THE SUBMARINE REVIEW

JULY, 1983

ARTICLES — PAGE

A QUARTERLY PUBLICATION OF THE NAVAL SUBMARINE LEAGUE

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OF
THE NAVAL SUBMARINE LEAGUE

From The President

The 225 members of the Naval Submarine League who attended our first annual Symposium made this a truly meaningful and useful event. The primary purpose of the day of talks and discussion was to provide an educational forum on submarine matters -- centered mainly around the direction to be taken in developing a new attack submarine. Not only do the Symposium speakers rate our sincere thanks for their excellent and candid presentations, but Admiral Jack Williams, the Banquet speaker, should also be cited for his sage advice and special brand of humor which made this a great occasion. Later, our Board of Directors set May 1, 1984 for the next such affair.

From the comments received, I feel we were provided a good base for expanding our thinking about today's submarine problems and challenges. Additionally, I welcome suggestions from our members which can help me steer the right course to best serve the needs of our expanding membership.

As of 1 June, 1984 the League had 857 members. This is 1127 short of the 1984 goal by 1 January, 1984. So far we're going great guns toward meeting this goal -- which appears to make the Submarine League self sustaining from then on. But it's going to require your effort and support to get there.

Having received several queries concerning the Naval Submarine League's goals and objectives, I would list (though they have not yet been formalized):

o To create an informed membership which can impart its knowledge about submarine matters to the public (including the Congress) so as to strengthen the U.S. Submarine Force in its national security posture, o To establish a dialogue on submarine matters amongst the League's membership, drawing on their past experiences, corporate memory and knowledge of submarine technology and operations, to strengthen our national strategic posture for war,

o To further the art of submarining,

o To use the perspectives and wisdom of submariners -- which has been developed over a span of more than half a century -- to help formulate national policy regarding the future of submarines, and

o To renew and strengthen the fraternal ties between those who are vitally interested in submarines and submarining.

Our first annual Financial Report, for the year ending 31 March, 1983, shows cash assets of $11,296.15 and no liabilities. So we're financially sound as we pursue these basic objectives.

The value of the Submarine Service to the national defense posture grows daily. Therefore we must be prepared to relay our knowledge and beliefs to others who should be kept abreast of the expanding capabilities of submarines and their increasing number of missions. All in all, the Naval Submarine League, I feel, is indeed needed by this country of ours.

Shannon

Editor's Notes

The objectives of the Submarine League which our President has outlined emphasize the importance of the dialogue created in this

Submarine Review. Getting submariners to document their ideas is not a simple matter, however. Yet, if the League is to prove useful, its members must overcome a long-held habit of reticence and take part in this exchange of ideas -- for the benefit of all. Again, I would repeat that your expressed concerns regarding submarines and submariners, both past and present, will create a far clearer understanding of submarine matters for all. And it will lead to closer ties between the active duty professionals and those on the outside as well as increase the level of understanding of specific submarine problems.

This edition responds to the heightened interest in Arctic submarine operations expressed by the CNO -- submariner, Admiral James Watkins. The probable use of the Arctic sea-ice environment as a bastion for Soviet ballistic missile submarines has become increasingly evident -- and alarming. The article herein on the emerging Soviet submarine technologies would indicate that their SSBNs are also likely to be protected by titanium-hulled Alfa submarines -- an additional concern for U.S. ASW forces which rely heavily on the new 688-class submarine. With this growing Soviet threat, the need for a better combat system in the next attack submarine becomes evident, and hence the conceptual direction being taken by today's submarine force in developing SUBACs becomes a necessary clue to the character of future SSNs. And, the idea that the primary weapon for this next SSN should have a driving effect on its design creates a concept to be considered.

The article on submarine aviation uses historical experience to challenge League thinking about the possibilities of airplane-carrying submarines. Since the Falklands War showed the criticality of far ranging ASW aircraft to missile defense of a fleet, this article leads one to picture a Soviet submarine which could launch a

Harrier-type aircraft against our key, early warning system for groups of surface ships. The S-34 submarine saga is another record from the past that tells a good story with a few lessons thrown in.

Quite a few League members have indicated that they would write for the Review, but seem to be waiting for things to write about. Hopefully, the material in the first two issues will suggest subjects which would be of great interest to our membership. For example: war patrol experiences with lessons for today's operations; why do the Soviets build exclusively double-hulled submarines while the U.S. builds single-hulled ones; is it worthwhile building a small, very fast nuclear sub for today's kind of sea warfare and how might it be put together? In the previous Review, an article suggested "Missile Boat or Torpedo Boat" how would they differ in design or how would a U.S. submarine fight a group of coordinated, mutually-protected enemy submarines? A recent Proceedings article suggests ways to improve the officer personnel situation on board today's U.S. submarines. What are "our" ideas on this? Many of our members are experts in some of these areas and can write knowledgeably and creatively about them. So, reread the objectives of our League and help develop a submarine dialogue through the Review which will be useful to all its members!

ARTIC SUBMARINE WARFARE

In an informal interview with newsmen on 19 May 1983, Admiral James D. Watkins publically articulated for the first time the U.S. Navy's strong new interest in the strategic opportunity and threat posed by U.S. and Soviet submarine operations under the Arctic Ocean ice. In a carefully worded but frank discussion he acknowledged that the Navy is "putting increased emphasis" on under ice operations to counter the "strong interest" of the Soviets in having their submarines there.

The CNO's significant comments may signal a shift in the focus of both U.S. and Soviet naval strategy to the Arctic Ocean which like a frozen Mediterranean separates the East from the West at the top of the world. The naval power that can control the depths beneath the ice cover of this central northern ocean will establish a dominant strategic position that can count heavily in both deterring war and terminating it on favorable terms if it begins. It is unfortunate that the traditional naval mercator perspective of the world and possibly a misreading of Soviet naval strategy linked with other organizational factors prevented us from using the foundation of our pioneering nuclear submarine under ice operations to secure the Arctic Ocean in the 1960's. Now we are apparently engaged in a scrambling technical and tactical developmental race with the Soviets to fill an Arctic naval strategic vacuum. The winner will have gained leverage that will be virtually impossible for the loser to offset at any cost in other maritime areas. Oil not withstanding, it could be plausibly argued that naval control of the Arctic Ocean is worth more than control of the Indian Ocean with the South Atlantic and South Pacific thrown in.

First, let's look at what the Arctic means to the Soviets. The technological transformation by nuclear power of the Arctic icecap from a barrier to a potential access route has made Russia more vulnerable than at any time in its history. Both Tsarist and Soviet security policy has been directed to building a buffer around the Russian homeland. This buffer policy has been successful. The approaches to the Great Russian economic, political, and emotional core of the Soviet Union are blocked by satellite states, distance and maritime chokepoints. A single unbuffered exception is the 8,000 mile long Soviet Arctic maritime frontier. In April, the edge of the Marginal Sea Ice Zone of the Arctic Ocean is less than 300 miles from the Kola Peninsula. Many of the things the Soviets value most are directly exposed to submarine seapower projected from the Arctic.

During the past 10 years, a Soviet naval strategy has emerged that is keyed to the protection of its SSBN force in homewater ocean bastions near and under the ice; which Admiral Watkins notes is "a beautiful place to hide." Soviet Navy general purpose forces have two interlocking primary missions. One is to ensure the survivability and flexible readiness of their SSN force to launch nuclear strikes; the other is to defend the Soviet homeland from attack from the sea. Both of these compatible missions require Soviet sea control of a sizeable portion ofthe Arctic Ocean. In any case, about two-thirds of the Soviet Navy general purpose forces and perhaps eventually all of its SSBNs will operate in peacetime and fight in wartime near or under the Arctic ice.

In an interesting aside, Admiral Watkins by saying "...if there are forces up in that area of the world, we'd better know how to fight them," seems to have made reference to strategic ASW. Such words also seem to put to bed the naive idea that holding the Soviet SSBN force at risk is destabilizing. Indeed a credibile U.S. wartime capability to attrit Soviet SSBN's could be a convincing deterrent to war.

The implications of a possible Soviet shift of Soviet SSBN forward patrol areas to the deep Laurentian basin on the Canadian side of the North Pole must be considered. The unusually highmissile deck freeboard of the TYPHOON class

SSBN may indicate that it can surface through the ice and immediately send as many as 420 nuclear warheads on express routes into the SAC bases and missile fields of the interior of the United States -- without a pause to clear blocks of ice from its missile tube doors. SLBM's launched from forward Arctic patrol areas would give as little or less warning as those launched from the current exposed YANKEE patrol areas off the U.S. coasts. The use of forward polar basin patrol areas would end the requirement for YANKEE open ocean transits and make them available to strike theater targets from protected Soviet homewaters. Additionally, if the Soviets wished to off-set NATO deployment of Pershing II missiles to Europe, the Soviet use of polar basin patrol areas, with their shortened missile arcs into the North American "heartland," would be much less provocative than Soviet placement of missiles in Cuba.

Control of the Arctic Ocean, on the other hand, may mean more to the United States than it would to the Soviet Union. It would firmly anchor a forward naval strategy on NATO's Northern Flank. And, in addition to denying havens and patrol areas to Soviet SSBNs there are other advantages that would accrue to the U.S. from Arctic naval dominance.

Access to the Soviet Homeland

The polar ice offers a direct, covered submarine route to the Soviet homeland. Ballistic and cruise missile arcs to the vitals of the USSR are short from the Arctic Ocean. The advantages of a seabased power presence directly adjacent to the Soviet Union as a politically and militarily more flexible adjunct to our NATO land presence is apparent.

Neutralization of the Soviet Northern Fleet

Two-thirds of the Soviet Navy's offensive power is concentrated in the Soviet Northern Fleet and in wartime would be held close to the Soviet Supreme High Command's vest in northern homewaters. This "fleet in being" made up of SSBNs and supporting general purpose forces is vulnerable to U.S. Navy SSNs, some of which could use polar approach routes to the Northern Fleet operating area. Early and vigorous attrition of the Soviet Northern Fleet would: (1) downgrade it as a factor in war termination negotiations, (2) limit damage to the United States and its allies in the event of escalation to nuclear war, and (3) open the way for the projection of the full range of naval power, including the use of Carrier Battle Groups, against the Soviet Union--at a juncture in a war when it would be most effective.

Forcing the Soviet Northern Fleet to cover the edge of the polar ice in the Barents Sea would extend its defensive perimeter and exacerbate its force allocation problems, particularly for modern SSNs. This, in turn, would ease NATO penetration through the Greenland-Iceland-Norway gap.

Pressure from the Arctic on the flank of the Soviet Northern Fleet and its Kola bases would deter or help check any Soviet offensive into northern Norway. If NATO can remain solidly anchored in Norway the security of Iceland, the keystone of our North Atlantic naval strategy, will be virtually assured. Arctic naval pressure would also divert Soviet submarines from an anti-SLOC mission whose importance may be increasing once again with apparent Soviet preparations for a protracted, all-conventional war option.

In summary, U.S. naval dominance of the Arctic is a solid foundation for operations that can lock the Soviet Northern Fleet into a defensive posture, neutralize it, and eventually unravel and destroy it as an effective fighting force.

Perhaps the biggest payoff of an Arctic oriented U.S. submarine offensive against the

Soviet Navy would be psychological. An immediate submarine counterforce campaign against the most important element of Soviet seapower -- the Northern Fleet -- in its own homewaters would have an excellent chance of highly visible success. This could have a potent effect on a Soviet Navy that has neither a tradition of victory nor a position of leadership in the military hierarchy.

In a sense, under-ice operations will serve as a force multiplier for the U.S. submarine force. Soviet diesel submarines make up a significant percentage of their combat power and can be a formidable adversary, particularly in their homewaters. Their newer boats have demonstrated impressive endurance on battery power. But their ultimate dependence upon the atmosphere for propulsion prevents them from operating in the polar basins and much of the Arctic coastal waters most of the year. This causes a welcome reduction in Soviet submarine players under the ice, although diesel submarines might remain a lethal factor in ice-edge ambush positions.

As another bonus, under-ice operational capability is a useful hedge against any unexpected Soviet technical breakthrough in nonacoustic detection of submarines. Most nonacoustic submarine signatures are blocked or attenuated by ice. If some hypothetical nonacoustic sensor made the oceans transparent, the ice would probably still remain sufficiently opaque to conceal submarines.

In spite of the pioneering under-ice voyages of NAUTILUS, SKATE, SEADRAGON, and perhaps most of the 637 class; much of the existing base of U.S. Naval technology may be inappropriate for warfare in the Arctic. Current U.S. submarines and their weapons and sensors were designed for deep water open ocean operations with little if any attention to under-ice capability. Some technological areas where there are serious shortfalls as well as promising opportunities are described below.

Submarine Weapons

The under-ice effectiveness of submarine weapons designed for open ocean use is highly suspect. The combination of ice cover and shallow water, often encountered in the Arctic, is a most difficult environment for acoustic homing torpedoes. U.S. ability to fight under the ice now hinges almost entirely on how well the MK48 torpedo works in the that demanding environment. Any attempt to execute an Arctic submarine strategy without a reliable under-ice torpedo is a waste of time and lives.

