



# Undersea Warfighting



July 2011

## Undersea Warfighting



The Navy's undersea warfighters bring a set of tools and capabilities to U.S. national security that are unique and indispensable. Enabled by stealth, surprise and boldness, undersea forces provide military impact and deterrent influence that is far out of proportion to their size and quantity. When our lethal and undetected undersea force operates in concert with the visible and intimidating power of carrier strike groups and the expeditionary capacity of the Marine Corps, the Navy-Marine Corps team provides a formidable, flexible and daunting conventional power projection force.

The role played by the undersea forces on this team is centered upon the military advantages provided by undersea concealment. Whether the water is deep, cold and empty arctic waters or shallow, warm and crowded tropical waters; whether it is peacetime or wartime; whether it is calm or stormy -- virtually everything our undersea forces do is to exploit concealment to enhance deterrence or warfighting capability. This concealment enables a wide variety of undetected operations, permits the penetration of enemy defenses, allows attacks to be conducted with surprise at the time and place of our choosing, promotes survivability and creates uncertainty and ambiguity that greatly complicate enemy planning and operations. But none of these advantages or attributes can be achieved without the tireless efforts of smart, audacious warriors. Our undersea forces must be manned by a cadre of undersea professionals with special technical and military expertise, skill at employing stealth, self-sufficiency, initiative, a penchant for tactical innovation and aggressive warfighting tenacity. These bold undersea warriors ensure that our exceptional undersea forces are ready to fight on short notice, can gain non-provocative early access far forward, exploit the full undersea maneuver space, seize the initiative with offensive action, and quickly adapt to changing situations including the dynamic chaos of war.

As undersea warriors, it is important that we understand the nature of this unique role we play, and the importance it has for the security of our Nation. Although the technologies, the adversaries and the locations have varied over history, the fundamental military purpose of our undersea forces has remained constant: *to leverage the concealment of the undersea environment to provide military advantages for the United States*. The skill set of the undersea professionals that deliver this military advantage is likewise unchanging. The purpose of Undersea Warfighting is to provide our undersea warriors with a shared professional foundation and perspective that will serve as a common bedrock upon which we build training, exercises and peacetime operations. This robust foundation will enable a smooth transition from peace to war should that be necessary. And to minimize the chance that such a war should be necessary, this foundation will help ensure that there is no question in the mind of any potential adversary about the lethality, survivability and effectiveness of U.S. undersea forces.

<p><b>Our <u>undersea warriors</u> are professionals characterized by:</b></p> <ul style="list-style-type: none"> <li>-- Technical ingenuity &amp; integrity</li> <li>-- Military expertise</li> <li>-- Skill at exploiting stealth</li> <li>-- Self sufficiency</li> <li>-- Initiative</li> <li>-- Tactical creativity</li> <li>-- Aggressive tenacity</li> </ul>	<p><b>Our <u>undersea systems</u> exploit the advantages provided by undersea concealment:</b></p> <ul style="list-style-type: none"> <li>-- Undersea domain reach</li> <li>-- Undetected operations</li> <li>-- Penetration of adversary defenses</li> <li>-- Surprise</li> <li>-- Survivability</li> <li>-- Ambiguity and uncertainty</li> </ul>	<p><b>Our <u>undersea forces</u> support their role in national security by demonstrating :</b></p> <ul style="list-style-type: none"> <li>-- Sustained readiness to fight</li> <li>-- Non-provocative early access far forward</li> <li>-- Full exploitation of the undersea maneuver space</li> <li>-- Ability to engage at the time/place of our choosing</li> <li>-- Emphasis on offensive firepower</li> <li>-- Adaptability to changing situations</li> <li>-- Ability to exploit chaos and confusion</li> </ul>
--	--	--

## Part 1

### The Necessary Attributes of U.S. Undersea Warriors

*Success in undersea warfare is dependent upon the skilled employment of technically complex machinery in an environment that is both physically and militarily hostile. Although the Joint Force leadership integrates the effects of undersea warfare with the broader efforts of the U.S. armed force, it is inescapable that undersea warfare is a type of solitary warfare that must by its very nature be conducted with little or no external support. Undersea combat requires a special breed of warrior who is technically and militarily expert, stealthy, self-sufficient, ready to exercise initiative, creative and aggressively tenacious.*

Undersea warfare, first and foremost, is about the undersea warrior. It is not enough for the U.S. Navy to equip itself with fast, quiet nuclear-powered submarines with superb endurance and offensive capacity and sophisticated payloads and off-board vehicles and systems. In addition, the Navy must be manned by undersea warriors with the proper attributes and training to make the best possible military use of these expensive and capable assets. In order for us to sustain the kind of attributes we need as a force to be effective, it is necessary to have undersea warriors with a special set of attributes. The U.S. Navy requires a professional cadre of undersea warriors who are characterized by:

- Technical ingenuity and integrity
- Military expertise
- Skill at exploiting stealth
- Self-sufficiency
- Initiative
- Tactical creativity
- Aggressive tenacity

Developing undersea warriors with these skills is a continuous process that begins with recruiting the highest quality personnel, providing them with the right training and operational experience and then steeling their leadership in the crucible of combat. This skill set is one that we practice during day-to-day operations in peacetime so that we will be prepared in wartime. Initiative does not suddenly show up in combat if it has not been nurtured and rewarded in peacetime. Self-sufficiency cannot be magically acquired during warfare – it is practiced routinely, so that operators gain a full appreciation for their capabilities. Innovation and creativity are expected in exercises and in routine operations so that we are confident that we will be able to innovate during war patrols.

#### Technical Ingenuity and Integrity

Undersea warfare platforms and systems are machines, and there is no possibility for success in undersea warfare if the machines and technical systems are not safely

operated and do not reliably perform as designed. Like aviation, undersea warfare is totally dependent on the satisfactory performance of the equipment that carries us into harm's way. Undersea warriors know that machines exact their own punishment for those who do not practice the necessary discipline in maintaining and operating equipment properly – that punishment may show up today or it may show up tomorrow, but poor maintenance will lead to trouble. Indeed, the failure to properly maintain equipment today may not result in an immediately observable impact, but it could lead to the premature failure of the equipment years down the road when some future warrior is depending on that equipment in wartime.

Undersea warriors then, first and foremost, are competent and disciplined operators and maintainers of their equipment. We know that achieving this level of excellence requires careful training and qualification and then adherence to rigorous standards of performance on the ship. We also know that this technical expertise is the *essential foundation* for warfighting effectiveness. It teaches us the limits of our equipment and gives us experience with designed-in redundancy and reliability enhancements.

It is easy to see how technical expertise applies to systems such as sonar, atmosphere control, torpedo and missile tubes, fire-control and propulsion.. But the need for technical expertise also applies to other areas that are not as obvious. The warfighting effectiveness of a submarine can also be quickly undermined by spare parts that are missing due to poor storekeeping, by food-borne illness due to poor sanitation, by injuries sustained underway due to unsafe work practices, or by a rattle in the sail due to a lost tool. The need for technical expertise in the performance of duty extends across all parts of a submarine crew and across all parts of the undersea force.

Just as technical expertise is at the core of avoiding material problems, it is also at the core of damage control. Practicing back-up modes of operation and exercising manual control of systems normally operated automatically are essential parts of building our technical expertise foundation. Drills to test teamwork and organized response have been an essential element of our success. Aggressive drilling and the careful collection of lessons-learned has been practiced within our best crews and institutionalized in the submarine force since before World War II. Our accumulation of best practices as a force over the decades has been one of our greatest strengths.

The hostility of the undersea environment places special demands on the character and integrity of undersea warriors. The safety of the entire crew often depends upon the word of an individual. Safely operating deep underwater in a complex machine with high-pressure fluids, nuclear power, lethal voltages, and high explosives requires a shared

culture of integrity, personal responsibility, teamwork and interdependence. Generations of submariners have passed these lessons down to us and we work hard to pass them along to each new undersea warrior. These ideas are a part of who we are – they are part of our undersea DNA.

### **Military expertise**

In addition to this essential technical foundation, undersea warriors have a firm foundation in the military practice of undersea warfare. This warfighting base includes a solid historical appreciation for what has been done in the past and how that heritage continues to impact the way we operate today. This historical underpinning includes an appreciation for how undersea forces have been used by other navies as well as our own and serves as a starting point for anticipating the potential military application of undersea forces in the future.

There are many aspects of modern warfare that have become highly automated in the computer age. On an Aegis-equipped warship, for instance, radars and sophisticated fire control and weapons systems can detect, track and intercept multiple aircraft automatically if desired. Undersea warfare, however, though highly supported by complex computer systems, continues to be fought in the battlespace of the human mind. The opaque nature of the undersea environment, the distortion of sound paths, the presence of interference and the active efforts of adversaries to confuse and deceive combine to place tremendous demands on the expertise of the undersea warrior. As we will discuss more in a later section, the ambiguity and uncertainty of the undersea are fundamental contributors to this.

Undersea forces often operate far forward without the support of other friendly forces. This means that undersea forces are often the only available asset in the area. As a result, since the First World War, submarines have been asked to exploit their solitary access to conduct a wide variety of military operations in those forward areas. Each of these categories of warfare has its own relevant military elements. Our submarine crews are small, with one half to one quarter the number of Sailors per ton of ship as our typical surface warships. The small crew on a submarine must be capable of performing each of the several different missions, such as anti-submarine warfare, anti-surface warfare, strike warfare, special operations forces support, information operations, intelligence collection or mine warfare. Often these separate operations must be conducted at the same time.

An essential part of the military application of undersea forces is an understanding of the geography of key hot spots throughout the world. These crossroads have shown up again and again as critical battlefields throughout history. There are certain attributes of these locations that impose key constraints on warriors. This is particularly true of undersea warriors, who operate in a manner that takes full advantage of the “three dimensional” undersea volume.

That certain places show up repeatedly in naval history is driven by the steady nature commercial shipping routes, trade centers, and choke-points. Undersea warriors must have a firm grasp of the constraints imposed on other platforms so that they can best exploit the available geography. Even with the advanced systems we have today, the implications of geography are timeless and a firm understanding of their character is critical for the undersea warrior.

### **Skill at Exploiting Stealth and Pressing the Attack**

Submarines operate in an environment of data-starvation rather than data overload. Fragments of information are examined carefully to extract the most possible meaning from them. Most critically, our undersea forces are routinely operated in a manner that refines and sharpens the ability of the warriors onboard to appreciate the degree of stealth that they have available to them. Stealth is an un-measurable effect that results from the interaction of a platform and a sensor, each operated by human beings, in a variable environment made up of natural and man-made effects. There is no “stealth meter” that glows yellow when risk gets high and red when our submarines are being counter-detected. Undersea warriors know that the only sensor for stealth is in the brain and guts of the warriors on the submarine. Our operating experience has proven that it is essential to carefully calibrate this “stealth judgment” of undersea warriors during peacetime so that it can carry over to wartime.

Prior to World War II our submariners were taught using canned exercises that were stacked in favor of the attackers, and as a result they mistakenly learned that they needed to take extreme stealth precautions in order to survive. They learned to make it standard practice to transit submerged during daylight, to conduct daytime attacks using sonar data from deep depths without aid from a periscope, and to minimize time on the surface. Transits were slow and time on station was reduced. Torpedo attack accuracy was very low. Too many Commanding Officers were not aggressive. At the start of World War II the average war patrol was conducted by a Commanding Officer with 15.7 years of service and by the end of the war, the average CO had 9.8 years of service, of which 3.5 years were in combat.

