furnish a fiber-optic communications link, required for transmission of "supervisory" commands from a "host' platform such as a submarine or surface ship to the UUV mission processor. The link must be ultra-thin to minimize drag when spooled out over thousands of yards and requires a tether management system with sensor and software.

The remote surveillance system mission-architecture operational requirement will "require a substantial sensor payload oriented to ASW." DARPA expects to complete development of the mission specification. Operational testing of this system aboard the UUV prototypes will be conducted from mid-1992 through mid-1993.

■

A NAVAL CONFERENCE ON THE HORIZON?

The Soviets, by relaxing their political control of the Warsaw Pact countries and Republics within the Soviet Union have at the same time reduced their ground army threat to Western Europe. The cold war against the U.S. and her NATO partners is believed to have ended.

At the same time, there has been no Soviet move towards reducing their naval forces. Soviet imperialistic moves overseas appear even more likely as Soviet imperialism within the Eurasian land mass seems to have been renounced. Additionally, Gorbachev's own military people have indicated that they believe he is putting them out of business. So he must -- to ensure his political power -- reassure the military officers that their future usefulness remains certain.

In this environment, the way in which Gorbachev might ensure successful moves outside of the Soviet Union is by calling a Naval Conference, similar to the Washington Naval Conference of 1921 and aimed at limiting the sea forces which might be used to thwart Soviet overseas actions.

With the navy he presently has under his control, he cannot risk overseas adventurism. The NATO navies and particularly the U.S. with her nuclear submarines stand in the way of his fleet gaining the measure of sea control necessary to carry out Soviet worldwide aggression. But, at a Naval Conference involving the major navies of the world, Gorbachev can be expected to propose a limitation on particularly nuclear attack submarines -- while not making strategic submarines a subject of negotiations. Similarly, he is unlikely to propose a limitation on attack carriers because he has little or nothing to deal away in order to reduce the size of the U.S. carrier fleet.

Greatly limiting nuclear attack submarines, however, would cater to a world in fear of war between the superpowers. And, it could be very attractive to the people of the United States who have been led to believe that nuclear submarines are the major destabilizing threat against world sea commerce -- ours and theirs.

How would an offer by Gorbachev to cut nuclear attack

submarines by 40 for the U.S. and 40 for the Soviet Union (not worrying about those of Britain and France), be regarded? The U.S. seems not adverse at this point to retiring their 37 STURGEON SSNs and 3 SKIPJACKs, while the Soviets should also readily scrap their 12 NOVEMBERs, 16 VICTOR Is, 5 ECHO 1s, and 7 HOTEL conversions. But then the U.S. would have only about 55 nuclear attack submarines while the Soviets still had at least 87 nuclear attack subs (most of which would be cruise missile boats) and another 170 conventional attack submarines -- enough to neutralize U.S. carrier strength and wrest control of the seas from the United States. Such a tradeoff might -- except to the dyed-in-the-wool nuclear submariner -- appear reasonable to almost all persons who have been led to believe that Soviet nuclears are considerably inferior to the U.S. ones.

Are our submarine leaders ready to prove why this would not be a reasonable proposal?

Ironweed

■

HANK MUNSON

Captain Henry G. Munson, cited in the January 1990 issue of *The Submarine Review* ("the Rasher's Fifth"), served as Commander of the U.S. Navy Hydrographic Office from April 1959 to June 1960 (The Hydrographic Office became the U.S. Naval Oceanographic Office in 1962). During his tenure as Commander, Captain Munson initiated the use of submerged, hovering submarines as platforms for observations of ocean wave height spectra, longitudinal and transverse cross-flow velocities, water temperature, water conductivity and water clarity in addition to measurement of boat motions such as pitch and roll angles and heave acceleration. The USS REDFIN (SS-272), for example, was one of the first boats specifically instrumented for oceanographic research during the period when very little was known about possible sea state effects on a POLARIS launch.

Pat DeLeonibus

■

THE FOUNDING OF U.S. NAVY'S SUBMARINE SERVICE

As you know, USS HOLLAND (SS-1), but usually known as HOLLAND VI, was bought for the United States Navy on 11 April 1900. She was commissioned (Lieutenant Harry H. Caldwell commanding) on 12 October in the same year.

Hence, the 90th anniversary of the founding of the U.S. Navy's Submarine Service is approaching.

I have, at my Museum, the only surviving example of the first Holland boats (HM Submarine Torpedo Boat No. 1, or HOLLAND 1, as she was called in the RN); and she is now fully restored to her in-service condition. It may be that I know more of the strange historical background in the USA than in the UK.

The Royal Navy is indebted to the U.S. Navy (by virtue of J.P. Holland's design) for its own Submarine Service. (Flag Officer Submarines is well aware of this and will doubtless be making the point on at least one of his trips to Norfolk and New London next year). Indeed, if truth be told the RN is actually indebted to what today would be called the IRA (then the Fenian Society and Noraid (then the Fenian Skirmishing Fund).

CDR Richard Compton-Hall
Director "The Royal Naval Submarine Museum"

[Note: See article "An Irish Invention" elsewhere in this edition.]

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HUNT FOR RED OCTOBER PREMIERE

On behalf of the Dolphin Scholarship Foundation and all submarine families, I want to extend to the Naval Submarine League and all your Corporate Sponsors our heartfelt thanks for the magnificent support you all have given the Foundation. We are deeply appreciative of the generous financial gift you have given to us by making the Dolphin Scholarship Foundation one of the beneficiaries of the premiere for ***HUNT FOR RED OCTOBER.***

As you know, our Submarine Officers' Wives have for 29

years been truly remarkable in their efforts to "take care of our own." We are proud of our growth in those years, from one $350 scholarship awarded in 1961, to the ninety $1,750 grants awarded these past several years.

Now, as we enter our 30th year, our hope and expectation is for continued growth. The proceeds received from the premiere will be a major factor in enabling us to reach our goal of growing both in number of grants awarded annually and in our ability to contribute even more substantially towards our children's educational opportunities.

Please accept the enclosed certificate as a small token of our appreciation for your most generous support.

Joan D. Bacon
Director

■

A BRONZE STAR FOR COMBAT SUBMARINERS?

I found an interesting thought in the February issue of the Sacramento Subvet Chapter publication, "PERI-SCOOP." It reads as follows, "President Peterson (of the Sacramento Chapter) read a letter from the last surviving Officer of the SCULPIN urging all to contact our Congressmen to pass a resolution to go to the President stating that all holders of the Submarine Combat Pin be awarded the Bronze Star. A precedent has already been set. Holders of the Combat Infantry Badge receive the Bronze Star."

I think that this is a wonderful idea! As a CO, I often felt the need for a better way of awarding medals to our crew members.

I believe that President Bush would understand this idea from his personal wartime experience with submarines. Further, since a precedent has already been established, it appears that the time is ripe for an organized effort to push such a resolution through Congress, if that's what it takes. I think the Naval Submarine League would gain stature and support among ex-submariners by spearheading this effort.

Bud Gruner

■

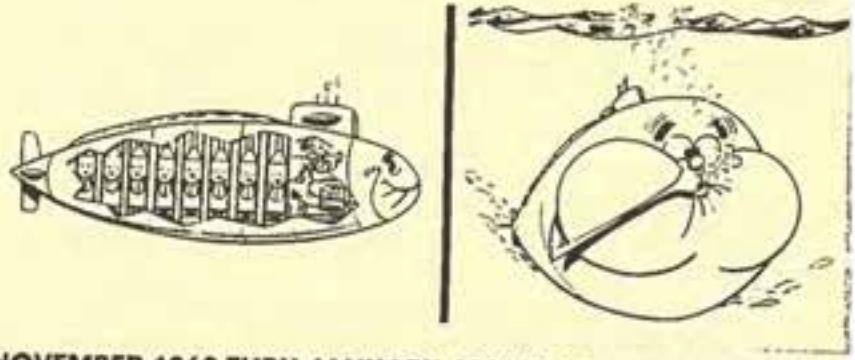
SSBN GEORGE WASHINGTON MEMORABILIA

I understand that there was at least one submarine named after George Washington, and on this account have thought that some memorabilia from that submarine would be an interesting addition to a collection of artifacts inspired by George Washington which is displayed here at Washington College, Chestertown, MD.

Specifically, we would be interested in getting some symbolic memorabilia from the submarine GEORGE WASHINGTON. Importantly, our college is the only one for which George Washington gave permission to use his name.