Now more than ever the outcome of encounters between submarines is driven by weapon effectiveness. Torpedo launch is a rare event that culminates hundreds of hours of search and usually many hours of tracking. Submarine vs. submarine combats are, in Admiral Gorshkov's words, a "battle of the first salvo." When a U.S. submarine launches a torpedo its initial significant acoustic advantage over a Soviet adversary dissolves, it is then subject to an immediate snap-shot counterattack from a fully alerted Soviet submarine. The exchange ratio in Arctic submarine vs. submarine torpedo combat is thus likely to be much lower than is presently estimated. The premium placed on the relative quietness and superior long range passive sonar detection of U.S. attack submarines is considerably lessened in Arctic waters. In situations where long range detections usually lead to short range attacks, exchange ratios may approximate those of the AIMVAL/ACEVAL air combat exercises. Kill ratios in these exercises were much less than anticipated for the more sophisticated platform with their superior detection capability. If extensive under-ice tests reveal that the MK48 is not highly effective, a program should be initiated at once to develop a suitable Arctic torpedo. It may be necessary to sacrifice guidance sophistication for reliability.

The current vertical launching system (VLS) program to put TOMAHAWK launchers in the 688 class will significantly increase SSN Arctic firepower. But larger missile/torpedo tubes than the 21-inch variety are indicated for future submarines. A good big missile/torpedo is better than a good little missile/torpedo. The Soviets understand this truism and we should too.

Arctic Mine Warfare

Under-ice mine warfare is a little explored topic. The prevailing mismatch between minelayer and minesweeper is nowhere greater than in the Arctic. Currently there is no technique to deal with mines planted under the ice. There, they remain a menace until they either claim a victim or wear out. The mining of Soviet SSBN under-ice patrol areas and transit routes is a high-leverage ASW option. It depends, however, upon the development of suitable Arctic mines and mining techniques. CAPTOR with its MK 46 payload may not be very satisfactory in this environment.

Arctic Surveillance

As Admiral Watkins observed, the Arctic is "a whole new ball game." There are two quite different acoustic regimes in the Arctic. Ambient noise is low in the deep polar basins -- partly because of the absence of shipping. Acoustic propagation is excellent, particularly at the very low frequencies associated with submarine blade rate tonals. In contrast, the Marginal Sea Ice Zone has a high ambient noise level caused by ice breakup and movement and, in some areas, it has the propagation problems inherent to shallow waters. There also may be unusual temperature and salinity gradients in Arctic waters because of the layer of ice at the surface.

Hard-wired acoustic surveillance systems may be impractical to place and maintain in the grinding ice environment. However, concepts for self-contained line and three-dimensional arrays that may be air dropped for self-penetration through the ice or planted by submarines are promising. Such arrays could be radio linked via satellite or through high altitude unmanned vehicle systems. It would take only a relatively few arrays to maintain adequate surveillance of the quiet, deep polar basins. In the sea-ice zone, the use of surface ship towed arrays to look under the edge of the ice may be useful.

Submarines lying motionless in narrow leads of open water between rough, hummocky Arctic ice are difficult targets to detect acoustically, visually, or by radar. This phenomena should be investigated from both the ASW and pro-submarine perspective.

<u>Submarine Communications</u>

Submarine communications have always been difficult in the trying physical and electro-magnetic environment of the Arctic. Long range communications with our submarines in the Arctic are a requirement. Some techniques, such as the use of a trailing-wire antenna, may not be practical for a submarine submerged beneath the ice. Interestingly, the pre-Cambrian granite most suitable for extremely-low-frequency (ELF) antenna fields underlies most of the Soviet Union, Canada, Norway, and Alaska surrounding the Arctic Ocean. Relatively small and highly survivable ELF transmission systems for low data rate communications to deeply submerged submarines in the Arctic could be quickly and cheaply constructed on the shores of the Arctic basin.

<u>Submarine Detection of Aircraft</u>

Submarines surfaced in the Arctic ice should passively detect non-emitting Soviet aircraft at longer ranges than the submarine can be counter-detected by the aircraft. Acoustics in air may be one approach to winning this passive sensor duel, along with the reduction of relevant submarine signatures. An encapsulated, leave-behind anti-aircraft missile such as the developmental SIAM (self-initiated anti-aircraft missile) might be useful for a submarine submerging in a polynya under aircraft pressure.

Ice Hardening

All first-line SSNs must be ice-hardened for Arctic operations. The desirability of designing a capability into SSBNs for surfacing through the ice for an immediate launch of missiles needs to be evaluated.

Summary

The U.S. submarine force tactics which are well suited for a deep water, open ocean scenario might be less usable in the Arctic. The time has come for a rigorous series of new Big Daddy type exercises benchmarked to under-ice operations and shallow sea-ice waters and should include the penetration of barriers comprised of several diesel submarines operating together. Naval domination of the ice covered reaches of the Arctic Ocean would give a very significant strategic advantage to either the United States or the Soviet Union. An unhindered use of the Arctic polar basins by one Navy would also dangerously affect the strategic balance. Conversely, the Arctic provides a new axis for the leveraged projection of U.S. seapower against the Soviet Navy and other elements of national power that are valued highly by the Soviets. A U.S. Navy Arctic offensive strategy is a practical option that needs to be set in place.

Hamlin Caldwell

EMERGING SOVIET SUBMARINE TECHNOLOGIES

The appearance of three new types of Soviet nuclear submarines -- the Typhoon, Oscar and Alfa -- indicate by their characteristics certain special capabilities which should impact on U.S. war planning. In addition, there are other new Soviet technologies which should affect U.S. concepts for naval war.

Unlike the Soviets, the U.S. has continued to build, since the Nautilus, a same kind of submarine — a nuclear submarine designed basically for a single mission, either as an SSBN for the strategic mission or as an SSN for the antisubmarine mission. The Soviets, on the other hand, have responded with a wide variety of submarines -- both nuclear and conventional --for a wide variety of jobs. Their approach is towards a total submerged-fleet concept where coordinated operations with other units, whether air, surface or subsurface, are emphasized.

By examining the characteristics of the new Soviet submarines as well as other supporting technologies, some judgements as to the probable operational use of these submarines can be made.

THE TYPHOON

This new, 25,000-ton ballistic missile submarine, carrying twenty SS-N-20s of over 5,000 miles range, was first considered to be either a bargaining chip in SALT talks or just a huge submarine, built "in mindless imitation" of the U.S. Trident -- and necessarily bigger, regardless. Had the Typhoon, however, been meant as a bargaining chip against the 24-SLBM Trident submarine, it would have been built with 30 to 40 SLBMs crammed aboard. Trying to just be bigger seems even sillier. The Typhoon, however, is a fast (over 30 knots) double hulled submarine, and is exceedingly tough with a reported spacing of over 4 meters between outer and inner hulls. Its lack of exposed propellers also suggests that stern chasing torpedoes would not tend to damage it seriously. More logically, then, the Typhoon, if operated shallow and protected by a similarly tough submarine (the Alfa), seems to be a particularly good Soviet answer for the strategic mission, a ballistic missile submarine which is survivable in "nuclear" war. As such, a force of Typhoons can be a fleet-in-being to politically influence the outcome of a "nuclear" war -- whether strategic or one confined to the use of tactical nuclear weapons. Such a force -- as postulated in Soviet writings -- could threaten strategic strikes against an enemy's homeland which would be so unacceptable to the enemy as to cause the Soviets to win the war.

THE ALFA

As suggested above, the Alfa seems well designed to protect a force of Typhoons in nuclear war. Its great cost for the titanium hull and the many difficulties titanium causes in fabrication seem justifiable only if the Alfa helps to ensure the Soviet's highest priority naval mission -- the strategic bombardment of shore objectives. The Alfa's titanium hull, while giving the Alfa more than a thousand meter depth capability, also makes the Alfa capable of withstanding tremendous shock effects from nuclear blasts. The Alfa's very high speed of more than 43 knots plus its well designed characteristics for shallow operations indicate that its great mobility can minimize the effectiveness of tactical nuclear ASW weapons. (The radius of destruction of an underwater nuclear blast is least against submarines near the surface.) The Alfa's titanium hull makes it virtually impervious to MAD (magnetic anomaly detection) gear -- carried by airborne units. Its double-hull design with long low conning tower appears excellent to reduce the detectable hydrodynamic wave effect on the surface of the ocean, which might be produced by a shallow running submarine. And its infrared signature at the surface of the ocean is likely to be reduced through less disturbance of surrounding waters. Additionally, with low planes deep under its bow it has proved highly stable when operating radically at periscope depth and is a noisy submarine only at very high speeds. Armed with a quiet, long range wire-guided passive torpedo it becomes an effective destroyer of enemy surface warship threats against Soviet SSBNs. And, if operated at low speeds and closely coordinated with other submarines, is likely to even provide a significant level of antisubmarine protection for SSBNs.

THE OSCAR

This double-hulled Soviet submarine is truly a modern "battleship" with its 24 big-warhead, long range (250 miles), antiship SS-N-19s of several mach numbers of speed, in vertical launching tubes which can be fired submerged, and its 32-torpedo load. At about 14,000 tons, it is far larger than any other SSN, and its guesstimated 120,000 shaft horsepower should make it capable of speeds well in excess of 30 knots. With more than two meters distance between its outer and inner hulls it should be virtually impervious to light-warhead, air launched antisubmarine weapons, and with its high mobility it should be able to either evade heavyweight torpedoes or prevent them from hitting effectively. The Oscar thus appears to be an anti battle group submarine, which can saturate the group's defenses in a near simultaneous attack with a rapidly fired salvo of 24 missiles from a great distance. (Firing all available missiles in a single salvo is consistent with the Soviet's "first salvo" doctrine.) At very high speed, the Oscar could then go to deep submergence and close the main units of the battle group through the hole blasted in the defenses of its missile targets. In a short time, the Oscar would be in a position for torpedo attack against units of lesser speed. Then, by firing passive, quiet torpedoes, it would make attacks which could not be properly evaded. The Soviets evidently realize that torpedoes sink carriers more efficiently than missiles.

THE CHARLIE

The latest Charlie with its submerged launch capability of the SS-N-9, 60-mile antiship missile and its 24-torpedo load, make this under 30 knots, relatively slow submarine, a major threat to convoys -- the missiles to take out the escorts, the torpedoes to sink the merchant ships.

OTHER TECHNOLOGIES

The latest Soviet submarines exhibit a marked reduction in their radiated noise, making them less susceptible to very long range detection. This sound quieting plus a marked awareness of operating means to reduce detectability from radiated noise, and a practice through good long range submerged communications of coordinated/combined operations with other noisier units (which provide a masking effect), develop an ASW threat of a new dimension. The very thick anechoic coating on the hulls of most of the Soviet submarines (of several inches) not only greatly reduces active sound ranging off such a coated hull but also cuts down markedly the terminal acquisition range of a torpedo's active sonar. This very effective torpedo countermeasure by itself, may force U.S. submarines into closer firing ranges to insure more precise locating of Soviet submarines or it might force U.S. submarines to go active before firing -- thus disclosing an attack.

The frequent Soviet submarine use of active sonar in combined ASW operations, with one unit active while others are passive, should have a significant impact on U.S. strategies.

What these techniques suggest is the high likelihood of one U.S. submarine having to attack several Soviet submarines supported by other units -- rather than a one-on-one situation.

The Soviet conventional submarine Tango appears to have carried diesel-electric technology to an advanced state. With up to eight days submerged endurance on the battery being evidenced and with tankage for about 20,000 miles on the diesels, these modern Fleet boats, carrying long range, wire-guided torpedoes or a mine belt of 40 mines pose a threat which can't be ignored as merely being a coastal one. The latest Kilos appear to be particularly designed for mine laying, carrying an exterior mine belt which lends itself to quiet launching of mines without a surge and with more simple compensation. In fact, the Soviets very large force of about 200 conventional submarines, which includes 60 Foxtrots, and the expectation that they will be used in coordinated operations with other submarines and surface ships, must be seriously regarded.

Some of the new technologies must be guessed at. The photographed protuberance near the stern of the Victor III submarines seems to indicate a use of linear arrays. Means to reduce drag and the submarine's hydrodynamic flow-wave seem to be identifiable from pictures of various Soviet submarine types. There is also some evidence of unconventional propulsion systems being used. The possibility, then, of Soviet submarines having a burst speed capability -- like cutting in the after burners on an aircraft -- should not be ignored.

THE IMPACT OF THESE SUBMARINE TECHNOLOGIES

The U.S. forward submarine barrier strategy is apparently being faced with, instead of a one-on-one type of encounter with a transiting Soviet submarine, a more likely engagement with a combined force in transit. This would probably involve a force of air, surface and several subsurface units in coordinated movement through a barrier area.

The U.S. strategy for protecting battle groups against Soviet missile attack, similarly needs reappraisal with the advent of the Oscar submarine. The Soviet's long range missile threat has been assumed to come basically from land based aircraft. An "outer air battle" response has thus been predicated. But the Oscar poses a perhaps more critical "outer submarine battle" response requirement, since the Oscar is likely to launch missiles with a far greater element of surprise than that obtained with land based air.

The U.S. strategy for insuring control of the seas is particularly at risk with the Soviet development of combined/coordinated operations (including submarines) for overwhelming a sea control group's defenses with a near simultaneous missile attack from a variety of launching platforms in widely diverse positions.

And finally, some of the new Soviet submarine technologies clearly point towards a Soviet readiness to engage in tactical nuclear war at sea, and to win such a war because their submarines are designed to survive in the nuclear environment.

