UNDERSEA WARFARE

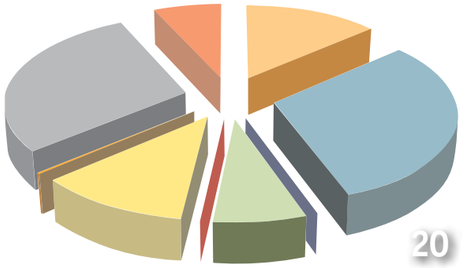
U. S. SUBMARINES... BECAUSE STEALTH MATTERS

U.S. Naval Strategic Deterrence:

An Unseen Global Force From the Ocean's Depth

INSIDE

Issue No. 60 Winter 2016



UNDERSEA WARFARE
THE OFFICIAL MAGAZINE OF THE U.S. SUBMARINE FORCE

U.S. Naval Strategic Deterrence:

An Unseen Global Force From the Ocean's Depths

On the Cover

A Trident D5 missile streaking over San Francisco launched by USS *Kentucky* in November 2015.

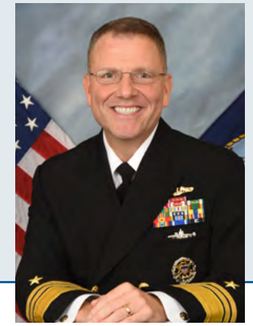
Photo by Abe Blair

Departments

UNDERSEA WARFARE is online at: www.public.navy.mil/subfor/underseawarfaremagazine

FORCE COMMANDER'S CORNER

Vice Adm. Joseph E. Tofalo, USN
Commander, Submarine Forces



Undersea Warriors,

Greetings from Norfolk! As I read this issue of *UNDERSEA WARFARE* and reflect on my first six months in command of the finest undersea force in the world, I was both humbled and proud.

I was first humbled by the sense of our history. We are and always have been a maritime nation. Our founding fathers clearly saw the importance of the maritime domain, for they stated in the Constitution that the Congress had the power "to raise and support armies"… but absolutely requiring it "to provide and maintain a Navy." History has proven them wise. Approximately 70% of the world is covered by water, 80% of the population lives within a few hundred miles of an ocean coast, 90% of global commerce travels not by plane but by ship, and over 95% of intercontinental communications (including financial transactions) travel not by satellite, but via an underwater cable. Our nation collectively rose to the challenge by providing and maintaining the most powerful naval force the world has ever known. Our people rose to that challenge as individuals as well. Great, courageous Americans fought conflicts like World War II in boats like the USS *Pampanito* (SS 383). Ingenious Americans gave us our modern arsenal of submarine launched missiles. It is important to look back at the initiative and motivation of those who gave us the Force we operate today.

"Because we are a maritime nation, a large part of the responsibility to prevent challengers from using the sea to threaten the U.S. and its allies will fall on the Navy."

But our nation faces a number of rising challengers. Recent developments have dramatically altered the political, economic, and strategic environment for the United States and our allies. Some of these changes constitute immediate threats to our security, and all of them represent significant new challenges for our Navy. Traditional nation-state actors strive for increased power and maritime influence. Because we are a maritime nation, a large part of the responsibility to prevent challengers from using the sea to threaten the U.S. and its allies will fall on the Navy. As anti-access/area denial systems proliferate, the share of this Navy responsibility that falls on the submarine and undersea forces will only grow. As you'll see when you learn about our budget in this issue, America continues to rise to the challenge of maintaining its Navy and its undersea forces.

And that brings me to how proud I am. I'm proud of the people who design, build, support, repair, and crew our undersea platforms and train our Sailors. I'm proud of the expertise, initiative, and toughness that they demonstrate every day. And finally, I'm proud to be part of the finest undersea force in the world during our time to continue the legacy of our great maritime nation.

Thank you for all you do – keep charging!

J.E. Tofalo

DIVISION DIRECTOR'S CORNER

Rear Adm. Charles A. Richard, USN
Director, Undersea Warfare Division

Undersea Warfare Team,

The Secretary of Defense just released the military's proposed FY17 budget for Congressional review. In simple terms, the Secretary of the Navy and the Secretary of Defense have strongly invested in submarine readiness and future capabilities. We were successful in achieving the investments we needed to fund the Ohio Replacement (OR) Program and the *Virginia* class, including the Virginia Payload Module, which will soon be simply called *Virginia* Class Block V. Leadership also sent a message by investing in additional heavyweight torpedoes and other programs designed to improve the capabilities of our force. We have built an across-the-board reputation as professional warfighters operating on the frontlines and must continue delivering on our commitments and be ready for decisive operations and combat.