William P. Jones
The Clifton M. Miller Library
Washington College
Chestertown, MD 21620

■



NOVEMBER 1960 THRU JANUARY 1961 USS George Washington (SSBN 598) departs Charleston, S.C. for first FBM patrol with 16 Polaris A1 missiles. USS George Washington establishes record for submerged operation . . . *66 DAYS 10 HOURS WITHOUT COMING UP FOR AIR.*

IN REMEMBRANCE

Vice Admiral W. F. Raborn, USN(Ret.)

WILLIAM FRANCIS RABORN, JR.

Submariners around the world are deeply saddened by the passing of Admiral "Red" Raborn, one of the founding fathers of our Submarine Launched Ballistic Missile Program.

The following is quoted from Admiral Raborn's obituary in the Washington Post on March 13, 1990:

> *As director of the development of Polaris missiles, he was said to have brought the energy of a sports coach and the enthusiasm of an evangelist to the assignment, and he was known for the pep talks he delivered around the country at the plants and factories where materials for the new weapon were produced. His style of administration was to work with a small group of subordinates, including one whose principal assignment was to search for talent, and he was a firm believer in the management policy that an overworked small staff was generally more productive than an underworked large one.*

We are all thankful for the good fortune of having had him on our side.

NAVAL UNDERSEA MUSEUM NEARING COMPLETION

Construction of the Naval Undersea Museum is 95% complete. While the first role of the museum was envisioned as a place to chronicle undersea warfare and its applications, the Navy in 1987 enlarged its mission to represent all undersea activities for the Navy and all aspects of the technology and phenomena used to explore the oceans.

The museum is the only one of its kind in the nation and houses artifacts related to all aspects of undersea exploration, including commercial and military applications. It is much more than a collection site for relics. It will serve as a national repository for technological advances in the field of undersea technology and will be a viable resource for researchers and scientists, and educational institutions, including elementary through high school classes. The museum of 68,000 sq. ft. houses an extensive library, orientation theatre, a 450 seat auditorium, an 18,000 sq. ft. Exhibit Hall and an 18,000 sq. ft. Repository.

In July 1979, after a nationwide search, the museum was donated by the U.S. Navy -- adjacent to the Naval Base property at Keyport, WA. After its completion the Navy will maintain and operate this facility. There will be no general admission fee to tour the museum. Of the $9.1 million needed for the facility $7.3 million has been raised to date. If present fund raising efforts are successful the museum can be opened to the public this year.

Acquisition of remarkable artifacts continues. The museum was fortunate in obtaining the deep submergence vehicle TRIESTE II, a deep sea exploration and research craft, which is displayed on the museum grounds. It will join an impressive list of acquisitions including a KAITEN torpedo (a one-man submerged Japanese KAMIKAZE) and a World War II submarine 5"/25 wet mount gun.

Recently the museum welcomed a new addition to its historical collection with the arrival of the MAKAKAI, a manned submersible built by the Navy to study the use of new materials and devices underwater. It was used for two-man observation dives, marine ecology studies, observation of experimental work stations, study of oil leaks, and underwater

photographic work.

This Museum facility will be a national asset and enable the Navy to preserve it's heritage and hard earned knowledge obtained through its efforts to utilize the ocean's depths both in peace and in defense of the nation.

Individuals who have artifacts, documents, appropriate undersea memorabilia to donate, or would like to become a member of the Foundation should contact the Naval Undersea Museum, Keyport, WA 98345. Phone (206) 396-6218.

■

IN THE NEWS

- The Washington Post of February 13 describes a Pentagon classified planning document, The Defense Planning Guidance, which "represents a basic set of policy principles to guide the military services in planning their forces, budgets and weapon procurements." It forecasts "intense superpower rivalry worldwide in the 1990s" and asserts that "fundamental Soviet objectives in the Third World do not appear to have changed" while "the Soviet threat in Europe has diminished," and that there "is a need to accelerate a technological revolution in modern weaponry." The article also tells of Admiral William J. Crowe, Jr's written statement last fall on military strategy, which said, in part, that "Future U.S. conventional forces should concentrate on those strengths that American allies cannot provide. Foremost among these are space exploitation, sea lane protection, global power projection and a secure mobilization base in the United States." (Ed. note: it should be recognized that while the Soviet threat against NATO forces -- protecting against an invasion of Western Europe -- has diminished, the need to control the oceans against the major threat of mainly Soviet submarines, is not diminishing.)
- An article by R. Jeffrey Smith in the 13 February Washington Post tells of recent arms control talks in Moscow. Relative to cruise missiles: "on air-launched cruise missiles, the two sides finally agreed to exclude a substantial

portion of each side's arsenal from the future (START) treaty limitations. However, U.S. strategic bombers will be arbitrarily counted as carrying ten cruise missiles while Soviet bombers will be arbitrarily counted as carrying eight, and that the missiles be deployed aboard 40 percent more Soviet bombers than U.S. bombers." The U.S. said it was willing to limit only long-range missiles," (like the nuclear-tipped TOMAHAWK of about 1500-mile range). But, the two sides could not settle on the exact type of sea launched cruise missile (includes the submarine SLCM) to restrain under a 'side agreement' that will not be part of the START treaty and will lack any inspection rights. While, Moscow wants to include only longer-range missiles armed with either conventional or nuclear warheads." Both sides agreed that, "Either side can produce an unlimited number of sea-launched cruise missiles," and that production will be monitored during the subsequent five years by both sides.

- A study by Rand Corporation, summarized in the Washington Post of 14 February notes that "Soviet operations in Swedish waters continued in strength through the first quarter of 1989, the date of the last available information, and this is in the fourth year since Gorbachev's ascendancy to power. Thus, "the Soviet political platform in Europe is directly at odds with the goals and potential consequences of the submarine campaign," (to penetrate with submarine probes the heart of Sweden's coastal defense zones, including the harbors of the country's major naval bases). "Gorbachev appears to have good reasons to see that these operations are brought to a rapid halt. But, that this has not occurred suggests that he either supports the underlying objectives of the campaign or will not curtail Soviet incursions until he can demonstrate they are causing more difficulties for the Soviet Union in the West than has been the case so far."
- SUBNOTES/Jan./Feb 1990 tells of the designing of a Submersible Landing Craft (the 560) by Seaforth Subsea of Edinburgh, Scotland. Such an underwater craft can carry troops while submerged at 4 knots, from a mother ship 30 miles offshore to the beach where it would surface to offload personnel and equipment -- then submerges "out of

sight until recalled by the landing party using transponder devices."

- NAVY TIMES of February 19, 1990, announced that Admiral Frank Kelso (a submariner) presently the Commander in Chief, U.S. Atlantic Fleet, was nominated by President Bush to be the next Chief of Naval Operations to succeed Admiral Carlisle A. H. Trost, the present CNO. Born in Fayetteville, Tennessee and a '56 graduate of the Naval Academy, Admiral Kelso as a 6th Fleet commander is credited with helping to orchestrate the capture of the hijackers of the cruise ship ACHILLES LAURO and the 1986 air raid on Libya. "If confirmed, Kelso will become the third nuclear submariner in a row to hold the CNO post."
- DEFENSE NEWS of 12 February, reports that the SEA LANCE submarine launched antisubmarine missile has been cancelled -- "because of technical issues that were uncovered during testing." This long-range, standoff ASW weapon uses the Mk 50 torpedo and had been designed to provide a 70-mile weapon which could extend a submarine's kill capability against an enemy submarine far beyond the maximum 20-mile range of the Mk 48 torpedo. It would also utilize the submarine's enhanced sensor systems to detect submarines out and beyond the second convergence zone, and provide a much swifter reacting ASW system than relatively slow torpedo systems. A concept to integrate the Mk 50 Advanced Light-weight Torpedo with a rocket and used in the Vertical Launch System, is under consideration as an alternate solution for the SEA LANCE failure.
- NAVY NEWS & Undersea Technology of 4 December, 1980, tells of "a new class of ballistic missile submarine which is starting to take shape on the drawing board." Concept definition of the successor to the OHIO-class boats calls for 16 missile tubes compared to the TRIDENT's 24, and SEAWOLF technology will be used. The smaller missile capability of this strategic submarine should better meet treaty limitations which might fall out of a U.S.-Soviet agreement and a Soviet thrust for better antisubmarine warfare technology. "The size and performance of the proposed submarine will depend on the type of missile fired. Alternatives include the TRIDENT D-5 or a smaller missile

with fewer warheads. The proposed submarine, it is estimated, would have a displacement of between 12,000 and 17,000 tons."

