THE SUBMARINE REVIEW

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FROM THE PRESIDENT

As most of you know we lost "Bill" Purdum on 21 January, 1988. Bill was one of the early "sparkplugs" in the formulation of the NSL. His advice and suggestions came to us in a flurry of correspondence and personal visits. His enthusiasm for the NSL concept never waivered and once the NSL was organized, he set his sights higher. Bill was the principle author for the concept of NSL Chapters and wrote the original Chapter By-Laws. These are in use today by all five of the NSL chapters. Bill was the first President of our first NSL Chapter -- the NAUTILUS Chapter, in New London, CT. For all these efforts we are most grateful. Bill personified the finest traditions of being a submariner. He cared little who got the credit as long as the submarine service moved forward. And from a personal viewpoint, since he served with me and Admiral Long as Engineer on PATRICK HENRY, we can attest to his being an outstanding shipmate. We all dearly loved Bill Purdum. His smile, his great sense of humor, his professional attributes will long remain with us. He will be missed!

Soon you will receive a ballot for the election of 3 NSL Directors, and accompanying it will be a preference form to indicate your willingness to serve the NSL. The NSL By-Laws contain a provision that a Director cannot serve more than eight years. The present cadre of Directors have served well, but their terms will soon begin to expire. We need to see the next generation of leaders step forward and to prepare themselves for service to the NSL. I ask your thoughtful consideration in marking this volunteer preference form. It is extremely vital to identify those individuals willing to serve in the various capacities. Remember you can always move up by starting at a committee or council level. Most of the officers and directors have followed this path. We need dedicated people to follow the footsteps of the Bill Purdums.

Finally, the NSL Advisory Committee has recommended that the NSL adopt a slogan that expresses the mission of the NSL in 4-5 words. I ask that the membership give this challenge some thought and send us your ideas.

See you on 8-9 June at the Annual Symposium. The agenda looks like another winner with a major presentation on Soviet Seapower being given on the 8th. This expansion of the agenda is in consonance with the recommendation of the Advisory Council.

Shannon

THE CHINESE SUBMARINERS

(The author, Commander Compton-Hall, recently spent a month in China, at the invitation of the People's Republic of China's Navy, lecturing to Chinese submariners, the Naval HQ Staff and Procurement Officials on lessons learned in submarine warfare from World War II onwards. The invitation probably arose from several international books Compton-Hall has written on submarine warfare, the latest of which (with Captain John Moore) is SUBMARINE WARFARE TODAY & TOMORROW, which is now required reading for Chinese submariners! Compton-Hall is Director of the Royal Navy Submarine Museum at Gosport, England, and was Ops Analysis Officer of COMSUBDEVGRU TWO from 1958-60.)

It was a single and surprising honour for a retired submarine commanding officer, to be invited to lecture to submariners in the Marxist-Leninist-Maoist People's Republic of China. But it was even more surprising to find an extraordinary degree of openness and willingness to debate in a Communist country. Granted, it took a couple of days to break the ice: but thereafter the atmosphere was warm and very similar to senior NATO Staff Colleges or Submarine Command Courses -- notably the British "perisher", where arguments and wild accusations are flung back and forth, while putting the world to rights, without over-much regard for accuracy or personal feelings. There was absolutely no reserve at Qingdao and no secretiveness save, of course, where unavoidably sensitive subjects such as nuclear safety or SSN noise-reduction problems were introduced.

All this was entirely unexpected. Others who had visited China warned that audiences would be formal, cautious, impassive -- and that there would not be many laughs. In the event, reactions were quite the reverse and all concerned seemed to enjoy themselves thoroughly. Submariners are the same everywhere -- except, perhaps, in a Soviet podvodnaya lodka where the Comrades are not always prone to be very comradely -- but that is another subject about which a great deal was learned in China.

The pace was typically brisk, especially at the Submarine Academy, Qingdao, where lectures started at 0740 every morning, including Saturday, going on with group discussions until the late evening and informal meetings at any time over a mug of tea in the spacious hotel suite assigned. There was no let-up on a Sunday either: some activity was arranged and searching questions from students continued even, for example, when climbing Mount Laoshan accompanied, as always, by two "minders", two lady-officer interpreters, a lady doctor (lugging a heavy medical pack), a chauffeur, an organizer, a guide -- and, like it or not, a gentleman from the Soviet KGB somewhere in the background. (Future visitors might care to note that, if they have no Flit repellent handy, a camera directed at a suspected KGB attendant works equally well).

The point about longish hours is made not simply to warn anybody who follows that some fairly hard work is involved (the Chinese Navy hopes for more lectures on various subjects in the future) but to emphasize the extreme keenness of their submariners to learn all they possibly can from Western experience. They gladly work very hard -- often far into the night -- and are outstandingly intelligent. Admiral Rickover would have loved them although they have started, very recently (and not least because of Limey contacts) to show a degree of flexibility as well as a healthy skepticism and an inclination to question technical and tactical dogma which might not have found favour with the late Admiral.

Their dedication is channelled towards a single-minded aim which was also the ultimate purpose of the lectures -- to bridge the technological and operational gap between the PLA(N) and the principal Western submarine services as quickly as possible. Although the bridge is fast being built it has to cross a thirty-year chasm.

<u>Submarine Numbers</u>

<u>Janes' Fighting Ships</u> and most other naval references for 1987/88 list the People's Republic submarine Order of Battle as 4 SSBNs, 1 SSB, 3 SSNs, 3 SSGs and 104 SSKs of the "improved MING", "MING", "WHISKEY V" and an overwhelming preponderance of "ROMEO" types. This Order of Battle was one of the things which gave rise to hilarity amongst the students: they said (having first checked that this information was unclassified) that the total number of hulls is 81, and, furthermore, that "very many are retired". In other words, the operational force is nothing like so great as the West imagines. The word "retired" means, of course, in reserve. The Chinese are extremely proud, and rightly so, of building their SSBNs and SSNs, as well as their latest SSKs, in

their own shipyards "down to the last nut and bolt" (a mild exaggeration); but they admit that the penalty of keeping the work "in house" implies very long building times. The first SSN took ten years and they are not optimistic about speeding up the process. Formal Soviet technical assistance was withdrawn in August 1960 (but there have probably been significant exchanges of information since then) and, although considerable help and advice has been given by other nations (perhaps with the French predominating until recently) it seems to have been scattered. One result of this, evidently, is that weapon system integration is unknown -- a matter which was repeatedly discussed during the lecture forums.

Weapon Systems

It is difficult to agree that Chinese weapon systems can really be dignified by that name. They appear either to be basic in the extreme -- similar to early USN "GUPPIES" or British "T-conversions" -- or assembled piece-meal from whatever source had been willing to supply them. Torpedo angling and depth-setting is mechanical -- similar to the old British torpedoes. However, it must be emphasized that the People's Republic is truly defensive in character and is primarily concerned with repelling amphibious forces rather than engaging in advanced submarine-versus-submarine warfare. Despite the fact the Chinese submarines are, in the main, equipped with no better than straight-running steam torpedoes of Russian design -- equivalent to USN MARK 14s or British MARK VIIIs -- they may be perfectly adequate for the prime purpose. Acoustic homers are known, and the Chinese would like to acquire British Marconi TIGERFISH, but there is reason to think that the home-grown smart weapons are of rather dubious value. Some extraordinarily advanced torpedo types -- are portrayed in the Military Museum in Beijing (of all places) but an objective observer is forced to suspect that most exist only as wishful thoughts.

As an aside, an enormous amount was learned about Soviet methods during the lecture tour because the Chinese submariners (and indeed most of the armed services) are modelled slavishly on Russian ways and means. If the Soviets have not radically changed their methodology there is good reason to think that, despite awesome material advances, they conform to the rigid, inflexible practices which some of us have always thought to be their weakness. Nor, by inference, are their anti-ship tactics aggressive to our way of thinking. For example, the idea of an SSK boring in at high speed to a large force or convoy, shooting down any interfering escorts on the way if necessary, came as something of a revelation to students schooled to the Russian way of thinking: the thought that once within a group of surface ships, a submarine is not only able to take out ship after ship (admittedly if given luck, but then fortune always favours the brave) but is also relatively safe -- to hell with the battery state, worry about that later -- provoked comments to the effect that this was a wholly new idea. Tactics in the Soviet Navy (unless quite recently revised) appear to insist on a much more cautious approach; and if the book says "do such and such" you do precisely that and do not deviate one tiny bit from the established rules. Nor, judging from attack-teacher instances, shall anybody question the commanding officer's assessment: if he says that the target angle-on-the-bow is 30 degrees it would apparently be unthinkable to query the estimate whatever the plot and calculator may suggest. Again derived from Soviet principles, the Chinese seem very keen on coordinated tactics; but these still further rigidify operations by all accounts and common sense.

Operational shortcomings like these will change, and change swiftly, in the Chinese Navy which is adopting a fresh, refreshing and pragmatic approach -- but we might wonder whether the Russians can ever become capable of achieving the flexibility which American and British submariners believe to be so essential for success in war.

There were too many snippets of information about Soviet practices to list in full, but, inter alia, it was learned that all standard (i.e. non-smart) Soviet torpedoes are fuelled by alcohol: however, the Soviet Navy has not taken the precaution of deliberately contaminating the spirit (as the USN did with the MARK 14) and Russian sailors -- conscripts who are allowed no booze -- drink the stuff to lessen the tedium of an arduous, depressing and thoroughly uncomfortable life below.

SSKs

The relatively new Chinese-built ROMEO "GREAT WALL No. 15" (PLA submarines are all numbered "GREAT WALLS") was said to be typical of the SSK force. It has the most appalling control-room/attack center layout imaginable. Based on the Russian design, it could well be that it is deliberately intended that the left hand must not know what the right hand is doing. This, again, would conform to what some of us believe to be true of the Soviet Fleet. The plot/chart table is in a tiny office by itself; the torpedo control calculator at the after end of the control room faces aft and is not visible to the Command Team; the sonar, in a cramped and inaccessible room with no external communications, is the HERKULES Soviet type with a frequency centered higher than ten Kilohertz and a miniature PPI display; there is no space for a Time Bearing Plot; and the attack periscope (with horribly awkward controls mounted on the tube and not on the handles) is so positioned that the Captain can scarcely get his body between it and the port bulkhead -- so viewing to starboard is, to say the least, difficult. The hydroplane controls -- one man, two buttons -- are situated forward where the operator can not be easily overseen. Somehow, the Chinese overcome these and other problems which would be thought quite intolerable in the West.

Much has been said about compartmentation in Russian boats but there is little evidence of that in a ROMEO. However, externally there are no less than fourteen main ballast tanks, six of which are fitted with Kingston valves. So far as damage control is concerned there seem to be adequate pumps but the principle feature is a multiplicity of medical chests. Every boat carries a doctor and again, by inference, there is a medical doctor in all Soviet submarines as well.

Personnel

The Chinese officers and men encountered were absolutely first-class by any standards. Admittedly, they were probably the cream; and men for a course of this kind, as well as for the submarine service in general, are drawn from volunteers who hugely outnumber those finally selected; but their IQ, quick-wittedness, smartness, determination -- and, come to that, their personalities -- were remarkable and admirable. Most seemed able to write software and construct equations as a matter of course; all were meticulous in insuring that they got to the heart of the matter; there were none who would not be a credit to our own services -- and, very likely, a Chinese submariner would be both popular and respected if he transferred on loan, exchange or whatever.

Having said that, management is a serious problem throughout the People's Republic. The Captain and Deputy Captain, Political Officer and Deputy Political Officer turn to with the rest every morning to clean ship. Things are much the same in civilian employment and the result is superficially sparkling (although the heads, always smelly in Russia and China, were kept locked in No.15) but this is really not the way to run a railroad or a submarine. To avoid the appearance of undue niggling, the point was made by showing students at work on a nearby building site where there was no foreman because everybody was equal -- of course. The score of labourers on the site were working from dawn to dusk at full belt: but the inefficiency and wasted efforts were alarming -- and doubtless frustrating to those involved. For instance, the concrete mixer was 100 meters away from a new stretch of concrete and barrows had to be wheeled over broken bricks to reach it: there was simply nobody to suggest either moving the mixer or laying planks across the rubble -- and exploding a string of good-joss fire-crackers after each stretch of concrete was completed, hardly substituted for a managerial inspection.

Strict quality control in the Chinese Navy is an admitted unknown to a large extent. Suffice it to say that there have been "problems" with the nuclear program but students were not pressed to expand on these.

Until now, new equipment and new tactics have been tested ad hoc in (more or less) operational submarines. Clearly, results have by and large, been disappointing: Western suppliers and advisers testify to that and the Chinese themselves have expressed some disillusionment with what they have been offered. Those of us who have been involved in trials of one kind or another can readily understand what has happened. The answer suggested to, and probably accepted by, the Chinese Submarine Service is to form a Submarine Development Squadron -- smaller than the USN activity at New London but run on the same lines. If this solution is indeed adopted, developments should be much more rapid than hitherto. The establishment of a Devron would also make it very much easier for the West to give assistance. For one thing, foreign observers need only see a limited number of submarines and hence national security, which the Chinese are paranoiac about, would not be unduly jeopardized; for another, selected crews would be accustomed to evaluations which, as we all know, are seldom successful and not popular in a normal running boat.

The Chinese are continually promising to adopt a rank structure. At present the officers all wear the same simple blue uniform without badges of rank, and they include what we would call Chief and Petty Officers in their number. It is a far from satisfactory system and the Chinese recognize this; but the snag lies in deciding whom amongst the Old Comrades (meaning very old in some cases) should be Admirals, Vice Admirals, Captains or nothing in particular. Face can not be lost; and the hurdle seems to be substantial if not insurmountable.

In short, although the Chinese submariners markedly follow the Soviet system in many ways there are two crucial differences between them and the Russians: Chinese hardware is poor but all-important software -- meaning personnel -- is very good indeed. If the Chinese Navy wishes its submarine force to become a first-line fighting arm it can certainly achieve that aim in a few years given continuing help from the West. There are those who might agree that the considerable effort involved in providing meaningful assistance would be rewarding and well worthwhile.

Commander Richard Compton-Hall, MBE, RN(Ret.)

COMBINED SUBMARINE AND AIRSHIP OPERATIONS

With the rebirth of the Navy blimp, it is appropriate to examine how it can augment potential future missions, particularly of ASW forces. History suggests a synergism between the capabilities of blimps and submarine operations. The importance of modern submarines in the Maritime Strategy suggests that now might be the time to revisit this relationship to determine if former practices have modern application in submarine warfare.

This past June, the U.S. Navy awarded the first contract since World War II to build a prototype lighter-than-air airship. A $168.9 million contract to construct a battle blimp outfitted with a large internal radar equivalent to that carried by the E-2C HAWKEYE has been awarded to Westinghouse and the British Airship Industries. If the prototype passes tests demonstrating its ability to serve as an effective airborne early warning (AEW) system, it will likely lead to the wide-spread re-introduction of the airship into the fleet.

With the re-birth of the airship (blimp), it is time for the underwater warfare community to examine how blimps can 1.) furnish surveillance for SSN operations; 2.) facilitate communications for submarines and 3.) operate offboard sensors of use to submerged submarines.

During the course of WW II, Goodyear furnished the U.S. Navy with a fleet of some 165 non-rigid airships. These blimps formed 14 squadrons, made more than 40,000 patrols and escorted over 89,000 ships in convoys throughout the world. The U.S. Navy claims that not one single ship was lost while under airship protection. There was, however, one airship, the K-74, shot down by a German submarine.

Throughout the 1950's the U.S. Navy utilized airships for anti-submarine operations and as an early warning system for incoming Soviet bombers. But the introduction of newer more sophisticated land based anti-submarine warfare airplanes resulted in the disbanding of the last of the Navy's airship units in the early 1960's.