It is your daily contribution to our nation's defense that validates the support we receive inside the Beltway. Let me give you several examples of how your efforts buy us street "cred" and how that credibility enables us to be the force the nation counts on.

"We have built an across-the-board reputation as professional warfighters operating on the frontlines and must continue delivering on our commitments and be ready for decisive operations and combat."

First, we must remain the best Submarine Force in the world. This is no small task given the challenges arising around the globe. We are depended upon to access A2/AD environments as the leading edge of the fleet in almost every future scenario. We must continue to learn how to fight our submarines to their limits in supporting our national defense. Because of the forward posture we maintain through deployments and the lessons we learn in using our shipboard systems, we are able to prove that we make full use of the warships given to us. Adm. Harris, PACOM, recently testified before Congress saying, "As far as the *Virginia*-class submarines, it's the best thing we have. It's the best thing we have and I can't get enough of them, and I can't get enough of them fast enough." I couldn't agree with him more.

Second, we must execute new construction and shipyard availabilities on time. We will continue to build two *Virginia*-class submarines per year, as well as beginning to build OR in FY 2021. We must become as good in executing shipyard availabilities as we are in fleet operations. Delays will hurt our ability to support combatant and fleet commanders. I recognize that the job of a "shipyard" Sailor, in both NEWCON and Overhaul, is not glamorous, but you are unsung heroes helping us to maintain today's submarines and build tomorrow's submarine fleet faster than ever. We, along with our industrial partners, need to continue to look for innovative ways to improve our availabilities and avoid costly delays to deliver these brand new submarines to Adm. Harris and the other corners of the globe.

Third, read the Design for Maintaining Maritime Superiority and the Commander's Intent, *and execute!* I have a copy of each on my desk, and I use them every day. Do not forget that everything we do is done with the goal of being ready to conduct prompt and sustained combat incident to operations at sea.

Our value to this nation's military is being recognized every day by our nation's leadership. These same leaders entrust us to perform challenging tasks at the far ends of the world. It is being recognized because you operate our warships with skill, integrity, and commitment. If you pay attention to the news, combatant commanders and senior political leaders are calling out for more submarines and undersea capabilities. We bring credible and consistent deterrence against weapons of mass destruction, as well as significant offensive capabilities in theater operations. Let's continue to understand and execute our roles, and let me know how I can help to make you and your boats stronger every day. Keep charging!

C. A. Richard

UNDERSEA WARFARE
The Official Magazine of the U.S. Submarine Force

Charter

UNDERSEA WARFARE is the professional magazine of the undersea warfare community. Its purpose is to educate its readers on undersea warfare missions and programs, with a particular focus on U.S. submarines. This journal will also draw upon the Submarine Force's rich historical legacy to instill a sense of pride and professionalism among community members and to enhance reader awareness of the increasing relevance of undersea warfare for our nation's defense.

The opinions and assertions herein are the personal views of the authors and do not necessarily reflect the official views of the U.S. Government, the Department of Defense, or the Department of the Navy.

Contributions and Feedback Welcome

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CHINFO Merit Award Winner

Silver Inkwell Award Winner

LETTERS TO THE EDITOR

In keeping with *UNDERSEA WARFARE* Magazine's charter as the Official Magazine of the U.S. Submarine Force, we welcome letters to the editor, questions relating to articles that have appeared in previous issues, and insights and "lessons learned" from the fleet.

UNDERSEA WARFARE Magazine reserves the right to edit submissions for length, clarity, and accuracy. All submissions become the property of *UNDERSEA WARFARE* Magazine and may be published in all media.

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FROM THE EDITOR

Stay connected, stay informed, and keep learning.

If you don't already follow us on Facebook and Twitter, now is the time to start!

Follow us to receive submarine related news and updates throughout the day, learn about submarine history through our daily entries, and interact with other readers.