- DEFENSE NEWS notes that retired Admiral William Crowe, former Chairman of the Joint Chiefs of Staff, has joined the Center for Strategic and International Studies group in Washington, DC as a counselor-in-residence. He joins Henry Kissinger and Zbigniew Brzezinski in this capacity.
- INSIDE THE NAVY of 12 February reports that the submarine combat system for the SSN-21 "will not be fully capable when it is delivered to the lead ship, SEAWOLF. Development of the AN/BSY-2 submarine combat system is about three months behind the program's current schedule and further problems could delay the delivery and increase the costs of the $1.9 billion lead SEAWOLF".
- Armed Forces JOURNAL International/January 1990 says, in an Editorial: "the Navy's Silent Service is speaking up. The SUBMARINE REVIEW had a masterful eight-page article in October, 1989, arguing for TRIDENT. It called for a force goal of about 20 instead of 18 TRIDENTs, noting that "all that needs doing ... is to remove the assumption that every missile carried by TRIDENT will have eight warheads ... This would allow each submarine to carry a few single-warhead missiles, giving them more political clout in protracted wars and make possible a force goal of about 20 TRIDENTs!" (carrying the approximate 3,400 warheads which a START agreement is likely to allow for submarines).
- DEFENSE NEWS of 11 December 1989 notes that the Department of Defense "is considering a variety of very intrusive arms control verification measures on its ballistic-missile submarines for a strategic arms reduction treaty (START) .... The flexibility to deploy the 7,000-mile-range D-5 would require an intrusive verification regime which we are willing to accept." General Robert Herres, Vice Chairman of the Joint Chiefs of Staff, suggested that "another alternative would be to make the D-5 a single warhead missile. You can have one warhead on the D-5 without redesign." Herres also suggested that between 3,200

and 3,600 warheads under the START ceiling be submarine based."

- NAVY NEWS & Undersea Technology of 30 October 1989 says: "The Navy is planning a far more sophisticated version (of SOSUS) called the Fixed Distribution System." It calls for replacement of various SOSUS lines "with a new line of underseas listening posts." The system will rely on fiber optics to transmit signals from the sea floor to information processing centers ashore. "The potential for (such) low-cost data acquisition and transmission systems which through their small size and burial are virtually undetectable, is obvious" -- combined with a low-cost maintenance, they are increasingly attractive.
- INSIDE the NAVY of 6 November, says that a National Intelligence Estimate claims that "over half the Soviet (submarine) fleet will be more quiet than an Improved SSN-688 by the year 2005 ... the (estimates) may for the first time admit that Soviet capabilities in submarine quieting and in non-acoustic/active sonar detection are so strong that it may bring into question whether Navy ASW plans are adequate." And, the Estimate will likely show substantially more R&D is being conducted in the USSR than in the U.S. undersea warfare program.
- The DOLPHIN of 26 October tells of the commissioning of the USS TOPEKA (SSN-754). The commissioning held at New London, Conn., had Senator Robert Dole presenting the commissioning address. The Senator stressed the importance of submarines; "America is at peace because submarines like the TOPEKA set to sea, and because outstanding servicemen and women continue to defend our country. Mrs. Elizabeth Dole, Secretary of Labor and the Senator's wife, was the sponsor for the SSN and had previously christened TOPEKA with a bottle of champagne ("which thoroughly drenched everyone standing nearby as she broke the bottle on TOPEKA's bow) at the launching of TOPEKA.
- At the launching of the WEST VIRGINIA (SSBN-736) at New London, as reported by the DOLPHIN of 14 October, Mrs. Robert C. Byrd was the submarine's sponsor and christened her. Senator Byrd, her husband, was the

principal speaker and said, "the Navy's essential mission remains unchanged. It is to deter those who would challenge us from doing so, and to avoid conflicts, not start them; but if war must come, to keep the sea lanes open and erect a Spartan wall for the defense of our country against attack. So to the officers and crew of the WEST VIRGINIA, I say when you get bored on these long patrols, when nothing is happening, remind yourselves that you are succeeding in your mission and that millions of your countrymen rely on you directly to safeguard their security and protect our way of life."

- Defense & Diplomacy, Jan/Feb 1990 tells of the announcement, "That the first Brazilian nuclear-powered submarine will be completed and in the water within five to six years."
- NAVY NEWS & Undersea Technology of 3 February notes that the Soviet's "slowed strategic programs, not yet officially disclosed in either capital, include the USSR's principle nuclear submarine the TYPHOON; its most interesting ballistic missiles, the SS-18 and SS-24; and its most sophisticated bomber, the BLACKJACK. The Soviets also appear to have delayed or suspended construction of a large aircraft carrier..."
- NAVY TIMES/January 8 lists the new Navy Captain selectees for promotion to Rear Admiral Lower Half. The submariners included in this selection of 30 unrestricted line officers and four officers of the restricted line to flag rank were; Dennis A. Jones, Director Command and Control Div., J-3 Joint Staff; Archie R. Clemins, Chief of Staff 7th Fleet; Richard A. Riddell, Chief of Staff, Submarine Force Pacific; Thomas J. Robertson, Chief Maritime/United Nations, J-5 Joint Staff; and the restricted line officer John F. Shipway (a 1220 management specialist), Attack Submarine Program manager, Naval Sea Systems Command. The youngest officer selected was Dennis C. Blair, 42, and the next youngest Jay L. Johnson, 43 -- both of whom are members of the Naval Academy Class of 1968. *NSL has also been advised that Hugh P. Scott, Commanding Officer Camp Lejeune Naval Hospital, has been selected to Rear Admiral Lower Half (Medical Corps.)*

- The Washington Post reports "a dramatic decrease in Soviet submarine patrols and other naval operations worldwide." This is confirmed by Admiral Frank Kelso, who told a Senate panel that the Soviets are sending "very few submarine patrols into the Atlantic. The Soviets have espoused a defensive doctrine. They've pulled back to support that defensive doctrine". Kelso also noted that the Soviet cuts in their naval operations are also being driven by Moscow's severe economic problems. Listed under proposed cuts in ASW programs for the FY '91 budget was a Navy proposal to speed retirement of its older attack submarines.
- DEFENSE NEWS of 22 January said that the Navy announced that its TRIDENT D-5 missile program is now "on track" and on schedule, following two successful test flights last week. The missile is scheduled to be deployed aboard the USS TENNESSEE in March.
- NAVY NEWS & Undersea Technology of 15 January reports that the GLENARD LIPSCOMB (SSN 685) "With half of its service life remaining" will be decommissioned "rather than refuel its nuclear core." The LIPSCOMB "uses turbine electric drive instead of steam turbines for propulsion. Although quieter than the 688-class, the LIPSCOMB proved slower and the Navy opted to pursue steam turbine propulsion instead of electrical drive." The LIPSCOMB does not require reduction gears, a significant contributor to the submarine's noise.
- Defense Electronics of January 1990 notes that the Navy and the House/Senate conferees agreed that non-acoustic ASW deserves well-financed research. The House and Senate agreed to provide $30 million in FY '90 funds for a new non-acoustic program under the auspices of the Office of the Secretary of Defense. "Shallow water submarine detection will become an important test of non-acoustic ASW, because the growing number of Third World countries with sophisticated submarines operating in shallow waters will require advanced detection means. Unmanned underwater vehicles will also receive $100 million in R&D funds over the next five years for ASW application."
- Captain William Manthorpe in the PROCEEDINGS, February 1990, reports that a perusal of Soviet newspaper

articles shows that Soviet "defense budget reductions of 1989 and 1990 in preparation for the start of the Thirteenth Five-Year Plan ... have resulted in cuts in the Soviet Navy by the end of 1990 ... Some 26 diesel-electric submarines will be reduced ... The Soviet Union has decided to completely eliminate from the Baltic Fleet all submarines of the GOLF class ... In 1989 (by October), 12 submarines were scrapped ... What the Soviet press has not made clear is that the ships being scrapped are old and obsolete units ... The Western press has reported the transfer of WHISKEY-class conventional submarines to foreign scrapping yards ... Many of these ships have been in reserve or inactive for a long time." (Jane's has noted in the past that in addition to the some 360 operational subs, the Soviets have kept in reserve some 75 more boats -- with skeleton crews.)