ADVANTAGES IN AIRSHIP-SUBMARINE OPERATIONS

The use of airships offers some key advantages for operational missions with submarines. Although fixed wing aircraft and helicopters are faster, neither can match the lighter-than-air airship's ability to stay airborne without refueling and maintenance. Also, estimates as to operating costs per hour reveal that a patrol plane is approximately five times as expensive in operations as the new blimp with its 11 day's endurance at cruising speed.

Missions requiring long endurance on station, such as monitoring sonobuoy fields, providing a communication relay for submarines, and surveilling key chokepoints may best be performed by an airship.

Airships can carry much greater disposable loads than aircraft. Larger quantities of sonobuoys, sensors and supplies can be handled by lighter-than-air vehicles with much more space available for equipment in an airship than in a fixed wing aircraft. Large radar scanners used for AEW can be installed within the blimp's bag, making better use of space.

There is the misconception that airships are easy to destroy. Modern airships use inert-gas helium which is a natural fire extinguisher. The gas pressure inside the envelope of an airship is usually only 0.5 to 1% above atmospheric pressure, so the leakage through bullet hole openings should be very slow. In the event of being hit by gun-fire the airship would have a much better chance of returning to base with its crew and equipment intact, than would a fixed wing aircraft or helicopter. It would also be much easier to repair. Moreover, it is doubtful that a hit on an airship's envelope with an impact or proximity-fused missile head would be sufficient to detonate the weapon.

It is also conjectured that the airship's massive size results in a large blip on a radar screen. Airships, however, would have little metal and would incorporate some of the same radar absorbing materials as used in stealth fixed wing aircraft. The new Navy blimp will be constructed of composites with all reflective components protected by radar absorbing materials. Since the airship's lift is obtained by its buoyant gas with little engine power needed for movement, airship engines produce a much lower infrared (IR) signature than do fixed wing aircraft and helicopters. If under attack, an airship, unlike other aircraft, can shut down its engines, thereby removing almost all traces of its IR signature.

The Navy's born-again blimp can fly at 40 knots and at 5,000 feet for up to 72 hours without refueling. Mounted in the airship's 354-ft. envelope, away from atmospheric interference and protected by a clean inert gas environment, it will be able to provide surveillance against sea-skimming missiles for a radius of at least 200 miles. It can also prove useful by delivering and monitoring sonobuoys, as well as towing an acoustic array.

But importantly, for submarines, an airship can be a remotely operated drone to augment submarine and particularly combined operations.

The U.S. Navy has funded two conceptual studies of high altitude drone airships. One unmanned vehicle would be able to hover in one location at an altitude of 70,000 ft. for periods up to 100 days. Its 500 ft. nonrigid airship design would carry 5 million cubic feet of helium. Intended military missions include air/sea surveillance, communications relay, and sensor readout.

In the past, airships have been traditionally cigar shaped, but today's technology is coming up with revolutionary designs providing greater performance characteristics for certain missions.

AIRSHIP SURVEILLANCE

The principle advantages of airships complement the tactical flexibility of submarine operations. Their long endurance and high payload provide the ability to extend detection ranges. The submarine can be provided with extended early warning of approaching surface threat forces on a real time basis, and groups of submarines can be positioned to meet enemy forces in a manner similar to the wolf-pack tactics of WW II.

The long on-station time of airships allow for barrier tactics in the vicinity of choke points similar to that currently employed by submarine forces. Airships operating together can extend these barriers over significant ocean distances. Sonobuoy fields laid by the airship and to be read-out by submarines could be maintained for long periods of time, replenished as needed, and repositioned as the threat changes.

An added feature inherent in airship design, that of low speed maneuverability, provides a possible expansion of sensor employment to a towed array or remotely controlled undersea vehicle. This would require submarine operations nearer the ocean surface, but is particularly effective in that the sensor employment platform is not in the water. Figure 1 illustrates this employment mode.

AIRSHIP WITH TOWED ARRAY

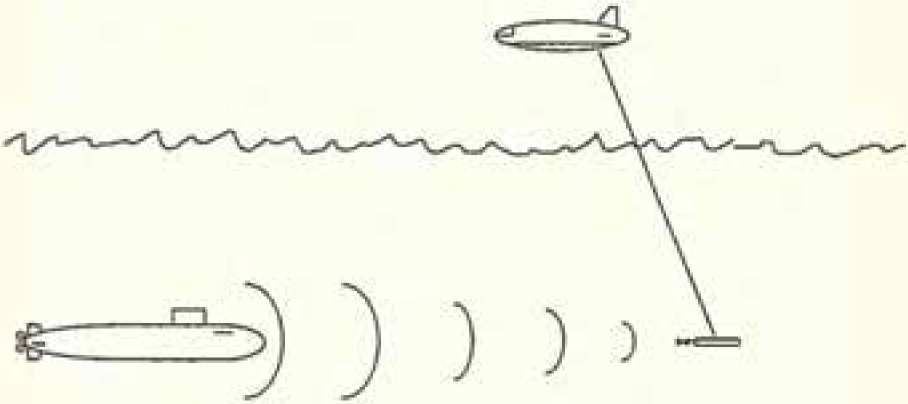

FIGURE 1.

The use of sensors in this fashion with a tethered connection to the monitoring blimp provides real time data collection and a greater range of sensor employment for the submerged vehicle. Again towed devices could be used in coordinated operations to extend the area of surveillance and increase the quality of information by providing multisensor aspects.

The combination of passive sensors and a tethered connection to a platform which is not in the water would provide little warning to enemy submarine forces that surveillance devices were in the area. Rapid processing of this information, optimization of counter force positioning and reliable dissemination to friendly submarines would enhance ASW effectiveness.

COMMUNICATIONS WITH SUBMARINES

The ability to reliably communicate with friendly forces is the key to this type of operation.

Historically the submarine has been cast in roles which do not require extensive communication with other forces. The tactical advantages attained through stealth and covertness typically outweigh the risk of exposure through communications. None-the-less, there are periodic needs during submarine operations for communications with other naval forces. The introduction of airships would not alter communication techniques for the submarine, but they would furnish a platform which can enhance the quality and quantity of information available to the submarine through current methods. The receipt of information is least dangerous to the submarine since it does not require it to send active transmissions and it can be accomplished on an area broadcast basis without revealing the presence of the submarine in a particular location. From its patrol station the airship can broadcast information from the shore or received from its own deployed sensors to merely the general area of submarine operations. Figure 2 illustrates some general communications methods.

SUBMARINE/AIRSHIP COMMUNICATIONS OPTIONS

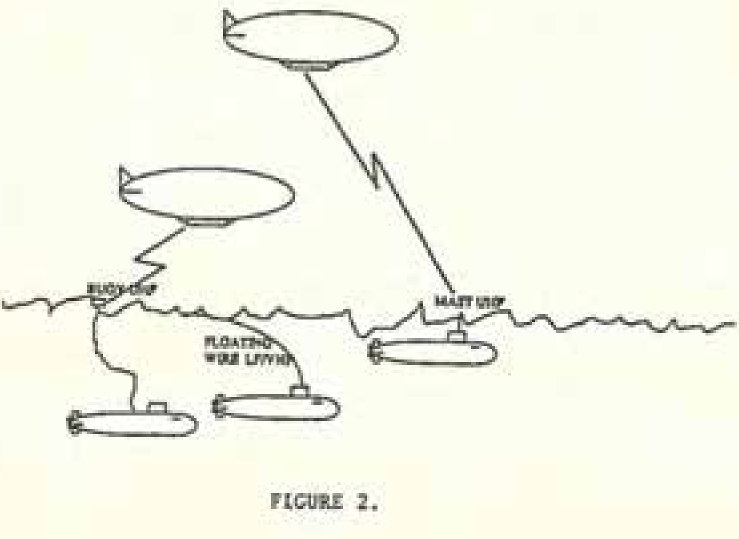

FIGURE 2.

In its capacity as an airborne command post, the airship replicates the communications role of a satellite. It has the advantages of not requiring the substantial space program resources -- being able to remain on station, eliminating the threat of antisatellite weaponry, and providing other capabilities beyond mere communications.

Airship personnel on the scene can provide tactical support to multiple submarine operations. The benefits derived from obtaining information through the airship's multi-sensors, however, should enable the massing of undersea forces at optimum locations. This would outweigh the temporary constraints for many scenarios. Once the submarine is directed to an attack position it is free to break communications until mission completion.

It is apparent that lighter-than-air vehicles outperform both fixed wing aircraft and helicopters in certain missions supporting submarines -- including ocean surveillance, sonobuoy monitoring, and communications relay functions. Airships are being lifted from the pages of history books to make a vital contribution to tomorrow's underseas operations.

Steven M. Shaker
CAPT R. S. Anderson, USN(Ret.)

RESCUERS FROM THE DEEP

On a Tuesday morning, February 1987, the U.S. nuclear submarine SCAMP was homeward bound to be decommissioned after 23 years of service. Weather forecasts the night before had warned of a ferocious winter storm sweeping up the East Coast. Packing winds of 80 miles an hour and waves as high as 60 feet, it menaced shipping but was of little concern to the SCAMP as she glided through the silent depths far below the fury of the storm.

Overhead, the BALSA 24, a 345-foot Philippine registered freighter, battled to survive -- a thousand miles east of Cape Cod. As mountainous seas burst over it, the ship lost headway. At 1645 its urgent SOS said, "Taking on water. Cargo shifting in holds. In need of immediate assistance." It was obvious the ship was going to sink. There were two lifeboats, but one was unusable because of the severe list on the ship.

A Navy P-3 ORION arrived and dropped a rescue canister containing a canopied life raft, close to the ship. Then one of the ORION's engines failed and it headed for home. Within minutes a Canadian AURORA was on station and relayed the last word from the BALSA 24: "All hope is lost. Abandoning ship."

The SCAMP rose to periscope depth for a routine noontime radio communication with the sub base. Almost immediately the radio operator told the skipper, Commander David Duma, that there was a Priority Flash coming in: "Proceed directly to vessel in distress in your area to assist in rescue efforts if possible" and a geographic location for the sinking ship was added.

The SCAMP went deep and raced through the sea to attempt a rescue effort. Only an emergency of this sort would cause a nuclear submarine, with its limited stability on the surface even in a slight sea, to surface in such a severe storm.

All furniture and movable gear was lashed down. Seasick pills were issued to all hands. Bars went up on bunks. The crew's mess was cleared and converted into an emergency ward for survivors. The rescue team mustered in exposure suits and armed themselves with ropes and safety harnesses. Chief Paul Conway, the submarine's diver, prepared to go over the side to assist men in the water.

In less than an hour, the SCAMP was within ten miles of the BALSA 24's last position. Rising again to periscope depth, Commander Duma raised his radio antenna and activated a flashing yellow beacon atop his mast. The Canadian AURORA radioed: "We have you in sight. Follow us to life raft." As the huge plane skimmed the waves, the SCAMP followed. At 1500 the AURORA dropped a yellow smoke buoy as Commander Duma spotted the BALSA 24. He then ordered "Stand by to surface. Rescue party to the main trunk."

The main trunk was a 30-foot vertical steel tube containing a ladder that led directly from the submarine's control room to a tiny open bridge atop the SCAMP's streamlined sail.

A 70-knot wind was blowing as Duma cracked the upper hatch and ascended to the bridge. He was immediately drenched with seawater. The bridge, 20 feet above the main deck was surrounded by foaming white water. Some of the cresting waves towered higher than the bridge. Wallowing and pitching, the SCAMP rolled like an egg. Gripping a handrail, Commander Duma then called down, "Rescue party topside!"

As the rescue team emerged onto the rain-swept bridge, the screeching wind tore at their clothing and ripped the words out of their mouths. At this, they realized that they would have to attempt the rescue from within the sail.

As Commander Duma maneuvered the SCAMP closer to the raft, Chief Conway descended down the inside of the sail to a small door at deck level. Snapping his nylon safety tether to a pipe, he unlatched the door and leaned out to tie it open. A breaking wave smashed against the door, snapping the line.

Duma realized that the plan to put Conway in the water to swim to the raft with a lifeline would have to be abandoned. Shouting to Conway to stay within the sail, he eased the SCAMP even closer to the bobbing raft. Above Conway's head, LCDR Beaudoin cracked open a small door and stepped out onto the horizontal diving plane. Tethered by a safety line, Beaudoin uncoiled a light heaving line with a weighted ball and, as a wave brought the wildly gyrating raft within 20 feet of SCAMP, let fly the heaving line. But the wind deflected the line from its target. As Beaudoin leaned out for another attempt, a wave swept him off the plane. Dangling helplessly at the end of his safety tether, he was dragged and battered against the submarine's hull. Petty Officer Godfrey, in the doorway of the horizontal plane then fired a gun which projected a lifeline. No sooner had the line streaked from the gun than the wind whipped it away from the raft. At that instant, a mammoth wave picked up the raft and swept it across the submarine's bow. It struck the SCAMP with a sickening thud and was then carried away into the foaming seas.

Duma swung the SCAMP around to follow, but with visibility fading fast in the waning daylight of the February afternoon, he felt there was no more time for another rescue attempt. Ordering his battered rescue party below, Duma secured the bridge and descended to the control room. After a conference with his officers he radioed to the patrol aircraft overhead: "No further rescue attempt possible tonight. We will remain on surface and try again at first light tomorrow."

All that night the SCAMP steamed slowly in a figure-eight pattern to keep the tiny blinking light atop the canopy of the liferaft in sight and to let the men in the raft see the yellow beacon on the submarine's mast. Commander Duma "wanted them to know that we were still there and still trying to save them."

Within the submarine "it was like riding a roller coaster." Men were catapulted from their bunks. In the mess hall a 200-pound soft-drink machine was ripped from its steel base and hurled across the room. In the reactor spaces, electricians wedged themselves into corners as they scanned their dials. "It didn't seem as if it could get any worse" recalled one man, "and then we would take another tremendous roll that would put us on the deck plates."

Toward 0300 the SCAMP's officers who had been tracking the raft through the periscope, noted that its blinking light had vanished. "We found out later," Commander Duma said, "that a heavy sea had smashed the raft's canopy, and it collapsed upon the men inside. One man was swept out the door of the raft and was never seen again."

It took the SCAMP three hours, working with aircraft overhead, to relocate the raft. Just as dawn was breaking, Commander Duma went back to the bridge, wearing an exposure suit. Peering through binoculars, he spotted through heavy rain squalls, the raft and saw that there were several people crouching within the torn canopy.

It was then discovered that during the night the heavy steel door at the base of the sail had been torn off its hinges. Chief Conway went down inside the sail and stationed himself in the narrow space at its base, where inrushing seas engulfed him every 10 to 30 seconds. The wind had dropped slightly, but waves were still running 40 feet or higher.

As Duma brought the submarine close to the raft, Petty Officer Lange leaned far out on the horizontal plane and heaved a line that struck the raft's doorway. The men in the raft then pulled the line inside the canopy and made it fast. But just as Chief Conway began to haul on the line, a wave lofted the raft high in the air and snapped the tether, leaving it dangling from the sail.

As the raft slid down off a wave, Lange tossed over a heavier line. One man in the raft grabbed the line and clung to it. "Haul away on the tether," Chief Conway shouted as he and Lange pulled with all their strength. Then the man who had been holding the line inside the raft jumped into the water beside the submarine and tried to climb the line hand-over-hand up to the sail plane. Beaudoin and Hardin leaned down to pull the desperate man up, but a heavy wave smashed him against the hull and he lost his grip and floated away.

When the men, huddled within the raft, realized that they were drifting away from the SCAMP, they tumbled out and grabbed the tether line. Now, with six men on the line, Conway and Lange tried to haul them in. As the first man reached the submarine a wave tossed him up on deck in front of the sail. Conway then leaped out and dragged him inside. The survivor, suffering from exposure, was quickly handed up to the bridge and passed down into the submarine, put on a stretcher and taken to the mess room where he was swathed in thermal blankets.