PHOENIX

(A recent news item tells of a small Soviet nuclear submarine in the range of about 2000 tons which has just been launched and which is guessed to make over 50 knots. Ed)

SUBACS - THE SUBMARINE ADVANCED COMBAT SYSTEM

The submarine community has begun development of a new combat system, the Submarine Advanced

Combat System. SUBACS will be the immediate successor to today's AN/BQQ-5 sonar and MK 117 fire control systems. It will eventually encompass the entire combat system including electronic warfare, exterior communications, and navigation systems.

SUBACS is being designed as a total system from the start, rather than as a family of separately designed, loosely interfaced subsystems as we have built in the past. SUBACS uses distributed microprocessors linked together by digital data buses to provide a degree of reliability and growth capacity not possible with today's systems. This comprehensive approach will enable SUBACS to support the new sensors and weapons we need to stay abreast of the threat throughout the life of the ships.

As the Navy develops new weapons and improves sensors to counter the improving Soviet submarine threat and accommodate new attack submarine missions such as strike warfare, the demands for computer capacity are growing rapidly. Today's combat systems, already near the practical limits of their computer capacity, were not designed for expandability.

Each new weapon, each new sensor, and each new mission also increases the amount of information the submarine crew must digest in order to fight the battle. This information must be sorted and presented to the submarine commander in a form which supports rapid decision-making in combat. Today's information load already taxes the capacity of the crews using today's methods. For the future, more computer assistance will be needed.

Addition of new capabilities is expensive and cannot continue indefinitely in today's systems. Where they require major modifications or wholesale replacement to accommodate growth, SUBACS can grow by adding hardware and software building blocks. When a change is needed, a component can be unplugged and replaced by another, or one added, with minimum disturbance to the rest of the system.

Just as the central computer design limits growth, so does space for new hardware in the 688 Class. This will be solved in SUBACS by the use of new space-saving microelectronics and dense electronic packaging technology. This approach is expected to recover over 400 square feet of deck space from the present combat system. Through SUBACS, computer reserves will be doubled, with a twenty percent built-in growth potential.

SUBACS will increase combat system effectiveness by improving overall system reliability and availability. Today's combat systems are somewhat like series electrical circuits -- the failure of a single component can put the entire system down. SUBACS, however, is more like a parallel circuit where if one component fails, the remainder continue to operate. Today's combat systems also contain components which were designed in the mid-60s. SUBACS will capture the latest technology and will be amenable to technology insertion. Its circuit cards will accommodate embedment of very high speed integrated circuits which are in the early stages of development.

Reliability can be improved considerably with the more modern design inherent in SUBACS -- which expects to achieve a 99.5 percent availability through redundancy in its distributed processing system. The key benefit from these improvements will be an extremely low probability of failure during critical phases of combat.

Life-cycle costs for SUBACS will be considerably less than for today's systems. SUBACS will reduce investment and ownership costs significantly through techniques such as system-wide parts commonality, modularized software, reductions in the number of types of power supplies and functional modules used, logistics standardization, fewer equipment foundations and less cabling. For example, the number of unique parts in SUBACS is being reduced by a factor of three compared to today's systems; the system contains 28 fewer cabinets, and requires 15,000 feet less cable. The system will also require less operator maintenance and will permit a 40 percent reduction in training costs through rating consolidation.

Costs to upgrade software are expected to drop through the use of a more efficient computer language, modularized software, and the use of Navy standard computers such as the AN/UYK-44 and the Enhanced Modular Signal Processor. SUBACS is also being designed to absorb the next generation of technology without major modifications -- a serious deficiency of today's combat system.

SUBACS will enter the fleet in three stages. Each builds on the previous one in a preplanned manner leading to the full system in the third stage. This phased introduction gets improvements into the fleet as they are ready without waiting until all are completed. It also spreads the technological risk over time so experience is gained with one improvement before the next is introduced.

SUBACS Basic, the first phase, will emphasize introduction of badly needed acoustic improvements which take advantage of systems now in development. Advanced sonar systems linked by high speed digital data buses will be installed with only minor modifications to the fire control system. This phase of the preplanned product improvement plan sets internal ship arrangements and establishes the overall system architecture so the full system can be backfitted on the first ships at minimum cost. SUBACS A, the second phase, will make major operability improvements, incorporate the fire control function into the integrated system architecture, and introduce the Enhanced Modular Signal Processor.

SUBACS B, the third phase, will add an improved sonar suite. SUBACS B will also introduce the integrated communication system and an expanded electronic warfare support measures suite. SUBACS will use a land-based test site which will be used for configuration management, software maintenance, and independent verification and validation testing. Each phase of SUBACS will be tested at sea aboard a dedicated SSN assigned to the submarine development squadron before it enters the fleet. Ships which received SUBACS Basic and A will get the full SUBACS B backfit in their first overhaul.

SUBACS will be installed in all new construction SSNs beginning with SSN 751. It will also be the combat system for any class of SSNs built as a follow-on to the 688s. It is being designed to maintain the qualitative combat advantage which U.S. attack submarines presently enjoy and must preserve if we are to compete with an ever-improving foe who outnumbers us.

CAPTAIN G.H. KANADY, JR. USN

WEAPONS AND THE NEW ATTACK SUBMARINE

The history of undersea warfare weapon development leads to two basic conclusions: the weapons developed for the attack submarine have suffered from serious deficiencies in numbers, effectiveness and reliability in the operational environment, while the weapons developed for the strategic ballistic submarine have been satisfactory in all respects.

It follows then that an examination of the two paths used in the development of different submarine weapons produces reasons why the two paths ended in such disparate results. Such an analysis shows that in the case of ballistic missiles, the optimum missile characteristics were determined. Then the missile was sized out and the platform designed to complement the weapon. Incompatibilities between the ballistic weapon and its submarine platform were identified and compromises made. The compromises usually favored the weapon even at the cost of platform effectiveness. As a result of this straightforward approach, the deterrent value of the strategic submarine system is referred to in terms of the weapon used -- the number of warheads that can be brought to bear on certain targets, the maximum range and accuracy, the confidence inherent to weapon use and the vulnerability of the system including the missile.

In contrast, the fast attack submarine weapon system is described in terms of platform parameters -- i.e., submarine speed, depth, radiated noise levels, and performance relative to similar foreign submarines. The characteristics of the attack submarine's weapons -- her torpedoes -- as to tubes for launching and targets available are evidently secondary to the importance of platform capabilities. Design compromises between the platform and the weapon favor the platform rather than the weapon. This is exemplified by the reduction from 10 launch tubes over the years to 4 launch tubes, the placing of tubes well back from the bow, the lack of emergency modes for launching weapons and the static number of loadout torpedoes -- while the size of the submarine platform was more than tripling.

An analysis is thus needed to determine what platform characteristics best complement antisubmarine or antiship weapon characteristics -- whether torpedo or missile -- to produce the most efficient use of our submarines for the destruction of enemy surface and submarine forces. The efficiency of the attack submarine should then be measured against targets and the circumstances under which they would be taken under attack.

The MK39, the first wire-guided torpedo was too slow to be used operationally and hence was dropped in favor of the MK37. But the MK37 eventually proved too slow for the newer Soviet submarines. A dual-platform torpedo was then called for, mainly to save money -- but also on the premise that a submarine's torpedo is little different than a torpedo used by a surface ship. Actually the MK48 was designed to meet the criteria of an over-the-side launch by a surface ship. The target would be aware of the launch, therefore the torpedo need not be covert. But it required high speed to catch an alerted target, which in many cases would immediately activate torpedo countermeasures. In my Bu Ord job in the early sixties we pushed the EX10 for antisubmarine use -- not recognizing that enemy surface ships would be possible targets. At that time, the Soviet surface fleet was little to be worried about. But its submarine force of over 300 units was. Thus, making the MK48 a dual-purpose torpedo -- secondarily to sink surface ships -- didn't seem critical. But as the MK48 was developed in the late '60s, it became apparent that while the weapon was optimized for submarine targets it was bound to suffer in effectiveness against a Navy with efficient surface warship targets. And while it was being designed to be effectively used primarily by surface ships, the covert, mobile character of the nuclear submarine presented such a different set of characteristics as to make effective compromises between the weapon and the vastly different types of platforms almost impossible. It seemed then that the best answer was to develop the MK48 for purely submarine use. Although only submarines now use the MK48 torpedo, it wasn't so designed. Indications were that another type of torpedo should be developed for surface ship targets when they became a valid threat.

It is not apparent that the characteristics of the nuclear attack submarine has in any way been driven by the MK48 torpedo. Today's submarines are little different than the nuclear submarines which used the MK37 torpedo.

Because there seems to be little relationship between the present torpedo design and the design of the platform which employs it, new torpedo characteristics should be responsive to the answers for comparable questions that resulted in the successful marriage of weapon and platform in the Trident program.

The questions which need asking appear to include:

a. What are the major surface and submarine targets which have to be distinguished for weapon planning purposes?

b. What are the numbers of targets of each type which will exist when the weapon is operational?

c. What is the probability of target countermeasure efforts and their possible effectiveness estimate?

d. What is the importance of warhead size to the type of targets to be destroyed? (The great distance between outer and inner hulls of recent Soviet submarines highlights this point.)

e. What is the type of terminal homing versus the sophistication of the target?

f. What is the optimum attack range for various classes of targets?

g. What is the tradeoff with missiles as a result of the these factors?

h. What technolgoy is available now or in the near future to meet the desired characteristics of a torpedo for the next decade?

i. What is the estimated quantity of torpedoes required by the attack submarine force -- the stockpile, based on an expenditure rate which reflects the hardness of modern targets and the wastage on false or inappropriate targets?

The answer to questions involving these elements should result in identifying those weapon characteristics and the numbers to destroy or immobilize a target population which needs to be well defined.

Whereas the SSBN and its SLBM were evolved from analyses similar to the foregoing and resulted in a platform which complements a weapon designed to best destroy a specific target complex, the nuclear attack submarine which is optimized for detection and classification of targets rather than for destroying them will probably require changes to accommodate a new torpedo for the '90s that is responsive to the factors just noted.

The foregoing questions have been addressed in depth in the past, but not within the framework of a platform/weapon system analysis comparable to that employed in the development of the strategic submarine/missile system.

The Falkland Islands War demonstrated how an inflexible straight-running, short-range, loud torpedo can have a platform, the nuclear submarine Conqueror, which with its great covertness and high mobility complemented the torpedo's shortcomings. Conversely, the quiet, long range, wire-guided Tigerfish torpedo which was also on board the Conqueror, if used against a high speed submarine would require a platform of great covertness and mobility like Conqueror. What is suggested by this Falkland's experience is that the nuclear submarine can normally attain a highly favorable attack position against a surface target, thus allowing use of torpedoes far simpler and less costly than the present MK48 torpedo.

Past torpedo war time experience shows that: there was a critical shortage of weapons at the start of each conflict; there were critical failures of supposedly well tested vital components, i.e., exploders and depth control mechanisms; and torpedoes were not rapidly produced under wartime conditions.

An awareness of torpedo history plus a good understanding of the important elements in deriving a concept for a torpedo leads to: an understanding of how the submarine platform can be designed to optimize the effectiveness of its weapon; a recognition of the futility of developing a dual-purpose weapon, a good definition of a single-purpose antiship torpedo and a different single-purpose anti-submarine torpedo; and finally, that compatible platform/weapon systems lead to less costly solutions for the destruction of the total targets available to attack submarines.

At present, there is great interest in the direction to be taken for the next attack submarine. If one starts with a concept for a best weapon -- whether it be torpedo or missile -- for the next SSN, and reflects those attack submarine characteristics which make the weapon most efficient, then the U.S. is certain to continue its dominance of the undereas and surface areas of the worlds oceans.

R.C. GILLETTE

LOSS OF THE THRESHER

(On the 20th Anniversary of the Thresher's loss, a memorial ceremony was held at New London, Connecticut. RAdm. Brad Mooney, Jr., the Oceanographer of the Navy and a guest speaker, recalls his experiences (as digested here) on that day in April 1963 when the news was broadcast that Thresher had sunk in 8400 feet of water. For Brad, remembering that event was particularly graphic since 16 months after the Thresher's loss, he was aboard the bathyscaph Trieste II when Thresher's hull was first discovered on the ocean's bottom. A New York Times editorial on April 13, 1963, noted that Thresher "was the lead ship of a class to run silent, run deep and run fast -- faster and deeper than any submarine of the past." And, Vice Adm. Ron Thunman in a message for the memorial ceremony noted the legacy derived from this tragic loss. "Our boats are safer, and tougher today and our procedures are better constructed and more carefully crafted." -- Editor)

<u>Remarks of Rear Admiral J.B. Mooney, Jr., at the Memorial Service for the 20th Anniversary of Thresher's loss</u>

"I want to share some very personal memories with you today which are intimately linked to the loss we remember at this 20th anniversary memorial service. This is a personal witnessing of the outpouring of genuine concern and shock, as experienced not only by myself but others I came in contact with immediately after the Thresher was lost.