- Unmanned Systems/Fall 1989 reports that DARPA has released a solicitation for the production of the prototype of a rapid mine-avoidance Underwater Unmanned Vehicle (UUV) capable of detecting mine-like objects. (It would be used out ahead of a submarine probing for minefields.) The mine-avoidance UUV's system would include fiber optic and acoustic data links to the mother submarine, sonars, vehicle, and mission controllers, and tether management systems. DARPA will supply the UUV and support equipment, a forward looking sonar, a side-looking sonar, sonar processing units, and a basic launch and recovery system.
- In an article by Norman Polmar and Ray Robinson in the PROCEEDINGS/ February 1990, the authors emphasize: "Looking at the extensive writings of Admiral Gorshkov and other Soviet writers, it is clear the Soviet Navy considers the submarine its capital ship ... The Soviet attack submarine has thus emerged as the ship that can make the difference in an *offensive* sea-control or sea-denial campaign."
- The Washington Post of 27 February tells of the world premiere of the movie *Hunt for Red October* in Washington, DC on February 26. Sponsored jointly by Paramount Pictures and the Naval Submarine League, the premiere had all of the familiar Hollywood flourishes. Tom Clancy, the author of the book on which this movie is based, was

"wearing his usual dark glasses and holding his cigarette German-officer style" and remained quietly aloof from most of the proceedings. But he did say "it's like having another baby." The movie was certainly a true winner -- with all of the excitement -- if not more -- than the very popular *Top Gun*. Captain Bill Habermeyer, director of the Navy's attack submarine division is quoted as saying, "An awfully good story turned into a wonderful movie". Then with the question, is it believable?, Habermeyer said "You have to sort of step back and enjoy it like any other movie" -- suspending some of one's critical sub knowledge. Admiral Bud Edney, the Vice CNO noted that "Sean Connery was a perfect Russian Commander. I loved it. We're thrilled about it. A good recruitment film." The article noted that Sean Connery was not at the premiere. "Maybe he didn't want to wear that white hairpiece again, that makes him look like Everett Koop". Attorney General Richard Thornburgh was there saying that "Our youngest son, Bill, is a sonar technician on the BATON ROUGE, so this is a very special evening for us." When his wife Ginny had asked their son what he did on the submarine all day, son Bill said, "Mom, haven't you read *Hunt of Red October?*"

- The Los Angeles Times of 1 March notes that the Soviet government newspaper Izvestia "reported that a real-life mutiny took place on a Soviet anti-sub destroyer off Sweden in 1975 -- inspiring Clancy's best seller, *Hunt for Red October*." The antisubmarine ship STOROZHEVOI, according to Izvestia, tried to escape to Sweden in November 1975. The ship's deputy commanding officer, Captain Valery Sablin, took over the ship and led the attempted mutiny. He planned to isolate the commanding officer and other officers and deceive the crew into obeying his orders. He did get the ship out of Soviet waters in the Baltic and did get his ship into Swedish territorial waters. But the ship was intercepted and returned to base. Sablin, it was reported, was tried by the Supreme Court's military wing and sentenced to death by a firing squad.
- An article in Armed Forces & Society, winter 1990, by William R. Bowman of the U.S. Naval Academy, tells of a study to examine the belief (held by Admiral Rickover) that

technically trained college graduates make the best professional naval officers for commands. At the core of this study was an examination of a college grad's performance as a military officer relative to his ability as a successful leader in a branch of the military. Actually, there was only a weak statistical relationship "between the academic world of the Naval Academy (which is oriented towards engineering) and junior officer fleet experience and performance -- as measured by fitness reports and job performance reports in various types of ships. The study focussed on the graduates' first six years in the fleet and while they were serving as division heads of submarines and surface ships.

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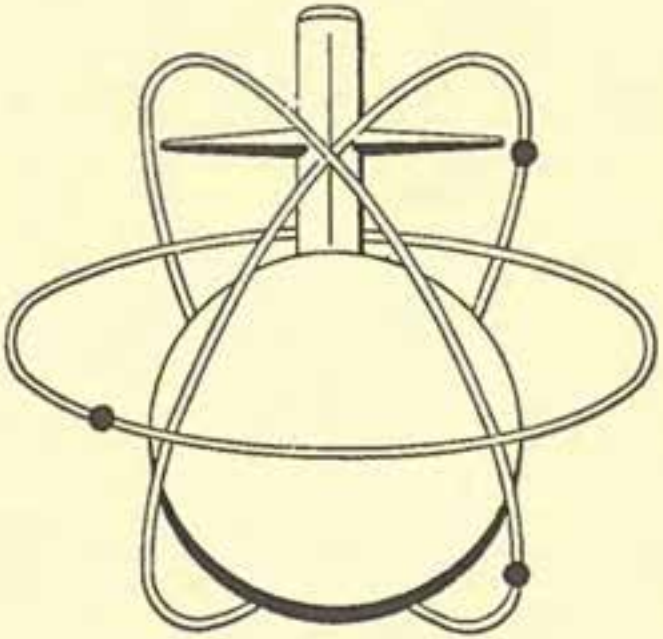

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715
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RICKOVER AND THE NUCLEAR NAVY

(The Discipline of Technology) by Francis Duncan
Naval Institute Press, Annapolis, MD 374 pages
ISBN: 0-87021-236-2

Reviewed by CAPT William D. Roseborough, Jr., USN(Ret.)

What? Not another biography of the famous (or infamous) controversial Admiral? Hasn't everything worth saying already been said in the numerous biographies already published?

The author claims that this current book is not a Rickover biography but is a history of nuclear power technology. While possibly true, it is so completely interlaced with the Admiral's direction and control of the navy nuclear power program as well as insights into his personality and philosophies that it undoubtedly constitutes the most accurate biography to date. Unlike most previous Rickover biographies, based primarily on information and interviews provided by Rickover himself -- or written over his objections -- this one is based upon virtually unlimited access to documents and nuclear power personnel at every level of involvement over the 8-year period from 1974 to 1982. During this period, the author was in residence in an office supplied by Rickover in his headquarters. Admiral Rickover was clearly using a historian to do the definitive biography of himself, H. G. Rickover. At the same time he was ensuring that Duncan would know what the Admiral wanted him to know -- and what he didn't want Duncan to know.

This book, written by an Atomic Energy Commission historian, of 25 years experience, is essentially a sequel to his *Nuclear Navy -- 1946 to 1962.* Duncan chose the point of departure for this book as the end of 1957, although there's some overlap with *Nuclear Navy* for continuity and readability. The author felt that naval nuclear propulsion development had reached maturity at that point and was being succeeded by one of application. The history of three broad areas of application -- submarines, surface ships, and power for electrical utilities are covered in eleven chapters.

The first chapter, titled *"Common Denominators"* and dealing with the LONG BEACH, NAUTILUS and Shippingport had only one common denominator -- all three used pressurized-water nuclear reactors. This chapter summarizes Rickover's background, surveys the navy nuclear propulsion program and describes the political framework in which both Rickover and the program operated. An 8-page summary of the Admiral's background listed three events which were crucial to his future career in both the Navy and in atomic energy. When, in early 1946, Rickover and four other naval officers plus two civilians were sent to Oak Ridge to determine the practicality of nuclear reactors for power generation, Rickover persuaded the AEC civilian project director to designate him as the senior naval officer in charge of the group with responsibility for preparing their periodic Navy fitness reports. From that point on, each in the group knew who was the "real" boss. Upon completion of their Oak Ridge assignment the group was ordered to BuShips for duty and became the nucleus of its nuclear power project.

In the newly formed AEC, although the Naval Reactors Branch was only one of six technical branches in the Reactors Development Division, Rickover got himself appointed head of the Naval Reactors Branch, thus planting his feet firmly in both BuShips and the AEC. Subsequently, he was able to play one against the other to get approval and funding for reactors. He was able to maintain the dual authority and to use it many times for the rest of his long career.

The third event, described by Duncan and amplified by Captain Ned Beach in his excellent *Foreword* to this book, was Rickover's struggle against the Navy establishment to get promoted to rear admiral -- in order to continue developing and controlling the nuclear power program. Using his influence with Congress and the press he was able to parlay his career up to the final rank of full admiral.