Meanwhile, Conway at his doorway in the sail, tried to haul in the five men still on the line. "I felt that we finally had them" he recalled. But just then the men on the line were deluged by another wave and Conway saw to his horror that the line had parted. "Grab the other line," he shouted. The men swam to the other trailing line and seized it. Conway and Lange began pulling them in. When the first man was within three feet of Conway's outstretched hands, and his feet had found the hull, a tremendous sea buried both him and Conway. Conway felt the line go slack. The man and his companions were hurled back into the sea and worse, the line was no longer attached to either the submarine or the raft. "Get back to the raft," Conway shouted, but only one man, believed to be the BALSA's captain, had any strength left. He alone got to the raft and clung to it.

Commander Duma made four more attempts to edge the SCAMP closer. Then a heavy sea picked up the raft and tossed it across the submarine's bow. Beaudoin and Hardin then crawled out on the port sail plane and tossed lines down to the raft. As they prepared to drop down and grab the last survivor, another big wave rolled up from the stern and smashed down on the sail, engulfing the rescuers and tearing the door to the horizontal planes off its hinges. The submarine rolled heavily to starboard, as the last survivor disappeared into the waves.

Below, a tarpaulin had been rigged to deflect water from the main trunk into a scuttle drain that led to the bilges, but as Chief Ehrhart started up the main trunk, tons of cold sea water poured down through the trunk. LT Bergen, who had been stationed at the top of the trunk, was struck by a heavy wrench and plummeted down the ladder landing on Ehrhart. A mass of water deluged the men in the control room. In the wardroom, a door burst open and a wall of water flooded into the room. Seawater spurted from panelled walls and ceilings. A river of water cascaded down a staircase to a lower level, flooding a berthing compartment just above the submarine's main battery hold.

"We're sinking!" someone shouted.

The submarine's stability was threatened by this sudden influx of water. The sea entering an open hatch is the submariner's ultimate nightmare.

In the control room, as rising water threatened to short-circuit electronic equipment, Captain John Snyder of Submarine Squadron Two -- on board as an observer -- shouted, "Shut the hatch! Blow forward ballast tanks. Sound collision alarm! Rig ship for flooding."

Up on the bridge, Commander Duma, realizing that his submarine was in great danger, made the most agonizing decision of his naval career. "Discontinue the rescue operation," he ordered. "Clear the bridge. Rescue party lay below." Then with one last look at the men in the water, he dropped down the ladder into the main trunk and slammed the upper hatch shut.

Water gurgled into the battery compartment beneath the lower berthing compartment deck. Mattresses were stripped from berths and flung over the hatches. Damage control parties moved through the submarine to pump water from the overloaded bilges.

Although the SCAMP wallowed in the mountainous seas, the men in the water and the empty raft were tracked through the periscope.

As soon as the flooding was brought under control, Commander Duma decided to resume rescue efforts. But the opportunity was lost. A Hercules aircraft out of Bermuda had thought that the rescue was finally succeeding, but as they dropped low over the ocean they saw that the submarine was in obvious trouble and had been forced to halt the rescue. The raft was blown downwind from the SCAMP, and some of the men floating in the water waved feebly at the aircraft before disappearing amongst the waves. They'd been dropped another raft, but they'd made no effort to reach it.

When the rescue effort ended that evening, there was only one survivor, Almer Rances, 27, a seaman from the Philippines. The next afternoon he was strong enough to take part in a memorial service for the 18 men of the BALSA 24 who had perished. Commander Duma read from the Book of Psalms while his weary crew thought of the men who had died. When the service was over, SCAMP dived deep below the stormy waters and headed for home.

Evan McLeod Wylie

(This story is condensed from Wylie's Rescuers From the Deep in Yankee magazine, January, 1988.)

SSN-21 SEAWOLF: THE SUBMARINE FOR ITS TIME

On July 26, 1987, The Washington Post printed a syndicated column by Jack Anderson and Dale Van Atta entitled "Submarines for the 21st Century." The column's criticism of the SSN-21 (SEAWOLF) program projected an authoritative ring that was enhanced by its spread on the editorial page. Revealed within the column, however, were the identifiable undertones of a few particular critics, none of whom has developed a convincing case among knowledgeable analysts and decision makers. Experience with their method of argument suggests that either those critics are unaware of the scientific approach to investigation, or they deliberately shun it in search of sensationalism. Unfortunately, such criticism of the Defense Sector is all too common. When it reaches the Public Domain it can undermine confidence in Defense decision making and erode support for important programs. The purpose of this article is to refute allegations of the kind contained in the Anderson-Van Atta column.

The column opens with the following salvo:

> "The Navy wants Congress to spend billions of dollars on a submarine that will ensure that the United States remains dangerously

behind the Soviet Union in the race for submarine supremacy."

The column then states that the SSN-21 has "second-rate capabilities," and adds that it "will be a full generation or more behind the latest Soviet attack submarines it will be expected to fight." This generalization is evidently drawn from the accompanying observations that "Soviet submarines go faster, dive deeper, have greater survivability, are better automated, have more advanced nuclear reactor technology and carry more powerful torpedoes and missiles than their U.S. counterparts." The Soviets are held to be "significantly ahead of the United States in submarine technology on their own," without regard to acquisition of technology from the West via recently publicized illegal sales. As an example, the use of polymer liquid to reduce drag and noise is advanced.

Because of alleged inferiorities, Anderson and Van Atta propose that the SSN-21 program be cancelled on the grounds that it is a waste of money. In its place, they propose to improve the SSN-688 class and launch a substantial effort to develop a "truly 21st century submarine." In their opinion, the improved SSN-688, being much less expensive than the SSN-21, would give the Navy "the numbers of submarines it needs to counter the Soviet submarine fleet" until a new submarine, technologically adequate for the world of undersea warfare fifty years from now, could be introduced.

Some of the Anderson-Van Atta observations about Soviet submarines are correct, although not all of those characteristics are contained in all Soviet submarines, nor even in any one class.

The flaw that I see in their analysis, conclusions and recommendations is that they do not deal adequately with the important parameter, quietness, and they fail to assess submarine capability in mission context.

By excluding the SSN-21, their prescription for a new submarine falls short of assuring the U.S. supremacy in undersea warfare capability. Instead, such an exclusion limits the U.S. Navy to the current 688 class and to future technology. Anderson and Van Atta appear to have overlooked two important points:

First, the SSN-688 is less expensive than the SSN-21 because it is less capable than the SSN-21. The unit capability of tactical submarines is in application. Differences in unit capability do not convert linearly to unit cost or to overall force capability. Thus, if the SSN-21 will be ineffective against the projected threat, the SSN-688 will be even a less effective substitute.

Adequate improvements to the 688 at lower cost is not possible because of the fundamental limitations of the SSN-688 design.

Larger numbers of SSN-688s would not produce a more effective force than would fewer numbers of SSN-21s. Moreover, the per-unit difference in effectiveness between the two classes is substantial.

Second, research and development beyond that of the SSN-21 involves uncertainties. To use these untested technologies in SSN-21 would be too high a risk to impose upon this high cost, quality platform. The ongoing program incorporates the Navy's best ability to employ available technology to requirements.

The issues raised by Anderson and Van Atta have been considered carefully over the past five years by the Department of Defense and the Congress. For example, several years ago, as SSN-21 development was approaching milestone-approval by the Secretary of Defense, the Navy undertook an extensive, searching examination of the adequacy of the SSN-21, as designed, to perform its missions. The recommendations of that study were reviewed by senior DOD officials and were accepted. It is not correct to say that SSN-21 will lag behind Soviet attack submarines, and it is unreasonable to call its capabilities "second-rate."

There is the temptation to measure U.S. submarines against those of the Soviets on the basis of comparative speed, depth, level of automation, survivability, reactor technology, and weapons. These factors cannot be taken in isolation or in combination, for this process does not yield the best tactical performance profiles.

Tactical performance capability depends on a complex relationship of many submarine parameters and to the ocean environment. Net assessments of weapons systems are not rationally developed in terms of "races" between similar capabilities and equipments. Rather, such assessments are based on the weapon or platform capability to perform as designed against the threat in specific fighting environments.

Soviet submarine technical and operational advances present significant problems for U.S. Navy planners and submarine designers. For example, any increase in operational depth or speed is of concern. The response to a deep submarine is not necessarily another submarine of equal depth capability. It might be an anti-submarine weapon is more effective at the deepest depths of an enemy submarine. To invest soley in depth capability without sound mission reasons is not cost effective.

A similar argument can be advanced in considering speed: It may be more effective to develop a weapon (such as SEA LANCE) that can reach a fast submarine at a long range, than to match submarine speeds. A weapon is best thought of as a system of Force (people, platform, weapons C^3I). Moreover, the relation of speed to mission application may be quite different for the U.S. than for the Soviets, leading to different conclusions. Thus some Soviet developments may not be matched by the same or similar developments in U.S. submarines. Rather, the U.S. might call for support of weapons programs or other anti-submarine warfare capabilities than depth or speed to match those of Soviet submarines.

Some Soviet advances are suited to their contemplated tactics. For example, increased automation in combat has specific purposes; reduce manpower, improve high speed control, etc. Automation may detract from efficiency, on the other hand, when improperly used where humans do a better job.

Some technical advances may be counterproductive for the Soviets. (The history of Soviet submarine development suggests that they are aware of this.) For example, high speed obtained at the price of high noise levels creates a serious disadvantage.

Other Soviet technical advances are made at the price of reduced safety and reliability, as in their nuclear reactor designs when compared to prevailing U.S. standards.

Finally, some alleged Soviet advantages are pure speculation and fantasies of a few well-meaning critics.

An important problem in warfare is asymmetry in performance, which is why net assessment in terms of similar systems can be misleading. For instance, battle tanks compete against not only tanks but also anti-tank systems. Aircraft carriers have to repel anti-surface warfare systems with limited counterforce. Asymmetry in undersea warfare requires the capability for submarines to perform missions against a wide range of threat projections. These missions are of broader scope than anti-submarine warfare. Attention to mission performance leads to establishing the appropriate combinations of submarine design performance characteristics. A combination of speed, quieting and high performance reliable weapons provides advantages in tactical ASW operations. Flexibility to use these capabilities and others, like superior command and control systems, permit desired mission performance under changing circumstances.

Thus, the U.S. Navy does not copy all of the design techniques employed by the Soviets, since the advantages for their Navy does not necessarily apply to U.S. submarines and the disadvantages may be severe and costly.

The mission aspects of design and performance and their relationship to technological realities were considered in shaping the SSN-21 program. The SSN-21 will meet U.S. mission requirements in a cost-effective manner by providing achievable operational capability for the U.S. to about 2010, at which time its follow-on will be built.

The conclusion that the time has arrived to introduce a new submarine class by no means obviates the continued utility and importance of existing submarines. Improved Soviet submarines are fielded neither all at once nor necessarily in high quantities, and mission asymmetries will create a continuing role for the SSN-688 class for a long time. Besides, until the SSN-21 is fielded we will be dependent on the SSN-688. In recognition of that fact, contrary to the impression conveyed by the Anderson-Van Atta column, the Navy already has an improvement program underway for the SSN-688. Even at its best, however, the improved SSN-688 will not be an adequate substitute for the SSN-21 in future undersea warfare.

It is not possible to improve an existing submarine of older design to the same level of performance that is achievable with a contemporary design. Thus, while there will remain many missions that the improved SSN-688 will perform well, there are some critical new missions connected with modern maritime strategy for which it will not suffice.

Research and development directed toward submarines beyond the SSN-21 will use new hull forms, hull materials, and propulsion systems, weapons and sensors and C^2. The importance of that effort must be publicized, for undersea warfare will be an increasingly dynamic activity in 21st century warfare. The significance of the submarine beyond SSN-21 is that it will probably depend for its success on evolutionary development that produced the series of prior classes. Past designs have evolved through stages of reactor power and efficiency, grades of steel for hulls, dimensions of towed arrays and sonars, automation of combat and control systems, all on and within the characteristic cigar shape with topside sail. However, it is conceivable that the SSN-21 will represent the practical limit to gains that can be realized through evolution of designs built around particular controlling features.

Further gains in stealth and tactical speed, and thus to improved performance of on-board sensors, will depend on new designs. The design of hull and acoustic arrays will be developed jointly. Some of the research and technology will be quite radical. Researchers and sponsors will be well advised to make room for and encourage new explorations as they better understand the underseas world.

In summary, the U.S. is planning a submarine program with a three-pronged approach that includes SSN-21. The first prong is the improved SSN-688, which will meet the Navy's needs for the next fifteen years. The final prong, imaginative research and development, will prepare the pathway to undersea warfare two generations hence. But the central prong is the SSN-21. By assuring our advantage through at least the next generation, SSN-21 may well assure our opportunity to have a more advanced program for the era beyond.

What are the returns from this three pronged investment strategy? One gain will be in anti-submarine warfare capability. Other gains, less obvious at present, will appear as submarines become increasingly stealthy and offensively capable. The design of the SSN-21 hints at the future with its unique capabilities to deliver weapons against surface targets from beneath the sea. The age of the true underseas tactical nuclear submarine is dawning; SEAWOLF is the first strong step.

David L. Anderson

LIMITING SLCMs: AN ARMS CONTROL SCENARIO

Since the SALT Negotiations in the 1970s, the United States and the Soviet Union have grappled with the problem of limiting long-range sea-launched cruise missiles (SLCMs.) The SALT II agreement would have put a temporary ban on deployments of these cruise missiles with a range greater than 600 kilometers. This agreement was never ratified, however, and both sides proceeded with the development and deployment of new long-range cruise missile systems. The U.S. developed the TOMAHAWK in three versions -- the nuclear-armed land-attack version, the conventionally-armed land-attack version, and the antiship missile. The Soviets on the other hand, developed and deployed numerous nuclear and conventionally-armed antiship cruise missiles, including the new 550 kilometer SS-N-19 carried by both OSCAR-class submarines and KIROV-class battle cruisers. In addition, the USSR developed two new long-range land-attack cruise missiles exclusively for submarine use -- the SS-NX-21 which is capable of being fired from a standard Soviet 21-inch torpedo tube, and the larger SS-NX-24 which currently is fitted on a single, converted YANKEE-class submarine.

At the Reykjavik Summit in October 1986, the U.S. and USSR agreed in principle that sea launched cruise missile limitations could be the subject of a separate arms control agreement. The U.S. Delegation to the Nuclear and Space Arms Talks in Geneva subsequently informed the Soviets that the United States could agree to an equal numerical limit on sea launched cruise missiles if satisfactory verification provisions could be worked out. The Soviets responded favorably, but insisted that deployments of such missiles be limited to submarines. The Soviet position rejects deployment of any long-range cruise missiles on surface combatants.

Assuming that verification difficulties can be resolved, and that the Soviets are willing to compromise on surface ship deployments, a possible arms control agreement to limit sea launched cruise missiles might look as follows:

- A limit on all nuclear-armed SLCMs with a range in excess of 600 kilometers to <u>600</u> missiles.
- Sublimits:
  -- <u>300</u> SLCMs on submarines.
  -- <u>300</u> SLCMs on surface ships.
- SLCM platforms limited to:
  -- <u>two</u> classes of submarine.
  -- <u>two</u> classes of surface combatant.