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The stunning photo of the Trident D5 missile streaking over San Francisco in November 2015 was captured by Abe Blair. Should you be interested in purchasing a print, visit www.abeblair.com or on facebook at www.facebook.com/abeblair

by Capt. Anthony Carullo

A Fighting Ship of the Highest Order

PART II: **Dicta of Submarine Attack**

From the Editor: This series highlights the fact that a submarine is a formidable warfighting machine. We, Submariners, have learned many lessons on how to employ the technological marvels that exist today in our SSNs, SSBNs, and SSGNs. We should not lose sight of the fact that we are training to be warfighters first. Capt. Carullo's article reminds us what it takes to be at the ready and why it is important. You can read Part I, "A Fighting Ship of the Highest Order—Procedural Compliance: The Bedrock for Bold and Deliberate Action," in the Winter 2013 edition of *UNDERSEA WARFARE* magazine.

Dicta – In United States legal terminology, a dictum (plural dicta) is a statement of opinion considered authoritative (although not binding), given the recognized authoritativeness of the person who pronounced it. The recognized authoritative persons that inspired these dicta are the skippers that were tested in the crucible of World War II.

Discipline – Wrongly confused with punishment, discipline is how an individual or a team learns what to do, when to do it, and in what manner it should be done to protect the ship, the crew, and to achieve victory in battle. Discipline is how the Commanding Officer unleashes the individual talents of the crew toward a singular purpose. While punishment attempts to correct bad behavior after it has happened, discipline prevents the bad behavior in the first place.

Discipline in Battle

Of the many missions a submarine and her crew must be prepared to accomplish, anti-submarine torpedo attack has to be first and foremost. The crew's very survival—and where the ship and crew will be placed in the annals of naval history—depends on their dedication to combat training and commitment to readiness. The team's focus must be clear and precise, the Sailors, tough.

Torpedo attack has little room for error and requires a dedicated approach to training—thousands of hours of study and practice where the boat (battle ready), her crew (manned and ready to target the enemy with a well-exercised weapons battery), and the Commanding Officer (bold, competent, and confident in the face of the enemy) become one. Focused and dedicated training ensures that the crew executes ship and weapons procedures to perfection so the Commanding Officer can adhere to the rules or dicta of attack. Only through this discipline in battle can the Commanding Officer and his crew become victorious.

"When a natural leader and born daredevil such as Mush Morton is given command of a submarine, the result can only be a fighting ship of the highest order, with officers and men who would follow their skipper to the Gates of Hell."

Vice Adm. Charles Lockwood on
Lt. Cmdr. Mush Morton and USS *Wahoo* (SS 238)

The Dicta of Attack

These authoritative rules or dicta must be second nature to the Commanding Officer to win victory in battle:

1. **Seize the initiative to get the enemy in your clutch.**

The Commanding Officer that can quickly assess, decide, maneuver, and attack will control the entire engagement. Keep the enemy on the surprise by aggressively maneuvering your ship.

Closing the enemy should only be done to attack; there is no separate and distinct event, but a continuum to the end result—the accurate delivery of a torpedo onto its target to achieve a swift victory in battle.

A disciplined crew can control the time and location of the engagement. Stealth is how the ship executes this surprise.

Knowing the strengths, weaknesses, and capabilities of your ship and your foe, is critical. Through aggressive, disciplined, and purposeful maneuvers you can play to your strengths and avoid his. Victory favors brave initiative.

Keep the battery at the ready and keep it warm—update weapons solutions continuously—the attack party should anticipate and act on your next move and be ready to adjust accordingly. Checking or delaying fire will lead to defeat.

2. Attack with aggression and purpose to achieve victory swiftly.

Be bold in the face of the enemy; bring out the full capabilities of the ship and the crew in an aggressive approach. A better prepared ship and crew always has the advantage; push both to the limit.

Keep your foe in your sights and on your screen, only break contact to drive to the firing point or to get the minimum information needed to continue the attack. Never present your tail to the enemy—our submarines have no aft tubes to bear.

Shoot when the enemy is squarely in your sights. Give your weapon the best chance to succeed, but don't lose the initiative or make your presence known solely to improve the theoretical chance. Preciously guarding every minute and sacrifice the last "check" to not lose the element of surprise.