In Chapter two, the author traces the development of new nuclear propulsion plants. An improved version of the reactor in NAUTILUS, the Westinghouse S5W, with a longer core life and with the same horsepower, was installed in SKIPJACK -- and eventually in 5 submarines of the SKIPJACK class, 14 THRESHERS, and 37 STURGEONs plus all 41 POLARIS

ballistic missile submarines. The chapter also covers GE's S6G reactor, installed in 48 LOS ANGELES class attack submarines, and the S8G installed in 12 OHIO class ballistic missile submarines. The author unfortunately credits SKIPJACK's superior performance to its S5W power plant rather than its use in an advanced hull form. Duncan does footnote that a description of SKIPJACK's hull could be found in Norman Polmar's *Atomic Submarines*. In fact, the significantly increased speed of SKIPJACK stemmed from an optimum-shaped hydrodynamic hull and the utilization of a single centerline propeller.

A 1961 document stated that reactor safety was the single over-riding design criteria, and against this standard Rickover tolerated no compromise.

In the words of the author, "Rickover had not settled on the pressurized water concept or continued its development without keeping abreast of other concepts. He had developed two sodium-cooled reactors -- SEAWOLF and its prototype plant -- which proved inferior to the pressurized water approach for ship propulsion." There were no reasons given for this statement, and it is apparent he accepted this statement made from someone above him -- since there is no evidence that he interviewed anyone about this matter, including Dick Laning, the SEAWOLF's skipper. There were initial metallurgical difficulties encountered in the primary side of the nuclear plant, but SEAWOLF was operated for many months without requiring access to the reactor compartment's shielded lower level. However, enough concern was created in Washington, so Rickover announced that the reactor would be replaced with a NAUTILUS type at the ship's first overhaul. Rickover did try a turbo-electric drive system in TULLIBEE, to have a quieter propulsion system. But no more ships of her type were produced since the THRESHER's characteristics far exceeded those of TULLIBEE. A natural circulating water reactor was tried in NARWHAL in order to reduce the noise produced by the main coolant reactor pumps.

Although many developments had shaped the U.S. post war submarine evolution, the author considered only two in his conclusion: pressurized water reactor technology; and Rickover. Reactor technology evolved in three phases: first,

NAUTILUS and SEAWOLF demonstrated the feasibility of the technical concept; then in the STURGEON and POLARIS submarines, Rickover's team provided only the nuclear reactors and stated that the characteristics of the submarines were largely determined by other groups; finally, he instigated and fought for the NARWHAL, the LOS ANGELES and the TRIDENT submarines, acting as the major force in getting these ships authorized and funded.

The THRESHER chapter is one of the most interesting parts of this book. Design and construction was assigned to the Portsmouth Naval Shipyard -- a departure from Electric Boat Company's monopoly on nuclear submarine design. THRESHER was designed to incorporate: reduced machinery-radiated noise; increased sonar capability and significantly greater depth. Her loss, two years after her initial sea trials was, in the investigation into her loss, credited to the unreliability of silver brazed pipe joints in the seawater systems for a submarine with a considerably greater operating depth than previous submarines, the inadequate discussions as to ship recovery procedures in case of flooding due to a piping failure; the failure to test the ballast tank blow system at deep submergence even though the blowing pressure had been increased from 3000 psi to 4500 psi; and the possible failure to maintain some degree of propulsion even though the reactor was scrammed. In effect, the vast amount of effort described by the author, for ascertaining the cause of the THRESHER's loss, led to a belief that a silver brazed seawater line had ruptured at deep submergence, the water under high pressure had sprayed electrical controls for the reactor, the reactor had scrammed, propulsion power was lost and the blowing of the ballast tanks resulted in the high pressure air control valves acting like refrigeration expansion valves as the 4500 psi air expanded. This caused the moisture in the high pressure air to freeze and block the airflow to the ballast tanks. Subsequently, a major "Sub-Safe" program was initiated for all follow-on submarines of the THRESHER class which included better testing of joints for the sea water systems, better welds, redesign of the expansion valves and other damage control features. Although Admiral Rickover had stated that "his procedures for reactor plant operation

were so rigid as to be a factor in the loss of the ship was an incomprehensible argument," he further stated that "for normal conditions, standard procedures were mandatory. In an emergency, the operator had to take whatever steps he thought necessary to save the ship." He did however take action after THRESHER's loss to reduce the time required to restart a nuclear plant.

The next three chapters deal with the political battle to get nuclear power surface ships into being. Initially Rickover had LONG BEACH, a cruiser, ENTERPRISE, an aircraft carrier, and the destroyer BAINBRIDGE authorized for construction. The Admiral's argument was that installing nuclear power in surface ships was not much more costly (about 25% more) than using oil-fired engines. But rising costs during the construction of these three ships caused a reappraisal of Rickover's "all nuclear powered navy, of major surface combatants." The cost estimate for BAINBRIDGE rose to a figure more than three times as great.

The Admiral's offensive with Congress to get more nuclear powered surface ships authorized, led him to urging Congress to resume the powers it had let slip to the Executive branch. He reminded the Rivers Committee that it was Congress who had forced the Navy into nuclear propulsion, and urged the Congress to take a strong stand and with-hold funds for certain other items. Was this insubordination?

Subsequent chapters deal with multilateral forces, the Shippingport nuclear power station, the nature of Rickover's nuclear programs over the years, the effect of the Three Mile Island disaster, and a final chapter on "the Discipline of Technology." As for helping other countries develop nuclear powered units in their navies, the Admiral played a major role in determining which nations could be helped. He seems to have rebuffed the French in their development of a nuclear submarine, but kept aware of the Frenchmen's progress on their first and experimental submarine GYMNOTE -- used for testing missiles designed for SSBNs. With the British, and the building of their first nuclear sub, DREADNAUGHT, Rickover imposed the restriction that there would be absolutely no changes in either the reactor or machinery plant without prior approval from his office. The reviewer of this

book went to England to follow the progress on their nuclear submarines and was shown the prototype of a British designed reactor which closely followed U.S. technology as developed for NAUTILUS. In the course of discussions with the Admiralty's officer responsible for shipbuilding, he asked me "How does one deal with that (blank-blank) Rickover?"

The Shippingport nuclear power station demonstrated three accomplishments: feasibility of the pressurized-water reactor for civilian electric power application; how pressurized-water reactors might be converted to breeder reactors; and how strict discipline must be used in the operation of civilian reactors to ensure safe and efficient operation.

His chapter on the nature of Rickover's programs is titled "The Devil in the Details." Whether "the Devil" refers to Rickover or as the author claims "hard work," is questionable. How he personally interviewed every candidate for his organization as well as the seagoing officers who served in his ships, how he demanded absolute loyalty and total dedication to his program, and how he insisted that once in his organization there could be no defections from it -- or there would be no effort spared to ruin that person's career if he quit the organization. But no one else in the nuclear program was as hardworking, as clever or as determined and ruthless as Rickover. Some promising navy careers were sacrificed by running afoul of Rickover -- but his philosophy was that the end justifies the means and he lived it to the fullest extent.

The Three Mile Island disaster on 28 March 1979, illustrated Rickover's procedures, training programs, and audits used to ensure safety -- plus a highlighting of the reactor safeguards examination to constantly check the material condition of the propulsion plants and the training of crews. This caused differences in the Navy philosophy and that of the civilian nuclear power industry, which could account for the Three Mile Island incident.

The final chapter attests to Rickover's claim that his organization was an island of excellence in a sea of mediocrity. While not defining "the discipline of technology" per se, he described several aspects. It means that an organization must adapt to technology, not technology to the organization. It requires exhaustive testing of materials and components to

determine the laws of nature. It requires thorough and deep consideration of the match between the product and its use -- and intense analysis of the present and anticipated future conditions of operation. Most importantly, Rickover believed that the discipline of technology conferred upon an individual the greatest challenge of all -- acceptance of responsibility. And that it was essential to the survival of society.

The value of this book, particularly for the serious student of naval engineering, is enhanced by the appendices, which include "Design and Engineering Principles" and "Reactor Plant Designations, Prototypes and Shipboard Plants." The bibliography is also a valuable source document.

In summary, this book is authoritative, well written and should be of interest to naval history enthusiasts. It is an essential contribution to a more complete understanding of the background and achievements of the naval nuclear propulsion program -- which is probably the most revolutionary change in the development of modern navies. As to its being the definitive biography of the man Rickover, it must be understood that at times the author's statements tend to remind one somewhat of the interesting book, ***The Objective History of the Civil War from the South's Point of View.***

■

THE U-BOAT WAR IN THE ATLANTIC, 1939-1945

By Captain Gunter Hessler

Published by Her Majesty's Stationery Office, London
ISBN 0-11-772603-6

Reviewed by Captain Charles Rush, USN(Ret.)