The unrealistic peacetime exercises had calibrated many of the first generation COs’ internal “stealth meter” to be very sensitive and this limited their aggressiveness and success. Of the 465 submarine COs who served during World War II, it was the top performing 15 percent who accounted for more than half of the ships sunk. Out of these 70 COs, only four were killed in action (Morton, Dealey, MacMillan and Gilmore) and only four of their ships were lost while they

were in command (*Wahoo*, *Harder*, *Thresher* and *Tang*).<sup>1</sup> This means the most successful COs and their crews as a group had a much higher survival rate than the submarine force as a whole. The submarines under the most successful 15 percent COs were three times as likely to return safely from patrol as were the submarines under the other 85 percent. Competence in pressing home the attack tended to co-exist with competence in surviving to return home again.

Today's undersea warriors make themselves ready for wartime operations by practice during peacetime that teaches the right lessons and rewards the right behaviors. Among the skills practiced are the exercise of stealth and deception. Stealth is about more than having a quiet ship. It includes operating that ship in the manner most appropriate to the mission so as to extract the most value for the smallest risk. Stealth is about more than being resistant to detection. Stealth is also about not being recognized or classified even in the event one is detected. Stealth is about exploiting techniques that prevent localization even if one is detected and classified. Undersea warriors work to ensure that all of these tools are in their toolkit because wartime may require the ship to take risks that result in detection, and the survivability of the platform will depend on the degree to which a crew leverages other tools that remain available even after detection.

Consider the example of a Marine sniper. A sniper in a camouflage ghillie suit is not *undetectable*. Indeed, in many cases the stealth of a sniper is not a function of avoiding detection, it is about avoiding *classification*. Sometimes when new snipers are entering training, the trainees are surprised when they are taken into the field and find that the "bush" that they have been next to for a half hour is actually a lethal marksman. Undersea warriors have the same appreciation for the layers of stealth available to them and the same skill and expertise at exploiting each of those layers.

During the First World War, the United Kingdom conducted an amphibious assault at Gallipoli in an attempt to break through to the Black Sea and Russia, thereby dividing the Ottoman Empire in Asia from the rest of the Axis in Europe. To aid in the defense of the forces at Gallipoli, submarines penetrated into the Sea of Marmara to operate against Turkish shipping, including the port of Constantinople at the eastern end of the Sea. These operations, undertaken during the first 20 years of submarine development and part of the first ever combat employment of these platforms, included a full range of operations: minefield penetration through a choke point, shore bombardment, swimmer attack with explosives on land facilities and rail lines, torpedo attacks on ships, the insertion and extraction of agents and the classic submarine mission of surveillance and reporting. Even at this

---

<sup>1</sup> The four COs do not match the four ships because Gilmore was killed in action by gunfire but the *Growler* was not lost and O'Kane was not killed in action although the *Tang* was lost to a circular run of its very last torpedo. O'Kane was on the bridge and survived the war in a Prisoner of War camp. See Blair, *Silent Victory* appendices.

early stage, submariners understood instinctively how to exploit their stealth. In a classic illustration that shows how effectively stealth can be used, submariners deployed artificial broomstick buoys to act as fake periscopes. These would draw the attention of Turkish destroyers, which would maneuver to ram the vulnerable "submarine," and thereby stumble unwittingly into a trap by creating a perfect broadside set-up for the lurking real submarine, ready with a torpedo attack. The creativity, innovation and cunning of deception and attack are at the heart of our undersea warrior training.

### Self-sufficiency

Because the nature of U.S. submarine operations will require extended operation far forward, it is axiomatic that undersea forces are self-sufficient and that the warriors that operate them must be capable of making due with what they have. Self-sufficiency is really as much about careful preparation as it is about creative repair work with limited supplies. The thoroughness with which the storekeepers stock the lockers is as much a factor in the endurance of the platform as the skill of the machinist with a lathe or the electronics technician with a solder gun. Likewise, routine proper maintenance will result in fewer maintenance challenges and go a long way to creating a force more capable of conducting its scheduled operations without the need for unscheduled external support.

Undersea warriors know that every stop in a port provides the enemy with a datum point to fill in his intelligence awareness. Every stop for maintenance requires a block of time away from the mission. Every period of time with a system down is a period of time with reduced redundancy and reliability, forcing the ship to take greater risk. There are military implications for unplanned schedule changes and the need for unplanned external support. These implications apply during peacetime as well as wartime. Avoiding unplanned maintenance port visits complicates the enemy's intelligence picture. The ability to execute the planned schedule during local operations is important to enabling other assets to stick to their plans. All experienced submariners know the challenge of revising a schedule at the last minute due to a materiel problem on another platform. Reduced time to prepare means less effective inport maintenance time, increased chances of the exercise being disrupted, and forfeiture of precious underway training time. It is an essential skill of undersea warriors that they be self-sufficient: they must minimize the occurrence of problems by sound maintenance and operational practices and they must practice their ability to repair those material problems that do occur with minimum disruption to operational schedules.

### Readiness to seize the initiative

Undersea warfare, by its nature, is fought far forward and with limited connectivity. In addition, undersea warriors often have access to insights about the posture, location and nature of forces that are not available to

commanders in the rear. It is essential that undersea commanders understand that they have the latitude to exercise judgment and act based upon independent knowledge gained while operating far forward. As a result, flag leadership relies upon defining priorities and a “commander’s intent” and then depends upon the initiative and judgment of the on-scene undersea commander to do the right thing. This latitude enables submarine commanding officers to make dynamic decisions during rapidly changing chaotic situations to best accomplish the intent of the overall commander.

The development of confidence in these on-scene undersea commanders is critical to the overall capability of U.S. undersea forces to deliver the effects expected. Initiative is practiced and expected during exercises and peacetime operations, and it is expected of junior personnel within the crew as they grow in seniority and maturity. Submariners are well known for pushing initiative down the chain of command. Like all other skills, the exercise of initiative is practiced and honed to keep it sharp.

There is little room for error in the operation of submarines, particularly in a combat environment. This is why the submarine force has long had a systematic training program leading to qualification in submarines and the awarding of dolphins. In 1924, a few years after aviators introduced wings as a recognizable device, the submarine force introduced a dolphin pin to signify qualification in submarines. Part of this training is recognition of the need for all submariners to have intimate knowledge of their platform and its systems so that they might be able to take the necessary action in any urgent situation that may arise during combat, casualties or routine operations. Submariners are expected to exercise initiative based on a technically sound foundation. Just as submarine commanders must exercise judgment and initiative in operating their ships, so must junior submariners exercise initiative in the conduct of their own actions within the ship. Initiative is a fundamental part of forceful back-up – an essential element of life on a submarine.

A junior helmsman on a submarine – an E4 perhaps – if given an order by the Captain at battle stations to put the rudder over right to reach a course that can be arrived at more expeditiously going left, is likely to notify the Captain that he is going the “long way around.” This gives the skipper an opportunity to correct his order if that was not his intention. A submarine commanding officer welcomes this kind of initiative because it shows that even one of the most junior Sailors on the ship has his head in the game and is thinking. This is the kind of teamwork that results in the best kind of warship, and it is the hallmark of a good submariner.

### **Tactical Creativity and Innovation**

Undersea warriors demonstrate tactical innovation as a habit. It is a recurring element in the history of submarine warfare that actual combat, once undertaken, is always very

different than what was anticipated prior to the start of hostilities. The rules inevitably change. Prior to the attack on Pearl Harbor, American submarines anticipating combat operations would have had to expect to operate under rules that required warnings to any civilian ship prior to attack. Six hours after the attack on Pearl Harbor, COMSUBPAC received the order from the Navy Department “Execute unrestricted air and submarine warfare against Japan.” This required quick adjustment to the operational employment of submarines and to how those submarines would conduct their patrols.

As discussed earlier, submariners anticipated far more capable anti-submarine warfare capabilities than they actually encountered, which led anti-submarine forces to have inappropriately high confidence in their abilities and submariners to have, on the other hand, inappropriately little confidence in their stealth. Winston Churchill described in his history The Second World War how he had been taken to sea in 1938 and shown how effective Asdic (active sonar) was in locating submarines underwater. He commented that he was surprised at the “clarity and force” of the return, as if it were “one of those creatures asking to be destroyed.” He lamented later, “No doubt on this occasion I overrated, as they did, the magnitude of their achievement, and forgot for a moment how broad are the seas.”<sup>2</sup> It is unclear what changes will await those embarking on the next war patrols, but undersea warriors should rest assured that the tactics, the rules and the military situation will be different than they expected, and that they will have to adapt themselves to the change or put themselves and their ships in peril.

Tactical innovation should be practiced on every ship, in every squadron and in every wardroom. The idea of the Ekelund range was born at sea and then confirmed and refined in Submarine School trainers. The idea of rapid torpedo reload during combat rather than after disengaging was developed and practiced by a young torpedo officer on the *Parche* in World War II, and was essential to the success of the ship against a Japanese convoy on July 31 1944. Red Ramage had entered the middle of the convoy at night on the surface and, clearing the bridge or all personnel but himself, shot 19 torpedoes in 48 minutes, in the process making himself the only living submarine Medal of Honor winner up to that time.

“Tactical innovation” is not necessarily confined to combat. In 1972, the *USS Barb* was sortied from Guam on one hour notice into a developing typhoon to make a 300 nm flank speed transit in an attempt to rescue the 8-man crew of a B-52 that had crashed into the ocean shortly after departing Andersen AFB. The heavy seas forced all other ships to clear the area, but *Barb* put together an innovative plan that succeeded in pulling 6 airmen from the 40-foot seas. With only the sail hatch open, *Barb* used men strapped to the fairwater planes and a team of six men below decks as the

---

<sup>2</sup> Winston Churchill, The Second World War, Vol I (Boston: Houghton Mifflin, 1985), p. 147.

“hoist” to pull the exhausted and injured fliers from the sea. A Torpedoman Chief who swam to the first group of lifeboats earned the Navy-Marine Corps Medal for heroism in lifesaving. This kind of creative employment of the systems on a submarine or on other undersea systems will continue to be essential in the future, and undersea warriors must practice it routinely if we are to depend on it.

The need for tactical innovation will grow in the future with the introduction of new undersea technologies, especially unmanned systems. The need for coordination among undersea systems will become increasingly important. Submariners are the Navy’s specialists in “undersea warfare” or warfare from the undersea. It is the responsibility of the submarine community to manage this warfighting area, ensure its completeness, and coordinate the capability set. Just as aviators enforce rules for the prevention of fratricide against aircraft, and surface warriors define the procedures for the mutual protection of surface assets, it is our role as submariners to define the rule set that governs the use of the undersea – to include the prevention of mutual interference, water space management, and the coordination of undersea systems to maximum effect.

Unmanned Undersea Vehicles (UUVs) will be a growing part of U.S. undersea forces, and it will be necessary for that growth to take place smoothly and effectively. For instance, the proliferation of UUVs may necessitate the emergence of a cadre of specialists or alternatively may be accommodated by adding UUV-expertise to the skill set of personnel already in the force. There may be UUV detachments that deploy to host platforms like submarines, ships or shore bases and employ UUVs from the host command. Or UUVs may be an organic part of each ship’s complement of systems. These are some of the challenging issues that undersea warriors will have to confront and solve in the coming years. One thing is sure: it is clear that in the near future, some approach will be necessary to identify and professionally develop a suitably expert group of personnel to employ UUVs and related systems. The undersea warfare cadre that is currently made up of submariners will have to be a part of that team.