Only reveal your presence with the torpedo homing on his ship—your enemy may already be preparing his attack on you.

"Press home all attacks. Do not be shaken off, make sure all torpedoed ships sink"

LCDR Creed Burlingame
CO USS *Silversides*

Attack with a full and ready battery, each barrel should be ready to spring into action. Shoot the number of weapons to do the job—a spare weapon in a sunken submarine saves nothing.

3. Hold tight to your attack position and only avoid weapons fire to survive and reposition while planning your re-attack.

Trust your men, your ship, and the discipline you instilled in both.

Keep the enemy in your clutch. If your covert approach was successful, keeping him trapped in your gun sights is the only defense you need.

If detected, make the confusion your ally. Force him to deal with the pressure of being under attack. If your approach was successful, you are better prepared to ensure victory.

If repositioning was required, return with the barrels loaded and the boys on the guns. The next engagement will only favor the ship with the most disciplined and alert crew.

Boldness In Battle

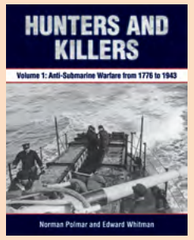
Only by having a firm understanding of the capabilities of your ship and the talent and discipline of your crew can you be bold in battle and, if necessary, push your boldness to the very brink of recklessness. A well maintained ship and a well-disciplined crew—with a professional mastery of attack procedures—keeps the margin between boldness and recklessness sufficient.

Hold fast to these dicta.

Captain Anthony Carullo is currently the Commander, Task Force 69 and Deputy Commander, Submarine Group 8 in Naples, Italy. He previously commanded USS *Greeneville* (SSN 772) in Pearl Harbor, HI.

Book Review

"Hunters and Killers" is the first comprehensive history of all aspects of anti-submarine warfare (ASW) from its beginnings in the 18th century through the important role of present anti-submarine systems and operations. Published in two volumes, the work discusses ASW operations in World War I, World War II, the Cold War, and today. In addition to tactical and strategic narratives of major ASW campaigns, the work covers the evolution of ASW sensors, weapons, platforms, and tactics.



This first volume looks at the often ignored reaction to the earliest submersible attack on British warships in 1776 to the first, primitive ASW actions of World War I. World War I saw the Germans use U-boats to devastate British shipping, nearly driving the country out of the war. Here the authors look at the development of the innovative but rudimentary sensors and weapons that the Allies used to counter the U-boat threats in the Atlantic and Mediterranean theaters.

Still, the U-boats were never completely defeated in the Great War, and the ensuing chapters about the two decades between the world wars narrate the development of sonar, radar, and ASW ships, as well as changing political attitudes toward undersea warfare.

The remainder of the first volume covers the first half of World War II's Battle of the Atlantic, from September 1939 to the U-boat crisis in the spring of 1943. This section discusses the influence of intelligence, gained mainly through cryptography, on the Battle of the Atlantic. Norman Polmar and Edward Whitman have created a thorough, well-researched reference for anyone interested in the development of ASW.

SUBFOR Commander's Intent

by Vice Adm. Joseph Tofalo

I released my *Commander's Intent for the United States Submarine Force and Supporting Organizations* on December 11, 2015. This document provides essential guidance to submarine crews and the vital personnel and supporting organizations who keep them ready to meet wartime demands.

The *Intent* updates and supersedes the *Design for Undersea Warfare, Commander's Guidance of 2014*, *Undersea Dominance Campaign Plan and Vision 2025*, and the *Integrated Undersea Future Investment Strategy* but preserves the essential direction of the previous documents. Our course is true, our traditions reinforce the right attributes, and we have much to be proud of. The *Intent* is less of a course change, but rather some small rudder to keep us in the middle of the channel as we face changes in set and drift.

The Force is on the right track, but the "currents" we operate in are definitely changing. For the past 10 to15 years, we have primarily supported a land war in the Middle East, emphasizing power projection ashore from uncontested sanctuary in the littorals. In contrast, over the next 10 to 15 years, the emphasis must instead be on high-end combat in contested blue water. A revitalization of U.S. sea power must increase our ability to decisively win high-end conflict at sea (thereby deterring conventional war) and maintain our strategic influence around the world.