The reviewer approached this formidable book with some trepidation, but soon found that he could not put it down. It is a fascinating and illuminating history -- the most definitive story of WW II U-boats.

The book covers strategy, tactics, weapons, technology and intelligence. The subjects are integrated so skillfully that it reads like a Russian novel superimposed on a Greek tragedy. Although one knows the eventual outcome, there is a great element of suspense.

When the early U-boats lost the battle, would the new high-speed, long-endurance boats be ready in time to reverse the outcome and perhaps win the war? It was close.

The hero of the story is Karl Doenitz, who not only had to fight the Allied navies and air forces but also the German Naval Staff, whose desk-bound officers were years behind him in operational thinking.

One can glean many insights from this history; one is the importance of the deciphering of the German's Ultra signals, which their cryptologists believed to be impossible. Now that Ultra has been declassified, it is evident there were many occurrences that at the time baffled the German high command.

At the outset of war, September 1, 1939, Germany had a paltry U-boat force ready: 24 coastal boats of 300-tons, 16 type VIIs of 770-tons, and 6 large Atlantic boats of about 1100-tons. Imagine in today's world of 10,000-ton attack SSNs that in World War II German submariners referred to an 800-ton boat as "large"!

Recognizing the inadequacy of the U-boat situation, Doenitz urged a large-scale construction program to raise the U-boat strength to 300. Admiral Raeder, the Commander-in-Chief of the Navy agreed, but the captain assigned to supervise the program on the Naval Staff in Berlin had no executive authority, so the program was bogged down.

Under orders, the U-boats initially maintained strict observance of international regulations which set forth conditions under which merchant shipping could be attacked. No unescorted ship could be sunk without first being stopped for search, and the crews had to be treated humanitarily. Thus, the U-boats could not operate effectively in British coastal waters due to the high probability that they would be detected and attacked while following these procedures. And, when they did attack, they discovered that their torpedoes had a high percentage of failures; the magnetic pistols caused premature explosions, and the torpedoes ran deeper than set. These defects caused disastrous consequences with the loss of many boats.

Despite these difficulties, the Type VIIc boat of 871 tons submerged, and 309 feet "diving depth," carrying 14 torpedoes, proved most effective in attacks on convoys. She was easily handled, had almost 10,000 miles endurance, and had splendid resistance to depth charging.

Efforts of the Naval Staff to micro-manage U-boat operations by detaching them for secondary tasks were resisted by Doenitz. He also noted in his diary: "My problem is to fight the bad weather and ice, to tackle excessive dockyard time, to cope with inefficient torpedoes, and not least to wage war on Britain." In fact, during the battle in 1940 for Norway, 26 attacks on British warships and 5 on transports resulted in no damage, due to faulty torpedoes. Doenitz summed it up, "...peacetime procedure can only be described as criminal. In all the history of war I doubt whether men have ever had to rely on such a useless weapon."

Finally, in June 1940, improvements in the torpedo began to show results. Torpedo failures decreased, and the boats achieved a high rate of sinking. Also, arming of merchant ships and their offensive actions, such as ramming tactics, resulted in an order to the U-boats: "U-boats are permitted to attack without warning all ships identified as hostile."

At the end of the first year of war, 28 U-boats had been lost, and 28 new boats had been commissioned. Then began what the U-boat commanders would later call the "happy time." They felt invincible -- sinking as many as 25 ships in a convoy, while enemy anti-submarine forces were weak and ineffective.

Nevertheless, Doenitz warned his commanders, "The war will go on for many months. We are fighting the most powerful navy (the British) in the world."

In early 1941, Great Britain got the convoy system into operation, so that it was necessary for Germany to make a transition to wolfpack tactics. The first boat in a "pack" that made contact became a shadower, while making frequent reports -- a task that required skill, tenacity and nerve. Meanwhile, the rest of the pack were getting into position to attack. Experience showed that it was best to go in on the surface at night, using high speed to attack and evade. When the U-boats were in position, came the fateful message: "Attack when darkness falls."

It became apparent to Doenitz that the U-boats needed long-range reconnaissance to detect the convoys, and he got a decision from Hitler to allocate some long-range aircraft to the U-boat command.

Fortunately for the British, the number of operational U-boats did not begin to increase until February 1941. By that time the strengthened British anti-submarine forces had forced the U-boats to move from the English coast westward into the Atlantic, where ship traffic was less concentrated. Thus the lack of U-boats prevented them from delivering a knockout blow early in the war.

Increasing demands by higher authority for the use of U-boats for secondary tasks continued to dilute Doenitz' efforts to sink ships bound for Britain. In 1941 and 1942, U-boats were diverted for use as weather stations, escorts for surface ships, reconnaissance for surface ship sorties that never happened, and Arctic missions.

Not until January, 1943, when Doenitz became Commander-in-Chief of the Navy, was he able to prevent this dispersion of his U-boat forces. But by that time he had to face even graver problems. British successes in the North Africa campaign made it necessary for the U-boats to concentrate in the Gibraltar area. They intercepted a hugh British convoy headed for the Strait. Despite a flat calm sea -- the U-boats pressed their attack, sinking a carrier and two other ships in the convoy. But they lost five U-boats. Further heavy losses were taken by boats attempting to break into the

Mediterranean, and those that made it found themselves in a trap. They could not return.

With Pearl Harbor, the U.S. merchant marine shipbuilding capabilities were made available to Britain. Within 5 weeks after U.S. entry into the War, U-boats had begun their operations off the east coast of the United States. Targets were so numerous between New York and Cape Hatteras that the U-boats encountered more targets than they could attack. American defenses were negligible. Navigation buoys and beacons were still lighted, and many merchant ships ran undarkened and used their radios carelessly. At times as many as seven U-boats operated off Hatteras, sinking targets at will.

But within six months the Americans had improved their anti-submarine forces sufficiently to drive the U-boats from the U.S. coast. The U-boats were then redeployed to the Caribbean, where they destroyed many ships, mostly tankers -- sending over a million tons of shipping to the bottom before a convoy system came into force. In September of 1942, most of the U-boats were pulled back to the crucial battle for control of the mid-Atlantic.

Radar equipped Allied aircraft, however, had by now a radius of action of 800 miles, while surface antisubmarine forces were equipped with radar and improved echo-ranging sonar. The freedom of U-boats to use high speed on the surface to close a ship could no longer be relied upon. Therefore, to regain the initiative, Doenitz recommended rapid large-scale construction of high submerged speed, snorkel boats and Walter Type U-boats, which used hydrogen peroxide in their propulsion cycle.

Moreover, the tanker sinking in the Caribbean had affected Allied convoys. To save fuel they were all routed close to the great circle track across the Atlantic, and escorts had to frequently leave their convoy due to a shortage of fuel. The U-boat packs then ravaged some of these convoys, but in November the boats were recalled to the Gibraltar area to oppose the Allied landings in North Africa.

To illustrate the gems of information in this book, I've taken a few from a single page on the last half of 1942's U-boat war:

- "The utmost priority must be applied to the development of an effective anti-destroyer torpedo, for without such a

weapon the future of U-boat operations is in jeopardy."

- "The possibility of firing rockets from submerged U-boats against attacking destroyers, was explored."
- "An asdic decoy was produced by the autumn. It was a cylinder of 15 cm diameter, containing a substance which on contact with sea water would discharge large quantities of gas. On being pursued, the U-boat would discharge 3 such cylinders to provide false echoes."
- "The best protection against depth charges was to dive deeply. For the new boats of Type VIIC the standard resistance was 200 meters which meant they could dive down to 300 meters without harm."
- "The pressure hull had been strengthened so much that the displacement increased nearly 250 tons."
- "Compared with WW I we have the bubble-free discharge and the trackless run which, however, reduced torpedo speeds to 30 knots."
- "Yet the depth-keeping and detonation qualities of the torpedoes have not reached the level attained in 1918."
- "The destructive effect of the warhead when used with the impact pistol is insufficient, as shown by many cases of freighters needing more than one torpedo to sink them." "In order to sink 404 ships, the boats needed 806 torpedo hits."
- "To conceal this new device (the F.A.T. torpedo) from the enemy it was used only at night, because of its conspicuous bubble track. It needed an accurate range, so that after the requisite straight run, the loop run would cover both sides of the target." (Its range was 12,500 meters at 30 knots.)