"I was Executive Officer of the Sea Robin when she arrived in Monaco for the Easter holiday in 1963. When the Sixth Fleet Staff notified us of Thresher's loss, I rushed to the Flagship at Villefranche, France, to see if my father was on the Thresher's sailing list, since he was an engineer at the Portsmouth Naval Shipyard and often rode the boats on their sea trials. Although I was relieved to learn he was not aboard, many of my close friends were on that list. My return to Monaco that evening was marked with a profound sense of loss and sadness. Later, I took a long walk by myself, along the seawall to collect my thoughts and try to dispel the feeling of gloom which weighted me down. Then I noted that the flag over the palace on the hill had been lowered to half-mast. It was a first revelation of the spontaneous outpouring of grief and sympathy by many others -- who were not part of the U.S. submarine service.

"The first person to share my loss was Ed Link, the inventor of the Link Trainer for aviators. He spotted me on the seawall and asked me to come aboard his small ship and have a cup of coffee and 'talk about it.' His ship, which was moored alongside the seawall, was supporting the diving operations he was conducting in the Mediterranean. Subsequently I discovered that he flew to the U.S. the next day to serve on the technical advisory committee which would determine how to search for the Thresher. On the following day, I met Winston Churchill's personal bodyguard who arranged a visit with Sir Winston at his residence in the Hotel de Paris. In a brief visit, Sir Winston expressed his sympathy and condolences for all Americans who experienced this loss, as well as his personal sense of shock and sadness at hearing the news.

"On the Saturday before Easter, we conducted a memorial service aboard the Sea Robin for the crew of the Thresher. Thousands of European people gathered on the pier to join us in the ceremony -- their heads bowed. Sarah Churchill represented her father. The Colonel of the Palace Guard represented Prince Rainier and Princess Grace. David Niven and his wife attended. From all, there was an overwhelming expression of sympathy for the families of our lost Thresher crew members.

"After the ceremony, wherever our officers and crew went, people stopped and expressed their condolences. It was as if all of Europe recognized this loss as a great American tragedy.

"On Easter eve our wardroom had dinner at the palace with Prince Rainier and Princess Grace. The Bishop of Monaco offered a table grace which included prayers for the men of the Thresher and their families. That evening proved an extraordinary demonstration of concern for our lost submariners and those close to them.

"These memories were brought to mind when I was asked to talk at this occasion. Twenty years have come and gone since we lost our friends and loved ones. But between then and now our Navy and our Nation were moved to action not only to make our submarines safer but also to develop the ocean science and technology which offers far better opportunities to find and rescue submariners in peril."

ARRIVEDERCI DACE

"Padio vante duo terco" (all ahead two-thirds), the Italian OOD ordered as the Dace (SS 247) cleared her berth and headed for Long Island Sound. Dace was on her final day of operations before being turned over to the Italian Navy. "Padio furmo" -- and the Dace was slowed for the railroad drawbridge at New London. The American crew of Dace hung close to the Italians they were training and who would shortly have to operate Dace without any of this seasoned help. The radar operator on the trip down the channel was still an American, "Range to Race Rock, 600 yards." Then later came ranges to Montauk Point and Block Island in English before an Italian radar operator took over.

With Dace in her operating area and with the Italian crew at all diving stations but still being supervised by their U.S. counterparts, the diving klaxon was sounded. The bridge was cleared. Then the boat started down -- the diving angle slowly increasing to 10° then more rapidly to 15°. "Adio rapido" (blow negative fast!) was ordered, a bit frantically. Crunch! Dace hit the bottom. And a report came from the forward room that the WFA sound head -- which should have been rigged in, but wasn't -- was damaged, with flooding around the sound head shaft. Dace was surfaced, and that was it for the day. As Dace made an early return to the Sub Base and nosed back into her berth there were a lot of red faces.

Later, at the de-commissioning of Dace when the Stars and Stripes were lowered for the last time on the old veteran of World War II we all had a lump in our throats.

I think that when the "Leonardo da Vinci" departed for Europe, a little of each of us sailed with her.

Allan L. Windle

SUBMARINE AVIATION

World War II was brought to the West Coast of the United States early one morning in September 1942, when a Japanese I 25 submarine surfaced about six miles off Cape Blanco, Oregon. Members of the crew scrambled onto the deck and proceeded to remove from a watertight hangar a small seaplane - A Yokosuka E14Y1 - called a Glen by the Allies. They quickly assembled the aircraft and hung two incendiary bombs on its underwing racks. The aircraft normally carried an observer but, due to its attack payload, he had to be left behind for this mission.

The pilot, Warrant Officer Fujita, took off, penetrated the forest belt of Oregon and dropped his two bombs causing, it is thought, some serious fires. A second attack was carried out a week later with similar results. These attacks showed that is was possible to carry out raids from submarines, although the range and bomb loads were very restricted.

The very first aircraft launched from a submarine is attributed to the German Imperial Navy during WWI. The German Army had advanced into Belgium and occupied the Port of Zeebrugge, famous for its giant breakwater. The German Navy then moved its U-boats into the port. One of the first to arrive was the U-12 commanded by Kapitanleutnant Walter Forstmann. A month later, the first contingent of the Imperial Navy's Air Service arrived, commanded by Oberleutnant zur See Friedrich von Arnauld de la Perriere. His unit consisted of three other officers, 55 enlisted men and two aircraft. The aircraft, Friedrichshafen FF-29s, were twin-float biplanes, powered by 120-hp engines.

The mission of the U-boats was simple, to sink enemy shipping. However, the role of the German Navy's air army had still not been clearly defined. It had been created at the very beginning of the war, but what it could or should do had yet to be established.

Friedrich von Arnauld, having received no instructions, decided to develop his own missions. He reconfigured the unarmed FF-29s to carry 26.5 pound bombs, and on Christmas Day one of his seaplanes flew across the English Channel, up the River Thames and dropped the bombs harmlessly on the outskirts of London. Although it was chased by three British aircraft, it returned safely. The aircraft themselves suffered more from fuel problems and faulty ignitions than they did from the British.

Forstmann and von Arnauld decided that if they took an aircraft to sea on the deck of a submarine and placed it in a takeoff position, they could launch the plane by partially submerging. This would effectively increase the range of the seaplanes. On January 6, 1915, the FF-29 was placed across the deck of the U-12 and lashed down. The submarine left the harbour, seemingly dwarfed by the 53-foot 2-inch wingspan, that stretched almost one-third of the submarine's 188-foot length.

No sooner had the U-12 left the safety of the breakwater than the captain realized that the heavy swell they were encountering might possibly endanger the operation. After less than an hour, it was decided to launch the seaplane. Captain Forstmann flooded the forward tanks and, despite the pitching of the vessel, von Arnauld's aircraft floated off the deck and took off without difficulty. He had intended to rendezvous with the submarine but decided against it. It is not known how close to the English coast the submarine was when it launched the FF-29, but von Arnault flew along the Kent coast undetected and then made his way back to Zebrugge.

The experiment had been partially successful inasmuch as the aircraft had been carried and floated off, but it was realized that calmer seas and more secure lashing of the aircraft were required.

Von Arnauld and Forstmann were eager to try the experiment again but the German High Command vetoed it. The idea lay dormant until 1917, when it was revived by the High Command so that the striking power of submarines could be increased. Some of the long-range, cruise type of submarines were to be equipped with aircraft for scouting purposes. Although plans were drawn up and designs prepared for the quick assembly and dismantling of seaplanes on board ship, the ideas were eventually abandoned.

While the idea was given up by the Germans, in 1927 the British submarine M-2 was commissioned as an aircraft carrier. She was ideal for such an assignment because of the 12-inch gun that was housed in a turret forward of the conning tower. The gun was removed and the turret modified to take a specially designed reconnaissance seaplane. Many designs were considered, but the one selected was a two-seat, unarmed, wireless-equipped Peto, designed and constructed by George Parnall and Company.

The Peto was not the first British aircraft designed for use on a submarine. In 1916, two Sopwith Schneider seaplanes were carried aboard the E22 submarine, lashed down on the deck. Even earlier, well before 1914, an aircraft called the Bristol Burnley X was built. It was designed to collapse and pack away on surface vessels and on submarines.

The Peto was mated with the ill-fated M-2. The little twin-floated biplane was locked onto a carriage that rested on two rails inside the hangar on the forward deck. The hangar crew of 10 found the room inside the hangar very cramped when standing by to get the seaplane launched.

The launch procedure went as follows: The pilot would ascertain from the captain when the boat was likely to surface. As it was impossible to start the engine while submerged, the lubricating oil in the tank and engine was heated up so as to shorten the running-up time once the aircraft was on the catapault.

As soon as the boat surfaced, the launch crew opened the hangar door and lowered it to form part of the launching platform. The airplane was quickly run out on its rails and locked into position at the end of the catapault, after which the wings were unfolded and locked in position.

The captain then turned the submarine into the wind and moved at such a speed as to show sufficient wind on his indicator in the conning tower, which ensured a safe takeoff. After opening the throttles wide and making sure that his engine was running correctly, the pilot raised his hand to indicate that he was ready to take off. The captain gave the order for the catapault lever to be pulled. The aircraft shot forward, slamming the pilot and his observer back into their seats, and was launched into the air. After the seaplane had carried out its objective, it returned to the submarine, landed and taxied alongside. It was then hoisted back on board by means of a small lifting crane on top of the hangar. Of course, all of this was possible only if the weather was calm.

The idea was never a complete success and on the night of January 26, 1933, an announcement from the Admiralty said that the submarine M-2 had dived at about 1030 hours off Portland, Dorset, and had not been heard of since. Destroyers and submarines searched the area and later the same night came the news that an object had been located three miles off Portland; lying in 17 fathoms on a sandy bottom. Salvage craft and divers were sent from Portsmouth and it was confirmed that it was indeed the M-2.

After days of frustration, the Peto was recovered from the submarine's hangar. Badly damaged, she was taken ashore for inspection. She was not preserved. The salvage work was initially abandoned in September, although at one point the M-2 was raised to within 18 feet of the surface before a gale sprang up and the boat sank again. How the accident happened is still a mystery, but it is probable that the inner hatch to the hangar was open at the same time that the hangar doors were, perhaps through a misunderstood order.

While the British were having their problems, across the Atlantic the American Navy had shifted its interest from submarine aircraft to small scouting aircraft carried aboard the airships USS Akron and Macon.

The U.S. Navy's interest in submarine aircraft had started way back in 1922. Two Heinkel-Caspar type U-1 submarine aircraft were received at NAS Anacostia towards the end of 1922. One was lost during an exhibition flight the following year and was used for spares for the other. The flight tests were completed by the end of 1923 and, although the aircraft didn't fly off a submarine, it did supply useful information for future designs.

The Navy accepted delivery of 12 additional submarine-based aircraft and, although built by two manufacturers, the design was the same. Six were constructed by the Cox-Klemin Aircraft Corporation of New York and were made of wood and fabric. The other six were manufactured by the Glenn Martin Aircraft Corporation of Baltimore and were largely made of metal. This enabled the Navy to compare the new techniques using metal rather than wood.

During October and November of 1923, tests with the Glenn Martin MS-1 were carried out aboard USS S-1. The S-1 had a complement of aircraft specialists from USS Langely aboard. Their duty was to erect and dismantle the aircraft and stow it away in the pressure-resistant tank aft of the conning tower. Unfortunately, it took nearly four hours to assemble the aircraft. This obviously was unacceptable and so modifications had to be made to cut down the assembly time. The modifications were carried out by the Naval Aircraft Factory at Philadelphia and, although the aircraft was delivered to them late in 1923, it was nearly two years before the modifications were completed.

In the summer of 1926, the complete cycle of assembly, launching, recovery and stowage of the modified Cox-Klemin XS-1, now designated XS-2, was assigned to the S-1. By the end of October, the launching crew had become so proficient with the modified aircraft that they could have the machine assembled, launched, afloat and with engine turning in 12 minutes. It took them only 13 minutes to recover, dismantle and stow away, which was a truly remarkable feat when compared with four hours on the original aircraft. The XS-2 had an effective scouting radius of approximately 130 miles.

Up to 1931, a number of tiny, foldaway aircraft were designed and submitted to the Navy, but none were adopted. In 1931, the Navy did purchase a Loening XSL-1 amphibian for submarine trials, but a number of modifications had to be carried out to improve its all-around performance. Although it was tested aboard the S-1, it was not accepted by the submarine service. Many reasons were given, including one which rumored that Naval Aviators did not relish the double hazardous duty aboard the old S boats!

The French had attempted to use aircaft on board submarines but met with very limited success. Their one and only attempt was on the 2,800 ton Surcouf, the pride of the French Submarine Services. Built in 1929, Surcouf was the second largest submarine in the world, the first being the British X-1 at 3,050 tons. A match for many surface warships, Surcouf had twin turret-mounted, eight-inch guns and formidable torpedo armament. The biggest drawback was that she was too large and too slow at diving. This meant that she was only at her best when on convoy duty and when her scout seaplane was ahead looking for enemy warships and submarines.

Surcouf had its hangar built as an integral part of the conning tower, and launch and recovery were achieved by using a crane after the submarine had stopped her engines.

Tests continued until 1942 when, on the night of February 19, Surcouf was in collision with an American frieghter while en route to the Panama Canal. There were no aircraft on board and there were no survivors.

To go back to the Japanese contribution to the submarine aircraft era, it all started for them at the end of the first World War. They acquired seven war-prize U-boats from the German Navy and adopted the best features into the design of their own submarines. The Japanese had always shown great interest in the use of submarine scouting aircraft and purchased two Heinkel-Caspar U-1 aircraft from the Germans in 1921.