The significance of the Submarine Force's contribution to the nation's maritime superiority is also in flux. Our SSBN force, currently carrying just over 50% of the nation's strategic assets, will increase to approximately 70% of our accountable nuclear warheads under the New Strategic Arms Reduction Treaty. Consistent with our history as a maritime nation, the responsibility to prevent challengers from using the sea to threaten the U.S. and its allies will fall predominantly on the Navy. As anti-access/area denial systems proliferate, the share of this Navy responsibility that falls on U.S. undersea forces will only grow. Our SSNs and SSGNs uniquely enable all-domain access and hold critical adversary assets at risk by exploiting the advantages of undersea concealment.

Our response to this changing environment will evolve along four lines of effort. First, we will continue to provide ready forces to the fleet. This directly contributes to enhancing power both at sea and from the sea. Further, we will employ those forces effectively by aligning development of tactics and capabilities across the spectrum of operating forces, operational commanders, partners and allies, and future capability developers. However, effectively employing a force today is not enough to maintain our maritime superiority; we must also develop capabilities for the future. Finally, everything we do rests on the foundation of our strength: our people. We must develop them to be leaders, treat them with honesty and integrity, create an environment that promotes teaching and learning, empower their pursuit of excellence, and facilitate ways for them to work better and smarter. This alone makes the other lines of effort possible.

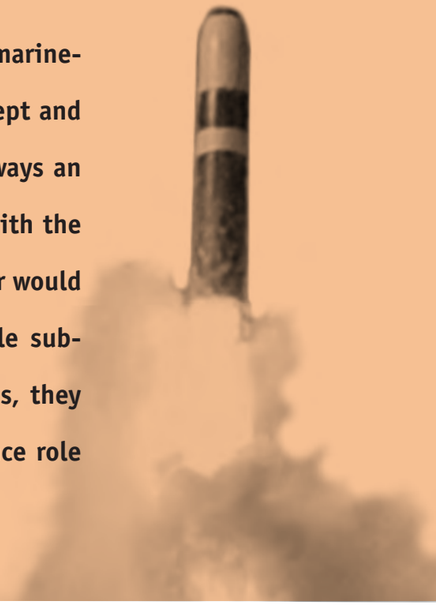
It is important to know what success looks like in any endeavor. Undersea Warfare Vision 2025 provides our vision of success in the following elements. We will know we've succeeded when we:

- **Own the Best.** We have the best undersea systems and platforms. For the Submarine Force, this means buying the best submarines and maintaining and modernizing them to ensure that we remain the best. It is also about buying, maintaining, and modernizing the best supporting systems, including off-board and surveillance systems, training infrastructure, etc.
- **Grow Longer Arms.** We maximize our effective reach from the undersea through increased weapon and sensor range, a broadened set of delivered effects in a wider variety of domains, and covering additional geographic area and missions through a network of manned and unmanned systems.
- **Beat the Adversary's System.** We beat the adversary's system by exploiting the undersea platform's inherent and long recognized advantages of surprise, confusion, and disruption.
- **Protect our Strategic Assets… and Threaten Theirs.** This includes protection from threats to our homeland, SSBNs on patrol, Carrier Strike Groups, critical undersea infrastructure, cyberspace, strategic ports and chokepoints, and submarines. Likewise, the main role of our Submarine Force is to hold the adversary's strategic assets at risk from under the sea.
- **Get on the Same Page.** We are tightly aligned and tactically on the same page in operations, planning, and investments. This includes ensuring that we exchange common operational data among air, surface, and subsurface assets. We must keep our naval, joint, and allied doctrine aligned with evolving threat forces' capabilities, behaviors, and intentions. This is also about ensuring that we are efficient in our pursuit of capability by avoiding redundant expenditures of effort and limited personnel, materiel, and fiscal resources.
- **Get Faster.** End-to-end, we must be "fast" in our operations, learning, processes, acquisitions, and innovation. This does not mean rushed decisions or isolated actions—we are bold, not reckless. Well-conceived, "fast" and efficient operations provide the adversary with less time to assess and react. A culture that includes the ability to quickly learn and adapt will always be better able to respond to threat and environment changes or an operational error. In our processes, we must aggressively pursue eliminating administrative procedures that do not add value and slow us down. In acquisition, the institutional inertia created by acquisition process habits must continue to be challenged. We must be faster in our innovation and also accept the fact that innovation involves some failure.
- **Be the Best.** Our people—military and civilian—strive to be confident experts of the highest character, and we must enable their toughness, resiliency, and professional development. We must develop our people to be leaders, do everything with honesty and integrity, always be teaching and learning, tirelessly pursue excellence, and constantly look for ways to work better and smarter. Success also rests on the effective accumulation of operational experience, a key advantage of U.S. undersea forces.