Acceptance of the SALT II definition of long-range would allow the Soviets to retain their large numbers of nuclear and conventionally-armed antiship cruise missiles. At the same time, the limit on "nuclear" SLCMs only would allow unconstrained deployment of U.S. conventionally-armed antiship and land attack cruise missiles. Limiting deployments to two classes of submarine would fit both U.S. plans to deploy TOMAHAWK on LOS ANGELES and SEAWOLF-class attack submarines, and Soviet plans to deploy two new SLCMs -- the SS-NX-21 and SS-NX-24 -- requiring two different types of launch platforms. Limiting deployments to two classes of surface combatant, on the other hand, would affect only the United States and would be a concession. The U.S. Navy currently plans to deploy sea launched cruise missiles on five classes of major surface combatants. However, we could still deploy a large number of nuclear land attack missiles on surface ships by confining deployments to our most modern surface combatants which will be fitted with the large magazine-capacity, vertical launch system.

An alternative scenario might combine an outright ban on long-range nuclear-armed cruise missiles using a lower "long-range" definition threshold, with greater freedom to mix in shorter-range cruise missiles. Such an agreement might look like this:

- A ban on all nuclear-armed SLCMs with a range greater than 300 kilometers.
- Freedom to deploy all types of SLCMs with a range less than 300 kilometers on any number of submarines and surface ships.

There is nothing sacred about the 600 kilometer SALT II threshold definition of long-range sea launched cruise missiles. Limiting nuclear-armed SLCMs with a range greater than only 300 kilometers would capture a number of the Soviet Navy's antiship missiles as well as the SS-NX-21 and SS-NX-24. U.S. nuclear land attack cruise missiles also would be captured by this ban. However, the U.S. Navy would be left with a major range advantage in conventionally-armed antiship missiles -- 600 kilometers for the antiship missiles vice 550 kilometers for the Soviet's SS-N-12 and SS-N-19. The U.S. Navy also could deploy conventionally-armed land-attack TOMAHAWKS. At the same time, an agreement along these lines would permit the Soviets to retain nuclear-armed antiship cruise missiles with a range less than 300 kilometers of which the U.S. Navy has none.

In conclusion, a compromise arms control agreement providing for equitable numerical limits on U.S. and Soviet SLCMs appears feasible. However, in the author's view, such an agreement must not be concluded unless and until effective verification provisions can be worked out. Without these, we could never be certain that the USSR had not exceeded the agreed limits. The small size of most cruise missiles and their ability, for the most part, to be fired from standard-size torpedo tubes will make verification exceedingly difficult. Nevertheless, the Soviet record of non-compliance with past arms control agreements, as documented in several Presidential reports to Congress, makes air-tight verification provisions an absolute must for any agreement on sea launched cruise missiles.

Dr. Edward J. Lacey

THE SOVIETS ON SUBMERGED UNSINKABILITY, 1959-1984

The Soviets have been using the term unsinkability ("nepotoplyayemost") since the late-1880s to describe built-in structural and mechanical features which prevent loss of ship stability, control and buoyancy under accidental or combat situations involving flooding, fire, or equipment shock damage. Unsinkability features were first incorporated into Soviet submarines in 1913. Soviet submarine survivability experts classify submarine unsinkability into two categories: surfaced and submerged unsinkability. Only submerged unsinkability will be discussed here.

Between 1959 and 1984 the Soviets altered their definition of submerged unsinkability three times. Each alteration suggests that the submerged unsinkability features built into Soviet submarines have been boosted. The definition of submerged unsinkability began to take on a different flavor in the mid- to late-1960s. For example, the definitions given by Novak and Lapshin (1959), Bukalov and Narusbayev (1964), and Yefim'yev (1965) differ from those given by Prasolov and Amitin (1973), Bol'shakov (1977), and Yakimov, Syromyatnikov and Radziyevskiy (1984).

Novak, Lapshin, Bukalov, Narusbayev, and Yefim'yev believe that in peacetime and wartime a submarine should always be brought to the surface when one or more compartments is flooding. On the other hand, Prasolov, Bol'shakov, Yakimov, Syromyatnikov, and Radziyevskiy believe that <u>wartime</u> submerged unsinkability should include the ability of a submarine to run submerged without losing control when (one or two) pressure hull compartments and their adjacent main ballast tanks are flooded. However, Prasolov, Bol'shakov, Yakimov, Syromyatnikov, and Radziyevskiy also believe that a submarine should always surface if propulsive power is lost or the submarine is incapable of developing sufficient speed to counter flooding, stability, and/or other damage caused by the attack.

It is significant that recent Soviet writings on submarine design and naval ship survivability theory indicate that flooded or damaged submarines should ascend to a shallow depth, restore combat stability, and continue (degraded) combat operations. The reason cited for this action is that at deeper depths watertight bulkheads may become unstable due to the hydrostatic load in a flooded compartment. The definitions of submerged unsinkability strongly suggest that modern Soviet submarines do not have many test-depth rated bulkheads.

In summary, modifications in the definition of submerged unsinkability very likely reflect a change in Soviet thinking on submarine combat survivability. In particular, it appears that the Soviets believe their submarine designs have evolved to the point where a submarine can be built to overcome many flooding casualties and continue, (but degraded) submerged combat operations, if the crew properly responds and uses the submarine's unsinkability features.

The evolution of the definition of submarine submerged unsinkability from 1959-1984 is illustrated below.

Novak and Lapshin (1959) defined submarine submerged unsinkability as:

> the ability of a submarine to navigate underwater and to ascend into a surfaced condition when part of the volume of the pressure hull is flooded and (some) of the main ballast tanks are (flooded).

Bukalov and Narusbayev (1964) defined submarine submerged unsinkability as:

> the ability of a submarine to reach the surface with some volume of the pressure hull flooded and adjacent main ballast tanks (flooded).

Yefim'yev (1965) defined submarine submerged unsinkability as:

> the ability of a submarine to submerge, and to run submerged without losing controllability when pressure hull compartments are flooded and the main ballast tanks adjacent

to them are (flooded). (However, Yefim'yev, at the same time, wrote that "Modern (nuclear) submarines cannot run submerged, even with one flooded compartment, and they have a much smaller degree of submerged unsinkability than optimum requirements would suggest.")

Prasolov and Amitin (1973) defined submarine submerged unsinkability as:

> the ability of a submarine, under conditions of damage associated with the entry of water into the pressure hull, to navigate at depths which do not exceed maximum depth, and to surface while maintaining sufficient buoyancy and stability.

Bol'shakov (1977) defined submarine submerged unsinkability as:

> the capability of a submarine to avoid excursions beyond test depth when water penetrates inside the pressure hull, and to ascend to a depth that does not endanger the stability of the bulkheads, or to surface (provided the situation permits this) retaining stability and trim which ensure the possibility to use the submarine for its designed purposes.

Finally, Yakimov, Syromyatnikov, and Radziyevskiy (1984) defined submarine submerged unsinkability as:

> the ability of a submarine to surface into a stable position with water entering the compartments of the pressure hull, or to continue submerged operations within depths safe for strength of bulkheads of the damaged compartment while maintaining speed.

The compilation of these definitions would yield the following modern day definition of submerged unsinkability:

> the ability of a submarine, under conditions of damage to avoid excursions beyond test depth after several compartments and their adjacent main ballast tanks have been flooded; and to ascend to a depth that does not endanger the stability of the bulkheads while maintaining speed; or to surface (provided the situation permits this) while maintaining sufficient buoyancy, trim, and stability.

John J. Engelhardt

SIMON LAKE AND HIS DIVING BOAT

In the years that followed the American Civil War, numerous inventors attempted to "modernize" what has now come to be known as the submarine. One such man was a red-bearded designer named Simon Lake. Born in 1867, he would live to see the tremendous success of underwater craft as both potent weapons of war and leisure vehicles before he died at the age of 78.

In reflection, Lake wrote: "I spent many happy hours .... cruising along the bottom of Chesapeake Bay with the watergate open, so that I might see what was going on at the bottom. Sometimes I speared fish through the open door, and often raked up oysters for our evening dinner, or set out trot-lines when the fishing promised to be good. If there were no fish to be seen, there were no fish to be caught, and the ARGONAUT moved on. At night the lights in the living compartment attracted fish by the schools when we were submerged."

Lake had first become fascinated with the concept of underwater exploration at the age of

11, when he chanced to read Jules Verne's Twenty Thousand Leagues Under the Sea. He read and re-read the text, which spoke of Captain Nemo and his amazing submersible, the NAUTILUS. In fact, he soon understood the details of the NAUTILUS so well that he began to visualize improvements on its design.

In 1881, when Lake was 14 years old, his family moved to the Toms River area of New Jersey. As the weeks rolled by, young Simon found himself spending more and more time drawing rough sketches of an underwater vessel. And, since he had from the beginning, cherished the concept of a diving compartment in which divers could leave and re-enter the craft, he was determined to design such a system. To this end, he spent long hours in the local library, studying the idea of air locks in diving caissons. He became convinced that a similar principle could work in a submarine.

Choosing to become a full-time inventor, Lake quit school just prior to his seventeenth birthday. Two years later, he was credited with the design and patent of a unique steering gear for use in high-wheeled bicycles. Although he constructed a variety of other ingenious devices, including an improved winding gear for oyster fishermen and a capping machine for a local cannery, he opted to devote most of his attention to designing and building a diving boat.

In June 1892, Lake heard that the U.S. Navy was trying to locate the best qualified inventor to construct a prototype underwater craft. Gathering up his extensive drawings, he traveled to Washington, D.C. There, he was escorted into the outer office of the Secretary of the Navy to await his turn. He was relieved to discover that only two others had come to submit plans: George Baker of Chicago, and John P. Holland, who had already constructed a working model known as the FENIAN RAM.

Lake had come equipped with an impressive argument as to the superiority of his vessel, which was based around the sound concept of ballasting with water. Basically, the principle called for a submarine to be built with huge tanks, housed just outside of its inner hull. In order for the submarine to submerge, water would be admitted into these tanks, and when the craft reached a desired depth, machinery within would close off its "holes," thus equalizing the pressure. The water could be expelled by air pressure when the operator wanted to return to the surface.

After explaining his ideas in detail, Lake was informed that the Naval Department would be in touch. Sometime later, the hopeful inventor was disheartened to learn that Holland had been granted the contract. Undaunted, he decided to build his submersible without support from the U.S. government.

To secure funding for the project, he traveled to New York City, where he hoped to get the attention and support of investors. The journey turned out to be a depressing failure, however, as his ideas were savagely criticized.

Deciding to place his dream for a full-scale model on hold, he drew up a second set of plans for a much smaller craft, the ARGONAUT JUNIOR. It had the advantage of being much lower cost, yet it would still possess all of the features that had become so important to Lake.

His aunt and uncle agreed to back this project, and with the help of his cousin, Bart Champion, he went to work. The craft was completed by the end of 1894, less than one year from the time that construction was initiated.

The JUNIOR was wedge-shaped, and measured approximately 14 feet in length. Sandwiched between the inner and outer shells, constructed of yellow pine, was a flat-sided, waterproof hull made of canvas and pitch. The conning tower was nothing more than a wooden box with glass portholes installed fore and aft. The submarine also housed a pair of 6-inch high glass portholes at the bow, with two others situated halfway down the hull on the port and starboard sides.

One of the strangest features of Lake's creation was its wheels. Two were mounted on a front axle, with a smaller wheel supporting the stern. These were used to move the craft to and from the water's edge, as well as to drive the vessel along the sea bottom once she was submerged.

Lake also installed his one-of-a-kind airlock system. It was set up as a second compartment, and it was pressurized by air from a compression tank taken from a defunct soda fountain. A plumber's hand pump was used to compress the air to as much as 100 pounds per square inch.

The JUNIOR's main power source was a manually controlled propeller crank, pushed by the operator's feet, with the front wheels connected to a bicycle chain.

With the assistance of cousin Bart, the ARGONAUT JUNIOR was pushed to the Shrewsbury River, where she was formally launched. They climbed aboard and cranked along the surface until they reached an old fishing hole approximately 16 feet deep. Lake closed and secured the hatch cover against its protective rubber gasket, and then instructed Bart to open the valve that would allow water to enter the ballast chamber. As his cousin dutifully obeyed, the JUNIOR sank smoothly out of sight. Once below, however, the pair discovered water gushing in through a tiny bolt hole, which Lake had forgotten to plug. Quickly, the inventor grabbed a small chunk of wood lying on the bottom of the boat and jammed it into the leak, solving the problem.

The maiden voyage of the ARGONAUT JUNIOR turned out to be a complete success. There was just enough ballast to allow the craft to hover gently on the murky bottom. And whenever the pedals were cranked, the sub crawled delicately along the seaweed floor.

During the following weeks, the pair explored the undersea world. Occasionally, they would pick up oysters or spear fishes through the open hatchway of the vessel's air-lock system. After only a brief period of success with the tiny submersible, Lake once again began to dream of constructing a full-scale model.

To accomplish this, the inventor formed the Lake Submarine Company and offered stock to people who were willing to invest modestly in the venture. Fortunately, he managed to sell shares to a local yard owner, who agreed to put Lake's plans into three-dimensional reality in exchange for installment payments throughout the duration of the building process.

The ARGONAUT was finally launched in August, 1897. She was shaped like an iron blimp, 36 feet, 9 inches long, and was topped off by a conning tower with four circular portholes. For sea-bottom movement, pedals controlled a pair of large cast-iron wheels, with a third, smaller pivoted disk, near the stern, to turn the ARGONAUT. Furthermore, the inventor had installed a gasoline engine for surface mobility to complement manual power submerged. Two hollow tubes were designed to stick out of the water whenever the craft hovered just below the surface, allowing for both engine exhaust and clean-air intake. When asked how his contraption would deal with any sudden underwater drop-offs, Lake explained that the vessel possessed enough negative buoyancy to float slowly downward to a deeper plateau.

Along with a pair of volunteers, Lake took the craft out into the waters of Baltimore Harbor to conduct a dive. After approximately two hours submerged, however, the trio developed terrible headaches forcing a surfacing. When the hatch was thrust open, one of Lake's companions passed out with the sudden surge of fresh air, while the other two men became violently nauseated. When the next day's run produced the same mysterious ill-effects, Lake investigated the engine compartment and discovered that it had been leaking deadly carbon-monoxide fumes into the enclosed cabin. The problem was resolved by the construction of an intermediate tank to trap the escaping fumes.

Despite the apparent success of Lake's machine, the Navy Department was not impressed. Lake wrote: "I do not know and I never will know why some men seem to be so obstinately antagonistic to anything which is new."

Through the craft's portholes, Lake managed to take some excellent photographs of numerous underwater creatures, which were later published in McClure's Magazine.

Lake was still unable to sell submarines. Failing to interest the U.S. Navy or scientific organizations, he struck upon a brilliant idea: he invited 28 socially prominent Bridgeport, Connecticut citizens to accompany him in a celebration at the bottom of the Pequonnock River.

A large crowd of onlookers gathered at the river banks, cheering, as the ARGONAUT sank from sight. When the merry voyagers failed to return at the appointed time, however, a rescue tug was dispatched to the spot where the top of the submarine's 50-foot long air pipe protruded above the surface. Repeated raps on the pipe failed to get a response, and the rescuers were convinced that all on board had perished. While word was sent to New York City for a derrick to dredge up the "iron coffin," silent crowds gathered along the shoreline to mourn the loss of the town's mayor, the owners of the railroad and telephone companies, numerous bankers, and other local dignitaries. Suddenly, nearly two hours past schedule, the ARGONAUT rose from its watery grave, with its occupants alive and singing "Down Went McGinty to the Bottom of the Sea."

Though the crowd of ex-mourners welcomed the safe return of their community leaders, they were not overly impressed with Simon Lake's reason for the delay; it seems that they had raked up enough oysters and clams to have a rather large, time-consuming, shellfish dinner.

Despite the crowd's angry reaction, the inventor had convinced the participants of the worthiness of his experiments. Hence it was Bridgeport money that was used to construct the next Lake submarine.