### **Aggressive Tenacity**

The concealment of the undersea will likely mean that undersea warfare will continue to involve ordnance exchanges and evasion. The success of the submarine force in the past has been built on a stubborn will to persist with repetitive re-engagements until the job is done or the opportunity is irrevocably past. Mush Morton famously told Dick O’Kane after a long sequence of engagements, “Tenacity Dick. Stay with the bastard till he’s on the bottom.”<sup>3</sup> This attitude of aggressiveness has been essential to effective undersea warfighting. There is an essential advantage to

exploiting the chaos and disorder that follow an initial engagement. Nerves are on edge and Sailors – like all humans – will be more likely to make snap emotional decisions. This urge can be exploited for good.

In general purpose forces, audacity and boldness are constrained by the fact that it is generally accepted that exploiting the order and discipline of a coordinated formation with mutually cooperating platforms is best. This environment of mutual dependence and collaborative effectiveness is appropriate for surface forces but is not the world of undersea forces. Surface forces and air forces create “concentration” and “mass,” but not so of submarines. Undersea forces operate with the objective of creating effects that coordinate with those of the broader Navy and Joint Force effort, but the best way for them to create those effects is generally to operate independently. Coordination and order require time and communication to create, and it is into those windows of uncoordinated disorder that the undersea force throws itself in order to keep the adversary off balance. It is the objective of the undersea force, far forward, to operate in such a manner as to create and sustain in the mind of the adversary a sense of disorder, vulnerability, chaos and uncertainty.

As with each of the undersea warrior traits discussed thus far, tenacity and aggressiveness are traits that must be practiced. This is not to say that peacetime operations merit the kinds of risks that wartime objectives might deserve. But it is to say that creative application of persistence within the appropriate bounds of the current exercise or operation is welcome and expected.

As Desert Storm approached, CDR Chip Griffiths, the CO of *Pittsburgh*, was in maintenance and was not scheduled to get out in time to participate. As one of only a few vertical TLAM shooters in the submarine force, *Pittsburgh* would be missed. CDR Griffiths, demonstrating the kind of aggressive tenacity that marked the great COs in submarine history, gathered his wardroom and the repair activity and asked “What is it going to take to get this ship out in time to be on the gun line?” The creative energies of an entire crew and tender were brought to bear on the problem and the *Pittsburgh* was out early, loaded with missiles, and deployed in time to participate. That is tenacity. That is the kind of unwillingness to fail that has marked great undersea warriors.

---

While having exceptionally talented and well-trained operators is essential to the success of undersea forces, it is not, by itself sufficient. Our undersea forces also must be equipped with the right kind of systems if they are going to effectively and fully contribute to national security. The next section addresses the advantages provided by undersea concealment that our undersea systems are capable of exploiting.

---

<sup>3</sup> Richard O’Kane, *Clear the Bridge* (Novato, CA: Presidio Press, 1977), p. 267.

## Part 2

### The Military Advantages of Undersea Concealment

*Undersea warriors must have a firm appreciation for the set of military advantages that come from undersea concealment. The exploitation of these advantages is the common bond that connects today's submariners with those of World War I, World War II and the Cold War. The Navy employs undersea forces in ways that best enable these advantages to be leveraged to achieve the broader military and geostrategic aims of the Joint Force and the Nation.*

Whether one is talking about today's undersea force consisting of predominantly submarines or tomorrow's force with an increased emphasis on UUVs and other systems, undersea forces will be expected to provide a set of unique military advantages. Undersea forces are characterized by their ability to operate underwater, which carries with it the attribute of undersea concealment, which leads to a range of different military advantages. These advantages, consistent with the CNO-approved "Concept for Leveraging the Undersea Environment," include:

- The ability to reach into the undersea domain
- The ability to conduct undetected operations
- The ability to penetrate adversary defenses
- The ability to conduct operations exploiting surprise at the time and place of our choosing
- The ability to survive without significant defensive payloads
- The ability to leverage the uncertainty and ambiguity of the undersea.

These advantages can be illustrated by a variety of historical and contemporary examples.

**Undersea Domain Reach:** Undersea domain reach is the most basic of advantages and it often can be achieved without an undersea platform. Undersea domain reach consists simply of the ability to put a system in the undersea environment, perhaps with no need or care for the degree of detectability or concealment. This system may be a sensor that needs to be underwater to perform properly or most effectively, it may be a recovery system that collects objects, it may be a system that drills for oil, it may collect fish, or it may dredge silt out of a shipping channel.

Some tasks requiring undersea domain reach are best done by undersea platforms. For instance, after the space shuttle *Challenger* was lost, undersea assets like the submarine NR-1 and various Remotely Operated Vehicles (ROVs) were employed to locate and recover the pieces of the vehicle off the coast of Florida. Stealth was not an issue, but the ability to put high resolution sensors near the bottom and operate recovery equipment was essential. Another common example of undersea domain reach is placing a sonar system at a given depth, favored by the physics of acoustic

propagation, to ensure its superior acoustic performance. Similarly, a surface ship exploits undersea domain reach when it adjusts the depth of a variable depth sonar. A submarine exploits undersea domain reach when it places its hull sonar and towed array sonars at the best search depth.

**Undetected Operations:** Undersea platforms enable operations in which the maximum effect occurs if they are undetected. Such operations include intelligence collection and surveillance, which by their very nature have special additional value if the adversary is unaware that the information or posture of its forces has been compromised. If collection is overt or detected, the adversary has a variety of courses of action available that can reduce the value of the intelligence. These include modifying plans that have been compromised, revising operating procedures or adjusting system technical performance. Most importantly, when an adversary is aware that certain information is being collected, it may exploit this fact by feeding misinformation or deliberately deceptive information to the collector. As a minimum, an adversary can just restrict the nature of its operations to limit what is compromised. Exercises can be cancelled or delayed, movements can be altered, or system employment can be limited to modes that are not being protected. These steps are costly and inefficient however. Most importantly, an adversary loses the ability to selectively employ these mitigation tools when surveillance is performed by undersea forces.

In addition to intelligence and surveillance, other operations benefit from remaining undetected. Changing the posture of the submarine force to move more assets to an area of potential conflict in advance of need can be done without provocation. This permits leadership to "lean forward" prudently without having media outlets report on the location or nature of the operations being performed. Another example of operations that benefit from remaining undetected are missions in support of Special Operations Forces. Such forces, if detected, could be placed at great risk and the success of their mission could be fatally undermined without the benefit of undetected support operations.

**Penetration of Adversary Defenses:** Undersea concealment greatly enhances the ability of forces to penetrate an adversary's defensive perimeter and take up positions within the adversary's "secure haven." This interior position enables access to higher value targets that are less well protected than when they are outside the defensive perimeter. Interior position enables increased potential for disruption. The fact that this penetration can occur without requiring the asset to fight its way in permits several second order advantages: (1) greater availability of offensive ordnance once the interior position is reached, (2) greater availability of targets in a relaxed security posture that are therefore more vulnerable, and (3) greater flexibility for U.S. leadership, which need not commit to kinetic measures as early and which can expect greater effects more quickly from assets that have achieved interior positions.



Harusame after Wahoo's  
"down the throat" torpedo  
shot in Wewak Harbor

An important and pertinent illustration of penetration from World War II was Mush Morton's bold exploitation of undersea concealment to penetrate Wewak Harbor in January 1943. In an operation that became legend and galvanized U.S. submariners, Morton aggressively interpreted his orders to "reconnoiter" Wewak. LT George Grider, a member of the wardroom, remembered being asked by Morton to define "reconnoitering" and said he thought it meant submerged periscope surveillance from far out at sea. Morton replied "Hell no. The only way you can reconnoiter a harbor is to go right into it and see what's there."

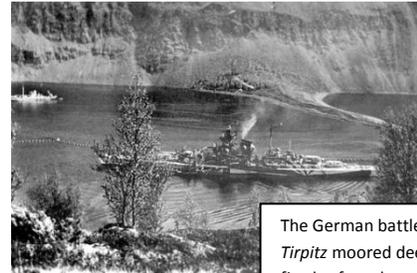
Grider later wrote, "... a submarine, as anybody knew in those days, was a deep-water ship that needed broad oceans and plenty of water under its keel to operate. And harbors are often treacherous at best, even when you enter them in surface ships handled by experienced pilots equipped with the very latest charts. It would be madness for the *Wahoo* to submerge and enter an enemy harbor whose very location on the map we didn't know." Once they were inside and a destroyer was spotted, a Sailor joked "We've reconnoitered Wewak harbor now. Let's get the hell out of here." Morton responded, "Good God no. We are going to go in and torpedo him...We'll take him by complete surprise. He won't be expecting an enemy submarine in here."<sup>4</sup> In the engagement that followed, *Wahoo* sank the Japanese destroyer *Harusame* and cleared the harbor. The next day, *Wahoo* sank an entire four ship convoy headed for Wewak. Clay Blair, in his history of the U.S. submarine war in the Pacific, *Silent Victory*, wrote that "This patrol, one of the most celebrated of the war, gave the whole submarine force a shot in the arm – or a kick in the pants."<sup>5</sup>

In the Atlantic that September, the United Kingdom provided another example of leveraging the concealment of the undersea to penetrate robust defenses and gain access to a high value target. Three midget X-craft submarines were towed by submarines to northern Norway to penetrate a fjord and attack the German battleship *Tirpitz* in September 1943's "Operation Source." The mini submarines penetrated the

<sup>4</sup> George Grider and Lydel Sims, "Mush the Magnificent" in *The United States Navy in World War II*, S.E. Smith, editor, (New York: Ballantine, 1967), pp. 440-446.

<sup>5</sup> Clay Blair Jr, *Silent Victory*, (Annapolis: Naval Institute Press, 1975), p. 386.

minefields and submarine nets and avoided the surface searchers in Norway's Kaafjord long enough to place at least four two-ton charges underneath the *Tirpitz's* hull which were detonated, flooding 1400 tons of water into the ship and crippling it for six months. The X5 was lost with all hands, but the X6 and X7 were attacked after placing their charges and the crews were captured.



The German battleship  
*Tirpitz* moored deep in the  
fjords of northern Norway

In a similar operation, on the night of 6 December 1941, the Japanese launched five midget submarines that had been towed to Hawaii to participate in the attack on Pearl Harbor. At least one of these submarines succeeded in penetrating the inner harbor and launching its two 2100 pound torpedoes at the battleships *Oklahoma* and *West Virginia*. The *Oklahoma* capsized. After transmitting a "mission complete" message the night of 7-8 December, the midget submarine was destroyed with scuttling charges by its crew in West Loch and was not discovered until 1944 by Navy salvage operators, who quietly disposed of the wreckage at the seaward mouth of the channel, where it was lost to history until it was rediscovered in 2009.

These penetration operations all underscore the success that undersea forces in the hands of bold seamen can have in bypassing complex defenses to gain access to high-value targets. These examples include evidence of some of the other undersea advantages such as surprise and survivability.

**Surprise:** The ability to strike the adversary at the time and place of one's choosing affords a number of fundamental military advantages, each of which amplifies the effect of an attack. First, the undersea attacker is able to choose the circumstances of the attack to fit the military need. Attack may be immediate or it may be delayed for various reasons.

During the Falklands campaign, the *HMS Conqueror* located and shadowed the Argentinian cruiser *General Belgrano* for a day while waiting for permission from the British War Cabinet to attack. In contrast, during the same campaign, when a possible submarine was detected, it was attacked with dispatch because submarine contact was so tenuous and fleeting that no time could be wasted. Of the scores of urgent attacks conducted against possible submarines, none achieved a kill. Attacks by undersea forces might be delayed to enable maneuver to create more optimal

geometry for maximizing damage probability and minimizing counterattack risk.