The first operational trials of the aircraft aboard a submarine did not take place until 1927 and, as with the American trials, launching operations were conducted by trimming down the stern and floating the aircraft off. The Japanese by this time had their own design available, very similar to the U-1 but with modifications such as a more powerful rotary engine. Although it was designed in 1925, the aircraft wasn't built until 1927 and operated from submarine I 21 for about 18 months.

The I 21 was too slow and too small for serious operations, so a larger boat was selected and, in 1930, the 1,400-ton I 51 had a compressed air catapault fitted to her after deck together with a hangar capable of taking two aircraft. Also at this time, the Japanese introduced a new aircraft, a 6-shi E6Y1 type 91 small reconnaissance seaplane. It was a miniature copy of the British Parnall Peto and used the same engine, the Mitsubishi Mongoose. By 1932, eight more models were built by Kawanishi and were known as the E6Y1-N. After aeroplanes were tested for three years aboard the I 51, the catapault was removed and the submarine was reassigned to general service.

The early 1930s produced a number of giant submarines based on the design of the huge German U-142 of 1918. Two of these were built with hangars capable of taking two aircraft, a the end of the first World War. They acquired seven war-prize U-boats from the German Navy and adopted the best features into the design of their own submarines. The Japanese had always shown great interest in the use of submarine scouting aircraft and purchased two Heinkel-Caspar U-1 aircraft from the Germans in 1921.

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At this time, the Japanese were still at war with the Chinese and these submarines with their aircraft were used in the China Sea as a deterrent against Chinese blockade runners. They appear to have been quite successful and were still in use up to 1941. It was in 1941 that the first submarine-borne operational monoplane came into service - the E14Y1 or, as it was known to the Allies, the Glen. It became the eyes of the

Japanese submarine fleet when it set sail to challenge the United States fleet in December 1941. It carried out reconnaissance over Pearl Harbor before and after the attack. Other submarines cruised the South Pacific and their aircraft scouted the harbours of Sydney and Melbourne, Australia, and of Hobart, Tasmania. There were a number of kamikaze-type missions carried out by the Glens - long-range reconnaissance flights that gave the pilot no chance of getting back to his submarine. One example was when submarine I 36 launched her aircraft from 300 miles off the Hawaiian Islands and, although the pilot was able to radio back shipping information, it is persumed that he crashed into the sea and was lost. At the end of 1941, the Japanese had 11 submarines capable of carrying scouting aircraft and, by the end of 1945, this number had increased to 27.

Meanwhile, in Japan, work was progressing on their secret weapon and kept so well under wraps that the United States did not find out until after the Japanese had surrendered. The weapon they had been working on was a giant submarine, described as I 400 class, an undersea aircraft carrier with hangar space for three aircraft. It was 400 feet long, displaced 3,900 short tons on the surface and capable of cruising for 37,500 miles without refueling. Originally, 18 were planned but as the war deteriorated material shortages caused the plans to be revised and only five were actually started. By 1945, three had been completed, one was dismantled while still on the slipway and one was destroyed in an air raid. Of three of the original five left - the I 400, I 401 and I 402 - two were completed as carriers and one as a supply boat.

Due to the cutbacks of the I 400 class in 1943, smaller, 2,900-ton, I 13 class submarines were converted to carry two aircraft. Of the four converted, two were completed, while the other two were still undergoing construction when the war ended. The I 13 class submarines had heavy-duty catapaults fitted on their forward decks, with 12-ton, electric cranes for recovering aircraft.

While the I 400 class submarines were under construction, plans were made to use the submarines and their aircraft for a raid on the Panama Canal. The normal scouting aircraft would be of no use, so a light submarine bomber was needed. The Japanese Navy asked the Aichi Aircraft Company to provide them with a suitable design. One of the requirements was that the aircraft could be catapault-launched without landing gear. The reason for this was that the saving in weight would allow for a larger bomb load and a larger fuel supply. After the raid had been carried out, the aircraft would return to the submarine, ditch close by, and the crew would be recovered.

Training for the Canal raids did not progress well. The crews practiced their bombing runs on large scale models of the Canal locks, but were often interrupted by attacks from U.S. Navy carrier aircraft. The beginning of July 1945 brought the first submarine flotilla together, consisting of the I 400, I 401, I 13 and I 14. The task force was equipped with 10 aircraft and, although the two smaller boats did not have the fuel capacity for the round trip to Panama, they were to refuel from the bigger boats.

They were provisioned for a four-month cruise but time had run out. They were diverted to attack Ulithi Atoll where U.S. carriers were anchored. On July 16, 1945, the task force was attacked by carrier aircraft and the I 13 was sunk. The other boats did not press home their attack on Ulithi and all the other submarines were still at sea when the war ended. Not one of the giant submarines saw action in spite of all the time and money spent on them.

The final progression in the use of submarines in aviation warfare came when in March 1946 U.S.

Navy Secretary James Forrestal approved the converting of two Gato-class submarines to guided missile launchers. The submarines that were converted were USS Carbonero (SS337) and USS Cusk (SS348). The weapon they were to launch was the American version of the German V1 called the Loon. The Loon was later to provide crucial experience and encouragement in the cruise missile program.

The first launch was carried out on February 12, 1947, from Cusk, while surfaced off Point Mugu, California. This was the first time a submarine had launched a missile. Eariler tests of the Loon had been carried out at the Naval Air Missile Test Station at Point Mugu. In these tests, Lockheed P-80 Shooting Stars had flown alongside the missiles in case they turned off their course and threatened populated areas. The same idea had been used during WWII, when Spitfires and Hurricanes of the Royal Air Force flew alongside the German V1s and turned them around by using their wingtips.

The submarines had a launching ramp installed on the deck behind the conning tower. The missile was contained in a 10-foot by 30-foot, steel, watertight capsule. When the submarine surfaced, the crew would open the capsule, assemble the Loon into a firing position, launch it and return below, leaving the submarine free to submerge.

Over the next few years, many test were undertaken, culminating on May 3, 1950, when Cusk surfaced, launched a Loon, then tracked and controlled the missile over a range of 105 miles. The American version of the V1 disappeared soon afterwards, bringing to an end an area of development that was soon to be superseded, but heralding the start of a new type of warfare.

Terry Treadwell
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THE INTREPID MUSEUM'S SUBMARINE GALLERY

The WWII aircraft carrier Intrepid, a Sea-Air-Space Museum with submarine exhibits is located at Pier 86 on the Hudson River at West 46th and 12th Avenue, New York City. Parking for visitors is at the end of the passenger ship terminal at West 55th Street. Hours of the museum are from 10:00 a.m. to 8:00 p.m., seven days a week except Christmas.

Since its opening in August 1982, almost three quarters of a million people have visited this museum. Although there are presently some submarine displays in the Technologies Hall on the hangar deck, a gallery devoted entirely to submarines will be opened in late 1983. Then, in a second phase of expansion of the Intrepid Museum, a submarine multilevel complex will be developed below the hangar deck.

Vice Admiral Phil Beshany, USN (Ret), a member of the Museum's Exhibitry Commission is providing the guidance for the future development of the submarine part of the Intrepid Museum. The availability of submarine artifacts and financing, he notes, will pace the submarine gallery's expansion. What is envisioned will encompass every element of the submarine story -- the evolution of the submarine, the Fleet Ballistic Missile Submarine's role and its technologies, the roles of attack boats past and present, the nature of the submarine's environment, etc.

The conversion of spaces below the hangar deck into a submarine complex is the top priority in the Intrepid Museum's growth plans.

(Ed. note...This article is done as a Staff paper written in 1961 from Admiral Kasatonov to Admiral

Gorshkov, Head of the Soviet Navy. Admiral Gorshkov had stated his belief in the primacy of submarines in modern naval warfare, and Admiral Kasatonov -- an experienced fleet commander and submarine design expert -- responded, so the author believes, in much this fashion. At that time, twenty years ago, the Soviet Navy was greatly concerned with their lack of initial success with nuclear submarines, while facing a period of U.S. submarine production which featured the high speed Skipjack, the covert Tullibee, and four other new types of nuclear submarines. The assumed recommendations of Admiral Kasatonov as to Soviet submarine design problems and directions to be taken to achieve a basically submarine oriented navy, stem from the author's good memory of that period along with his hindsight provided by a close observation of Soviet submarine developments down to the present. The title of the article is merely an editor's whim, suggested by the catch-up nature of this Staff paper.)

THE TORTOISE AND THE HARE

A Staff Paper Prepared
by
Kasatonov for Admiral Sergei Gorshkov

December 1961

PROBLEM

Submarines can be powerful and reliable weapons which possess the operational combat properties to solve a wide range of tasks in the World Ocean. To assure the success of their combat operations, they must be sufficient in number and be provided the latest developments in technology. Atomic-powered submarines now being built in our country provide great improvements in mobility and strike power over diesel submarines: however, they have not achieved design performance levels in terms of concealment, submerged speed, and reliability. While we are faced with these problems, it is apparent that the United States has been able to maintain a continuum of technical and operational achievements in their submarine programs. Should these trends continue, Soviet submarines will be faced with an enemy so technically superior that feasible advantages in numbers will not be sufficient to assure the success of their combat operations.

BACKGROUND

Over the past four years, the United States has introduced six new classes of attack submarines which are claimed to be designed primarily to combat other submarines. Three of these classes, the SKATE, the SKIPJACK, and the THRESHER, are in series production; while the remaining three, the TRITON, HALIBUT, and TULLIBEE, are single units built to investigate the advantages of specific technologies. The American submarines have high fighting qualities, are provided with the latest advances in the field of shipbuilding, and have proved themselves with extended under-ice operations and submerged circumnavigation of the world.

Successive classes of American torpedo submarines appear to represent measurable improvements in operational performance. Even the earlier SKATE Class (launched in 1957) has a speed advantage over both our nuclear torpedo-carrying and winged-missile-carrying submarine classes. Just a year after the launching of the SKATE, the first of its successor class, the SKIPJACK, was launched. Although smaller than our nuclear submarines, our intelligence indicates that this ship can achieve speeds of over 30 knots, while unofficial press releases suggest even higher speeds.

The near 40 percent speed advantage of this class is but one of the reasons that we have ceased production of our nuclear submarines. The disappointing performance of our two classes is being investigated and corrective action will be taken. In the meantime, the first units of the new THRESHER Class were launched this year. This ship is purported to have a greater depth of submergence and improved concealment characteristics. Even before the first of this class has gone to sea, the American Navy is seeking Congressional support for a more capable follow-on class (SSN-637).

Although we believe the Soviet Union will be unmatched in underwater weaponry when the submerged launched ballistic missile, winged missile, and rocket torpedo become operational over the next years, our prognosis for ship capability is not as favorable. The specific modifications necessary to provide our current atomic submarines the ability to perform at their original design level are only now being defined. The follow-on classes to these first atomic submarines will probably not be to sea for another five years. Based on past performance, it is not unreasonable to expect two or even three more advanced classes of American attack submarines will have been introduced. Furthermore, considering the statement by the American submarine Admiral I.J. Galantin in the Naval Institute Proceedings of June, 1958, we should anticipate that those American submarines will be able to attain speeds of 50 knots or more.

DISCUSSION

Atomic Power

It is, of course, possible that U.S. submarines could be reaching the limits of atomic submarine performance with so many recent advances; however, research in new areas of technology make this unlikely. First and foremost is the atomic power plant itself. Under the direction of Admiral Rickover, the research in this area can be expected to be both continuous and rigorous. The United States has already accumulated thousands of hours of at-sea experience with a liquid metal reactor before removing it from SEAWOLF, and is known to be examining several different options for advanced submarines.

MGDG

Magnetohydrodynamic generators are devices which produce electrical energy by the motion of an electrically conductive fluid or plasma through a transverse magnetic field. Nuclear power submarines are a candidate application for a closed loop MGDG once it becomes operational. The working body in the closed loop can be a gas or a liquid-gas. In the latter case, a liquid metal heat-transfer fluid is fed through the reactor where it is vaporized. The vapors are ionized and then fed through a magnetic field or channel at high velocity where the energy of the ionized vapor (plasma) is converted into electrical energy. The metal vapors are cooled to complete the condensation and an electromagnetic pump can be used to feed the condensate back through the reactor. Such a system appears to be most compatible with a liquid metal atomic reactor. More importantly, it can be very quiet and compact compared to a pressure water reactor (PWR) system. Although the potential of MGDG (referred to in the U.S. as MHD) technology is being investigated by many countries, including the American Navy's Bureau of Ships, this appears to be a technolgy area where the Soviet Union is likely to take the lead.

Hull Design

The shark-type hull pioneered by the diesel submarine, ALBACORE, is certainly partly responsible for the high speed of the SKIPJACK Class. Speed can be increased by reducing drag on the hull, as well as by increasing power. The advantage to drag reduction is that, unlike many power options, decreases in drag rarely have concomitant increases in noise. Our designers are carefully examining this and other hull designoptions, and surely the Americans will continue this research. In addition to this, there are other methods which could be employed to decrease the drag of submarines. These include: the ejection of drag reducing additives around the hull of the ship; the use of turbulence damping coatings modeled after dolphin skin; and covering the surface of the hull with gases. Techniques used in aviation, such as slat ventilation and boundary layer suction, also may be feasible.