There were no wheels on Lake's newest creation; its design was more in line with what might be considered a conventional underwater craft, by today's standards. Dubbed the PROTECTOR and launched in 1902, she was 65 feet long and weighed 130 tons. Furthermore, she operated with gasoline engines on the surface and battery power underwater. Other additions included a small gun mounted on the craft's foredeck and a practical periscope, which Lake called an omniscope. Yet the U.S. Navy was still unimpressed.

Lake's submarine design eventually found an interested party in Russia, which was then at war with Japan. After a good deal of negotiating, Lake agreed to part with the PROTECTOR, promising to build an additional five submarines in the future. A day after the contract was signed, the first #125,000 down payment went into the inventor's personal bank account.

Along with a small contingency of technicians, Lake made his way to the port city of Kronstadt, Russia, where he remained for the next seven years. During that time, he assisted in the construction of his five underwater vessels for the czar's navy, and trained the Russians in their operations. Though none of his vessels would see action in the Russo-Japanese War, Lake did manage to accumulate a handsome profit. Next, he relocated to Austria, where he designed that nation's first two submarines. Later, he signed a contract with the Krupps Company of Berlin, Germany, for another of his well-designed craft.

Eventually, the aging inventor returned home, where he instructed workmen at his Lake Torpedo Boat Company to begin work on a vessel that he would name the SIMON LAKE X. Believing it to be the best design ever, he wished to offer the ultimate in submarines to the U.S. government, certain that they could no longer overlook his accomplishments. Yet, when the navy refused to even watch a test run of his newest vessel, Lake traveled back to Europe and sold it to a country anxious to own it. With its latest purchase, Russia owned no less than 11 Lake submarines.

Not until the business of buying underwater boats was taken out of the navy's hands and given to Congress did Simon Lake sell a submarine to his homeland.

Lake's SEAL, commissioned into the U.S. Navy on October 28, 1912, had a surface displacement of more than 400 tons, a length of 161 feet, and a beam of 13 feet. She was the largest submarine ever constructed up until that time. She housed a crew of 24 men. Jules Verne's number-one follower had finally gained a few followers of his own.

Louis S. Schafer

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MEGATRENDS IN ASW

To paraphrase John Naisbitt's best seller MEGATRENDS, "In ASW, we have been moving from the old to the new. And we are still in motion. Caught between eras, we experience turbulence, yet amid the sometimes painful and uncertain present, we proceed unrelentingly."

Many of the concepts in the book, MEGATRENDS, also apply to the future status of Anti-Submarine Warfare (ASW). We need to assess the Navy's most difficult and challenging warfare area. By doing so, we can determine if our current efforts, and the directions of those efforts, are sufficient to defeat the ASW threat through the next decade and to successfully conduct ASW operations in the next century. It will require a rethink of all aspects of our current submarine ASW efforts. More money in larger active and passive acoustic systems may very well not be the key to success.

- THE MOST RELIABLE WAY TO ANTICIPATE THE FUTURE IS BY UNDERSTANDING THE PRESENT. A comparison of Soviet/U.S. efforts in submarine construction quickly focuses this concept. In the past ten years the Soviets have constructed fourteen different classes of submarines, while the U.S. has constructed only two classes; one SSN and one SSBN. While the projected ratio of Soviet to U.S. submarines remains approximately

3:1, the more alarming bench mark is the overall decrease in detectability of each class of submarine. The average reduction in radiated noise for Soviet nuclear submarines which have undergone recent overhaul or are of new construction has been significant. Where we once considered detection ranges of nautical miles, we now worry about hundreds of yards. The topic of "acoustic parity" has received well deserved attention recently through the realization that as detection and counter detection ranges converge, all phases of ASW are affected.

- SOCIETIES, LIKE INDIVIDUALS, CAN HANDLE ONLY SO MANY CONCERNS AT ONE TIME. ASW is the major warfare concern of the 1980's and will continue to be for the near and distant future. We have sufficiently bounded the problems associated with other forms of warfare -- Amphibious, Electronic, Surface and Anti-Air -- because they are physically and intrinsically easier to address. Beginning in 1984, however, both the Atlantic and Pacific CINCs identified ASW as their #1 priority and CNO has clearly stated that ASW was his primary concern. Barring some unforeseen breakthrough, ASW will remain the top priority because of the inherent difficulties associated with detecting, classifying, localizing and prosecuting submarines in the ocean medium.

- TRENDS, LIKE HORSES ARE EASIER TO RIDE IN THE DIRECTION THEY ARE ALREADY GOING. An excellent indicator of the Navy's trend in ASW is the recent ASW Continuum of 1985. This Continuum was structured to evaluate "own community" ASW knowledge, and was derived from interviews with over 2,500 Navy personnel reflecting the knowledge of other related ASW communities. In all, over 11,000 data points were used in the analysis which identified three major weaknesses; 1) the fleet ASW knowledge was below expected standards; 2) there was little continuum of ASW knowledge and 3) the knowledge and skill levels to conduct effective coordinated ASW operations was insufficient. These results were dramatic, realizing that, as detection ranges and acoustic search rates for individual ASW platforms decrease, the need for coordinated, or "combined arms" ASW skills is not only required, but essential.

- HIGH TECH TECHNOLOGY PRODUCES HIGH TOUCH RESPONSE. Whenever new technology is introduced, there must be a counterbalancing human response -- high touch -- or the technology is rejected. This High Tech/High Touch concept applied to ASW is best reflected in the debate as to whether ASW is an art or a technological problem. To many, ASW is the purest warfare art form since it involves engaging an adversary who may never be detected until too late. VADM Metcalf, for one, believes in the art form definition. He states: "Knowing how to fight in this (ASW) realm is ... an art acquired through training and old fashioned experience. ASW Surface Warriors are ...ARTISTS." On the other hand, there are those who believe that the answer lies primarily in signal processing: that enough time integration, filtering, and signal amplification of an acoustic signature will result in detection and recognition of submarines.

Why this warfare area is so difficult lies in the fact that, from the acoustic, and equally the non-acoustic factors, the ocean favors the submarine. In the ocean environment, sound normally bends toward colder water initially and therefore bends toward the ocean bottom where it is likely to be scattered or absorbed. Even with "good" sound propagation, the inherent spreading absorption and scattering losses associated with sound travelling through the oceans often makes acoustic detection improbable. The ocean, moreover, continues to get noisier while threat submarines get quieter.

Another difficulty is the current limits to accurately predict acoustic conditions. The underseas battlefield is hardly surveyed in the acoustic detail necessary. Therefore, the true conditions in an operating area may be recognized too late.

- THERE ARE THREE STAGES OF NEW TECHNOLOGY. During the first stage of technological innovation, technology usually takes the path of least resistance, that is, it is applied in ways that do not threaten people. This reduces the chance that the technology will be rejected. This low risk approach applies to current efforts to build bigger acoustic systems. Even with movement into the second stage of new technology, submariners still cling to the belief that the ASW answer must lie in acoustic detection. In this second stage of technology, the microprocessor is used to improve what we already have -- but that will not effectively solve the growing ASW problem. It is thus, the third stage of technology which needs to be aggressively pursued -- using inventions scarcely appreciated now. Acceleration of the third stage and reduction of time in the acquisition process are called for. While the ASW "breakthrough" has been awaited for over forty years, the sad truth is that if it becomes a reality it will take another decade, under current acquisition procedures, to become a fleet asset.

- LONG RANGE PLANS MUST REPLACE SHORT TERM PROFIT. Since it has taken the Navy many years to give ASW its number one priority, ASW efforts should be focused on long term objectives, while addressing short term and immediate shortfalls. The blind acceptance that larger and more powerful acoustic sensors are the key is the easy and short term viewpoint. The future of relying on acoustic means of detection is not clear. The CNO's thoughts on the subject, however, are: "Our advantages are decreasing. Soviet submarines are getting quieter and harder to detect. At some point in the future, it can be postulated that they will become as quiet as the ambient sea, and then we will have to turn to other methods of detection. We must continue to make good decisions about the kind of ASW forces we want in the future."

To combat a quiet opponent, the future submarine force will require non-acoustic sensors for initial submarine detection. Where is there a long term investment directed at solving this unavoidable acoustic predicament?

- CONCLUSION: ASW IS IN THE "TIME OF PARENTHESIS," THE TIME BETWEEN ERAS. The acoustic means of detection are still believed in, even though the acoustic signature is evaporating while our training, command and control structures and R&D efforts are centered on the high tech, short term, low risk solutions. The application of MEGATRENDS' concepts to current ASW efforts illustrates these facts. The future has not been embraced, as the known past has been clung to in favor of the unknown future.

We are in the second stage of ASW technology and need to be in the third stage, aggressively pursuing unimagined acoustic and non-acoustic sensors, systems and weapons. We need an ASW program that parallels the current SDI effort. Also, no matter how sophisticated ASW technology will become, success will still depend on the ASW team interaction and experience. Knowledge of, and the ability to predict the acoustic and non-acoustic battlefield will be a key to success.

Even MEGATRENDS' conclusion applies to our current efforts. In this time of uncertainty we have extraordinary leverage and influence -- individually and institutionally -- if we can only get a clear conception, a clear vision of the challenges ahead. There can be no hesitation, NOW is the time for bold initiatives. The Naval

Submarine League can provide an invaluable service by maintaining the information flow to the public on anti-submarine matters as well as encouraging innovative directions for ASW solutions.

LCDR Thomas Q. Donaldson, V, USN
and LT Doyle P. Riley, USN

DISCUSSIONS

SUBMARINE R & D PROGRAMS

In the January 1988 issue, THE SUBMARINE REVIEW's editor suggests that "the Congress believes that the Navy's requested submarine R&D programs have not reflected the potentials of certain technologies which can markedly improve our submarines." He describes an array of issues, technologies, developments and ideas which are not funded to the degree that their supporters consider adequate. Prominent among the issues are submarine double-hulls, drag reduction techniques and satellite-based laser communications. The thrust seems to be that these developments have been ignored improperly in the allocation of development monies.

Recognizing that the historical precedents usually cited demonstrate that often the military services have been too conservative in adapting technological advances, I would like to offer another view of Captain Ruhe's issue based on my experience in having had to make hard choices between too many needs and too few dollars.

All submariners desire to dive deeper, go faster, turn tighter, detect the enemy more acutely, process more information faster, communicate easier in ships which can be manned by fewer men; all of these desires to be fulfilled at lower costs. In considering new developments which offer a significant improvement over present ships -- already the best submarines in the world -- priority has to be given to those which collective wisdom indicates have the highest returns for the technical and monetary investment, e.g. sound quieting, weapons capability and load, sensor size, shape and location, processing equipment, speed with endurance and maintainability.

Like those on the House Appropriations Committee list, all these items require R&D investment. All have merit but not equally so. And which is of more value than the other depends in great measure on one's experience, outlook and responsibilities. I would submit that the most biased judges of such tradeoff are in the R&D community -- starting with the scientist who has the pride of invention extending through the manufacturer who seeks jobs and profits and Congressional advocates who often use new R&D efforts as an excuse to escape funding current needs.

Just as one ought not to change the set of the sails as soon as he relieves the watch, there is merit in the argument that existing systems ought to be treated with great care before radical changes are made for these are the product of a development process which examines in an orderly manner new ideas for military, technical, economic and political soundness as a matter of routine. In this process, new ideas must prove themselves.

Admiral Arnie Schade taught me that "...new ideas have a high mortality rate." Even in the richest times, funds are never adequate to pursue all the R&D one would like. Tradeoffs must be continually and carefully made between basic research and advanced development, between incremental improvements of large numbers of existing systems for reasonable sums versus huge expenditures to gain small numbers with radical improvements, and similar competitive propositions.

Only occasionally in history are there technological developments which justify radical efforts and expenditures. Jet aircraft, nuclear power and the satellites are examples in our own time while gun powder, screw propulsion, rifled cannon, and central gun-laying could be cited as historical precedents. Not many developments can be categorized as this significant.

Incremental developments result in a great variety and range of improvements. Characteristic of such improvements has been the ability to adapt them to a wide range of equipments or platforms shortly after their initial development at relatively modest costs: homing torpedoes, sound quieting, digital sensing and processing, VLF radio and SATCOM. It is in the comparison of these incremental gains that lay the hard decisions on where to allocate R&D funds.

For example, no immediate substantive problem with communications to submarines was identified which the proposed space based laser communication system would correct. The CNO's staff identified the value of this system and our judgements were substantially different than the system's promoters. The CNO staff has to try to evaluate the incremental worth to battle effectiveness of any particular development and then weigh that against the resources needed to develop and deploy such a system. Estimating the value which can be reasonably expected to be gained in a development against the gains made with some other use of the funds is best done by knowledgeable skeptics. For the laser communication system, it meant comparing the cost-benefit gained by adding this system to several which already provided excellent service for submarine forces. This judgement then had to be balanced against use of resources to develop communications systems for which we have no current capability and which are absolutely necessary if naval battle forces are to be able to operate in a jammed environment. There is no argument that a laser system would be useful. But in a tradeoff of available funds, its merits have been outweighed by other needs.

My compatriots in the SSN development business wrestled with these similar problems although in a somewhat narrower scope since they did not have inter-platform tradeoffs to consider. As an occasional consultant and sometimes referee in parts of these arguments, I know that no one was in favor of slower, shallower, more costly submarines with fewer weapons and more people -- which take longer to build. Each potential improvement for the near and far future had to face scrutiny as being achievable technology at the best cost and then prioritized against other requirements. When completed, these efforts represent a coherent package -- a collection of what can be done at costs worth the effort. Reality means meeting the expected threat with machines that will do the job. We'd like a submarine that could fly, but we ought not to spend any money trying to get it.

During the process, promotion of new developments by their advocates must be viewed with suspicion. As submariners, we have a common experience with technical differences revolving about postulated ASW threats to our submarines. There are theorists who predict that technology will make the ocean transparent although oceanographers and submariners take a more realistic and skeptical view. Inventors, promoters and developers collectively and individually hardly ever acknowledge the limitations to their technology. As a scarred veteran of the Joint Tactical Information and Display System development, I have been a party to such limits and failure to acknowledge them. The need for this system to support a forward deployed battle force was clear and well established. There was universal agreement that the technology was "available." Unfortunately after a hundred million dollars was expended without a product, the Secretary of the Navy terminated the program reluctantly.

Apropos to this problem of Congressional management and interference is former ASN(R&D) Gerry Cann's comment, also in the January issue, that "...it is almost impossible to put together a forward looking program because of the zealous oversight from those in the Pentagon and on the Hill." Great effort is expended by the Navy to construct programs so that they can sustain this scrutiny and survive such mischief as is made in them.

All of us have had the responsibility of being careful to spend the people's money where it counts. In doing this we occasionally spend some where it produces no gain and sometimes fails to exploit fully a technology which could provide benefit. However, I am convinced these are extremes. In the main, new ideas warranting attention get it. As is repeatedly argued, "Quality wins."

As defense funding stops increasing, arguments in and between the Services will get less objective and more acrimonious. In this environment of stringent resource limits, even more than in periods of plenty, advocates of new ideas in and out of the Service contribute to that collective wisdom by promoting the best facts they can in favor of their ideas. The whole selection and decision process is open and incremental. Required to support the President's budget submission, it is repeated every year or more often. So there are continuous opportunities to introduce new ideas and evidence.