A second advantage of attacking with surprise is that the attack can be undertaken at a time when the target is at less than full readiness, enabling greater probability of inflicting more damage. The surprise attack on Pearl Harbor was timed to coincide with the lowest military readiness of the U.S. fleet, thereby increasing the likelihood of inflicting greater damage at less military cost to the attacker.

A third advantage of surprise is that it creates chaos, an effect which can result in second order damage such as collisions as well as degraded military efficiency. Orderly and systematic response is difficult when under the threat of continuing attack, thus reducing counterattack effectiveness. Surprise is one of the undersea warriors best tools.

**Survivability:** Undersea concealment enables submarines to move about without detection, creating vast areas of uncertainty and greatly complicating the problem of an adversary that desires to hold them at risk. This has the effect of “defending” the submarine from attack without necessitating any significant degree of payload volume being dedicated to defensive weapons. This, in turn, enables greater offensive punch by utilizing available payload space almost exclusively for offensive capabilities. In addition, concealment greatly complicates battle damage assessment by an attacker. An attack may be undertaken on a possible submarine and, afterward, when no submarine is detected, the attack is judged successful. In fact, an unscathed submarine may be moving away and may still be vulnerable to attack, but the fact that its location and condition are unknown protects it from this follow-on attack.

Our SSBNs rely upon undersea concealment to provide them with the survivability that enables them to provide an “assured response” even after an adversary first strike. Survivability is the combined result of reduced detectability (stealth) and operations in broad ocean areas, placing a huge geographic burden on searchers.

In addition to stealth and the search challenge provided by broad ocean areas, undersea forces also employ defensive systems such as countermeasures to reduce the chance of damage from an adversary attack. Shock hardening, damage control, redundancy and robust construction add further survivability.

**Operational Ambiguity:** The final military advantage provided by undersea concealment is not widely recognized, but it is in many ways one of the most important advantages of all. The fact that ocean is opaque makes it difficult to know what is going on underwater, and this obvious fact has profound implications that distinguish the undersea domain from the air or the sea surface. In the air and surface domains, the unaided human eye is capable of long-range detection of targets and, as a result, even unsophisticated adversaries can monitor

those domains. Not only can targets be seen, but they can be quickly recognized and tracked with sufficient precision to enable making confident decisions. The contrast with the undersea environment could not be starker.

Undersea, only those adversaries capable of skillfully employing highly specialized and expensive sensors are capable of making detections. Even when detections can be made, they are often uncertain, foggy impressions that lack firm classification, offer little position or movement information, and do not enable prompt action.

Even when it is clear that “something” has happened or is going on, the concealment of the undersea and the challenge of gaining access to the undersea make confident facts hard to come by. This difficulty and ambiguity impose significant burdens on those who depend on the undersea. It complicates the work of fishermen who must choose where to cast their nets. It obscures what happened to the *USS Scorpion* and the Air France Airbus that disappeared in thunderstorms over the Atlantic. It enables drug smugglers to scuttle their submersibles if they are caught and have confidence that the sunken evidence will not be found. It caused the expenditure of extensive ASW ordnance by the UK against non-submarine contacts during the Falklands War.

On March 26 2010, a North Korean midget submarine torpedoed the South Korean frigate *Cheonan* in the Yellow Sea, breaking it in half and killing 46 sailors. The North Koreans denied making the attack. During salvage operations extending over weeks, the ship and the afterbody of a torpedo of the type used by North Korea were recovered from the seabed. A multi-national group of technical experts reviewed the available information and provided a formal report concluding with confidence that a North Korean torpedo attack was the cause of the sinking. It is the nature of the ambiguity of the undersea that despite all of the data and technical analysis and weeks of work on the part of scores of experts, the media in the United States and other nations continue to refer to the sinking as “allegedly” the work of a North Korean torpedo.

This operational ambiguity can also be exploited to create the impression that undersea forces are in one place instead of another, to imply that accidents or natural factors are at work rather than hostile actions, or to distract, disrupt or slow operations. Each of these act to spread out or divert the attention of enemy forces, reducing their effectiveness and decreasing their confidence.

**Scapa Flow, October 1939:** The early months of World War II provide us with a case study that illustrates all of the advantages of undersea concealment being brought together and exploited in a single operation, sometimes referred to as the most famous German submarine attack of the war.

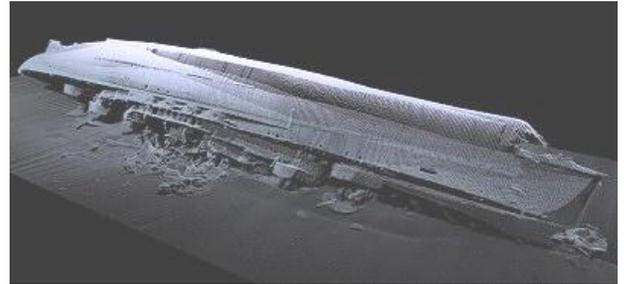
Looking for a way to rally confidence that Germany could take on the Royal Navy and weaken the British blockade, Karl Doenitz and his staff developed an audacious plan for a German submarine to penetrate the principal port of the British Fleet at Scapa Flow and attack whatever shipping could be found in the massive roadstead. (During World War I two German submarines had been lost attempting such an operation.) Careful staff work and reconnaissance had revealed a potentially exploitable vulnerability – a fifty foot wide gap in the blockships and submarine nets guarding the many entrances to the anchorage. A favorable moon and tidal cycle would create a narrow window the night of 13-14 October.

Gunter Prien, a former merchant marine sailor and Doenitz's favorite submarine commander, was hand-picked for the task and given a weekend to review the plan and tell Doenitz if he could do it. When he announced it workable, the plan was dubbed Operation P. After turning in his enigma machine and all classified holdings not related to the operation, the *U-47* got underway from Kiel on 8 October, bound for the north end of Scotland. The *U-47* transited the North Sea at night, resting on the bottom during the day (undetected operations). After an undetected transit, the *U-47* surfaced the night of 13 October at 2331 to enter Kirk Channel. After one false start, Prien penetrated the gap in the defensive blockship barrier and entered Scapa Flow undetected (penetration of defenses).

Prien found the battleship *Royal Oak* at anchor with the tender *Pegasus* and attacked with two torpedoes each from 3500 yards. The attack was conducted with complete surprise against a totally unalerted target (surprise attack at the time and place of one's choosing). One torpedo misfired, two missed and one detonated against the bow of the *Royal Oak*. The crew of the *Royal Oak* and the admiral onboard interpreted the thump as an internal problem of some sort and did not realize they were under attack. No order was given to action stations or to improve the watertight integrity of the ship (ambiguity and uncertainty). Prien exploited this ambiguity and, seeing no sign of reaction, circled around while reloading to make another attack. He fired three bow tubes at the *Royal Oak*. All three hit the starboard side of the ship and it capsized 13 minutes later, killing more than 800 of the 1200 crewmembers aboard. Undetected during the resulting chaos, the *U-47* had departed Scapa Flow again by 0215 and headed back for Wilhelmshaven (survivability) for a hero's welcome.

In Hitler's U-Boat War, Clay Blair wrote that, "the feat at Scapa Flow had certainly got Hitler's attention and firmly planted in his mind and all German minds that a single cheap U-boat manned by merely forty-four men could sink a huge battleship manned by 1,200 men. From that it was not difficult to imagine what carnage a vast fleet of U-boats could inflict on Great Britain's thinly armed merchant marine. Thus the idea that Germany might, after all, defeat Great Britain at sea with U-boats gained credibility. The long-term impact of

Scapa Flow was therefore immeasurably beneficial for the U-boat arm."<sup>6</sup>



This composite image of the *HMS Royal Oak* as it looks today was constructed by stitching together a three dimensional picture from many passes with a modern high-frequency sonar. The ship is resting on the bottom with the starboard side – with the three torpedo impacts – down toward the seabed. The damage to the bow from the first torpedo hit is clearly visible on the right end of the image.<sup>7</sup>

In summary, then, undersea concealment provides an array of military advantages that can be exploited by undersea forces. These advantages can be gained as part of individual operations, such as that of the *Wahoo* at Wewak harbor, or they can be integrated with the operations of other parts of the Joint Force to achieve compounded benefits, as was the case with the Japanese attack on Pearl Harbor.

A failure to properly integrate with the Joint Force can just as surely diminish the impact of a stealthy undersea operation. On October 8<sup>th</sup>, the day Prien got underway, the British Home Fleet sortied from Scapa Flow to intercept the heavy cruiser *Gneisenau* which appeared to be heading out via the North Sea on a North Atlantic surface raiding mission. The *Gneisenau* did not break out and returned to Kiel, and the Home Fleet anchored briefly at Loch Ewe, in northwest Scotland down the coast from Scapa Flow. The *Luftwaffe*, unaware of Prien's mission, ordered a low level reconnaissance flight over Scapa Flow on the 12<sup>th</sup> of October, two days before *U-47* arrived, and this was interpreted by the British as a prelude to a bombing attack. As a result, the bulk of the Home Fleet remained at Loch Ewe and only the flagship *Royal Oak* returned to Scapa Flow. Had this coordination error not occurred, Scapa Flow would likely have been crowded with many more ships (potentially four battleships and an aircraft carrier) and the damage inflicted by Prien might have been even worse.

<sup>6</sup> Clay Blair, *Hitler's U-Boat War* (New York: Random House, 1996), p. 109.

<sup>7</sup> Image of the HMS Royal Oak from Divernet.com: [http://www.divernet.com/Wrecks/159269/scapa\\_flow\\_in\\_3d.html](http://www.divernet.com/Wrecks/159269/scapa_flow_in_3d.html)

## The Cooperative Maritime Strategy

In general, it is the role of our undersea forces to exploit the concealment of the undersea to gain a variety of military advantages in engaging adversaries. These advantages can, in turn, be exploited by the Joint Force to aid in the achievement of any number of specific operational or strategic objectives.

Our Cooperative Maritime Strategy emphasizes six “core competencies” that U.S. maritime forces should collectively provide: Forward Presence, Maritime Security, Sea Control, Power Projection, Deterrence and Humanitarian Assistance/Disaster Relief. While the Cooperative Maritime Strategy is relatively new, these core competencies are old and are for the most part the same as they were in the late 1970s when a comprehensive view of “effects-based” missions were first defined.

Undersea forces make valuable contributions to each of these core Navy competencies:

- **Forward Presence:** This refers to the sustained, day-to-day presence of U.S. naval forces in forward operating theaters, aiding in the deterrent value of those forces as well as the speed with which they can be brought to bear in a contingency. Forward Presence enables participation in exercises and operations with other U.S. allies, furthering U.S. regional interests. If the U.S. Navy did not ensure that an influential portion of our forces were kept present forward, then the vast distances that would have to be covered would delay our forces’ arrival. This delay would be easy for potential adversaries to exploit, making the need for Forward Presence an essential element of our security guarantees. As we will discuss more below, undersea forces in particular take advantage of forward presence to ensure their early presence in key locations, to conduct undetected operations and to enhance deterrence.
- **Maritime Security:** This refers to the steps necessary to ensure the routine security of U.S. and allied maritime commerce flow, also on a day-to-day basis. It is the result of the collective efforts of naval forces, the intelligence community, law enforcement, allies, and governments. Protections against terrorism and against the use of maritime platforms as terrorist enablers are both key elements of Maritime Security, as are counter-narcotic operations and other law enforcement assistance efforts. Undersea forces provide important intelligence collection and surveillance that helps cue maritime security activities by other parts of the U.S. government and by U.S. allies and friends.
- **“Sea Control”** is the ability of one state to employ the sea for its purposes while denying adversaries the

ability to do the same. “Sea Denial” is a subset of Sea Control that usually is limited to the ability to deny an adversary use of the sea, but may not include creating the ability to make full use of the sea. “Sea Dominance” is a more expansive term than Sea Control, and suggests robust and sustained Sea Control over large areas. “Sea Superiority” is Sea Control over a defined geographic area for a defined time period. Undersea forces are exceptional at providing the Sea Denial element of Sea Control, but because undersea forces by themselves have limited ability to fully exploit that denial, it is usually understood that larger general purpose naval forces provide the ability to project power or otherwise leverage the secure environment created by effective Sea Denial.