This is only a summary of the *Commander's Intent*. Please view it in full at http://www.public.navy.mil/subfor/hq.

by Thomas Lee

The History of America's Undersea Strategic Deterrence: From V-1 to D5



The United States was not first to conceive or develop submarine-launched missiles, but it was the first to capitalize on the concept and emerging technology, making it a viable reality. Stealth was always an integral advantage of submarines, but combining that stealth with the reach of missiles made a truly formidable combination. No longer would submarines be limited to seaborne and shoreline targets. While submarine-launched missiles are by their nature offensive weapons, they quickly took on the arguably more important strategic deterrence role of preventing wars between major powers.

America's first successful submarine-launched missile was the Loon, which was a slightly larger, re-engineered version of Germany's V-1 flying bomb. The Navy didn't begin experimenting with launching the Loon from a submarine until 1946, but that wasn't the first missile launch from a submarine.

German Origins

German scientists began work in the 1930s to develop rockets to be used for space exploration. The German government later funded this research because it came to see that rocket technology could be applied to weaponry. Development of Germany's first rocket-propelled weapon began in 1941, which eventually led to Germany's V-1 flying bomb in June 1944 and the V-2 rocket in September 1944, both liquid-fueled. In 1942, British intelligence acquired photos and sketches of a crashed test model, which were shared with the United States.

The V-1 was essentially the first cruise missile, albeit rudimentary, able to fly at predetermined altitudes and guided on a given heading by a gyrocompass. A timer—an odometer driven by a vane anemometer (measures wind speed) and adjusted for observed prevailing wind conditions—determined the point at which the missile would drop from the sky, detonating on contact. The V-2 was a ballistic missile, which followed an arced—or ballistic—trajectory to its target area. Shortly before Germany was defeated, it had begun using a ground-based radio guidance system to direct V-2s to their intended target areas.

The First Submerged Rocket Launch

The Germans were the first to explore the idea of launching a guided missile from a submarine. In seeking how Germany might strike the U.S. mainland, two brothers, Ernst and Friedrich Steinhoff—Ernst a rocket engineer and Director for Flight Mechanics, Ballistics, Guidance Control, and Instrumentation at the Peenemünde Army Research Center who later worked for the U.S. government with Werner von Braun, and Friedrich the CO of *U-511* and later *U-873* who died of wrist wounds in Boston after surrendering to USS *Vance* (DE 387)—began discussing the possibility of launching an artillery rocket (aimed but unguided) from the deck of a submerged submarine. This concept was tested on *U-511* in May and June of 1942 using a standard army launcher. The tests showed that the rockets could be successfully launched from a depth of 15m below the water's surface.[3]

Germany never used these weapons against the U.S. mainland because the project was delayed due to concerns with the launcher. Launchers were, however, installed on three U-boats and deployed against the Russians during Germany's retreat in 1945. The Germans claimed to have used them but there are no records indicating damage inflicted by rockets.[4]

German engineers also conceived of placing a V-2 missile inside a watertight tube that could be towed by submarine to a location near the U.S. coast. The tubes could then be trimmed to a vertical position and the missiles launched. The submarine would have to remain on the surface, however. The war ended before the concept could be tested, but the Soviet Union's Golem submarine-towed missile launcher, produced in the 1950s, was based on captured German plans of this system.[5]

The Allied nations were eager to acquire these rockets, their production facilities, documentation, and the engineers who developed and produced them so as to begin or enhance their own rocket programs. On April 11, 1945, as Allied forces were advancing through Germany toward Berlin from opposite directions, the U.S. Army 3rd Armor Division captured intact the subterranean Mittelwerk V-1 and V-2 production facility at Nordhausen. There they found a treasure trove of V-1 and V-2 parts and rockets in various stages of completion. The Soviet Union, however, had been given jurisdiction over Nordhausen at the Yalta conference. Between May 22 and May 31, the U.S. 144th Motor Vehicle Assembly Company loaded 341 rail cars with rocket-related materials and moved them to Antwerp, Belgium, for removal by ship to the United States, just one day before Soviet troops were scheduled to arrive in Nordhausen.[1] The United States got by far the lion's share of the hardware, documentation, and engineers, including Dr. Werner von Braun.