Jerry Holland

WHAT MIGHT BE OBSERVED IN PICTURES OF SURFACED SOVIET SUBMARINES

The AKULA: It is seemingly the same as the ALFA only the AKULA appears to be twice as large in displacement. Its sleek, low-slung sail, well faired to the main deck and without sail planes, promises a high degree of hydrodynamic stability in high speed radical maneuvers. This sail-configuration should reduce generated vortices which would normally increase boundary layer separation -- producing destabilizing forces and increasing drag (causing loss of depth, snap roll, settling by the stern and loss of speed). A similar sail design is observable on an earlier-produced ALFA submarine, reported to have made 43+ knots in high speed maneuvers. Its pod on the stern cannot logically be considered to be a towed array system. Its shape is consistent with a Soviet MHD propulsor while the whiteness of its surface after underway operations would indicate a use of cryogenics inside the pod. The raised longitudinal pipings on either extreme side of the main deck are evidently not safety tracks (they would only hazard a man trying to so use them). Rather they seem to be raised piping to pour low pressure air laterally across the main deck in order to decrease the turbulence drag (on the very well designed low drag hull) and possibly form a bubble shield against a surface warship's small-warhead weapons -- like hedgehogs which attack vertically downward. The arrangements of limber holes suggest the use of syntactic foam and hard tanks between outer and inner hulls, except where gear between the hulls should be responsive to changes in sea pressure with changes in depth. The white painted door edges near the bow would indicate that the space inside the door is used for some manned underwater activity. Like salvage fittings, a man returning to a submerged submarine would have to know where the doors open -- in order to stay clear of them during their opening.

The AKULA rides so high in its pictures that over 35% reserve buoyancy apparently exists.

<u>The OSCAR</u>: Its faired, low-slung long sail (without sailplanes) indicates a good hydrodynamic stability in high speed maneuvers. The plimsoll marks on the after part of the sail suggest an expected use of the OSCAR in an exposed-sail type of operation. Acting as an AEGIS ship for surface forces? Or an anti-air picket? A peeled-off tile shows a thickness consistent with the rubber-like tile acting as a compliant coating -- in addition to the tile's acting as an anechoic surface over the submarine's outer hull. The tiles are reportedly of four inches or more in thickness and are seemingly attached to the hull with what seem to be piping for fluid transfer? The huge hatch, on a raised deck just aft of the sail, seems to represent a stowage area below the main deck for something big like amphibious gear, boats, small submersibles, or 28 cells for vertically-launched anti-air missiles. (The hatch seems too big for housing just communications buoys.) The handrail at the base of the sail, compared to the raised longitudinal piping on the main deck, illustrates the fallacy in ascribing a safety track function to the piping. The lack of limber holes suggests that most of the spaces between the outer and inner hulls is filled with syntactic foam or its equivalent, and that void spaces are flooded through doors in the bow. The widely separated positions of the masts in the sail indicate a reduction in their mutual interference and reinforcing signatures -- reducing their detectability from mainly airborne sensors. Do they indicate a secondary control center? And possibly non-penetrating masts? The gear on the top of the rudder is evidently for a towed array. The OSCAR's surfaced aspect suggests over 35% reserve buoyancy.

<u>The TYPHOON</u>: The bow planes are longitudinally striated and the tips have holes like an air-

craft's wing to minimize vortex formation at the tip -- thus reducing boundary layer separation. The four holes down the stern of the conning tower below the sail appear to be vortex controllers. The conning tower -- a CIC-type structure? -- indicates a function for the TYPHOON which would be more than its strategic use of nuclear ballistic missiles would require. The two vertical slots at the after part of the sail appear to be suction holes to reduce vortex formation off the sail. The two large hatches aft of the sail and on the main deck are about 6 meters by 4 meters in size and have white painted hatch edges for submerged use by humans -- similar to submerged use of salvage fittings. The volume suggested below the main deck is inconsistent with communication buoys and is more likely used for manned small submersibles, etc. The excessive size of the TYPHOON suggests functions which are not being credited to this 40,000 ton submarine -- beyond the strategic nuclear function. (Its dimensions indicate this displacement, not the 25,000 tons credited to it.) This huge submarine is possibly the "battleship" of the Soviet Fleet -- a submarine which can operate world-wide and which can threaten carrier battle groups in war, whether conventional or nuclear. The fins sticking up on either side of the hull, just forward of the rudder appear to be means for vortex control, to increase the efficiency of the propulsion system. The two scoop-like protuberancies which seemingly would increase the drag of this submarine only slightly and may possibly be used to gobble up vortices produced by the sail and increase propulsion efficiency. Note that they face the hatches -- like the DELTA IVs, only the DELTA IV have these protuberancies forward of the hatches. Thus they may be used to observe (by TV?) submerged activity. The TYPHOON has no limber holes, (perhaps there are limber holes with covers?) despite the probability that there is a great amount of space between the outer and inner hulls (up to 4 meters by estimates). And, the surfaced aspect of the TYPHOON indicates considerable reserve buoyancy -- over 40% of displacement. The staggered small holes down the after part of the main deck appear to be so spaced as to reduce lateral formation of vortices which would reduce propulsion efficiency and increase drag.

The ALFA: The bow planes in the bow are unusually low -- probably for increased control of stability in high speed operations.

The SIERRA: The white coating observed on the top of the pod on the stern would indicate the use of cryogenics inside of the pod. The considerable number of limber holes indicate a use of this submarine involving a good deal of surfacing and submerging during a war patrol. Their activity is probably different than a VICTOR III's, since the VICTOR III has virtually no limber holes, while still being credited with attack submarine functions.

The VICTOR III: The coke bottle shape of the outer hull indicates a very good laminar flow. A difference in the color of the paint on the outer hull indicates some sort of polymer stain for changing boundary layer flow conditions.

W. J. Ruhe

(The above observations were made from mainly photos in the annual SOVIET MILITARY POWER. Other sources are JANE's Publications, newspaper pictures, etc.)

CONCEPTUAL EXPANSION FOR SUBMARINE OFFICERS

Many of the Navy's best and brightest officers are serving on SSN's and SSBN's. Duty in submarines has become almost career long. I heard one SSBN skipper say that he might retire after 30 years uninterrupted service with a TRIDENT command in submarines.

While continuity of service certainly builds expertise much needed in such a complex service, one wonders whether the needs of the Navy and of the officers involved are best served: and whether they might be better served for the Navy and the officers.

The world outside the Nuclear Submarine program is changing with increasing rapidity, and now "jointness" is becoming a factor in promotion potential. It seems important that a program be set up to aid in bringing ideas and concepts from outside into the nuclear submarine force and perhaps aid others by providing them with what has been proven in the submarine force.

One advantage of the SSBN program is the relative schedule predictability which might make it possible to plan for a week between patrols during which officers could be provided travel and access to spend time with other service activities to develop expressed intellectual interests. Squadron training officers could make the arrangements and clearances, especially if such a program had been encouraged at the top.

In a Navy, and in a submarine force, most of the best ideas have come from the officers of that service. Most of the operational concepts and many of the technologies now being used are at least 20 years old. What the future will hold for such operational concepts as various joint operations, coordinated attack, and use of new technologies such as superconductivity, fiber optic information transfer, robotics, RPV's, lasers, holograms, artificial intelligence, new materials, fuel cells, and many, many others, will come from officers of the submarine service.

They should be given the opportunity to

develop conceptual abilities of value to themselves and their Submarine Service. In wardrooms of my commands, we were very successful in sending officers or senior petty officers off to become expert in such subjects as: mining, wire guidance, computerized management, freeze dried foods, advanced materials handling, quality control, clothing development, aircraft control, SAC missions, powder metallurgy, advanced restaurant management, inventory management, microfilm management, audio-visual training equipment, and management information systems.

In the years after WW I, battleship officers worked very hard running those capital ships of the Navy. As WW II approached, I noticed as a young officer, that the aviation officers seemed to have a broader grasp of the Navy and the technical world around them. It was not surprising to me that for many years they became dominant in the Navy. I think one of the reasons was that their inherently short flights left them more time to get around more than did the duties of the battleship officers.

Let's make sure that the officers of what some call the capital ships of the modern Navy don't get into the same rut.

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

A SUBMARINE DESIGN FOR ALL SEASONS?

U.S. submarine warfare, as pictured today can be readily and simplistically described. Our submarines will respond to the Maritime Strategy by conducting independent forward barrier operations or go into Soviet bastions to rapidly attrite enemy submarines including strategic ones and thereby critically reduce the enemy's high seas threat to U.S. battle groups and merchant convoys carrying vital support to overseas U.S. forces -- while also reducing the enemy's strategic submarine threat. At the same time, our submarines would provide a screening function for surface battle groups, and our ballistic missile submarines would ensure their survival by laying doggo in the vast reaches of the world's oceans.

Simple? -- very -- and readily played in wargames and trained for in peacetime, with U.S. submarines specifically and well designed for such operations.

Despite our best planning, submarine warfare is unlikely to follow exactly this pattern if history is to be reckoned with. First, today's war of attrition against enemy submarines has to be quickly accomplished to be consistent with the U.S. Maritime Strategy. Yet, decisiveness by our submarines in World War II, in their primary mission of destroying Japanese merchant shipping, was gained only after long, drawn-out operations.

Second, U.S. submarines before World War II trained for and were played in exercises as "fleet" pickets. Yet when WW II started, U.S. submarines were used in other roles different from their planned primary mission -- that of attriting the Japanese merchant fleet.

Third, although submarine commands in the past (particularly the German and Japanese) seemingly recognized the best way to use their submarines in war, when war actually started a higher command overrode the submarine command which had been responsible to meet war requirements and called for some missions which were different than those planned for, or higher commands changed the way planned-for missions were to be carried out. The Japanese high command, for example, called for a different use of their submarines -- responsive to fleet requirements -- than the submarine commanders had contemplated.

Fourth, the U.S. submarine mission of today is focussed on the Atlantic and the Pacific. They are of equal importance, but the submarine operations in the Pacific proved in WW II to be quite different than those in the Atlantic. With the Arctic and Indian Oceans now also important theaters of submarine warfare, the concept of a quick U.S. attrition of enemy submarines is being considered on a worldwide basis.

Fifth, attriting the enemy's strategic nuclear submarines is necessarily a political decision and will not always follow military planning. In the past, International Law for wartime military operations and Rules of Engagement for peacetime restriction of military action have been subject to civilian interpretation and change. At the start of WW II, the shift to unrestricted submarine warfare -- away from International Law's clearly defined requirement to warn an enemy merchant ship before submarine attack, and to render assistance to survivors after attack -- illustrates the difficulty of submarine planning for conflict.

Sixth, today's expectation that there will be several days of strategic warning before the onset of a big war should be temporized by the total surprise of Pearl Harbor and the Soviet emphasis on a surprise "first salvo" to initiate a war at sea.

Submarine policy and planning, then, are developed to produce submarines of the highest achievable quality in certain vital characteristics, keeping in mind other capabilities whose quality may necessarily be limited both by funding and by the optimizing of the special qualities particularly desired. This makes good sense based upon the past.

For example, the "fleet submarine" designed just before WW II was optimized for: extremely long surfaced range -- about 16,000 miles (with converted ballast tanks); long endurance at sea -- over 60 days; a great load of weapons -- up to 26 torpedoes; high speed on the surface -- about 21 knots; high stability surfaced and submerged; very good survivability against the types of weapons visualized at that time; and very good maintainability of machinery while at sea. As a consequence of emphasizing these characteristics over others, the fleet boat was able to adapt extremely well to the changed nature of the warfare environment in which they actually operated and not inflexible to changed missions.

Similarly, today, the optimized characteristics of U.S. nuclear submarines are responsive to the possibility that our submarines will be employed in ways other than currently envisioned. To minimize too wide a variance, our submarines are being designed for: great quietness even at relatively high speeds; extremely long detection and tracking capability on enemy ships; unlimited range; high mobility and great endurance totally submerged; high operating reliability; very good under-ice capability; and a very large load of offensive weapons.

Phoenix

LETTERS

AN IRANIAN SUB IN THE PERSIAN GULF?

An article on page 93 of the October 1987 SUBMARINE REVIEW reported that the Iranians were about to launch a mini-sub for use in the Persian Gulf in May. I would note that about the same time as the Bridgeton incident, the CNN cable news network broadcast a news story concerning the naval buildup in the Gulf. As part of that story, the network ran film which had apparently been supplied or obtained from Iranian sources which showed several types of Iranian naval craft. One rather interesting 3-5 second segment showed what appeared to be a very small submarine (perhaps 15 to 20 feet in length) moving on the surface with the casing barely showing on the surface. Two sailors (passengers might be a better term as neither looked to be in any sort of uniform) were standing on the casing near a very small sail and were holding on to a mast/periscope. The vessel was moving away from the camera and was not any sort of small boat.

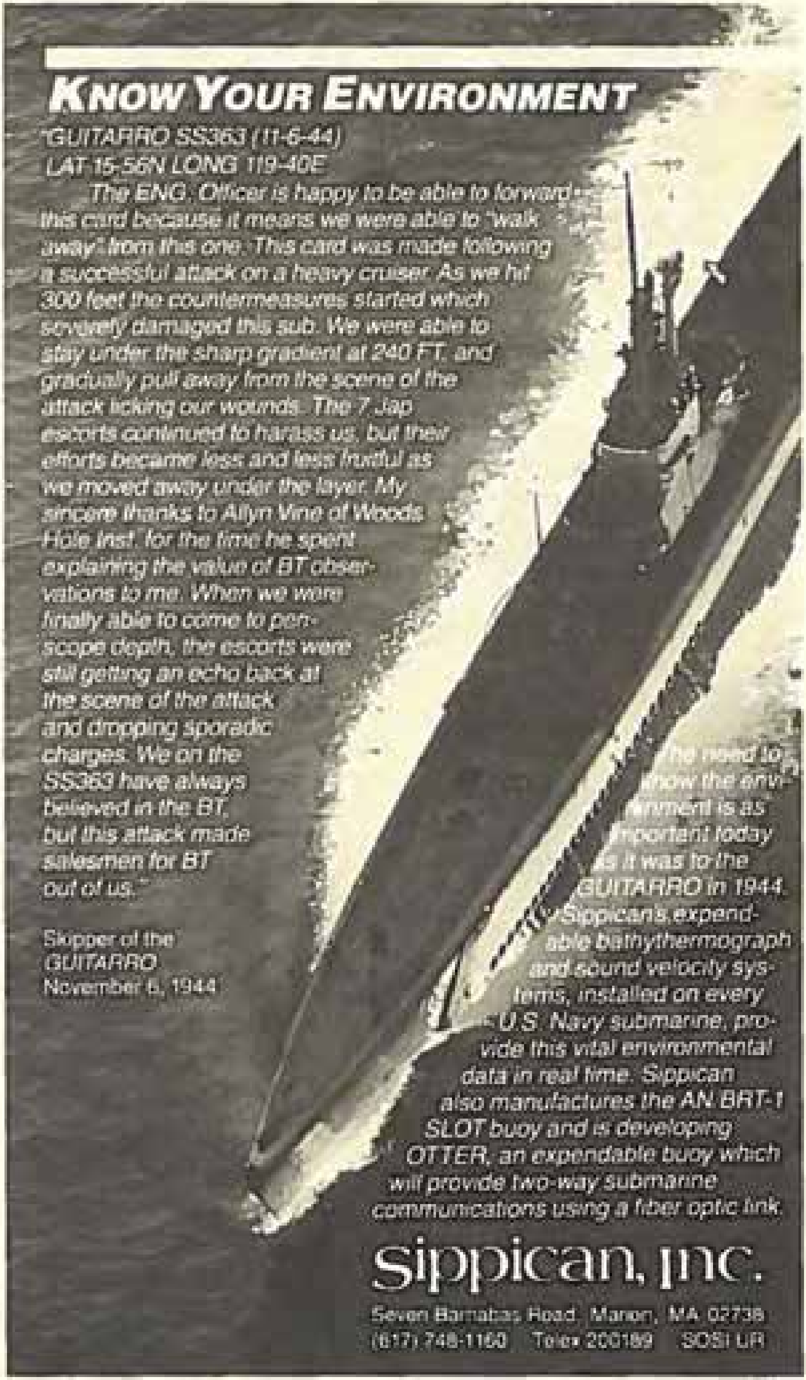
David L. Kimble

THE COVENTRY FABLE

William P. Gruner, in his article on intelligence information for submarines, (January 1988 SUBMARINE REVIEW) repeats the story that Winston Churchill decided not to defend Coventry against heavy German air attack rather than risk exposing the fact that the British were reading Luftwaffe ciphers. This story, which has been in circulation for some time now, seems to have been pretty well disposed of as false. The most comprehensive account of the Coventry raid from the intelligence standpoint is probably to be found in R. V. Jones, The Wizard War.