- **Power Projection** refers to the use of maritime forces to project power ashore, to include strike operations (such as by air or missile) or amphibious operations. Undersea forces carry about one third of the Navy’s strike missile inventory, but that striking power is limited compared to the capacity of a carrier air wing or a Marine Expeditionary Force to project power. The real value of the undersea strike capacity is in its ability to be delivered with surprise from close-in against particular high-priority targets. This “little or no-notice” context greatly increases the military value of power projection and may serve an essential role in permitting general purpose forces to gain subsequent access to the theater of operations.
- **Deterrence** includes more than *nuclear deterrence*, which is provided uniquely within the Navy by ballistic missile submarines. Deterrence also acts on a day-to-day basis by influencing other states not to take actions contrary to U.S. interests because of a clear threat that the United States will “impose costs” if that action is taken. The costs that are included extend far beyond the use of military force. Undersea forces greatly amplify the threat of force by the United States because it is not necessary that the U.S. Navy be visible in order for it to be holding an adversary at risk. This creates a deterrent threat even when overt forces are not present. As we will discuss more below, warfighting readiness is a key element to effective deterrence.
- **Humanitarian Assistance and Disaster Relief (HADR)** is an expression that usually conjures up the image of helicopters delivering aid to earthquake victims or rescuing mariners in distress. These are, indeed, the bulk of the HADR efforts for which the Navy is well known. The contributions of U.S. undersea forces to HADR are much narrower and highly specialized but, when submarine rescue or undersea search is needed, there is really nothing else that will suffice. U.S. undersea forces contribute to the United States as a “global force for good” by making available highly

specialized submarine rescue and undersea search capabilities. Other nations need not develop their own capability because they can rely on us to provide if necessary. The international cooperation that we gain working with other nations to be prepared for potential undersea emergencies helps act as a foundation for other areas of cooperation.

Now to gain a fuller appreciation of how these military advantages from undersea concealment have been exploited over the history of submarines and undersea warfare, we will take a brief look at this history, considering not only our own Navy but the navies of other nations as well.

### Part 3

#### A Brief Review of the Historical Application of Undersea Warfare

***Submarines around the world have long benefitted from a significant degree of both mission flexibility and ability to adapt to a changing operational environment. As a result, it has been common to use them for many other purposes beyond those for which they were intended. Different nations have used submarines in different ways, each approach tailored to their individual geopolitical situations. The most militarily significant and historically proven wartime role of submarines has been the attrition of shipping. Other roles such as attacking warships, laying mines, supporting the insertion or extracting of personnel, nuclear deterrence, land attack and intelligence collection have also been important. The specific roles of U.S. undersea forces in the future are likely to come from the same list but, consistent with past history, may include other unexpected new missions as well.***

#### **Flexibility and Adaptability**

Although the broad military advantages created by undersea concealment have been basically the same over the last century of submarine operations, this does not mean that each country has faced the same military situation or needed the same type of undersea forces in its particular time and place. Variations in geography and trade routes, the march of technology, and the constant evolution of threats and international opportunities have resulted in the wide range of undersea platforms and force mixes over the last century.

In addition to diversity in the nature of the hardware in undersea forces, nations have also shown a great deal of variety in how they *employ* their undersea forces. Indeed, nations have used undersea forces of the same type for different purposes, even in the same campaign, theater and battle. This historical practice underlines two key ideas in the use of undersea forces: flexibility (the ability of the same platform to be employed for multiple purposes without

reconfiguration) and adaptability (the ability of a platform to be quickly and inexpensively reconfigured or reloaded to later perform a very different role). An example of *flexibility* in U.S. undersea forces is the ability of a commander to use a submarine and its ADCAP torpedoes in an anti-surface role or in an anti-submarine role without missing a beat. An example of *adaptability* in U.S. undersea forces is the ability to load a submarine with a sea control load-out (emphasizing maritime attack) or a strike load-out (emphasizing land attack).

#### **Submarine Roles in the First World War**

The appearance of important quantities of submarines in naval forces during the first decades of the 20<sup>th</sup> century stimulated great debate about their military utility and potential legitimate uses. As late as 1900, many British did not endorse submarines as a legitimate tool because, in the words of Rear Admiral A. K. Wilson in 1900, submarines were “underhand, unfair and damned unEnglish.”

The London Declaration of 1909 stipulated the rules under which Britain would play and, although not ratified, this declaration was the accepted code of conduct as war approached. These rules were consistent with long-standing, generally observed rules of warfare regarding “prizes” and required that the civilian crew be allowed to abandon a ship before it was taken over by a prize crew or sunk. These “rules” were observed for much of the war by most on both sides.

*Innovative Thinking about Submarine Role:* Having procured some Holland boats for “testing,” in 1904 the British ran an exercise in which the five small Holland submarines were tasked with “harbor security” but succeeded in “sinking” four warships. Admiral Jackie Fisher later wrote, “It is astounding to me, perfectly astounding, how the very brightest among us fail to realize the vast impending revolution in Naval warfare and Naval strategy that the submarine will accomplish.” Theodore Roosevelt, who had written a history of the U.S. Navy and had been Assistant Secretary of the Navy, wanted to see submarines first hand. In 1905 he became the first U.S. president to ride underwater on a submarine when he got underway aboard the *Plunger*. Upon his safe return, he instituted submarine pay in recognition of the hardship and danger of submarine duty.

In 1910, the British began to experiment with more aggressive submarine employment than the original “harbor defense” model. During fleet maneuvers, two D-class British submarines “sank” two enemy cruisers as they left their home port, some 500 miles from the submarines’ base.

In 1912, LT Chester Nimitz, veteran of command of three submarines, made a presentation to the Naval War College in which he advocated an innovative tool for drawing warships into a position in which they could be attacked:

“drop numerous poles, properly weighted to float upright in the water and painted to look like a submarine’s periscope.”<sup>8</sup>

*Disproportionate Impact:* The First World War began during July and August 1914 with a series of war declarations, counter declarations, and mobilizations. On September 22, 1914, Otto Weddigen, the young German commander of the *U-9*, sank three British armored cruisers off the Netherlands in the course of about 90 minutes. This represented the first loss of major enemy combatants to submarine attack in the history of warfare.

*Deception:* During much of the war, attacks on merchant ships were governed by the pre-war principles of the London Declaration, requiring “firing across the bow” of a potential victim and then allowing the ship to be abandoned in a controlled fashion prior to sinking. This led to the allied development of “Q-ships” which were armed vessels masquerading as merchants that would draw in U-boats, dramatically “abandon ship” with an artificial “panic crew” and then open fire when the U-boat got within range. The resulting U-boat losses and the increasing pressures of the British blockade on Germany led to the implementation of “unrestricted submarine warfare” in the spring of 1916 and then again in 1917.

*Convoying:* Britain resisted convoying to protect shipping because of the tremendous inefficiency it was expected to impose on port facilities and vessel movements. Many doubted its effectiveness. By early 1916, the German submarine blockade was sinking more ships in a month than could be built in a year. In the face of these numbers, the British experimented with employing convoying and the results were so much better that it was retained as a practice for the rest of the war.

The *Lusitania*: The sinking of this passenger ship by a German submarine on 6 May 1915 resulted in nearly 1200 deaths and became an iconic image that turned public attitudes against Germany. This case provides a stark example of the military importance of properly constraining attacks to remain within the directed limitations. The *Lusitania*-like sinking of unauthorized targets would recur again and again in World War I and II and would become a major element in morale and diplomacy.

*World War I Operational/Technical Innovation:* By the end of the war, Germany had lost 45 percent of its submarines but had put Britain under significant pressure with the submarine blockade. Depth charges had been invented and active sonar was being used. Convoying had been practiced and proven. Torpedo problems had been experienced and overcome. Deceptive coloration, false

periscopes, Q-ships and other exploitation of detection and classification limitations were part of the toolkit on both sides. Exclusion zones were employed. Radio transmission locating technology was used to cue defensive convoy routing. When attacks on passenger ships or hospital ships occurred and civilians were killed (almost certainly by mistake), the events were sensationalized by both sides. Unrestricted submarine warfare had been employed. Submarines had irreversibly become a part of war, as had radio, aircraft and tanks. Over the course of the war, submarines had grown to be much larger and carried more weapons over longer ranges.

The American submarine force began the war with about 30 submarines and had no measurable impact on the outcome of the war. Short range American submarines were employed almost exclusively for convoy escort.

*Submarine Roles:* Anti-surface warfare using torpedoes or mines was the dominant submarine mission during the war. Supplementing this role, the British employed submarines in the Dardanelles to support the Gallipoli amphibious operation very creatively, including anti-surface warfare, shore bombardment, the insertion and extraction of personnel (both agents and saboteurs), and intelligence collection. *All of the major roles common to today’s submarine force (except nuclear deterrence) had been employed within the first few years of World War I.*

## Submarine Roles in World War II

One of the important lessons of the First World War was that a larger submarine force at the start of the conflict might have been enough to change the outcome of the war. The head of the German submarine force, Admiral Doenitz, anticipated that he would need 300 submarines in his total force in order to provide 100 on-station (100 in transit and another 100 undergoing repair, maintenance or training). This anticipated operating cycle was fairly close to what was actually practiced in the Atlantic and was also similar to that used by the American submarine force in the Pacific Ocean.

*Uncertainty about intended role:* Greater range, payload and endurance likewise would have made an important difference for the kind of commerce raiding role that submarines played in World War I. In the interwar period, however, there was a long-running debate about whether the United States should build a greater number of smaller submarines or fewer larger submarines with greater range. This debate was resolved in favor of the larger submarine on the grounds that the threat of war would enable production increases without having to change the design. Despite this emphasis on large-submarine performance that would be invaluable for independent operations such as commerce raiding, navies still anticipated that the role of the submarines was likely to be more closely aligned with the fleet than in World War I – hence the name “fleet submarine.” Based on the Allied treatment of Germany as a “mad dog” for declaring unrestricted submarine warfare,

---

<sup>8</sup> CAPT Brayton Harris, *The Navy Times Book of Submarines*, cited online at [<http://www.submarine-history.com/NOVAtwo.htm>] includes each of the World War I and innovation examples cited above.

there was a general doubt that friendly navies would follow such a policy in any future war. The German Navy, on the other hand, unambiguously anticipated that the role of its future submarine force would likely be the same as it had been in World War I. Indeed, once they abandoned the Treaty of Versailles in about 1935, the Germans undertook a large scale build program which, although it did not provide the 300 submarines by the war's start desired by Doenitz, did provide him with about 54 operational submarines capable of ocean warfare by the fall of 1939.