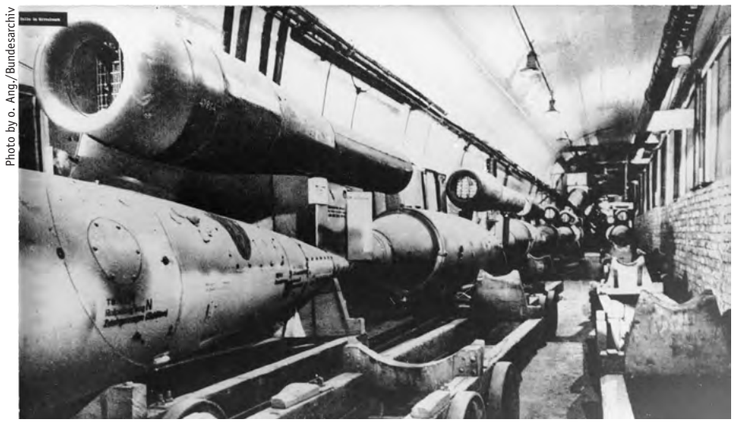


Photo by o. Ang./Bundesarchiv

Assembled V-1 rockets in tunnels at Mittelwerk facility after capture by U.S. forces

Loon

The United States began development of its first jet bomb in 1943, the JB-1, which used a flying wing design. Over 17 days in July 1944, the United States succeeded in reverse-engineering Germany's pulse-jet engine using crashed V-1 duds sent from Britain. This engine was used in a redesigned missile modeled after the V-1 and dubbed the JB-2, or Loon, which had a range of 50 nautical miles (NM) as limited by the guidance signal from the launching submarine, or 135 NM if a second submarine were in position downrange to continue broadcasting guidance information. The Loon's design was identical to the V-1 except for being 60cm longer at 8.25m and having a 5.4m wingspan, 6.35cm wider than that of the V-1.

America developed an improved guidance system for the Loon using radio command, which enabled a Circular Error Probable (CEP)[2] of about 5,500m (¼ NM cross range and ½ NM downrange). While this accuracy was better than that of the V-1, it was quite poor by today's standards. The radio command operator could also execute simple in-flight maneuvers such as changing the approach course to avoid enemy forces directing counterattacking aircraft down the Loon's bearing. The next step was to figure out how to launch the Loon from a submarine.

In 1946, the U.S. Navy began work on a submarine-launched version of the Loon. USS *Cusk* (SS 348) became the first submarine to launch a guided missile on

A Triad of Strategic Deterrence

After World War II, a new era, the Cold War, began. Rising tensions between the West and the Eastern bloc nations led to increased development and production of nuclear weapons. The first means of delivering these weapons were bombers, followed by intermediate-range and intercontinental ballistic missiles (ICBMs). The final piece of what would be known as the Triad was the submarine-launched ballistic missile (SLBM). While heavy bombers provide advance notice that action is being taken and the ability to be reassigned or recalled, and land-based missiles assure prompt first-strike capability, the SLBM would complete the equation. Nearly undetectable, the submarine-based capability offers stealth, survivability, and assured second-strike capability, thus upping the ante of true strategic deterrence. They could be deployed in such sufficient numbers that not all of them could be targeted.

February 12, 1947 and was the first to be re-designated as a guided missile submarine (SSG) on January 20, 1948. The missile was carried in a hangar attached to the deck behind the conning tower and would have to be maneuvered onto a ramp to be launched. The submarine had to remain surfaced for this procedure, making it vulnerable to attack if spotted.

Regulus

Entering the 1950s, the Cold War was just heating up. The U.S. government's highest strategic priority was to develop a strong deterrent against a potential first strike by the Soviet Union. It was in this atmosphere that the developments in submarines, the atomic bomb, and missiles converged.