Intelligence reports indicate that the use of high, molecular weight, polymer additives to reduce drag on torpedoes and ships is being examined in the United States and Great Britain. The additive can either be ejected at high speed in a fluid concentrate, or applied directly on the hull in the form of an ablative paint. Although there are no specific data that this research is being pursued for submarines, it is unlikely that this application will be overlooked. The status of this research is unknown, but it should be pointed out that the effect was initially recognized by a British researcher almost 15 years ago.

In a series of publications since 1957, the German scientist, Max O. Kramer, who now resides in the United States, has described his invention of a drag reducing coating. The coating is claimed to reduce the frictional drag of a surface by over 50 percent. It is known that the U.S. Navy has expressed an interest in this coating. Vice Admiral C.B. Momsen, the inventor of the Momsen lung submarine escape apparatus, has stated that the coating will make submarine speeds of 60 knots possible. (BOATS, Vol. 57, No. 3, March, 1960)

Bionics

At the U.S. Naval Ordinance Test Station in China Lake, California, there is a research program to examine sea-animal locomotion in an effort to identify new ideas for improving torpedo performance. (NAVORD Report 6573, 10 August 1959)

Many of the concepts being investigated have been already described above; however, the biological or bionic approach is unique and is probably worthy of attention. Soviet researchers, such as the renowned A.G. Tomilin at Moscow State, Yu G. Aleyev at Sevastopol, and S.V. Pershin from Leningrad, acknowledge the viability of this approach and, with Admiral V.I. Berg, encourage its exploitation in our own country.

Propulsors

Research at the Navy-sponsored water tunnel at Pennsylvania State University has demonstrated that, as in aeronautics, significant increases in the underwater speed of submarines and other underwater vehicles will require new types of propulsors. This research has concluded that ingestion of the boundary layer and thrust augmentation can extend the speed range where conventional rotating propulsors are efficient. However, continued increases in speed are likely to force a progression from the propeller, to the pumpjet, to the ramjet, and eventually to the rocket. (ARS Journal, December, 1960)

The Office of Naval Research has been sponsoring additional research on underwater jet engines at the Aerojet-General Corporation in Azusa, California, for over ten years. It is apparent that this research is directed more toward weapons that a submarine might carry, rather than the submarine itself. Propulsor concepts which do not seem to be receiving much interest in foreign submarine design are both ventilated and supercavitating propellers.

Concealment

Our current atomic-powered submarines are susceptible to detection by acoustic, magnetic, hydrodynamic, radiation, and electrical field sensors. Some of these fields will be substantially weakened as new technologies intended to improve the speed and depth characteristics are implemented. For example: reductions in drag will decrease broadband acoustic signatures associated with turbulent flow and propeller cavitation; new thrustors may totally eliminate propeller cavitation; if accepted, proposals to examine new steel alloys and even titanium for hull fabrication would reduce magnetic and ELF signatures; drag reducing coating designs could be combined with the more traditional radar absorbing and anechoic designs to produce a combination coating; and MGDG plants would remove the need for cooling pumps and possibly other rotating machinery which generate low-frequency, acoustic noise.

It is important that we carefully monitor the trends in all signature areas. Two obvious pitfalls must be avoided. The first relates to expending precious resources in an effort to suppress signatures which will be reduced or eliminated by new technologies already under development; and the second relates to reduction of one signature at the expense of one or more other signatures. For example, before a great deal of expense is directed toward sound isolation of large machinery, the unfavorable effect of increasing the volume of the ship on hydrodynamic and magnetic signatures must be considered. If a new technology, such as MGDG, will eventually eliminate the noisy equipment, resources may be better expended in some other direction. In the case that the noisy equipment is essential and likely to be required in the future, then a careful analysis of the effects on all related signatures must be conducted to assure concealment in combat actions.

For these reasons, it is appropriate that we don't focus our concealment effort solely on reducing low-frequency machinery noise. As in all aspects of submarine design, no one factor should be considered separately. Concealment is most important; however, a <u>submarine which will not engage in combat actions because of risking concealment is of no value</u>. Once concealment is lost, the submarine should have the ability to escape with speed, depth, and at that time -- after engagement -- with low signatures. From this perspective, I believe we have already taken the correct course in developing concealment-related technologies and that we must continue to pursue that course.

Stability and Control

As speeds increase, the ability of a team of men provided with hand-operated plane and rudder controls diminishes. Although these techniques were adequate for diesel submarines operating at speeds of ten knots, submarine speeds of 30 knots or more demand responsiveness and precision which can only be obtained with automatic controls. Despite the inability of our intelligence apparatus to provide the details of American automatic control systems, such as "CONALOG," our own limited experience at speeds of just over 20 knots makes it clear that ship controls must be automated to assure the safety of the ship and its crew.

Summary

Soviet atomic submarine production has been delayed while several techniques are developed and tested which will enable these submarines to achieve speeds in the mid-20 knot regime. At the same time, American submarine technology is advancing at an extraordinary rate. New classes of high-performance U.S. submarines are being introduced almost continuously, and high-level Naval officers confidently expect that submarine speeds of 50 to 60 knots can be achieved. In addition to their very successful developments in atomic power, the Americans have apparently made advances in defining optimum hull shapes, and developing synthetic coatings to dampen turbulent energy and reduce drag on the hull. Some of these advances have been stimulated by the new science of bionics, the study of engineering in nature, such as in animal locomotion. Other technologies which are being developed to support these advances in submarine technology are polymer ejection, new propulsors, and automatic ship control systems. Whether or not the United States has made any significant advances in developing a MGDG for submarines or is actively pursuing the adaptation of aerodynamic concepts such as slat ventilation and boundary layer suction is unknown.

RECOMMENDED ACTION

New Concept Development

The current technical advantages enjoyed by American submarines are too great in magnitude for the Soviet Navy to continue with a traditionally structured submarine research program; that is, a program which relies on the evolutionary development of new technologies. If we are to succeed in carrying out our goals in the World Ocean, we must bound ahead of the Americans with revolutionary new concepts. It cannot be a question of whether or not the Soviet Navy will consider technical risks, but rather how much risk we can tolerate and still perform the operational tasks for which the Navy is responsible. In the words of V.I. Lenin, "War is won by he who has the greatest techniques, organization, discipline and the best hardware... without hardware and without discipline it is impossible to live in modern society -- one must either master modern technology or be crushed."

Moderate Risk

To revitalize our scientific and technical base, I recommend we pursue two development tracks simultaneously. The first track entails moderate risk. I want to emphasize that this is not intended to be synonymous with low risk or no risk, but clearly involves the exploitation of technologies with which we have little or no first-hand experience, yet some experience base does exist. The experience base may not be directly related to submarines, or it may even be foreign experience. Examples of this include: gasification of the boundary layer which is being developed for river boats; ventilated propellers which we are now developing; and smooth damping coating which are being developed in the United States. Since there is moderate risk in exploiting these technologies, we must be willing to accept the eventuality of having limited success with the lead unit of a class. That experience will accelerate our advances in those technologies and provide, in the near term, an advanced class of submarines which will be able to perform the operational tasks assigned the Navy while more complex technologies are being developed on the second track.

High Risk

The second track is a high-risk track which is focused on the development of bold and innovative concepts. Like the American ALBACORE and SEAWOLF Classes, these submarines may be one of a kind which are built for the single purpose of accelerating the development of revolutionary new technologies. We should not expect these submarines to be immediately successful. But we certainly can expect to learn a great deal in the design, construction, and fitting-out periods, as well as during experiments and trials at sea. Examples of the technologies to be developed on this track are fully automatic controls, titanium hulls, peristaltic pumps and thrusters, or other bionic-derived concepts. To establish this high-risk track, I recommend we approve Admiral A.I. Berg's proposal to build a series of "fish-like" submarines which employ many of the features Tomilin, Pershin, and Aleyev claim contribute to the high speed and simultaneous concealment of fish. As said earlier, the Americans are already pursuing bionics with obvious success (for example, the SKIPJACK hull design). Like the moderate-risk track, more than one program can and must be pursued at a time, so, the approval of Berg's proposal does not eliminate alternative proposals, such as those forwarded by the Fourth Design Bureau.

Chronology

The objective is to leapfrog the American technology. Such an objective cannot be achieved in a short itme. In addition to vigor, we will need tenactiy and patience. High risks yield high payoff -- in time. Should these recommendations be approved, then moderate-risk systems can be at sea in about five years. However, high-risk technology developments require intense and careful basic research, as well as continued development. Once a program is started, we must be willing to change direction and make major alterations as new knowledge is gained. It will take ten years to field such advanced prototypes, and probably another five years to evalute them fully in the ocean environment. Hence, we must plan and be willing to accept a phased program where the most advanced technologies may not be fielded on front-line combat systems for 20 years.

Coordination

As lessons are learned from the high-risk programs and the risk is eliminated or substantially diminished, then there must be a mechanism to change tracks so the Fleet can benefit from these advancements at the earliest possible time. Hence, our submarine technology program must be centrally coordinated and continuously reviewed. This review authority must have the authority to modify or redirect ongoing submarine production to assure that the latest available technology is at sea. In this fashion, the last unit of a class may be significantly different and more advanced than the lead ship. Totally new classes need to be introduced only when new technologies are so different from previous technologies that class modification is impractical.

K.J.M.

A SAGA OF THE S-34

The S-34 began operations out of Dutch Harbor in April of 1942. After an initial 14-day uncounted patrol to Amchitka Island and back -- without incident -- repairs were made and the 34 boat shoved off for a first patrol to the Paramushiru Islands, south of the Kamchatka Peninsula. With the Div Com, Comdr. B.G. Lake, aboard, Lieutenant Tom Wogan the 34's Captain had orders to intercept traffic between Attu and Paramushiru and then stop off at Holtz Bay in Attu on the way back to Dutch Harbor, to transport any of the Aleut Indians who might wish to return to Alaska. May was supposed to be a good month for Bering Sea operations but S-boats were apparently not designed for the North Pacific storms encountered. The winds ranged up to 100 knots and crest to crest distance between waves was over 1000 yards. While cruising on the surface, the control room barometer varied at least three inches in pressure due to the low pressure in the trough and higher pressure on the wave crests. No baths were taken because of the danger of getting pneumonia. Drop-seat underwear had been donned on leaving Dutch Harbor, not to be removed until return to the barracks at the end of the patrol. A hundred miles short of Paramushiru, contact was made on two unescorted freighters of about 2000 tons each. Despite no radar, no echo-ranging gear and a badly fogged periscope the S-34 reached a good firing position. With a range of 900 yards, three MK10 torpedoes were fired. They ran hot, straight and normal for 500 yards and then the engines stopped -- the freighters moving past the 34 unharmed. Later it was learned that these torpedoes were unstable in water temperatures below 30°F and the recorded ocean temperature that day was 28°F. Paramushiru proved a weird place with continual fog and a yellow-tinge to the sky from all of the sulfur pouring out of the volcanoes on the Islands. The harbor was clogged with icebergs and floe ice, and the 34 boat moved around inside the harbor without finding anything. On the way back to Dutch Harbor, the S-34 stopped at Holtz Bay in Attu where the Div Com fell overboard and although rescued in 20 seconds he turned blue and never warmed up until back in the barracks. Also, the Aleut Chief, Mike, was contacted, but he declined an offer to take his people back to Alaska. Next day, after the 34 left, the Japs invaded Attu. So Mike and his tribe spent most of the war with the Japs.

The S-34's second patrol, and the reason for this story was a different matter!