*Maritime Resource Interdiction:* In fact, the major role of the submarine forces of the United States and Germany in World War II were very similar. Both saw their submarine forces as tools for interdicting the maritime commerce and resource flow of their principal adversaries. The American submarine forces sought to cut off Japanese industry from raw materials and to cut off Japanese military forces from logistics support (food, fuel, ammunition, parts, troops). The Germans saw the role of their submarines to be interdicting the flow of supplies to Britain and to Russia, principally from the United States. Engagement of warships was undertaken but with less priority.

*Torpedo Issues:* The United States, the Germans and the Japanese all suffered from torpedo failures at the start of World War II. The parallels were surprising. Both the Germans and the British found their secret magnetic exploders ineffective and retired them. Although this was reported to our Navy Bureau of Ordnance, no action was taken to check the performance of U.S. magnetic exploders. The Germans recognized the problem the soonest and implemented the earliest action to recover. Within three months Doenitz had ordered the magnetic exploders disabled. The United States took almost two years to recognize and recover from three independent problems: torpedo run depth, the magnetic exploders and the contact fuse. It was not until all three problems were addressed that torpedo performance improved. This corrective action depended upon aggressive feedback and experimentation at the fleet level in order to provide sufficiently convincing evidence for the Bureau of Ordnance to acknowledge there was a problem.

*Special Missions:* American submarines conducted many special missions involving the insertion, extraction, or re-supply of agents or military forces in the broad archipelagos of the Pacific. For example, in early February 1942, shortly before the loss of the island of Corregidor near Manila, the submarine *Seadragon* slipped in to evacuate 25 people (17 of whom were members of the Cast unit associated with the exploitation of communications intelligence (ULTRA)). It was critical to protect the expertise and the gear, and the unit was re-established after evacuation.

*Reconnaissance:* Submarine reconnaissance became a much larger part of the mission set than had been the case in any Navy in World War I. The terrain of the Pacific was so unknown that undersea reconnaissance was often essential to

create a baseline of information. Also, by the end of the war, a large fraction of U.S. submarines were engaged in so-called "life-guard" operations, stationed forward to extract downed aviators and prevent their capture by the Japanese.

*Limited Effectiveness of Some Submarine Forces:* The Italian Navy provided an Atlantic presence as large as that of Germany, but due to much less effective employment by leadership, the force had a much smaller impact. The Italians avoided wolf-packs and, in general were less aggressively used.

The Japanese submarine force was large and technically capable. It also had at its disposal a wide variety of types of platforms, capable of a diversity of missions. Like the Italian force, however, the Japanese force never delivered on its potential. It began the war with innovative operations, such as the employment of five towed mini subs in the attack on Pearl Harbor and submarine launched aircraft in attacks on Oregon. By the second or third year of the war, however, the innovation had largely disappeared and the Japanese I-boats were used for resupply, evacuation, and monitoring.<sup>9</sup> Poor communications security and highly structured command and control offering little opportunity for initiative led to the loss of scores of Japanese submarines. They were sunk by American submarines and other naval forces which exploited ULTRA to enable ambushing the Japanese as they executed precisely ordered transits with specific times and places.

The Russian submarine force, although the largest in the world at the start of the war, was largely neutered by platform limitations, geography and aggressive German ASW mining efforts in the Baltic Sea. Russian submarines were largely constrained to short range arctic patrols in the Barents, with few target opportunities. In the Baltic, the force was largely penned in by aggressive German minefield laydowns that exploited constrained Russian geographic options. Most of the major Russian submarine attacks in the Baltic occurred late in the war as the Germans executed a hasty evacuation from eastern Europe.

*Submarine Losses:* Losses of submarine forces on the Axis-side were huge. The Germans, Japanese and Italian submarine forces lost in excess of two thirds of their front line submarines. Although small in comparison to Axis submarine losses, American submarine force losses were greater as a proportion of those who served than the losses in any other branch of the U.S. military. Half of the U.S. losses were the result of ASW counterattacks following a submarine attack and another quarter were likely losses to mines. The remaining quarter was the result of the diverse range of other causes. Importantly, much of what we know about U.S. submarine losses is the result of detailed postwar analyses and was not information available in real time. Identifying the cause of a submarine loss during the war was challenging and often had to depend on guesswork.

---

<sup>9</sup> Blair, *Silent Victory*, p. 553.

*Key Role: Maritime Resource Interdiction:* In summary, the submarine forces that played the most significant role in determining the outcome of the war – the American force in the Pacific and the German force in the Atlantic – were engaged in unrestricted submarine warfare against adversary shipping. The Russian and Italian forces, although executing the same mission, did so with geographic restrictions and self-imposed operational constraints that hampered their effectiveness. The British submarine force made its biggest mark in the Mediterranean conducting operations against the Italian and German surface forces.

### **Submarine Roles in the Cold War**

*The Soviets:* The role of submarines changed dramatically in the years following World War II. At the end of World War II, the role of the U.S. submarine force was very limited, overshadowed by the threat of the Soviet submarine force – greatly expanded during the postwar years of our drawdown. If World War III happened, it looked like it would involve a repeat of the Battle of the Atlantic with the Soviets operating the submarines. Since World War II's Battle of the Atlantic had been won by the combined efforts of the surface navy and aircraft, and since there were no Soviet sea lines of communication to cut, it looked as if there was no real need for a robust U.S. submarine force at the dawn of the Cold War.

*U.S. Submarines Undertake ASW:* As the Russian undersea capability grew with the exploitation of captured German Type XXI submarine designs, the ASW problem began to look even more challenging. The Navy started to look for more effective ASW approaches. The commanders of the Atlantic and Pacific submarine forces had cooperated in undertaking exploratory research to determine if submarines might be useful in ASW and this led to the creation of the Development Squadrons (2 and 12). In 1949, everybody “knew” that submarines could not perform ASW, but within a mere 15 years, submarines had become the cornerstone of ASW. This was due to their combination of access to the undersea environment (with its improved sonar performance) and their stealth (which enabled a submarine to kill without being killed).

*Nuclear Power:* The emergence of nuclear propulsion, when combined with the advent of robust atmosphere control, precise navigation and improved sonar systems, freed submarines from the need to expose themselves at the surface, enabled them to place their sensors in the best listening depth, and permitted sustained high-speed operation that was previously unimaginable.

*Ballistic Missile Submarines:* The Cold War saw the introduction of the ballistic missile submarine with the dramatic parallel development of a platform and a launcher and a solid-fueled missile. The speed with which Polaris put to sea on the *USS George Washington* was an engineering feat that set an example for the space program to later follow. The

survivability of submarine ballistic missiles fundamentally changed the calculus of nuclear deterrence, virtually eliminating any advantage from a surprise attack, greatly stabilizing superpower interactions.

### **Submarine Forces in Transition**

At the end of the Cold War, the mission of the Navy moved from ASW against a large Soviet submarine force to “From the Sea” littoral warfare and strike operations. In stark contrast to 1948, when “everybody knew” that submarines could not perform ASW, now “everybody knew” that *the principle mission submarines did was ASW*. Again, undersea forces demonstrated their operational agility and adaptability. After firing only 5 percent of the TLAMs in Operation Desert Storm, the submarine force moved to delivering about a third of the missiles for Operation Enduring Freedom and Operation Iraqi Freedom.

The Russian submarine force remains one of the largest in the world, but it is shrinking as older, less-capable submarines are replaced with smaller numbers of more capable submarines. Importantly, however, Russian undersea systems – from submarines to sensors to weapons – are being exported around the world and are a part of the arsenal of many potential U.S. adversaries. This fact alone means that Russian undersea developments continue to require careful attention.

The North Korean submarine force remains among the largest in the world, but because it mostly consists of small mini-sub, this statistic is somewhat misleading. Focusing exclusively on South Korea, the North Korean force emphasizes mining, anti-ship torpedo warfare and the insertion of Special Forces or other clandestine operatives into the south.

The mission of the Chinese submarine force is the most ambiguous of the major submarine forces today. The Chinese force is clearly growing rapidly in both numbers and capability, and it is equally clear that one of its major purposes is the interdiction of U.S. naval warships. What is unclear is whether the Chinese also consider the submarine force a tool for disciplining Japan, South Korea or other states in regional confrontations. In particular, what role do their submarine forces play beyond a blockade role in the Taiwan scenario?

In the Post Cold War world, the role of the undersea environment in the day-to-day economic security of the United States has grown dramatically. The vast majority of oil and natural gas available in the Atlantic basin comes from the sea, either in the North Sea, the Gulf of Mexico, Africa's Gulf of Guinea or off Brazil's coast. In addition, the “information superhighway” can be said to travel along the seafloor, where fiber-optic cables carry more than 95 percent of all international telecommunications and internet traffic. These critical undersea infrastructures will become part of what undersea forces have to defend in the future.

As the threats change in the future, the submarine force's payloads and operating profile must evolve to hold new types of adversary assets at risk. Over history we have seen the payloads change from Mk 14 torpedoes to the Mark 18 electric torpedoes to Regulus missiles to ballistic missiles to cruise missiles to advanced torpedoes to UUVs and UAVs. Today it is clear that the submarine force of the future must be capable of holding both surface warships and submarines at risk, it must hold land targets at risk, and in the future it may need to be able to hold other classes of undersea targets at risk – infrastructure or UUVs or sensors. There will always be a demand for this ability, and as the future places surface platforms at increasing risk, there is a possibility that the Navy and the Joint Force will need to increasingly turn to undersea forces for more of its ability to threaten adversaries.

### **The Role of U.S. Undersea Forces Today and in the Future**

When the history of the missions of undersea forces is considered, there are clear patterns that emerge. We need to carefully consider these patterns as we look forward to the future of our own undersea forces.

Undersea forces have been forced to adapt to new weapons, new operating environments (e.g., under ice or in shallow water), and new missions (e.g., nuclear deterrence, ASW and Strike). Certain roles have remained constant and are likely to remain core missions in the future: anti-ship operations, intelligence collection, and the insertion or extraction of personnel or equipment. Based on historical realities, we should be ready to engage in maritime interdiction. Certain vulnerabilities have recurred in history and will recur unless prevented: torpedo reliability issues, misplaced confidence in the security of communications, poor understanding of losses, and backlash from attacks on protected classes of targets. Extra effort must be taken to protect our force from falling into the same traps past submariners have fallen into. Certain strengths have also recurred: greater stealth than anybody appreciates, greater ability to gain access to "secure places," and greater operational creativity and military flexibility. We must nurture the development of these same attributes and skills today.

As we look forward, it is useful to determine what attributes the U.S. undersea force of the future must possess. We must define a direction for our skilled undersea warriors to go, a target for them to pursue as they train personnel, develop new doctrines and procedures, address new technologies and adversaries and geographic locations. There is a list of key attributes that our force must possess if it is to do the task that is expected of it in an uncertain future.