Despite continued U-boat success in the Mediterranean and the North Atlantic, Hitler and the Supreme Command failed to realize that U-boat operations were more damaging to the enemy for the effort involved than any other type of warfare. Doenitz, on the other hand, was more determined than ever to develop the U-boat into the paramount weapon. He became C-in-C of the Navy in 1943, when the tide was running swiftly against Germany, and immediately started actions to reverse the Allies' momentum. U-boats were fitted with radar; F.A.T. circling torpedoes reached bases at a rate of 100 per month; and flak boats were armed with A/A guns. The latter,

effective against a single aircraft, failed to cope with multiple attacking planes and had to be abandoned. A better submarine became the only possible solution to winning the sea battle.

A few notes from mid-1943 to illuminate the story:

- In mid-October 2 U-boats returned from the Indian Ocean having spent 31 weeks and 29 weeks continuously at sea -- being refueled and resupplied with torpedoes and stores at sea by "milch cows".
- Between July 23 and 3 August 22 U-boats were lost in the Atlantic. It was felt that radiations from their Metox radar intercept receivers were being picked up by the Allies' aircraft at great ranges.
- The quadruple 20 mm gun mounts allowed the U-boats to stay on the surface and fight it out with attacking aircraft -- but the 40 mm gun was being produced to better kill the aircraft. A "flak boat" recorded an action: "Two of my 2 cm guns have been shot out of action. 11 members of the gun crew were wounded ... decided to dive."
- The electric, acoustic-homing torpedo, the G7s arrived in the fleet in October 1943.
- In May '43 Hitler approved a program to build 40 subs a month.

The arrival on the scene of numbers of Allied escort carriers which provided continuous air cover for the convoys nailed the lid shut on the conventional U-boat. For an interim time the schnorkel, an air tube that permitted diesel boats to charge batteries without bringing the hull of the boat to the surface, brought some relief for the old boats; but it was a stopgap, not a solution. The Germans' Atlantic campaign collapsed and they abandoned the North Atlantic battleground. Then, unable to stop the Allies' Normandy landings, the U-boats lost their Brittany bases and withdrew to the fjords of Norway.

However, the U-boat navy prepared to stage a dramatic comeback, for they had one more chance to wrest control of the seas from the surface and air forces. In 1943, contracts had been placed for 360 Type XXI and 208 Type XXIII high-submerged-speed "Electro" boats. The Type XXI was a streamlined 819-ton submarine with very powerful batteries and a schnorkel. The boat was designed for a maximum

submerged speed of 18 knots, or a speed of 12 to 14 knots for ten hours. This would allow the boat to gain a good attack position while submerged. The Type XXIII was a small schnorkel boat of 300 tons and a submerged speed of 12 knots, designed for work in the North Sea and shallow water areas.

Speer, the Armament Minister, promised completion of the first Type XXI by April 1944 and a total of 30 by July 1944; he promised the first XXIII boat by February 1944, and 19 more beginning in April 1944.

Despite subsequent delays, 120 Type XXI and 61 Type XXIII U-boats were completed and commissioned before the capitulation in early May 1945.

Sea trials showed that these U-boats were excellent submarines. The XXI could fire a "programmed spread" of six "Lut" torpedoes in less than a minute. The torpedoes spread out fanwise until they reached the convoy track, then began running in loops. The theoretical probability of 95 to 99 percent hits was achieved on firing trials.

Concurrently with the high-priority work on the "Electro" boats, the Germans built six Walter hydrogen peroxide boats, which attained submerged speeds of 23-25 knots. On 26 May 1944, contracts were placed for 100 Walter boats capable of making 25 knots for 10 to 12 hours.

While these building programs were turning out new-design boats, the older U-boats equipped with schnorkel were sinking ships in the shallow coastal waters off England. But from January, 1945, until termination of the war on May 9th of that year, the Germans lost 75 of the older boats.

In the last weeks of the war, eight of the small, fast type XXIII boats made patrols off the coast of England and sank six ships.

None of the new U-boats was lost in action. However, 111 of them were scuttled a few days before the surrender.

Doenitz and his U-boat sailors fought with incredible courage; 28,000 of them lost their lives in the battle. The reviewer, a wartime submariner, has some understanding of what they endured. Had their leader, Doenitz, been given a free hand sooner, they should have prevailed.

It is well to remember that although the early surface-

dependent U-boats were eventually defeated, the precursors of the "true submarine" which went to sea after the war was lost were not. As the introduction to the English Version of this history points out: "... the submarine persists as a dangerous weapon which others -- having learned the lessons -- may one day use as instruments for world domination."

■

SUBMARINE VERSUS SUBMARINE: THE TACTICS AND TECHNOLOGY OF UNDERWATER CONFRONTATION

By Richard Compton-Hall

David & Charles, Newton Abbot, 1988
ISBN 0-7153-9178-X

Reviewed by Tim Crabtree

The latest book written by the Director of the Royal Navy Submarine Museum at Portsmouth, England, should be a part of every naval library. If it isn't, ***Submarine Versus Submarine*** is still a jolly pulse-throbbing read. It is written through an experienced submariner's eyes mainly from a Soviet perspective. This is an important and creative feature of this book. The book's introduction contains an open note to Admiral of the Fleet, V. N. Chernavin, and General of the Army, P.I. Ivashutin, requesting how their interpretation of submarine warfare would differ from the author's. He's interested in knowing this; so am I.

The author makes quite clear in the introduction, that there has only been one sinking of a submerged submarine by another submerged submarine, that of U-864 by HMS VENTURER on 9 February 1945. Annoyingly, occasional clerical errors interrupt the readers' comprehension of the submarine tactics suggested by Compton-Hall. But this should not be a put-off from the creative interplay between submarines which are outlined.

This is a reference volume which should be useful reading for submariners and on the book shelves of their boats.

It is a book to be quoted from, especially in THE SUBMARINE REVIEW, but it should be recognized that the author has a subscription. He has given information on how

to join the Naval Submarine League in the book's acknowledgements. This may explain the increase in the Submarine League's foreign membership in a year's time, from 39 to 52. Hopefully more than 13 people have read the book!

In 192 pages, profusely illustrated with photos, diagrams and double-page paintings, the author has divided his book into two parts: the first being an explanation of submarine ASW mechanics; the second taking the reader through scenarios submariners may find themselves facing in future combat. While the entire book is stimulating, the scenarios of underseas battles are the most thought provoking.

Part one, "Understanding the Technology," is divided into twelve chapters: the Soviet threat; submarine construction; propulsion, speed and endurance; sound, sonar and non-acoustic indicators; secondary sensors; navigation and communications; submarine ASW weapon systems; submarine launched missiles; operations under the Arctic ice; re-emergence of midget submarines; self-defence; and a summation containing random thoughts not easily fitted in other chapters called "Powerful Forces, Practical Problems."

In the midget submarine chapter, unsurprisingly, Compton-Hall states the case for Maritalia's gaseous storage toroidal anaerobic Diesel submarine designed by another Submarine League member, Signor G. G. Santi.

The author slips in a couple of his own sea stories. My favorite is his tale of when he was skipper of HMS SPRINGER in 1957. Then, he deliberately rammed his boat into a sonar ball being dunked by a helicopter. Luckily the helicopter wasn't pulled into the sea; nor was the author court martialled. But he came pretty close. It makes one wonder how the author would have done during the Second World War but such speculation must be tempered by the strong anti-war theme to this book, especially when ICBMs and SLCMs are discussed.

Part two, "Action and Faction", comprises ten chapters putting forth scenarios dealing with Soviet SSK tactics (to appreciate and develop our own tactics a recognition of how the Soviets are likely to fight with their submarine is necessary); Soviet SSN tactics; non-aligned submarines armed with nuclear SLCMs used as blackmail tools; submarine pirates;

covert intelligence gathering; midget marauders; skirmishing in the Pacific; Arctic operations; NATO submarine operations within Soviet waters; ending with a sobering two-page chapter entitled "The Survivors." (In the aftermath of a massive nuclear exchange, submarines, the author feels, will be the only meaningful fighting unit at sea.)

Submarine Versus Submarine is an important book making well the case for all subs, both "big'uns 'n little'uns". And it is a prophecy for our politicians if they ever intend to take us into another World War.

■

ALBACORE - A NATIONAL HISTORIC LANDMARK STATUS TO BE CELEBRATED

ALBACORE has been designated as a National Historic Landmark by the National Park Service of the Department of the Interior. This prestigious status will be celebrated at a ceremony on Sunday, 6 May, at 2:00 P.M., commemorating the 5th anniversary of the ship's landing at Albacore Park. Dignitaries from the Department of the Interior, State Government, City Government and the U.S. Submarine Community are expected to participate.