The S-34 departed Dutch Harbor in June 1942 to intercept shipping and report on action in the Attu area. No contacts were made to the west of Attu where Japanese landing forces were expected. On 20 June while patrolling just north of Attu, contact was made on a pinging destroyer to the south of the 34 boat. The skipper headed for the sound source. Just east of Sarana Bay he sighted a DD patrolling off the entrance. Battle Stations were manned and an approach was commenced. The DD reversed course and disappeared in the fog toward Sarana Bay. The seas were calm for a change, and the fog was patchy. The bearing on the DD's screws changed to the north. During a quick periscope exposure, Captain Wogan yelled, "We've hit the jackpot!." On my fast look through the scope I sighted the DD's stern going away, but when I swung to the harbor entrance there was an anchored tanker fueling two DDs port side. The range was 6000 yards. Attack was broken off on the first DD and an approach started on the tanker. Our charts were obsolete but indicated that there would be good depth right up to the firing point. During the approach, the sonar man kept track of the patrolling destroyer. Twice the 34 changed course to show the continually pinging DD a stern profile. The Captain conducted a text book approach. Quick exposures of the periscope were used, making it doubtful that the enemy suspected the presence of the 34. However, the 34 acted oddly. I sensed we were in shallow water - but after checking the dead reckoner and the charts, it appeared that we had at least two fathoms under the keel. A final ISWAS solution, with a range of 1000 yards, torpedo run of 1000 yards and a 90° starboard angle on the bow, was obtained. It was a perfect set-up for a no-speed target. The skipper ordered, "Fire three fish on the next look." With the order "up scope," a tremendous noise like an explosion occurred which sounded like depth charges, although none on the S-34 had ever heard underwater explosions before. The boat rocked and bumped. The skipper ordered, "All ahead full, take her down to 100 feet." Nothing happened. Then "up scope." When the periscope unfogged he muttered, "We're aground." Then "All back emergency." Nothing moved. Then "All stop." Chief Electrician's Mate Leonard called out, "If we're aground, I suggest that you blow all the fuel out of #3 Main Ballast Tank. That will make us light enough to float off the reef." He offered to unwire #3 MBT vent so that the tank could be flooded for diving. All S-boats making long patrols carried their #3 MBT full of fuel and had the vent wired shut to prevent accidentally opening it, releasing the oil. #3 MBT was blown. The Captain, on the scope, reported, "I can see our bow out of water. They are shooting at us," — and this could be heard through the hull. "The outboard DD has cut her lines and is heading our way. The DD astern has reversed course and is heading for us." This running account spurred faster blowing and faster venting. The Skipper finally announced, "We're levelling off. There's oil all around us. All back emergency." With a great grinding sound, the 34 boat backed clear of the reef. "Right full rudder, flood #3 MBT," was then ordered. With DD projectiles landing all around the 34 she headed for the bottom. At the last instant, before ducking the scope, the Captain got two Mk X torpedoes off towards the DD which had broken away from the tanker. There was one final glimpse of the DD as it passed down the 34's port side at an estimated range of 30 yards. The Skipper's last remark before lowering the scope was, "Stand by for depth charges close aboard, our torpedoes were near misses." Just as the periscope was housed, seven depth charges at three second intervals knocked everyone off his feet. The boat was driven bodily sidewise through the water. Then she hit bottom in 178 feet of water. Virtually all gear was secured in order to listen and evaluate the situation. As the 34 bottomed, the diving officer Lt. (j.g.) Thompson bit the stem off the pipe he chewed on. Compartments reported no major leaks or damage. The 34's riveted hull could take more than the designers knew. The CO said he'd seen the destroyer's depth charge crew, dressed in white, pushing over depth charges. The sound man reported that the DD after depth charging the 34 had gone aground on the same reef which the 34 had just vacated. Their charts were no better than ours! The first DD we had seen, closed the 34 but did not try to attack since her sister ship was on the reef. The huge oil slick left by the 34 could have tricked the DD into thinking that the 34 was sunk. A quick council of war between the three senior officers -- one Lieutenant, and two JGs -- arrived at a decision to remain bottomed for a while to see what the enemy would do. The picture conjured up provided the following scenario: No. 1 DD was patrolling off the entrance to Sarana Bay; No. 2 DD was aground on a reef; No. 3 DD and the tanker were in the same relative position where we first found them. Within ten minutes after bottoming, small high speed screws were heard from the tanker's direction. They were heading for the grounded DD, presumably to help free her. The Skipper decided to play dead for the next couple of hours. All machinery was shut down, the gyro as well. It seemed to make an awful racket when it was the only motor running. The 34's attack was at 0930 on 20 June. There was no way of knowing how long the 34 would have to stay down. All were optimistic about getting out of this situation. All hands were told to hit their bunks and try to relax. Time went by slowly. During an attempt to play cribbage on the gyro table, I announced, "this is my sixth wedding anniversary." All that I got were a few looks of sympathy.

DD #3 could be heard trying to pull #2 DD off the reef. At about 1600 they seemed to have succeeded. The twenty to thirty foot rise and fall of the tremendous tides in the Aleutians were helping. The tanker also got underway, and as it passed overhead the soundman imagined that they were dumping their garbage on the 34. After another hour the clanking sounds of chains or cables being dragged over the rough volcanic bottom were heard. The sounds became louder and louder and then shifted to the other side of the boat and diminished in volume. The Japs were dragging for the 34 but had missed. By 0300 on 21 June, the activity diminished, although one of the destroyers could still be heard, pinging in the distance. By this time, Chief Torpedoman Yutz, the Chief of the Boat, had provided calculations for spreading CO_2 absorbent throughout the boat and in determining the proper mixture of CO2/man/cu.ft. to compensate for the amount of carbon dioxide given off by the exhausted crew. At about 0330, 19 hours after bottoming, and with no sound of pinging or screws, the CO decided to start the gyro and to let it settle down, then take a heading to get out of Sarana Bay. When the gyro motor-generator set was started, it sounded like a B-25 bomber engine. This also started DD activity, so "Shut the gyro down" was good news. Then Chief Machinist Mate Wiggins reported sounds on the hull over the after battery compartment. The squishy sound of something moving across the 34's topside could be heard in the control room. Someone guessed it was a diver attaching a line to the 34's after battery hatch. Then he'd be able to slide a depth charge down to the 34. A second guess was that the diver was attaching a bouy to the 34 which would let the destroyers track the 34 if she managed to get off the bottom. Another joker said he was trying to open the after battery hatch. Wiggins then re-enforced the cables which held the hatch closed. The noises lasted for twenty minutes, then ceased. At about 0430, Electricians Mate 3/c Bonine reported that he could get no readings of specific gravity on the battery. This convinced the Skipper that shortly he'd have to get the 34 underway and out of the harbor. The pressure inside the boat was almost seven inches. All CO_2 absorbent was used up and a number of the crew were passed out. In another hour the skipper felt he wouldn't have anyone left to do even the simplest task. The gyro was started at 0600, and let to settle for twenty minutes. The Main Ballast Tanks were then gently blown, just to get the 34 off the bottom. The motors were started with the batteries in parallel. Only a handful of the crew were available for duty. A Battle Surface Gun party of four groggy men was formed, because surfacing was necessary -- DDs or not. "Let's go," said the Skipper, and up the 34 started, sounding like a threshing machine. She was leveleed off at 150 feet on a heading of 060°T while crawling for the harbor entrance at a speed of about 1½ knots. No pinging was heard, so for the next three hours, taking constant gravity readings on the batteries, the 34 moved to the northeast, fortunate not to go aground again. At 1030 the skipper brought the 34 up to periscope depth to take a look around. After levelling off at 36 feet, he ordered "Up scope." It wouldn't move; it was jammed. He then ordered No. 2 periscope raised, but then couldn't see a thing through it because it was totally fogged. "Stand by for Battle Surface" he ordered anyhow. With a half-conscious crew at their battle stations, the Captain ordered, "All ahead full, down angle on the bow and stern planes." The boat was sluggish; full speed with a dead battery produced only a few knots. So the skipper ordered all planes on full rise, all main ballast tanks blown and as the boat passed 30 feet, "open the hatch." With excessive pressure in the boat it was difficult for Benny Allen, the No. 1 man out, to undog the hatch even though he swung a leather mallet backed by his 220 pounds of brawn. The hatch finally popped open and the pressure blew the first three men out of the conning tower like corks. Benny landed in the water, No. 2 landed on deck, No. 3 hung on to the forward antenna, and I, as No. 4 lost my shirt.

But, there was no need to pursue the Battle Surface Gun Action. A super pea-soup fog enshrouded the S-34. The Skipper then headed northwest for the Commandorski Islands -- just in case the enemy was hoping to intercept the 34 out to the east. The S-34 had been submerged for 25 hours, used up all her CO_2 absorbent, bottled oxygen, and battery and almost all the energy of her crew. After two hours of running on the surface at maximum speed in the fog, the 34 was headed for Dutch Harbor at slow speed with one engine on battery charge. The crew recovered rapidly with fresh air circulating through the boat. Soon all were in good shape. The 34's speed had been drastically reduced by bent propeller shafts and nicked propellers. In addition, the boat could not be pumped up to its normal draft because the ballast tanks would not pump dry. We finally did reach Dutch Harbor, however, and all of us rushed to the barracks for a shower and a change of underwear.

Squeak Anderson had arranged for a floating crane to lift the stern of the S-34 for damage inspection and found that the two propeller blades looked like tulips. Divers found jagged holes in all MBTs, and they said the boat's stem looked like the letter S from contact with the bottom of Sarana Bay. There were also the marks of five suction discs about six inches in diameter, spaced about eighteen inches apart, which had completely taken the paint off the hull over the after battery compartment. The "squishy sound" seemed to indicate that a giant squid had been wrestling with the 34 boat while she was playing dead (well why not?). Within days, the S-34 was patched up and sent to Bremerton NSY for a complete overhaul. Lieutenant Commander Wogan went to the Tarpon, after being relieved by Lieutenant R.A. Keating, who took the S-34 on four more patrols in the Aleutians.

Mike Sellars

DISCUSSIONS

NAVY STRATEGY AND THE SUBMARINE

As a Naval Aviator during the 1930's, I was always frustrated by the complete lack of appreciation of the Senior Officers of the Navy for the airplane as a vehicle that would change the face of war at sea as well as our Maritime Strategy. Only WW II and actual combat brought aircraft into the many roles they now play in our plans for war at sea. Our Senior Officers only envisioned the airplane as a scouting system for our Battle Line in the classical approach to a fleet battle. Early warning, reconnaissance, air lift, dive bombing and many other roles were not even thought about in those days.

Today history repeats itself in the world of the submarine. We have been blinded again! This time by a propulsion plant! Our submarines are far from being effective warships. Weapons make a warship, and though our submarines can go around the world without refueling they can't be very effective when they have too few weapons! The weapons they have today are torpedoes, soon they will have the TOMAHAWK, but his is not the crux of the problem. The truth of the problem is that the Navy has not exploited the submarine across the spectrum of Naval Strategy. As it stands now the submarine in the U.S. Navy plays a single role in conventional war like the airplane was expected to do before WW II. For strategic war, submarines like the TRIDENT play a deterrent role and history shows that it wasn't the submarine force of the U.S. navy that brought the Polaris system into being.

It is strange that we have Chiefs of Naval Operations pushing stongly for such things as Hydrofoils and Small Aircraft Carriers but no one pushes for the many roles that a submarine can and should do in a war at sea. The role of the submarine to meet the problems of a sea war are many and not just associated with the "power plant!" If one gets wrapped around the axle as to whether a submarine should be nuclear powered or conventional, one will lose sight of the forest for the trees. History is a good teacher and indicates how nice it would have been to have had enough submarines to help protect our tankers along the East Coast in the early days of WW II. It would also have been nice to have enough submarines to be able to mine many places. To have enough submarines to have good barriers in the Caribbean, as well as in other parts of the world where we needed such protection would have been equally nice.

If one thinks the Naval Aviators are in concrete about aircraft carriers, one should contact the nuclear submarine community! Arguing about whether a submarine should be nuclear or diesel does nothing but evade the critical question that faces us in the exploitation of the submarine at sea as a part of overall U.S. Naval power. This question will be tackled when rhetoric has been overtaken by facts. We have said for years we wanted an SSN attack force of 90 submarines -- now its 100. We are not going to get there. Today's attack submarine is basically a torpedo boat for sinking ships as was done in WW II. But today the ships to be sunk are Russian submarines to be engaged in the classical WW II scenario of one on one! We must have a broader approach to the use of the submarine regardless of the propulsion plant! It has many roles including operations with combined forces that must be exploited.

The advent of the HARPOON and the TOMAHAWK give rise to many questions. What is an Attack Submarine? Is it a torpedo boat or an attack vehicle with long range missiles for use against surface ships and shore targets? Such questions really need discussion rather than what should be the propulsion plant. How many people in battle have been killed by propulsion plants?

This may be a strange article by an "Antique" Aviator for a publication about submarines but history is a good teacher and it is time our submarine community was awakened to the over all potentialities of the submarine as a vehicle in the Strategy of our Navy.

J.T.H.

REFORM IN THE NAVY

In the December issue of the Proceedings, Commander John Byron in his article "Diesel Boats Forever" indicates that "the Reformers" are way off base, because the conventional wisdom of the naval establishment shows that nuclear boats are superior in all respects to diesel boats. Any deviations by members of the Naval Submarine League, as to what might be an improvement in the submarine picture, could thus be construed as an attempt at "reform." Thus, some thoughts on the historical dynamics of innovation in the navies of the world and the U.S. Navy in particular, seem applicable.

For the past century and a half each major innovation in the U.S. Navy has been the product of a small group of naval officers fighting the naval establishment. Success has come, almost without exception, when these groups of "reformers" have gained support in Congress.

Congress has had a good track record in their battles with the naval establishment on matters of system innovation. Their support was critical in the cases of Admiral Isherwood on steam propulsion, Admirals Fiske and Sims on fire control, Admiral Dewey and others on submarines, Admirals Tower and Moffit on aircraft carriers, and Admiral Rickover on nuclear propulsion.

This political support of the "reformers" was not a matter of the politicians being interested in gadgets. It was generated by frustration with the Navy's inability to support emerging changes in national policy with compatible strategic innovations.

It appears that the Russians do not have the same problems in getting their Navy to innovate. Innovations in Russian weapon systems (such as the Alpha class submarine) suggests that these changes are in response to changes in strategies as dictated by changes in national policies.

To argue that the nuclear attack submarine is the best weapon for sea control is as irrelevant as the pre-WWII arguments for the battleship. The Russians are as unlikely to refight the Battle of the Atlantic as the Germans were to re-fight the Battle of Jutland. Changes in political objectives demand changes in strategies and tactics.

Congress is challenging the military establishment to become more strategically innovative. This challenge is apparently not recognized when attempts are made to prove that today's submarine is superior to those of forty years ago.

F.C.L.

LETTERS

(A few of the comments received -- just wanting to say they liked the first edition of the Submarine Review and want to be sure it is continued. Ed.).