### **The Necessary Attributes of U.S. Undersea Forces**

***Informed by the history of undersea warfare and the contemporary international situation facing the United States, it is possible to identify the attributes that U.S. undersea forces will require in the future. As we have seen, individual nations have employed their undersea forces in a variety of ways. Although we cannot see the future, we can see what kinds of undersea capabilities are likely to be of great deterrent and warfighting value to the United States, and we can make sure that our undersea forces deliver those attributes and capabilities to the Navy, the Joint Force and the Nation. These required attributes have a strong linkage to the U.S. submarine force's World War II and Cold War heritage.***

Although undersea concealment provides certain theoretical military advantages, a nation's undersea forces must have certain attributes in order to take full advantage of these potential benefits. To extract the maximum military utility out of the advantages provided by undersea concealment, the United States needs undersea forces that possess the following attributes:

- Readiness to fight on short notice
- Ability to quickly and non-provocatively gain early access far forward
- Ability to employ platforms and systems capable of fully exploiting the undersea maneuver space
- Discretion to choose the time and place of engagement for maximum effect
- Emphasis on endurance, self-sufficiency and offensive firepower
- Ability to adapt to changing situations
- Agility to create and exploit chaos, disruption and confusion

### **Readiness to Fight on Short Notice**

U.S. Navy forces have global responsibilities and must be capable of providing global coverage on short notice. In order to provide this global coverage within abbreviated time lines, it is essential that our undersea forces be ready to fight with little or no warning and have the ability to rapidly take up positions that can either deter the further escalation of conflict or intervene effectively. There is inadequate time for undersea forces to be able to finish preparations for war, conduct a slow transit and then conduct a careful, methodical penetration. Nor are our forces so large that we can afford as a nation to have enough forward all the time that we don't need to swing or surge forces in response to contingencies. Our forces must be capable of repositioning or deploying in a war-ready posture on short notice -- the sooner the better.

Our forces must be completely ready on a day-to-day basis for the most likely contingency – the one that would

demand a short-notice deployment for war – and be largely ready for other more specialized missions. These other missions are less likely to be tasked on no-notice and are more likely to involve some preparation or load-out time. Again the principle is, the sooner a submarine can be ready, the better for the military mission and for the success of the submarine. Entering a theater to join a conflict already in progress carries with it inherent disadvantages, and it is far better to be in position early. The more ready submarines are, the sooner they can be deployed and the sooner they arrive in theater, ready for action.

#### **Early access far forward**

Submarines must be prepared to penetrate adversary defenses quickly and deeply, in order to gain the preferred firing position against the adversary's most valued assets. Early access means earlier departure, higher speed transits, and prompt penetration. Prompt penetration is enabled by early planning, wardroom discussions and "table top" exercises with exchanges about how one side would defend and how the other should best penetrate. Available charts and resources should be studied in advance and discussed in depth. Even if mission tasking is different from that reviewed beforehand, the practice of having gone through the review will make the "real thing" much more efficient and effective. Practice operations in local operating areas can be undertaken to develop lessons about what approaches are effective.

The kinds of locations that constitute "far forward" vary with the adversary and the scenario. The water may be deep, cold and wide open or it may be warm, shallow and crowded or it may be anywhere in between. Wartime or Phase 0 penetration is unlikely to follow the "middle of channel" route that is favored in peacetime transits. As a force and as individual platforms, we must gain increased confidence in our ability to use *all* of the available water. We must gain experience operating in these waters and systematically validate our bathymetric data and learn what are the best safe methods to gain insight into what works and how quickly we can position. Consciously routing our submarines via unfamiliar routes and then executing the transit safely is an essential skill that must be developed at all levels of the submarine force. At the headquarters level, processes that manage risk and feedback lessons must be institutionalized so that the information gained from each new transit is integrated with past data and fed back to the operating forces. At the squadron and platform level, commanders must have in place methods for both learning and teaching the lessons from these transit demonstrations.

#### **Ability to exploit the full undersea maneuver space**

Not only must our individual submarines be capable of effectively using all of the available waterspace, but U.S. undersea forces must include a broad enough mix of platforms and systems such that there is no geographic

location or depth of ocean-connected water that is beyond the reach of U.S. undersea forces. For maximum effectiveness, U.S. undersea forces will strive to deny potential adversaries any safe haven at all.

The evolution of unmanned undersea vehicles will further our ability to reach into shallow and dangerous water with sensors or payloads anywhere on earth. This will enable us to both deter more effectively by denying havens that are currently available, and it will also help us provide greater effective coverage from a smaller number of manned platforms as force levels decline in the future.

#### **Ability to engage at the time and place of our choosing**

The United States is a maritime power. One of the most fundamental advantages of maritime power over a land power is that of maneuver and movement – the ability to deliver force in a variety of different places with little notice, making defense difficult. Undersea forces take the advantages of maneuverability to the next level by enabling engagements to occur at the time and place chosen to best comport with the military needs of the United States. This does not mean that all attacks will be optimal, but it is a distinct advantage when compared to the condition faced by our surface forces, where there is mutual detection and mutual engagement. When undersea forces prepare to execute an attack, they can delay pulling the trigger until better circumstances can be met. This timing flexibility could enable direct access to the highest value target first, or reduce the likelihood of a miss or enable the submarine to better position for a follow-on attack or a more effective evasion.

By being able to conduct attacks on forces in or near sanctuaries, our attack is less likely to be thwarted, countered or survived by the adversary. In addition, conducting attacks in places that are more "secure" results in greater disruption of the adversary's sense of security and ability to prepare for and execute plans on a schedule and with the required forces. It is more disruptive to attack someone when they do not expect it or when they feel they are safe.

This ability to attack at the time and place of our choosing will enable us to address higher value targets when they are more vulnerable and create a greater disruption to adversary plans. This means that the military utility of each attack is amplified to create greater effects than if the attack had been conducted in a different time and a different place. In World War I the British submarine force went to great lengths to penetrate the Dardanelles and conduct attacks against Ottoman warships moored in Constantinople – a location thought by the Ottoman Turks to be secure. Rioting resulted among the population when it became clear that the British Navy was able to reach the city. The attack by Gunter Prien on Scapa Flow in October 1939 discussed earlier caused tremendous disruption to British security confidence, resulting in investigations, the firing of people in leadership positions and a changed basing posture for the Home Fleet.

### **Emphasis on offensive firepower**

As U.S. naval forces are reduced in number due to fiscal constraints, and as more of the surface Navy is pressed to divert payload volume to defensive weapons – including Ballistic Missile Defense systems – it will be even more important for our undersea force to retain its emphasis on offensive firepower, a long-standing quality of our weapon loadout. With the minor exception of countermeasures, the payload of submarines is dedicated to ordnance used to deliver attacks on adversary land or maritime targets. Well over 90 percent of undersea payload is reserved for offensive weapons. This is especially important because of the degree to which the endurance of undersea forces is payload limited. Because of the risk and time invested in penetrating to a far forward position, it is important to maximize the scope of the offensive impact that a submarine can have once there. This means that a larger offensive payload is better. Unlike surface ships that can replenish many (but not all) of their types of weaponry at sea and forward, submarine forces must retire to the rear to reload. This long-distance, risky transit to resupply is minimized by larger offensive payload volumes.

### **Adaptability to changing situations**

Undersea forces are regularly employed for purposes other than the reason they were built. This is true of U.S. as well as other nation's submarines. Sometimes this mission change requires hardware adjustments and sometimes it just requires creative employment by operators. Sometimes the platform does not change but the payload has to be adapted.

An essential element of this adaptability is being a “generalist” in terms of what kinds of targets can be handled and how. Just as a highly specialized animal that is very specifically matched to a particular type of prey is vulnerable to extinction if that prey disappears, so it is that a highly specialized submarine capable of handling only one kind of target will be of little use if the military situation only serves up other types of targets. A “generalist” -- that is, a predator that is capable of handling many different kinds of prey depending on the situation that presents itself – is the kind of platform that submarines need to be. When submarines operate forward, as we have already discussed, they are often the only platform available in the area and thus, if they are not capable of effective attacks then the enemy can continue to operate with impunity. In World War II, as targets became scarcer, our submarines had to become greater generalists and it became more important for them to employ deck guns against smaller targets.

As adversary platforms diversify from large combatants to smaller, faster, shallower ships capable of lethal attacks on large platforms, we should anticipate that the weapon changes will follow. In addition, as future warfare places greater constraints on the collateral damage allowed, it

may become more useful for submarines to have available weapons that are capable of disabling ships without sinking them, thus permitting a sort of increment of damage to cripple the potency of enemy forces. As we saw in the previous section, successfully conducting warfare within the constraints imposed by civilian leadership is critical to the effectiveness of an undersea warfare campaign.

### **Exploitation of chaos, disruption and confusion**

Our undersea forces welcome the disruption and confusion that can be induced uniquely from undersea operations that exploit uncertainty and ambiguity. To do this, undersea forces use decoys and deception to compel adversaries to believe that they are where they are not and to believe they are not where they are. A significant part of the value of attacks conducted with surprise far forward is the fact that they induce the adversary to expend a significant share of its resources in protecting assets that are, in fact, not being targeted. The fact that undersea forces cannot be detected but may be present compels adversaries to take defensive measures against them even when they are not there. This is roughly akin to the significant airport security measures that we must take today to protect against terrorists whether there is a terrorist in the line or not. As we know from our own air travel experience, when an enemy must divert resources to protect against unseen threats, it slows and weakens their ability to exercise various initiatives and may also result in the need to abandon some desirable plans because there are insufficient resources available or because timelines cannot be reliably met. In order to exploit this ambiguity, undersea forces must have the ability to reach out geographically or in time to cause effects at places or at times different from their actual location. This can create the effect of multiple platforms at work when there is only one. This approach is especially valuable when it is desirable to create the military impact of a larger force when only a smaller one is available. At the same time, this compels the adversary to divert his defensive or anti-submarine effort to other locations besides where the platform is, further improving survivability and the psychological impact of undersea operations. In summary, the availability of tools that enable undersea forces to create the impression of diverse locations and operational timing will act to amplify the military value of undersea forces. This is a necessary element of the undersea forces of the United States.

In summary, the long distances and remote location of operating areas require that U.S. undersea forces be ready for wartime employment on short notice, be capable of quickly transiting to and penetrating and adversary defensive perimeter to take up a far forward position, exploit interior positions to conduct attacks with surprise at the time and place best suited to U.S. military needs, sustain an offensive posture by virtue of a heavily offensive load-out, and be equipped to exploit the ambiguity of the undersea to create force-multiplying effects against the enemy's forces, defenses and psyche.

## Part 5

### Summary

The importance of undersea forces to the national security of the United States and its allies grows with each passing year. Not only are technologies proliferating that will increasingly stress the survivability of our overt forces, but undersea energy and information infrastructure are becoming more and more essential to our way of life. History provides a guide that suggests that there are a handful of missions that will always be expected of undersea forces (such as maritime resource interdiction), that there are recurring weaknesses in submarine forces (such as inadequate appreciation of the ability of adversaries to exploit communications), and that there are recurring strengths (such as greater stealth and ability to penetrate than was expected).

Our undersea warriors will have to use these insights from history as a guide, but not as a crutch. For one other key lesson of the past is that undersea warriors must adapt quickly to changes that may undermine “old truths.” Our undersea warriors will have to be innovative and aggressive while carefully avoiding the need to relearn lessons from the past. Effective undersea force employment must rest on the foundation of technical excellence across all aspects of the undersea forces.

The concealment of the undersea provides undersea forces with a range of advantages that can be wisely leveraged to help deliver military impacts far out of proportion to the size of the undersea force. When this lethal and survivable undersea force is coordinated with the full, visible and intimidating power of carrier strike groups and the expeditionary capacity of the Marine Corps, the Navy-Marine Corps team is as formidable, flexible and daunting as any conventional military force in the world. Ensuring that undersea forces continue to carry our share of the burden will require constant attention to the principles and rules that have guided us for decades. We draw our success from lessons learned by generations of undersea warriors, and we include in that lesson the need for the flexibility of mind and spirit to seize new opportunities as they come and prudently skirt both old risks and new ones.