None of this, of course, detracts from the validity of Gruner's main thesis: That the best intelligence is of no value if it does not reach the operator who needs it.

Maxwell P. Schoenfeld, Ph.D
Professor



KNOW YOUR ENVIRONMENT
"GUITARRO SS363 (11-6-44)
LAT 15-56N LONG 119-40E
The ENG. Officer is happy to be able to forward this card because it means we were able to "walk away" from this one. This card was made following a successful attack on a heavy cruiser. As we hit 300 feet the countermeasures started which severely damaged this sub. We were able to stay under the sharp gradient at 240 FT. and gradually pull away from the scene of the attack licking our wounds. The 7 Jap escorts continued to harass us, but their efforts became less and less fruitful as we moved away under the layer. My sincere thanks to Allyn Vine of Woods Hole Inst. for the time he spent explaining the value of BT observations to me. When we were finally able to come to periscope depth, the escorts were still getting an echo back at the scene of the attack and dropping sporadic charges. We on the SS363 have always believed in the BT, but this attack made salesmen for BT out of us."
Skipper of the GUITARRO November 6, 1944
he need to
know the envi-
ronment is as
mportant today
s it was to the
GUITARRO in 1944. Sippican's expendable bathythermograph and sound velocity systems, installed on every U.S. Navy submarine, provide this vital environmental data in real time. Sippican also manufactures the AN BRT-1 SLOT buoy and is developing OTTER, an expendable buoy which will provide two-way submarine communications using a fiber optic link.
sippican, inc.
Seven Barnabas Road, Marion, MA 02738
(617) 748-1160 Telex 200189 SOSI UR

WW II SINKINGS

With regard to Karl Hensel's suggestion regarding the 87 FACT BOOK on WW II submarine sinkings, (p. 75, Jan 88 issue) I am nearing completion of a comparison tabulation of U.S. submarine attacks during WW II versus the Japanese records of losses, to be published by the U.S Naval Institute, probably late this year.

As a general comment, I have found the Joint Army-Navy Assessment Committee report (JANAC) to be more reliable than I expected. I do not anticipate adding many sinkings to those already reported, although many errors will be corrected. The biggest advance over JANAC will be the addition of all reported cases of damage (JANAC listed only sinkings).

Unfortunately, in dealing with Japanese losses one does not have the advantage of the excellent records kept by the Allies (the winning side) on their losses. I am afraid we will never be able to find satisfactory answers to all problem cases at this late date.

John D. Alden

A SUBMARINE JOINT OPERATIONAL TACTICAL SYSTEM

Relative to Bert Findly's article in the January 1988 issue of THE SUBMARINE REVIEW, JOTS requires frequent automated data entry into each unit's computer to keep the tactical picture up to date.

But, Mr. Findly's rationale leaves many questions unanswered. For instance, how would this automatic data transfer occur with submarines at speed and depth? While the author acknowledges the need for submarines to remain covert, he does not explain how the submarine would participate in a battle-group's JOTS net without remaining at periscope depth with an antenna exposed.

He says JOTS could prevent mistaken attacks between friendly subs in the battle-group, but direct support SSNs generally possess the best ASW picture in the group. The author also postulates "...an antiair and outer air-battle role ..." for the direct support SSN which is not possible today and not planned for the near future. And, Mr. Findly refers to dumping the tactical picture to the submarine "... via the Shore Targeting Terminal (SST)." But the SST currently does not transmit JOTS data and is not planned for this purpose.

I am not questioning the benefit of outfitting submarines with JOTS, but what is a reasonable concept of operations for storing and relaying time-sensitive tactical data information to SSNs in direct support of a battle-group?

LT Steven A. Dudley, USNR-R

WARTIME INTELLIGENCE

The January REVIEW carried an article, page 21, on the writer's lack of intelligence information, prior to each of his WW II patrols -- that skippers had little prior knowledge of what to expect.

I was far more fortunate, prior to the only patrol I made, beginning December 1943, with one day's notice to take command of a boat nearly ready to depart, the Force Staff in Pearl dug out for me every patrol report dealing with Area 4 for the first two years of the war. I was then able to plot on tracing cloth over a chart, the locations, courses and data for every ship (and plane) contact, some 52 major ship convoy and task force contacts; also conflicting currents encountered running between the islands (a major concern), 2 mine fields, 2 submarine near-groundings, intermittent beacons on islands, customary routes, etc. It was surprising how much easier it made planning how best to cover routes and change positions if detected. The only Ultra received was right on the nose!

Karl Hensel

SUBMARINE RADIOMEN ASSOCIATION

The Submarine Radiomen Association is seeking those select personnel who earned their dolphins while wearing the sparks of the U.S. Navy Radioman rating. We currently have one formally organized chapter in the Washington DC area with national membership approaching 100. Chapters are being organized in New London, Charleston, San Diego, Vallejo, and Bangor. The goal of our organization is to promote excellence of submarine communications through group participation and recommendations to the force commanders, various systems commands and the submarine support community. Membership is open to active and retired RMSN (SS) through O-10s that are qualified to wear dolphins and have served in the Radioman rating.

Contact: Don Basham - President (703) 799-7777
Fred Bannon - Secretary (301) 869-9612

IN THE NEWS

o *The Southeast Georgian*, 8 October 1987, contained an article on the recently deceased Captain Bill Purdum. One of the Submarine League's most active members, and former president of the NSL NAUTILUS Chapter in the New England area, Purdum was remembered in this article by Alan Lipsett as "The naval officer who in 1977 introduced Camden County to the idea of supporting Fleet Ballistic Missile Submarines at Kings Bay, Georgia, which at that time was a mothballed U.S. Army shipping terminal." Lipsett noted that Purdum had said that "the Kings Bay project was one of the most important things I worked on while I was on active duty." Purdum then asked, "How well has the Navy lived up to its promises of 1977?" At that time, "the Navy promised a $40-50 million payroll at the $92 million Naval Base. Today the payroll is $85 million and by the time it gets to be a TRIDENT base it will cost $1.7 billion." Also, in answer to Purdum's question "Has the Base lived up to its promise of increased employment?" the article by Lipsett stated that "earlier predictions that 1000 new jobs would be created each year, have proved conservative with more than 10,000 additional jobs by 1995." It is emphasized that "the TRIDENT submarine force will continue to be the strongest leg of the defense Triad and that these submarines will be a part of this area for many years to come."

o *Defense Week* of 14 December 1987, in an article by Paul Bedard tells of Navy plans to backfit the new sonar and fire control system developed for the SSN-21 into not only LOS ANGELES and STURGEON-class submarines but also into TRIDENT submarines. TRIDENTs would get these improvements starting in 1992. This TRIDENT program according to "Navy officials" is in response to Soviet submarine quieting advances, and secondly to use common systems on subs, thereby easing logistic nightmares. Although this would provide TRIDENTs a good capability to fight back if a Soviet attack sub located a TRIDENT, there is apparently no intention of sending TRIDENTs in search of Soviet boats instead of trying to avoid contact. The new fire control system, called Combat Control System Mk 2 "would boost the TRIDENT's detection and attack capabilities. A change from the BQQ-6 sonar system to the BQQ-5E is also contemplated."

o PATROL, the Submarine Base, Pearl Harbor newspaper, reported on the Memorial Service held for Vice Admiral Ralph Christie, 94, who died on December 20th after a long illness. A captain at the outbreak of World War II, he commanded a majority of the Atlantic based submarines. Briefly assigned to the Naval Torpedo Station as inspector of torpedoes, he quickly was promoted to Rear Admiral and was then ordered to Submarines Southwest Pacific as Commander Task Force 71. Yearning for combat he made unauthorized war patrols in BOWFIN and HARDER. "Admiral Christie was quick to recognize the valiant and heroic deeds of our submariners and became well known for his dockside presentations of medals to returning submarine skippers." It was he who fought to see that Commander Sam Dealey of HARDER was posthumously awarded the Medal of Honor. Christie retired in 1949 upon promotion to Vice Admiral.

o INSIGHT/January 25, 1988 notes that the Soviets have begun test launches of their SS-NX-21 cruise missiles from AKULA-class SSNs, in the Sea of Japan. With a range of 1,800 miles, they can be launched from standard submarine torpedo tubes. "It appears that the Soviets are planning to deploy them on submarines of the VICTOR, SIERRA and AKULA classes." There are three AKULA-class submarines in service and a fourth is under construction.

o An editorial by Cherie Edris and Sherrie Friendly in the DOLPHIN of 4 December, 1987, makes some excellent points about the wives of submariners. "The first thing that comes to mind is the bonding we share with special friends. We don't go through this (separation from husbands) alone: we have each other to depend on. Submariner wives are a strong and special breed. We need to pat ourselves on the back. We have grown stronger as individuals; we have learned to cope. We have become independent and self-reliant and can handle many problems alone, from paying bills on time, handling car repairs, juggling work and children, to major crises such as serious illness. We stretch ourselves and grow every day. We adapt! Let us not look back with sadness on deployments, let us look back with pride for all we have done."

o Tom Clancy, author of "Hunt for Red October" writes in <u>Policy Review</u> about "America's favorite whipping boys -- the military" and how the Left attacks the competence of men and women of our armed forces. Clancy feels that the U.S. submarine community "is composed of the most in-decently competent professionals one could ever hope to meet." He notes their lack of awe for "the Russian Navy which is the most formidable in the world." And he asks himself, "Why aren't American submarine captains properly terrified by the Soviet Navy? Where does this confidence come from?" Then Clancy observes that "The confidence comes from the fact that, unique among military forces, the submarine community operates against the Soviets on a daily basis." Whereas the U.S. Navy has its "Top Gun" tactical training school for naval aviators against simulated "aggressor" Soviet forces, "The submariners, can and do con-duct the same sort of operations continually -- against the real thing. They track Soviet surface ships and submarines, gather intelligence of various sorts, and generally conduct themselves as though on a war footing at all times. The first rule of war is that one should know one's enemy;

the men driving the fast attack submarines do, and they think they can win."

o An article in the Washington Post of Feb. 21 by P.D. Zimmerman and Alton Frye proposes electronic locks as a key to the next Arms Limitations treaty which would probably, in part, deal with limiting sea launched cruise missiles (SLCMs). The main problem with SLCMs is how to count and verify those which are nuclear armed and carried on submarines -- since from the outside they look the same as conventional SLCMs. A device such as a Permissive Action Link is proposed which requires a special code to electronically unlock the nuclear SLCM before it can be detonated. But to solve an Arms limitation problem, a Permissive Action Link could be used to seal a canister containing a conventional SLCM with half of the electronic unlocking code supplied by the U.S. and half by the Soviets. That way, conventional SLCMs could not be converted to nuclear weapons -- without knowledge of the American and Soviet inspection teams. If an unauthorized attempt was made to open the canister of the conventional SLCM for a conversion of warheads, the canister's sealing mechanism could have an explosive charge which would disable the guidance system of the SLCM rendering it useless. If the SLCM was, by acceptance of both sides, removed from its canister for repairs, modification or maintenance, it would then later be resealed into its canister by inspection teams of both sides. If the conventional SLCM however was to be used in war, a firing of the SLCM from its canister could have an inertial time-sensitive device built into the Permissive Action Link which would negate the coded electronic unlocking device.

o The Proceedings/February 1988 has an item by Norman Friedman which describes a 100-foot test-model of the SEAWOLF SSN-21. This battery-propelled, computer controlled, free-swimming vehicle will be used to simulate high-speed maneuvers and measure the expected flow field over the submarine. This model is reminiscent of the ALBACORE. It represents a reversion to the ALBACORE's length-to-beam relationship. The model's control surfaces will evidently require special tests not only to measure the efficacy of control but also to determine the noise created by control-surface movement at high speed. Similarly, the flow over the hull may affect the placement of sonars.

o <u>Aviation Week and Space Technology</u> of 19 October, 1987, tells of a number of submariners who are pushing for an early 1990s start of a proof-of-concept program for an encapsulated surface-to-air missile for offensive submarine missions," although "the Navy in the past has rejected the idea of an anti-aircraft missile for defense, contending that it is easier to escape the threat (than to fight back)." The use of SSBNs for launching small satellites into space is also being evaluated -- as a potential role in the SDI.

o <u>VFW</u>: December 1987 puts out a call for information on all U.S. submariners who served in WW II. The SubVets organization is putting together a history of U.S. submariners of WW II, and is seeking additional biographical information for inclusion in Volume III -- Volumes I and II having been completed. A brochure on the kind of information needed can be obtained from Robert A. Link, U.S. Submarine Veterans of WW II, 32 W. Bolton Avenue, Absecon, NJ 08201.

o The SubVets of WW II in their <u>Submarine National Review</u> have "an appeal" from the editor urging "all submariners to boycott goods manufactured by Toshiba."

o A news release from SUBRON Six tells of how the 130 crew members of the modern nuclear submarine SILVERSIDES, while out on their last three-month deployment under the Atlantic Ocean, had a fund raising project to provide the exterior lighting for the old fleet boat, SILVERSIDES. This WW II relic is now a tourist attraction and part of the Great Lakes Naval and Maritime Museum at Muskegon, Illinois. One of the men on the present SILVERSIDES said, "The crew was really behind the fund raising, ($2,236 was raised while on patrol by holding auctions, selling trinkets, running a 'Las Vegas' night and holding other contests.) Our crew wanted to do this to help out the guys who used to work on the old SILVERSIDES. They served under a lot of arduous conditions during World War II, more than we can imagine. It is our namesake and our heritage and we wanted to save it -- and that's what we worked for."

o <u>NAVY NEWS & Underseas Technology</u> of 18 December 1987, tells of the investigation of Soviet submarine technology by a House panel of "staffers," headed by an Armed Services Committee Staff member, Russel Murray. Murray recalls "wanting to go to war with Japan convinced that America's better warplanes and ships would stop Japan's military expansion, (back in 1941). But we found out the hard way that their planes were just as good, if not better than ours and their ships were as good as ours." Murray makes this observation as he and four other staffers look into the state of Soviet submarine technology -- to reduce the chances of being surprised by the reported innovations being made in the Soviet submarine navy. "The list of suspected innovations is long" and, "Others, outside the service, fear the Navy's intelligence community is underestimating Soviet advances." The 4-inch thick tiles which cover the outer hull of Soviet submarines is one innovation being examined. "The Navy says the tiles are anechoic. But many analysts are sure the Soviets use their tiles for more than absorbing sound. They believe they reduce resistance so Russian subs slide more easily through the water. This makes them faster without adding power." The pod on the stern of the VICTOR IIIs and the AKULA is also being looked at. Its opening at the back of the pod has been shown to be 15 inches in diameter -- far too big for a towed array system. "Contrary to Navy views, some defense analysts believe the pod is for propulsion." Photos show it being "coated with something white" suggesting it might be ice and that the pod is extremely cold because it could house a cryogenic power plant of the MHD variety. Other Soviet technologies are similarly being examined.

o <u>Navy Times</u> of 15 February notes that Naval Academy midshipmen are selecting nuclear power training and submarine duty in declining numbers. Whereas 155 midshipmen out of a total 1094, chose submarine duty in 1986, in 1988 only 119 out of a class of 1141 want to go into submarines. (None of the approximately 70 women in either class selected submarine duty.) "An Academy official said there is no specific explanation for the declining popularity of nuclear training."

