

NO FREE LUNCH

By Admiral Carlisle A. H. Trost

Admiral Carlisle A. H. Trost, Chief of Naval Operations, recently addressed the Submarine Technology Symposium at APL.* The symposium was dedicated to examination of advanced technologies to support potential future missions for submarines. The admiral's message is wide-ranging, visionary, and realistic. It deals with future trends for Navy missions, potential roles of submarines relative to other elements of the Navy, new technologies of primary importance, and the role of industry in developing and introducing technology into the fleet.

J. R. Austin[†]

These days you are hearing a lot about new technologies and new roles and missions for submarines. If an outsider attended this symposium, he might leave thinking that submarines alone are the answer to every naval warfighting mission and problem. After all, it seems that submarines enjoy the best of all worlds. They can roam the oceans at will—undetected. They can seek out and destroy their own kind—the enemy submarine. They can wreak havoc with ships on the surface—warships and merchant ships alike. They can alter the complexion of the battle ashore by striking at an army's rear echelons a thousand miles inland with precision guided land-attack missiles. In the future, the technologies discussed here may permit a submarine to turn the tide in the battle for air superiority by denying enemy aircraft the use of the skies. They may be able to disrupt the enemy command and control network by destroying orbiting satellites, while simultaneously reconstituting our own satellites. Some say that we could even have submarines launching and recovering manned and unmanned aircraft for both reconnaissance and strike.

It all sounds great but, unfortunately, there is no free lunch. The technology and capability, in some instances, are available today—in others, they may be available in the future to accomplish these missions. The major questions are: Does it fit into our plan for the Navy, and, if not, what do we give up in return?

I want to discuss a few of what I consider to be the more promising new mission areas that submarines can undertake and the technologies we need to support them. Up front you must always keep in mind that the submarine's primary advantage, the very reason for its conception, is its ability to operate covertly. As we look at new and oft-times imaginative roles for submarines, we need to make sure that the benefit outweighs any subsequent loss of covertness. We also need to maintain a clear picture of which new roles would serve to complement, not necessarily replace, other arms of the Navy.

For example, it is difficult to imagine any new technology that would allow a submarine to control the airspace out to the ranges we require or, dollar for dollar, match the tactical air and naval gunfire's ability to put a lot of ordnance on a target.

But even before we look at new mission areas, there are things we can do to improve the capability of our submarines to accomplish their primary mission, anti-submarine warfare (ASW), which will remain the submarine's primary mission.

The ASW problem is getting much more difficult. The sea environment is growing more opaque, not less. I do not foresee any technology that is going to suddenly make the submarine easier to locate. Our principal threat today remains the Soviet Union. In the last ten years, the Soviets have stolen, bought, and developed on their own the technology to field very fast, big, heavily armed, and now increasingly quiet submarines. Other countries are developing and fielding a wide range of capable, conventionally powered submarines that, if sold to or developed by a potential adversary, can pose a threat to all ocean commerce. From the submariner's perspective, what can we do to improve ourselves in ASW?

As with most warships, a lot of space, weight, and expense is consumed in just getting the weapons and sensors to the battlefield. As marvelous as the U.S. submarines' reactors and propulsion plants are, if we could reduce their size and improve their efficiency there would be more room for additional warfare-related equipment and weapons. We would benefit from smaller and, if possible, more powerful propulsion systems. The use of high-temperature superconductive technology and composite materials may make this possible. Think of the space savings, not to mention the potential increase in quieting, that can be realized if we can do away with massive reduction gears and long propeller shafts and replace them with an electric drive configuration. Combine this with magnetic bearings on the electric motors and drive shafts, and we've got a lot of new capability. The natural follow-on to this is the exploitation of technology that would allow us to eliminate the steam turbine and condenser altogether and directly convert the thermal energy from the reactor into electric energy. We

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[†]Supervisor, Submarine Technology Department, APL.

may be able to do all this to improve our capability and not sacrifice, but instead improve, our inherent stealth.

We could also be better at finding and killing other submarines by increasing the overall effectiveness of acoustic sensors and processors. With the introduction of the AN/BSY-1 in the *San Juan* and subsequent SSN-688(D)-class ships, we've taken a big step in that direction, and the BSY-2 system being developed for the SSN-21 will be an even greater advance. We should not stop here in acoustic processing. The incorporation of fiber optics, very high speed integrated circuits, new computer concepts, and high-definition television technology into existing and follow-on combat systems can significantly improve our ability to detect and identify an acoustic energy source. Soviet quieting efforts have been very successful, and the new generation of Soviet conventional submarines is silent and has long legs. There are places in the ocean where ambient noise can mask the presence of any submarine; however, there is still time and room to exploit this diminishing but still visible window of acoustic vulnerability.

And of course there's plenty of room for improving our current ASW weapons by incorporating much of the same technology. Faster detection and classification, combined with improved propulsion, will yield faster, deeper, more lethal, and perhaps even stealth torpedoes to match the increasing threat.

Those are just a few thoughts on the submarine's primary mission. Now, what about the new missions and the technologies to go with them? Because of its inherent survivability, a submarine can be an active participant in all three warfare dimensions—four, if we separate space from air warfare. This would certainly expand a fleet commander's range of options and equally complicate the enemy's problem.

Let's look at strike warfare and long-range anti-shiping capability. We've already made inroads into incorporating this into our attack submarines, with vertical launch tubes and the Tomahawk and Harpoon cruise missiles. Improvements here are dependent upon, first, better and more capable missiles, and second, connectivity of the submarine with the rest of the force. Right now there are no technological limitations on our improvements in cruise missiles. We are taking full advantage of improved circuitry for guidance, better and more efficient engines for longer range, and aerodynamic improvements for maneuverability and radar stealth.