Undersea forces, when used effectively, operate far forward and independently. They exploit stealth for survivability and carry offensive payloads. They penetrate adversary safe havens and hold critical assets at risk, whether those assets are ships, submarines, land targets or even critical information. To be effective, the operators of these undersea forces must practice and drill as realistically as possible, gaining new insights into how best to employ the forces we have against the adversaries we face.

While we cannot be sure what the future holds, by prudent preparations, we can make sure that our undersea

forces can fully support any of the many directions the future may take. Accordingly, U.S. submarines are expected to provide the United States with the ability to operate undetected, to assume a wartime posture quickly and non-provocatively, to rapidly penetrate adversary defenses to gain far forward positions of advantage, to conduct early offensive action designed to seize the initiative, and to exploit this interior position, speed, stealth and operational agility to disrupt adversary planning, slow timing, undermine confidence and disrupt operations. This ability – made evident to our potential adversaries – will act as an important deterrent to adversary hostile action inimical to U.S. national security interests.

*Undersea warriors by their nature always seek to improve their operational skills and habits, build enhanced wartime readiness, and reinforce initiative and expertise. We in the current generation of American undersea warriors are no exception; we are proud but never satisfied.*

## Appendix A

### Background on U.S. Submarine Operations in World War II

Undersea warriors should have a shared foundation of historical knowledge upon which to draw as they adapt to the changing security environment in the future. The number of stories from history that one finds repeated across time and nationalities suggests that there is great value in studying this history. In addition, undersea warriors will benefit from having a degree of “cultural literacy” or a shared baseline of foundational information from which they can all start. This baseline is critical.

#### Submarine force contributions and losses in World War II

Summary: The influence of the U.S. submarine force on the outcome of the war in the Pacific was disproportionately great. The official joint Army-Navy report compiled after the war concluded: “The war against shipping was perhaps the most decisive single factor in the collapse of the Japanese economy and logistic support of Japanese military and naval power. Submarines accounted for the majority of vessel sinkings and the greater part of the reduction in tonnage.” [Clay Blair, Silent Victory, p. 879]

#### Key Statistics:

- In 1682 war patrols, submarines sank 1314 Japanese ships (5.3 million tons) (55% of all Japanese maritime losses)
- The U.S. submarine force in World War II (including back-up personnel and staffs) was composed in total of about 50,000 officers and men and “represented only about 1.6 percent of the total navy complement. In other words, a force representing less than 2 percent of the U.S. Navy accounted for 55 percent of Japan’s maritime losses.” [Blair, p. 879]
- Of the 50,000, about 16,000 submariners actually made war patrols and of that 16,000, 3507 were killed in action, a casualty rate of almost 22% -- the highest of any branch of the military. (Even when compared to “all submarine force personnel,” the loss rate is 7% -- about double that of the Marine Corps in World War II.)
- Of the 288 submarines that served in World War II, 52 were lost (18%): about half (25) to depth charging and bombing from aircraft, about one quarter (13) probably to mines, and about one quarter due to all other causes, including non-combat operational losses (3), grounding (4), friendly forces attacks (2), circular run torpedoes (2), gunnery (2) and being bombed in port (1).

- Each fleet boat submarine displaced about 1500 tons and carried 24 torpedoes and deck guns
- About 11 torpedoes were expended for each ship sunk, and the average ship sunk displaced about 4000 tons.
- On average, each submarine spent a cumulative total of 109 days on patrols during the war and sank a total of 4.5 ships (about one ship every 24 days on war patrol)
- Seven submarine officers were awarded the Medal of Honor: Howard Gilmore, John Cromwell, Red Ramage, Sam Dealey, Gene Fluckey, George Street and Dick O’Kane
- There were 465 submarine COs who served during WWII, but the top-performing 15% (70) accounted for more than half of all the ships sunk; of those 70 COs, only 4 were killed in action (<6%) (only 3 were lost with their ships: Morton, Dealey and MacMillan)
- In December 1941, war patrols were conducted by COs with an average of 15.7 years of service but by July and August of 1945, the average CO had 9.8 years of service (of which 3.5 were war)
- For comparison, the Axis submarine forces of Germany, Japan and Italy each lost no less than 2/3 of their submariners during World War II

#### Books to read:

- William Anderson and Clay Blair, Nautilus Ninety North
- Clay Blair, Hitler’s U-Boat War
- Clay Blair, Silent Victory
- Eugene Fluckey, Thunder Below!
- Michael Gannon, Operation Drumbeat
- Edwyn Gray, The U-Boat War
- Brayton Harris, The Navy Times Book of Submarines
- Max Hastings and Simon Jenkins, The Battle for the Falklands
- Larry Kimmett and Margaret Regis, U.S. Submarines in World War II
- Richard O’Kane, Clear the Bridge
- Richard O’Kane, Wahoo
- Norman Polmar, Cold War Submarines
- Theodore Roscoe, United States Submarine Operations of World War II
- Jordan Vause, Wolf

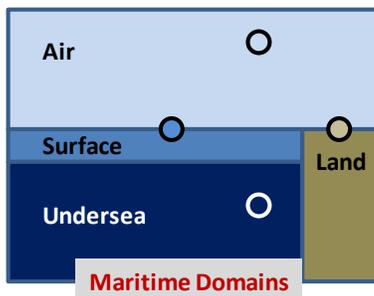
## Appendix B

### Definitions of Terms and the Undersea Domain

#### Undersea Forces

The U.S. Navy's undersea force is a subset of the forces available to the Navy for maritime operations. Undersea forces are those elements of the Navy that operate in the undersea domain and exploit it for military purposes. In this way the undersea community is similar to the air and surface communities: each operates in its domain and leverages it for the unique military advantages that the domain provides. Aviation provides the Navy with unique speed and mobility. The surface force provides the Navy with visible weight and sustainable endurance. Undersea forces provide stealth and surprise.

Undersea forces today consist primarily of submarines and, increasingly, Unmanned Undersea Vehicles (UUVs) and Remotely Operated Vehicles (ROVs). Other undersea systems, such as sea-bed sensors and networks, have played and will continue to play critical undersea roles.



Sorting systems into domain-related categories is not as "black and white" as it may seem at first glance. Almost all platforms have the ability to operate in multiple domains and employ sensors or weapons that can reach across domains. Submarines and aircraft, for example, can operate on the surface of the ocean during a part of their operating cycle. During this time, however, they are not exploiting the advantages provided by their primary domains – speed and mobility for the aircraft and stealth and surprise for the submarine. As a result, they are sub-optimized and have greatly reduced military utility.

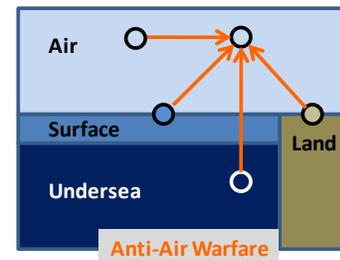
The ancient Greeks used the word *telos* to mean the essential nature of something, the feature or characteristic or purpose that makes it what it is. The defining trait of aviation forces is the use of flight to provide the military advantages of speed and mobility. The defining trait of surface forces is the use of the surface of the ocean to support military power with mass and sustainment. The defining trait of undersea forces is the ability to militarily exploit undersea concealment. Some systems, such as undersea surveillance ships (TAGOS), operate across domain boundaries and reach into the undersea but are not, strictly speaking "undersea systems" because they are

not able to exploit the most fundamental advantage of the undersea – concealment.

#### Undersea Warfare Areas

"Undersea warfare" is not a commonly understood term, and in many ways the area of undersea warfare is rendered unnecessarily complex because the terminology is imprecise. It is essential for undersea war-fighters to use a shared set of definitions and terms.

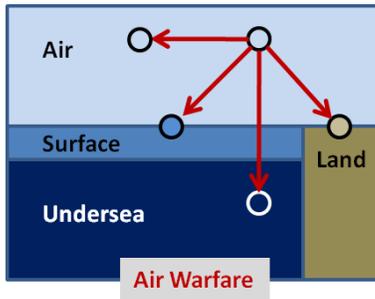
One way to characterize warfare areas is to classify them by reference to a class of targets. Anti-air warfare, for example, is warfare that targets aircraft and missiles and other flying objects. In other words, it is warfare that targets anything in the air domain. Anti-surface warfare is similar to anti-air warfare in that it is about holding at risk targets that operate on the surface of the ocean. One would anticipate that there should be a corresponding term for warfare against targets that operate in the undersea domain, but there is no such term in common usage. "Anti-submarine warfare," sounds like it fits into the same category, but it is different in a fundamental way. It is about holding *submarines* at risk – a platform type -- but it is not about holding at risk "any targets in the undersea domain." Underwater mines, for instance, are not in the ASW target set. UUVs are not ASW targets. Undersea sensor systems are not ASW targets. There is, in fact, no formal, joint term to describe the class of warfare that holds general targets in the undersea domain at risk. To fill this void, the term "anti-undersea warfare" can be used as the undersea equivalent of the anti-air and anti-surface warfare areas, and can be defined as "warfare against undersea systems."



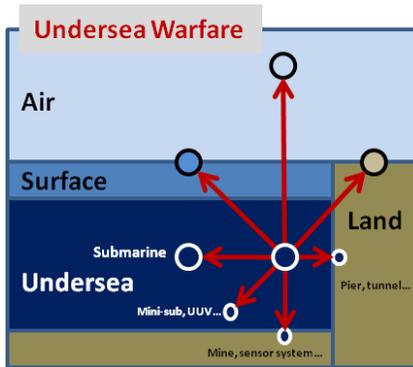
Another way to categorize warfare areas that provides different insights is to divide them by the platform type conducting the warfare. In this way, we have "air warfare" which is warfare from the air, regardless of the target set; "surface warfare" which is warfare from the surface regardless of the target set, and "undersea warfare" which is warfare from the undersea, regardless of the target set. These warfare areas overlap those that are centered on the target set.

Talking about warfare areas by platform type is useful because it gathers together warfare knowledge that needs to be in the professional skill set of different warriors with different platform-based expertise. Aviators, for

instance, need to be concerned about both “air warfare” and about “anti-air warfare.” “Air warfare” is the kind of warfare they execute – the kind done from aircraft. “Anti-air warfare” may or may not be done by aviators, but it certainly targets platforms in the air, and aviators have a vested interest in making sure that they are not targeted by other friendly forces. The same interests apply to surface warfare officers and anti-surface warfare and submarine officers and anti-undersea warfare.



*Anti-undersea warfare*, then, consists of more than anti-submarine warfare. It also includes what is often called “mine countermeasures” but what could also be called “anti-mine warfare.” In addition, anti-undersea warfare includes warfare against a variety of other systems that operate or exist in the undersea environment and are worth targeting. These systems might include torpedoes, UUVs, seabed systems of various types, and other undersea infrastructure. For the purposes of completeness, all of the systems other than submarines and mines can be lumped together as targets in a warfare area called “anti-subsea warfare.”



Naming these kinds of warfare is not just an exercise in building taxonomic categories, it is important for completeness. For instance, when the Navy assesses its capability portfolios, there is an underlying assumption that the range of warfare areas being used is complete and that, if they are all covered adequately, that our naval capabilities are “whole.” However, if there are important areas of warfare that are not included, then the approach for portfolio assessment is flawed because it leaves gaps. Naming these warfare areas is a necessary first step to assessing whether they are dealt with in a complete manner.

**Undersea Warfighting**

**Commander United States Submarine Forces  
7958 Blandy Road  
Norfolk, Virginia**

**July 2011**