o <u>Jane's Defense Weekly</u> of 23 January, 1988, reports that an SSN built by the Soviets sailed for the Indian submarine base at Vishakhapatnam on 9 January. There is speculation that the Indian Navy has leased this missile firing nuclear submarine, which has eight externally mounted missile tubes for evidently cruise missiles. And that the Indians will acquire, eventually, four such submarines. A team of at least 200 Indian sailors have been in training in the Soviet union since 1984 to man the Indian submarine. However, the reactor technical staff must still be backed up, initially, by Soviet naval engineers.

o <u>NAVY NEWS & Undersea Technology</u> of 8 February notes that the naval airship (blimp) has been removed from the 1989 budget by the budget analysts -- who cut to zero the $100 million programmed in FY'89 for the lighter-than-air blimp. Westinghouse Airship Industries Inc. which is developing the blimp concept "is giving up hope of rescuing the program from the budget axe." An industry source estimated that #100 million would build the first airship, with later blimps costing $10-30 million per unit.

o Jane's Defense Weekly of 16 January tells of a YANKEE-class Soviet submarine, refitted to carry the SS-N-21 cruise missile, being photographed in the Norwegian Sea. The photo revealed that the YANKEE's 153 meter long hull had been lengthened by 10 meters and its sail had been made 3 meters longer. "Norwegian sources have now indicated that between 20 and 40 cruise missiles can be carried in the missile compartment amidships."

o NAVY NEWS & Undersea Technology of 15 January, reports that on January 5th the Navy awarded General Dynamics (Electric Boat Division) a $644 million contract for the 15th TRIDENT. The other bidder for the contract, Newport News, seemingly "turned in a non-competitive bid by adding $85 million in tooling costs to its bid and by stating it could not deliver the TRIDENT when the Navy wanted it." In an earlier issue of NAVY NEWS & Undersea Technology of 18 December 1987, it was related that Navy Secretary James Webb had recommended that the TRIDENT be cut out of the 1989 budget but that this was overridden by Defense Secretary Frank Carlucci who restored its financing in the FY'89 budget.

o Defense Week of 25 January describes the plans of Vice Admiral Bruce Demars relative to using surveillance drones remotely controlled by submarines. This plan, first suggested last year, "was shot down by defense budget appropriators." But it seems that Admiral DeMars is not letting it drop. Drones, or remotely piloted vehicles, would be used to "Expand the surveillance capabilities of attack submarines and broaden the role of the sub. Drones would be launched when a U.S. sub captain believes an enemy vessel is nearby but undetectable by most means. Using the drone's sensors, the submarine-based operator could direct the sub's weapons to the target." David Stanley, in Jane's Defense Weekly of 28 November, says, "Projects for operating air vehicles from submarines may gain impetus from other motives than the need for target fixing. Rapid and continuing improvements in methods of finding and hitting air, sea and land targets put a high defensive premium upon concealment underwater."

o CNO (OP-02) has incorporated an important CNA study on submarine contermeasures in the Defense Technical Information Center (DTIC) library. DTIC code AD955539L has been assigned. Use of this particular document is restricted to registered users of DTIC with a SECRET FACILITY CLEARANCE. A DTIC registration package can be obtained by calling DTIC central register at: (703) 274-6871.

o USS TULLIBEE (SSN 597) will decommission in June 1988 at Portsmouth Naval Shipyard, Portsmouth, NH. All former crew members and interested personnel desiring to attend the decommissioning ceremony or obtain further information can contact YNCM(SS) Frank W. Reinhold, USN - Chief of the Boat, at Autovon 684-1648/1577 or Commercial (207) 438-1648/1577.

SUBMARINE TECHNOLOGY SYMPOSIUM

As announced in the January 1988 REVIEW, a Submarine Technology Symposium will be conducted on 1-2 June 1988 at the Johns Hopkins University Applied Physics Laboratory in Laurel, Maryland. At this writing, response to our invitation has been overwhelming. As predicted, we will have a sellout (seating capacity 500). A review of the list of attendees indicates that the goal of bringing together the national leaders in the technologies applicable to future submarine warfare will be attained.

Program Chairman, Dr. Gordon Smith of APL, and his four session chairmen have forged an exciting agenda:

1 June 1988

Introductory Session

Call to Order	G. D. Smith
Welcome to APL	C. O. Bostrom
Welcome to STS	ADM R. L. J. Long
Keynote Address	VADM B. DeMars, USN
Symposium Objectives	VADM B. M. Kauderer

Advanced Submarine Technology

Overview	Dr. R. Clark / DARPA
Composite & Adv. Materials	H. Vanderveldt / Am. Welding Institute & J. J. Kelly / ONT
Structural Acoustics	E. Harper / AT&T
Future Passive Acoustic Sys.	S. Lemon / Gould
Submarine Hydrodymanics	R. F. Hoglund / ORI
Lunch: DARPA Sub Technology	R. Moore / DARPA

Combat System Information Management

Overview	R. Chapman / NUSC
BSY-2 Architecture	F. DeBritz / GE
Expert System Applications	G. Korzeniewski/PDI
Neural Proc./Acoustic Data	D. Alspach / Orincon
Automatic Detection Techniques	
Combat Doctrine & Decision Sys.	J. Gersh / APL
Adaptive Data Processing	A. M. Vural / GE

Dinner - Dr. Graham / President's Science Advisor

2 June 1988

Offboard Systems Technology

Overview (Chairman)	H. Talkington / NOSC
Perf. of ROV/AUV Systems	W. Grabowski / APL
Power and Propulsion	R. Cauchon / Gould
Underwater Communications and Data Links	R. Cyr / Sonatech
Navigation and Controls	W. McFarland / Draper
Materials and Structures	B. Hayes/Martin Marietta
Sensors and Processing	G. Bane / Rockwell
Fiber Optics	S. Cowen / NOSC

Coordinated Operations

Overview	R. Hunt / APL
Data Fusion to Support Surveillance Cueing	F. White / NOSC
Advanced Communications	W. Rigdon/J. Schwell /NOSC
Blue-Green Laser Communications	P. Titterton/GTE
Active Sonar Bistatics	R. Williams / OAS
LR ASW Cruise Missile	M. Roth / APL
Summary and Questions	VADM B. Kauderer

Dick Thompson, APL Submarine Technology Dept. took charge of all the administrative and logistic aspects of the Symposium -- invitations, responses, security, housing, transportation, two luncheons and a banquet. All is on track and running like a well-oiled machine.

In a major coup, Dr. William R. Graham, Science Advisor to the President and Director, Office of Science and Technology, Office of the President, has accepted our invitaion to be the principal speaker at the banquet. Mr. Robert A. Moore, Deputy Director Systems and Technology, Defense Advanced Research Projects Agency, will be our speaker at the luncheon on 1 June.

In summary, this first ever Symposium promises to be a professional event of which the Naval Submarine League can be extremely proud.

B. M. Kauderer
General Chairman

BOOK REVIEW

SUB COMMANDER

by Richard G. Sheffield, Computer Publications ABC: Greensboro, NC 165 pp.

The primary purpose of Sheffield's book is to teach his readers tactics and strategy for the WW II submarine computer simulation games presently on the market. A second purpose is to show how actual WW II attacks by successful skippers employed these tactics. The author has obviously researched WW II war patrol reports extensively and he presents a short reading list which will certainly be a help to ambitious computer game players who want to learn more about WW II submarining while they are learning how to "beat" the game program.

Old WW II submariners will find many errors which may amuse or anger them, but they must remember the purpose of the book and excuse the author, who is only interpreting what he has read. There are exciting excerpts from war patrol reports of such stalwarts as Red Ramage, Dick O'Kane, Dave White and Red Coe which make the book more interesting and provide authenticity to those readers who don't examine them too closely. If you are playing any of the four computer games presently on the market, the book is probably well worth reading. In any case, it is well written and won't bore you. However, the most valuable contribution of the book to submariners, old and new, is its delineation of how the computer simulation works, the assumptions which are cranked into the problem model and how the player can beat them.

During my last three years on active duty (1962-65) I was a member of the Weapons Systems Evaluation Group in DOD. During that period WSEG war-gamed very many different submarine actions against a wide variety of targets and counter action in much the same way as today's computer war games. The situations were aimed at future warfare and ranged from the prosaic to the wildly imaginative. Authenticity was provided by a team of very capable systems analysts provided by the Institute of Defense Analysis on contract from OSD. We had ready access to information of the highest classification and the latest computational techniques. The results came out in the form of thick reports which were summarized for the "Top Brass" in a series of curves giving the probability of success in the situations simulated.

Although the computer works in nano-seconds, the preparation of a simulation model to put into the computer is a laborious process. At every stage of the conflict the probability of success on both sides is affected by many factors each of which reacts upon the other. The assignment of these detailed, internal probabilities becomes highly subjective and is a matter of dispute among the war-gaming officers (who often have preconceptions of the result) and with the analyst. The result is compromise and the thick reports are full of cautionary statements that the results are significant only under the assumed conditions. If one reads them carefully they are of great value. If you only look at the curves you may be misled. The output is mathematically precise, the input, however, is largely subjective.

An example of this difficulty is portrayed in the account of the first attack Red Coe made on SKIPJACK. Red had come from two successful patrols on the S-39 shooting straight shots with MK 10 torpedoes using the MK-6 Angle Solver, the "banjo." On this attack he decided to use the same tactics ignoring the TDC. Remember, in SKIPJACK the TDC was not in the conning tower. So the Captain was working the problem in the conning tower on the banjo and the rest of the fire control party was working it in the control room on the TDC. Red misjudged his speed and when he took a look he was too close to wait for the banjo solution. Changing a banjo solution for an angle shot at close range with a high bearing rate is an impossible task. But the TDC in the control room was grinding away and had a solution. Red fired at 650 yards, 300 off the track with a 50° right gyro on a 20° track. (Sheffield considers this to be the first "down the throat" shot. Red wouldn't have called it that.) He got one hit and the target broke in two. At the time of the explosion, the second fish aimed at the MOT had run 20 seconds or about 500 yards. Since it hit amidships, it looked like a perfect solution and Red was right in being impressed by his "magic box."

The attack occurred in May 1942 and the troubles at the time with the MK 14 torpedo have been widely publicized. What is not so widely known is that the torpedo advance and transfer curves used for input into the TDC were also defective. On a 50° right-gyro, the fish should not have gone where the TDC thought it was. But it sank the target and that's what counts in war.

I had great admiration for Jim Coe and I wanted to be his second when he took the CISCO out in 1943. That job went to Gus Weinel, the number one man in the class of 1936. Red's luck ran out and CISCO was lost on her first patrol. All the guts and brains in the world won't do it all the time.

Old Submariners will be amused to learn that in playing the computer game "Up Periscope," if one outwits the program, hits the reset button at the right time and then escapes the escorts by shifting to the large scale chart, he can become an "Admiral." The submarine admiral in WW II had a tough job. He had to pick submarine skippers based on: war patrol reports which were self serving; enemy reports and intelligence which were worse; and dockside gossip among the officers which was worst of all. That the admirals managed so well is a tribute to their wisdom and intuition.

The distinguished historian, Arnold Toynbee in "A Study of History" described the dilemma admirably in a short paragraph which I have treasured for years:

> "There is one thing which must remain an unknown quantity to the best-informed onlooker because it is beyond the knowledge of the combatants, or players themselves; and it is the most important term in the equation which the would-be calculator has to solve. This unknown quantity is the reaction of the actors to the ordeal when it actually comes. These psychological moments, which are inherently impossible to weigh and measure and therefore to estimate scientifically in advance, are the very forces which actually decide the issue when the encounter takes place. And that is why the very greatest military geniuses have admitted an incalculable element in their successes. If religious, they have attributed their victories to God, like Cromwell; if merely superstitious, to the ascendancy of their 'star,' like Napoleon."

Frank Walker, Jr.

IN REMEMBRANCE

CAPT ALAN B. CRABTREE, USN(RET.)
VADM RALPH W. CHRISTIE, USN(RET.)
CAPT DOMINIC PAOLUCCI, USN(RET.)

SUBMARINE RELATED VIDEO CASSETTES

Members of the LEAGUE having good quality VHS cassettes which they wish to share with the general membership are encouraged to make the cassette available to LEAGUE headquarters for a brief period; your cassette will be copied one time and returned. Copies will then become available on request.

ABOUT MEMBERS

THE MEMBER is the most important person in our organization.

THE MEMBER is not an interruption of our work -- they are the purpose of it.

THE MEMBER does us a favor when they call.

THE MEMBER is not a cold statistic -- they are human beings with feelings and emotions like our own.

THE MEMBER is not someone to argue or match wits with.

THE MEMBER is deserving of the most courteous and attentive treatment we can give them.

THE MEMBER is not dependent on us -- we are dependent on them.

THE MEMBER is the life blood of the NAVAL SUBMARINE LEAGUE

NAVAL SUBMARINE LEAGUE
HONOR ROLL

BENEFACTORS

ADVANCED TECHNOLOGY
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NSL FACT BOOK

A revised edition of the NSL FACT BOOK is currently under preparation. The first edition was warmly received by the membership as a useful and informative reference document. We hope to make the second edition even more valuable. Any suggestions in regard to content or format are desired. In addition, new material that you feel should be included will be welcomed. We intend to wrap up the revision on 1 September 1988 and mail to our members in November. Send comments or material to the NSL, Box 1146, Annandale, VA 22003. We would appreciate any help and assistance and welcome volunteers to serve on the FACT BOOK Committee.

Jimmie Jones
NSL FACT BOOK Chairman

PIGGYBACK REUNION
at the 1988 Symposium

USS STICKLEBACK (SS-415)
8 June 1988
Contact Bill Greenlaw, 476 Lymington Rd.
Severna Park, MD 21146
(301) 544-3514

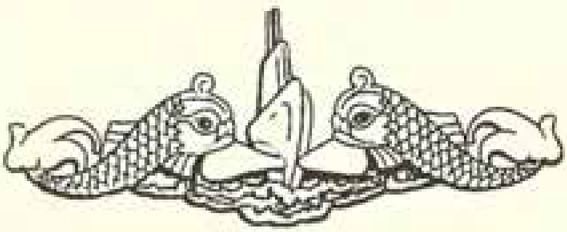
IN REMEMBRANCE

CAPT WILLIAM H. PURDUM, USN(RET.)

An early NSL sponsor

A person who touched people's lives in the finest sense.

A PROFESSIONAL OFFICER AND GENTLEMAN



MEMBERSHIP STATUS

	Current	Last REVIEW	Year ago
Active Duty	914	898	823
Others	2643	2591	2360
Life	134	128	114
Student	25	25	17
Foreign	34	30	23
Honorary	11	12	0
Total	3761	3684	3337

HAVE YOU GOTTEN 2 NEW MEMBERS FOR 1988?

Circulation of this issue exceeds 5750

UNDERWAY ON NUCLEAR POWER

The NSL has obtained VHS and 16 MM copies of the educational film "Underway on Nuclear Power." This 22 minute production centers about the nuclear trained engineers that operate the Navy submarine and surface ships. A good description of each type of ship, its mission and capabilities is provided. William Shatner of "Star Trek" describes the Navy's Nuclear Power Program and the nuclear powered ships. An excellent aid for introduction of the modern Navy to all audiences. Copies of the VHS tapes have been provided to each Chapter. Loaner VHS and the 16 MM film are also available by calling Pat at NSL -- (703) 256-0891.

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THE DATES FOR THE 1988
SIXTH ANNUAL SYMPOSIUM

are

JUNE 8-9, 1988

at the

RADISSON MARK
PLAZA HOTEL
Alexandria, Virginia

MARK YOUR CALENDARS AND
SAVE THESE DATES!

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

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

A $100.00 stipend will be paid for each major article published to help offset the authors cost for paper, pen and typing. Annually, three articles are selected for special recognition and an honorarium of up to $400.00 will be awarded to the authors. 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.

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

NAVAL SUBMARINE LEAGUE