But the connectivity (in command, control, and communications) is a problem, and it is not limited to a submarine's expanded role in strike warfare. Improved connectivity will be required for all new submarine missions, as well as to enhance its capability in ASW.

What can we do to improve connectivity? First, connectivity is inexorably linked to communications, and today that means two-way communications. If we are going to have submarines emerge from the classic self-contained engagement into the spheres of multidimensional warfare, they are going to have to have a real-time battle-management picture. They are going to need reliable, secure, and covert communications with other

forces. Let me emphasize that the communications must not be vulnerable to intercept. High-rate laser data exchange with satellite links is certainly a promising prospect. A wideband submerged communication system could go a long way to solving the connectivity problem.

Second, as with long-range engagements from all platforms, finding your target in the fog of war is a problem, a problem certainly not limited to submarine engagements. The use of remotely piloted vehicles (RPV's) is one answer. The surface Navy is making inroads in this technology and deploying RPV's on long-range Tomahawk shooters. From the submariner's perspective, an RPV could be an in-house capability, providing the shooter real-time TV, IR, radar, or ESM (electronic surveillance measure) information. Remotely piloted vehicles can provide post-engagement battle-damage assessment that is essential to preserve limited weapons. The submarine could either have its own tube-launched RPV or passively exploit the data from other units' RPV's in a cooperative engagement scenario. There are a lot of possibilities.

In anti-air warfare (AAW) and space warfare, the limits of imagination are the only limits on possibilities. Submarines could positively influence the outer-air battle or even intercept bogeys as they took off from inland runways, if they were equipped with subsurface-to-air missiles and had the total battle-management picture.

In space, the submarine's missions might include reconstituting surveillance and communication satellites. On the offensive side, a submarine could play a decisive role in anti-satellite warfare by deploying with a magazine of ASAT (anti-satellite) missiles. Again, in space and AAW, the submarine's effectiveness would be a function of connectivity.

There are a lot of possibilities, and my list certainly contains just a few. But back to my original premise on no free lunch. We must also consider the trade-offs.

First, new missions could effectively limit, if not completely preclude, the submarine's participation in its primary mission, ASW. Valuable magazine space, previously occupied by torpedoes, might be filled with SAM's (surface-to-air missiles), SSM's (surface-to-surface missiles), ASAT's, or RPV's, and a submarine actively involved in three-dimensional warfare no longer can devote the time and maneuver required to effectively prosecute other submarines.

Second, and most important, any new mission is going to relinquish some margin of stealth and thereby reduce the submarine's survivability. ASAT or SAM launches could be dead giveaways. Intercepted two-way communications can quickly be correlated to a position. The launch, recovery, and even control of an RPV could signal the presence of a submarine attempting to remain covert.

As we discuss and evaluate new mission possibilities, we must continually reassess the trade-off and determine if it is worth it. Concurrently, we must constantly balance the need for redirecting our limited submarine assets to other missions. Again, the submarine threat from the Soviets alone could preoccupy most of our force in time of war. In the last two decades, we have planned

and achieved a balanced force structure that permits us to meet the broad range of threats to our global national security interests. One military community or weapon system may not be an effective or affordable replacement for another, but rather, they can and should synergistically enhance each other.

The face of warfare is changing because of these new technologies, and we should not hesitate to explore the possibilities. There is a lot that private industry can do to improve our capability for those missions where we determine the trade-off to be acceptable. Many of these technologies are certainly not limited to military application, but have broad commercial applications. It is to our nation's benefit that our industry remain in the forefront of pioneer efforts in superconductivity, lasers, high-speed circuitry, computer design, composites, and others. Industry needs to take the risk and stay ahead of the rest of the world.

We can do much to shorten the time from laboratory to fleet introduction. Technology is moving so fast today that there is a tendency to keep bright ideas in the lab, just to see what the next discovery will be. Sound judgments need to be made to push the most promising technologies out the door and onto our ships. Unfortunately, we are in a period of very tight fiscal constraint, so we can't have everything we want. This too must be factored into the decision process.

You, the technical community, can help in our efforts. Stay alert and don't be bashful. Go for what you believe can continue to give the United States the edge—

not only in submarine warfare, but all theaters of warfare and technologies.

THE AUTHOR



ADMIRAL CARLISLE A. H. TROST began his career by graduating first in the Class of 1953 at the U.S. Naval Academy. During the next 12 years, he served as a submariner, as an Olmstead scholar at the University of Freiburg, and as executive officer on nuclear-powered attack and ballistic submarines. In 1965, he reported as Military Assistant to the Deputy Secretary of Defense. In 1968, he took command of USS *Sam Rayburn* (SSBN 635), but soon returned to Washington as Executive Assistant and Naval Aide to the Under Secretary of the Navy. In 1973, he was selected to flag rank

and assumed command of Submarine Flotilla One in San Diego. After promotion to Vice Admiral in 1978, he served as Deputy Commander in Chief of the U.S. Pacific Fleet, and in 1980 assumed command of the U.S. Seventh Fleet. After service as Director of Navy Program Planning, he was promoted to Admiral and became Commander in Chief of the U.S. Atlantic Command, until his appointment as the twenty-third Chief of Naval Operations in 1986. Admiral Trost has received numerous national and foreign decorations, including two Distinguished Service Medals, three Legions of Merit, and Japan's Order of the Rising Sun.