In achieving National Historic Landmark status, ALBACORE joins NAUTILUS, now on display in Groton, Connecticut. This status is well deserved by both ships as indeed they form the roots of our modern submarine fleet. NAUTILUS, of course, was the first ship in the world to be propelled by nuclear power. The unqualified success of its nuclear power system forever lifted restrictions on submerged speeds and endurance of submarines. However, it's hull shape and other characteristics did not promote achieving high submerged speeds. Attainment of these very high speeds as well as safe and effective control during submerged operations was the basic mission of the experimental diesel-powered submarine ALBACORE. It's design was the first to employ a near ideal streamlined hull form with center line, counter rotating propellers to maximize propulsion efficiency, and control surfaces configured and located so as to ensure safe

and effective maneuvering at high speeds. ALBACORE underwent five major alterations during its operating life to ensure attainment of these vital operating characteristics. It was, in it's day, the fastest and most maneuverable submarine in the world. Lessons learned in the operating experiences of both ALBACORE and NAUTILUS are now incorporated into the designs of today's ballistic and fast attack submarines enabling them to form the most effective undersea fleet in existence.

ALBACORE was built at the Portsmouth Naval Shipyard and launched in August of 1953. The skill and dedication of many people in the New Hampshire - Maine seacoast area brought this fine ship into being. Today's residents of this area may be justifiably proud of ALBACORE's achievements and the recognition it is now receiving. They and others interested are cordially invited to attend and celebrate ALBACORE's new status at this event.

Eugene Allmendinger

■

THE SUBMARINE REVIEW

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

Articles for this publication will be accepted on any subject closely related to submarine matters. Their length should be a maximum of about 2500 words. The content of articles is of first importance in their selection for the REVIEW. Editing of articles for clarity may be necessary, since important ideas should be readily understood by the readers of the REVIEW.

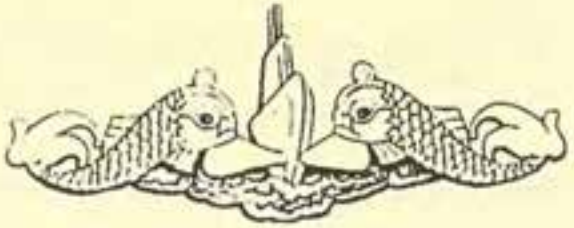
A stipend of up to $200.00 will be paid for each major article published. Annually, three articles are selected for special recognition and an honorarium of up to $400.00 will be awarded to the authors.

The views expressed by the authors are their own and are not to be construed to be those of the Naval Submarine League. In those instances where the NSL has taken and published an official position or view, specific reference to that fact will accompany the article.

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

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.

■



NSL ACTIVE DUTY PRIZE ESSAY CONTEST

(See discussion in the President's letter)

Categories:

- Senior Active Duty (O-5 & above)
- Junior Active Duty (O-4 & below)

Prizes:

- $500.00 for winner in each category; includes the normal $200.00 publishing stipend

Judging:

- Final determination in January 1991
- Judging by NSL Editorial Review Committee
- Award to best essays dealing with ***Submarine Roles and Missions in the Detente II Era***

Rules:

- Essays must be *individual* efforts of about 2500 words or less; entrants by more than one author are not eligible for judging
- Submissions to NSL must be clearly marked as entries for the NSL ACTIVE DUTY PRIZE ESSAY CONTEST
- Essay entrants will not be published prior to judging except with prior concurrence of the author
- Winning entries will normally be published in the Submarine Review

WINNERS OF THE NSL-USNA SUBMARINE WRITING COMPETITION

The Naval Submarine League and the United States Naval Academy conducted a pilot submarine writing competition in the fall semester 1989. Fifty-four midshipmen submitted bright, fresh ideas in submarine technology, weapons, and tactics in unclassified articles intended for possible publication in THE SUBMARINE REVIEW. These forward-thinking future naval officers offered new insights (and re-examined old ones) into the future of the Submarine Force -- and perhaps their own.

Prizes were awarded to the top three entries as follows:

Midshipman Joseph S. Zurzolo - First Prize - $200.00
SUBMARINE WARFARE IN THE 1990's: A New Direction
(Printed in this edition of THE SUBMARINE REVIEW)

Midshipman Trip William Armstrong - Second Prize - $150.00
DARKENING THE DEPTHS WITH THE SEAWOLF

Midshipman Michael Lane - Third Prize - $100.00
TAMING THE UNDERSEA BEAR

The Naval Academy judging committee included distinguished military expert Martin Binkin and prize-winning author LCDR Tom Cutler as well as some outstanding submarine officers assigned to the Naval Academy. A special "well done" is due LCDR Doyle Gillespie who continues to be our sparkplug in the Yard.

The excellent quality of the submissions and tremendous interest generated at the Academy has stimulated discussion of expanding the competition to include NROTC units.

■

USNA SUBMARINE SELECTORS

Congratulations and welcome aboard to the following Class of '90 USNA Midshipmen who selected submarines as their warfare specialty:

Thomas Allbee
Edward L. Anderson
Gregory Archbold
Dean Asher
Michael Badorf
Bryan Baquer
James Barney
Philip Beckman
Mark Behning
Broderick Berkhout
Matthew Berra
Jeffrey Blankenship
William Bogan
David Bogner
Adam Bovshow
Steven Brock
Gary Bruce
Daniel Brunk
Robert Bunger
John Burns
Jay Butka
Thomas Callander
Thomas Callender
Eugene Canfield
Mark Carroll
John Chimenti
David Colegrove
Neil Covington
Thomas Creek
Derek Cribley
Neil Cucuzzella
Christopher Culver
Scott Dimeler
Mark Dixon
Leonard Dollaga
David Dorton
Jeffery Drake
Kurt Egleseder
Dana Emerson
Keith Erdman
Gregory Eytchison
Thomas Feddo
David Fong
James Forrester
Norman Freebeck
Robert Frye
Michael Gabriel
Andrew Gentry
Thomas Gesell
Joseph Giacobbe
Mark Godfrey
Daniel Gordillo
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Michael Warner
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Martin Whitfield
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Mark Winick
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Eric Zerphy
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SUBMARINE: Steel Boats, Iron Men

SPECIAL PRICE FOR NSL MEMBERS!!

The NSL is pleased to offer its members VHS copies of **Submarine: Steel Boats, Iron Men** at a special price. The sixty minute film, produced by Varied Directions, Inc. with the assistance of the NSL, gives the public its first look inside a nuclear submarine in twenty years. A film team caught the Commanding Officer and crew of the USS HYMAN G. RICKOVER in action. Also included are interviews with some of the most honored submarine commanders, and an overview of the development and strategic use of the submarine in both world wars.

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WE WANT TO KNOW!

The **SUBMARINE REVIEW** is your magazine, and it should serve your needs and desires. Please help us to help you - take a few minutes and tell us what you would like to see more of, less of or whatever.

As a result of recent feedback, we have made the following changes for your convenience:

- Each new Article begins at the top of a page
- The author's name is placed at the beginning of Articles

LET US KNOW WHAT YOU THINK!

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SUBMARINE TECHNOLOGY SYMPOSIUM - 1990

The Johns Hopkins University
Applied Physics Laboratory
8, 9, and 10 May 1990

The 1990 Submarine Technology Symposium will provide a classified forum wherein those technologies that may be important to the capabilities of submarines and related systems can be advanced and examined by experts in government, academia, and industry. The objective is to broaden the technical base available to the Navy and to expedite the operational availability of this important technology. The theme of this third Symposium will be to examine technologies which could enhance the performance of the submarine's role in ASW. In addition to the five technical sessions described in the *January '90 Submarine Review*, The Honorable H. Lawrence Garrett, III, Secretary of the Navy, will be guest speaker for the Banquet. Dr. D. Allan Bromley, Assistant to the President for Science and Technology, and Dr. Charles M. Herzfeld, a member of the CNO Executive Panel, will speak at the Symposium Luncheons.

Attendance is by invitation, and restricted to U.S. Citizens with a DoD SECRET clearance and a certified need-to-know. Since space is limited to 500, registrants will be considered in the order in which responses are received. League members holding a current DoD SECRET clearance and certified need-to-know who are interested may obtain additional information by writing to:

Mrs. Patricia Dobes
Submarine Technology Symposium 1990
Post Office Box 1146
Annandale, VA 22003
Telephone (703) 960-7781
FAX: (703) 642-5815

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