"Congratulations on your first issue of Submarine Review. It is going to be a fine house organ putting forth the point of view which has been lacking. I wish this had been going 25 years ago."

"The first journal is more than I expected. I was a 'white hat' during the war, respected our officers but never realized the strain they were under constantly. Could you let me know if M.V. Moore, Dev Group Commander in 1964 was Gunnery Officer on the RATON during the war?"

"Just finished reading the first issue and enjoyed it very much. I would like to point out that I (Capt. W.G. Ellis) am CO of the USS City of Corpus Christi, not Cdr. William Owens, whom I relieved on 28 August 1981."

"Found the Submarine Review to be beautifully done. The Review was well printed and am sure it will become widely popular. Congratulations and continued good luck."

To the Editor:

Richard Laning's "Submarine Command in Transition to War" was the premier article of the inaugural issue of The Submarine Review. It exemplifies what I think the Naval Submarine League is all about. It provides useful food for thought for today's and tomorrow's skippers from a man who had the "Right Stuff."

But my principal reason for commenting is that Dick Laning has cited comments from VAdm. Bob Rice to prove his point -- that they didn't all make it. Bob and I are the only two left from DRUM's original wardroom. Nick Nicholas, the Exec of later SALMON fame, died in 1970; Manning Kimmel, engineer, was lost in ROBALO in July 1944; and John Harper, communicator, in SHARK II in October.

Bob did indeed feel he was old for the job. I recall clearly a day in 1943 at Pearl Harbor when he confided this to me, expressing real envy for my youth. I was 26!

He was a meticulous skipper, a quality gained, as Dick suggests, during the peacetime years. But he was also a superior teacher, and early on made it clear to all of us that DRUM existed to sink ships. He was the most skillful periscope handler I ever saw.

That was not all he was good at, however. "Normal" wardroom conversation leaned regularly to history and literature. His later job as Head of the Department of English and History at USNA was no accident.

The best example of his maturity came on the first night in area, south of Tokyo, on DRUM's first patrol. We shot two single MK14 torpedoes on the surface and sank the seaplane tender MIZUHO (Bob was the only one on board who was privy to the extreme torpedo shortage in April 1942). Following the successful attack, we were driven down by a destroyer; and fired one more MK14, which ran deep under the stopped target. For 15 hours, we listened to our first depth charges, some close, others distant (but who could know then?). With the battery gravity down to 1.025, about 0200 the next morning, Bob concluded that we must surface even if the enemy was "up there". His guidance to us began: "If we don't make it, my only regret is that this fine new ship has not done the job for which it was built." Fortunately, we did make it; and DRUM did do its job!

Mike Rindskopf
DRUM 1941-1944

IN THE NEWS

o A Congressional Budget Office Study has concluded that nine additional Trident submarines "would provide the same number of warheads as both of the land based missile systems under consideration," the MX and the small ICBM. While the combined life-cycle costs of the MX and the small ICBM would exceed those of nine Tridents "by a factor of more than three."

o Admiral James Watkins, the CNO, in plugging for a new attack submarine program, stressed that in addition to this new submarine being bigger, more powerful, faster, deeper-diving and with a far better sonar suite than the present 688 Class, it would also additionally be "hardened" and configured for under ice operations. He noted that the Soviets are "demonstrating a strong interest in operating under the ice" and that "we'd better be able to fight them in that region."

o The recently released report of the President's Commission on Strategic Forces (the Scowcraft report on the MX) included a recommendation that research begin now on smaller balistic-missile carrying submarines, each carrying fewer missiles than the Trident, as a potential follow-on to the Trident submarine force. The report said that such small subs would present lower-value targets and "present radically different problems to a Soviet attacker than does the Trident submarine force."

o On May 17 the Florida (SSBN 728), and the nation's third Trident submarine, was delivered to the Navy. Electric Boat, the builder of Trident submarines, has seven more of the 560-foot-long, 18,750 ton vessels in varying stages of construction.

o Cutting the cake this year at the Submarine Birthday Ball in Washington, commemorating the 83rd anniversary of the Submarine Force, were the host VAdm. N.R. Thunman, USN, Adm. John G. Willimas, Jr., USN, VAdm. Lawson P. "Red" Ramage, USN (Ret) as the senior submariner at the Ball, and Lt. David A. Veatch, USN, the most junior.

o In a by-line Stockholm, Sweden, it is reported that a Swedish government commission in their findings which were published on April 26, 1983, concluded that the Soviets had tested spy subs in the inner Stockholm archipelago in October, 1982. The commission said that on the basis of sonar recordings and imprints on the seabed it was concluded that unmanned subs were sent on reconnaisance missions from Soviet mother subs, and that underwater photos showed the mini-subs to be about 50 feet long. At least six submarines -- including three manned midgets with a bottom crawling capability of a hitherto unknown character -- were considered to have penetrated the archipelago area with three of the submarines evading a massive hunt in the Horsfjarden bay where a main Swedish base is located. The imprints left by the subs inside the bay showed what appeared to be tractor-type tracks of one submarine as it maneuvered along the sea floor, and more conventional marks from a second submarine of propellers and a keel. The report noted that there had been at least 40 incidents of submarine intrusions in 1982, and that the judgement that the recent intrusions were Soviet, had been confirmed. (The apparently long submerged endurance of these mini-subs is a new, unknown capability).

o On May 3rd the Naval Submarine League held its symposium and evening banquet with a strong agenda of submariners focussing on the main topic of the day, the character of the next nuclear attack submarine. Admiral Al Whittle, Chairman of the Board of the Naval Submarine League opened the day's symposium and introduced the speakers. In the morning session, Commodore Chauncey Hoffman talked to the growing Soviet underseas force, and VAdm. N.R. Thunman described the evolving U.S. submarine force and the nuclear attack submarine concepts for meeting this challenge. The Honorable George A. Sawyer, Assistant Secretary of the Navy (Shipbuilding and Logistics) told of submarine acquisition problems and their solutions. In the afternoon session, VAdm. Steve White gave the positions of the force commanders relative to missions versus force level, and RAdm. J.H. Webber described the R and D involved in generating a new attack submarine design. At the banquet, Adm. J.G. Williams described the useful role which the Naval Submarine League can play in getting the Navy the best follow-on nuclear attack submarine possible.

o An item in Sea Power, March 1983, notes that when the Secretary of the Navy was asked to comment on a report that a Soviet Tango-class submarine was seen in the Adriatic Sea with a twin surface-to-air missile launcher aboard, he said: "We know they have developed such a system. We are confident they have such a missile." Later in the article it was described as being an SA-14 type. Although this is the first observed Soviet submarine anti-air weapon, the British for quite a few years have had Blowpipe mounted on the bridge of their submarines in a quadruple launcher. Blowpipe (like the SA-14, which is also possibly laser guided) is a small heat seeking missile which in its infantry version saw considerable use in the Falklands War. This shoulder-held weapon accounted for ten high performance aircraft -- nine Argentine and one British. The Secretary of the Navy contends that the U.S. Navy does not require a submarine surface to air missile because Soviet maritime patrol aircraft have been unable to locate U.S. submarines.

o In the President's early June action on the Budget, he asked Congress to approve appropriations in the next two fiscal years to build nine new submarines, two of which would be Trident submarines and the other seven would be 688-class attack submarines, three for Fiscal Year 1984 and four for the following year. The House Armed Services Committee, moreover, has approved three 688-class submarines and one Trident for Fiscal Year 1984.

o On 21 May 1983 the USS NORFOLK (SSN 714) and the USS ALBUQUERQUE (SSN 706) were commissioned in

Norfolk and New London respectively. The Honorable Caspar Weinberger was the speaker at the NORFOLK commissioning, with Senator Pete V. Domenici, the Chairman of the Senate Budget Committee the principal speaker at the ALBUQUERQUE ceremony. Mrs. Weinberger and Mrs. Domenici are the ships' sponsors.

o Flag officer moves have been heavy this summer. The following three star and above changes are noted.

- ADM Robert L. J. Long, CINCPAC retired 1 July 1983.

- ADM William J. Crowe, Jr., relieved ADM Long as CINCPAC on 1 July 1983.

- ADM John G. Williams, Jr., CHNAVMAT retires 1 August 1983.

- ADM Steven A. White, relieves ADM Williams as CHNAVMAT on 1 August 1983.

- VADM Kenneth M. Carr became Deputy & Chief of Staff, CINCLANTFLT and CINCLANT on 1 April 1983.

- VADM William J. Cowhill, DCNO became J-4, JCS on 1 July 1983.

- VADM Edward P. Travers, Vice Chief of Naval Material retired 1 June 1983.

- VADM Bernard M. Kauderer relieved VADM White as COMSUBLANT on 27 June 1983.

- VADM Powell F. Carter, Jr., relieved VADM Carr in March 1983.

- RADM Charles R. Larson relieves VADM Edward C. Waller, III as Superintendent of the Naval Academy this summer.

- RADM Albert J. Baciocco, Jr., COMSUBGRU SIX has been nominated for a third star and to relieve VADM Monroe as OP-098 in August 1983.

BOOK REVIEWS

"BATFISH", the Champion "Submarine-Killer Submarine of World War II" by Hughston E. Lowder with Jack Scott - Prentice-Hall: 1980:226 pages.

"BATFISH" will be a nostalgia trip for WWII submariners and education for latecomers as Lowder, one of her Radiomen, takes the reader from Commissioning in Portsmouth, N.H. through 7 war patrols to her final resting place as a monument in Oklahoma, over a thousand miles from the nearest sea.

Some fine photos help set the atmosphere and include a younger 'Jake' John K. Fyfe, and 'Bob' Robert L. Black, well known to many of us. BATFISH (SS310) sank 14 enemy ships, heard many depth charges, made the usual delightful liberties at Pearl, Midway, Freemantle, and San Francisco, missed Japan's mightiest battleship Yamato, weathered typhoons, fretted about trigger-happy friendly aviators, and raced around on life guard duty as did many of us.

What made BATFISH truly unique was her sinking 3 Japanese submarines in 3 days. What makes that part of the story truly gripping is that we can empathise with both BATFISH and her targets. How often has each of us sighed "There but for the grace of ...?"

Somehow her handsome last skipper, 'Walt' Walter L. Small missed having his picture included in what has got to be one of the greatest submarine stories told. Regrettably, charts are not provided to add clarity to the narrative for those not familiar with war areas.

R.B.L.

"THE AMERICAN SUBMARINE", Second Edition, by Norman Polmar, 1983 Nautical and Aviation Publishing Co. of America; 170 pages.

After fitful starts, the line of submarine development became well established just about a century ago and has continued at rates varying from busy to frantic until now. Polmar has achieved a remarkable overview in a copiously illustrated compact 170 pages easy and fascinating to read.

Every retired submariner will want a copy with which to enjoy the nostalgia of reliving the quarter to third of this history he inhabited. Each Wardroom needs a copy so all the officers can share a perspective about the segment of the development line they influence. School libraries need it to provide potential submariners a view of the continuity into which they may enter. Each submariner needs a copy with which to show his son what he does and what his life means.

The Author shows that submariners have placed themselves in danger and discomfort in efforts to achieve naval missions from the Revolution to the present as technological opportunists of each time frame. Propulsion has gone from one manpower through multi-manpower, sail, steam, gasoline-electric, diesel-electric up to about 6000 horsepower, to nuclear power up to 60,000 horsepower. Hull materials have gone from wood to iron to steel to HY 80 steel to aluminum to titanium. Weapons have gone from screw attached mines to spar mines to launched mines to torpedoes to homing torpedoes to guided missiles to ballistic missiles to homing missiles to MIRVed missiles.

Similar decibel changes have been made to happen in such other characteristics as hull form, environmental controls, endurance, operating depth, detection methods, detection avoidance, communications, speed, and ruggedizing. Most of the phases in these evolutions are illustrated and described. The author gives well deserved credit to Cmdr. John Alden and his excellent book "THE FLEET SUBMARINE IN THE U.S. NAVY."

Many fun games can be played with the information contained: 'What well known officer was last CO of U.S.S. Plunger SS-2 Ensign C.W. Nimitz. Who was her most famous visitor? President T. Roosevelt.

I was able to detect just 10 errors. They are all inconsequencial so I'll not name them; you'll have more fun looking for them. Many of the truly heroic men of submarine development are mentioned; many are not. I hope future works will bring out such names as O.P. Robinson, Carlton Shugg, Ralph Kissinger, Lou Roddis, Joe Pierce, 'Red' Gates, J. 'Bill' Jones, Bill Roseborough, Mike Moore, Levering Smith, Tom Dunn, 'Fuel Oil' Johnson, Mandell, Panoff, Rockwell, Dan Daspit, Frank Andrews, Paul Backus, Hank Arnold, Harry Jackson, Chet Smith, Frank Lynch, and about a hundred others who became my heroes.

Of great interest are the parts on the many configurations which have been derived from fleet boats since WWII; including SSR's, transport and cargo submarines, various research submarines, various LOON and REGULUS launchers, SSK's, SST's, and the ALBACORE.

The evolution of the NUCs and the SSBNs brought out a number of facets unknown to me even though I lived through part of that era on active duty.

Polmar has written a book which will interest many, including submariners at various career stages.

Dick Laning

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

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

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

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

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

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