Even while testing the Loon aboard *Cusk* and later USS *Carbonero* (SS 337), the Navy was already working with Chance Vought Aircraft Industries on specifications for its next guided missile, the subsonic Regulus, later named Regulus I. The Regulus was about 3½m longer than the Loon and had a 1m longer wingspan when its wings were in the deployed position. It was nearly twice as fast as the Loon, had a greater range of 500 NM, and carried a larger—and nuclear—warhead. Like the Loon, however, the Regulus required the submarine to be surfaced for launching, had to be launched from a ramp, and was guided by radio command, requiring a second submarine to act as a guidance relay to direct it to its target. It was also, like the Loon, liquid-fueled. Liquid rocket fuel had to be stored outside the missile and loaded into the missile immediately before launching. In addition to prolonging exposure on the surface, storing and handling the highly flammable fuel was dangerous in the sealed environment of a submarine.

While *Cusk* and *Carbonero* each carried a single Loon missile, two other fleet boats were converted to SSGs, USS *Tunny* (SS 282) and USS *Barbero* (SS 317), each carrying two Regulus missiles in their missile hangars. On July 15, 1953, *Tunny* became the first submarine to launch a Regulus missile. A month before this test launch, Chance Vought had begun development of an improved guided missile, the Regulus II.

In 1954, the Navy began building its second generation of guided missile submarine. The purpose-built USS *Grayback* (SSG 574), USS *Growler* (SSG 577), and the first nuclear-powered guided missile submarine (SSGN), USS *Halibut* (SSGN 587) were each designed with two missile hangars. Each missile hangar could carry either two Regulus I missiles or one of the in-development Regulus II missiles for a total of two to four missiles per boat. *Grayback*, *Growler*, and *Halibut* were launched in 1957, 1958, and 1959, respectively.

Even as the Regulus II was being developed, Navy leaders recognized its shortcomings. The most significant hurdle to overcome was the one that the Navy most wanted addressed: a missile that could be launched from a submerged submarine. This would require not only a new missile and launching mechanism, but a new type of submarine as well. As early as 1955, the Navy committed to developing this new missile, the Polaris.

The Regulus II was successfully test launched in 1956, but the program was ended in 1958 because of progress being made on the Polaris. The Regulus II was never deployed, but the Regulus I was deployed on U.S. submarines from 1958 to 1964. During that time, U.S. submarines made 41 strategic deterrent patrols armed with the Regulus I. The number 41 was soon to have great significance to the U.S. Submarine Force and the nation's security.

Polaris A1

While the Loon and Regulus were cruise missiles, the Polaris A1, developed by Lockheed Missiles & Space Co., was America's first true submarine-launched ballistic missile (SLBM). In addition to using solid fuel, Polaris more than doubled the range of the Regulus I, was more than twice as accurate, was nearly 10 times as fast, and carried a warhead more than 12 times as powerful. Polaris, while becoming operational a year later than the Soviets' first SLBM and having a range less than the 1,500 NM desired by the Navy, was nonetheless a game changer.

Heading up the newly established Special Programs Office (now called Strategic Systems Programs) and the Polaris Program was Rear Adm. William "Red" Raborn, who was given exceptional authority and latitude to make the Polaris a near-term reality. His team included the inventive and persistent Dr. John Craven, whose job it was to figure out how to launch the massive new missile from a submerged submarine.

Russia's SLBM threat

Beginning in 1958, our Cold War enemy, the Soviet Union, began commissioning its *Golf II*-class diesel-electric ballistic missile submarines, followed in 1959 by the *Hotel I*-class nuclear ballistic missile submarines. Each of these was designed to carry the Soviet Union's new R-11FM (Scud-A) missile, which could be launched from a surfaced submarine in about 12 minutes. Three silos were placed aft of the sail and the sail was extended to enclose the silos. The Scud-A had a range of about 80 NM when armed with a 50 kiloton nuclear warhead. From 1958 through 1962, the Soviet Union produced 22 *Golf II*-class and 8 *Hotel I*-class submarines, averaging about six boats per year.

Soviet *Golf II*-class (Project 629) ballistic missile submarine.

from a submerged submarine.

There were other advancements that came together at this time to make the Polaris a success. There were breakthroughs in reducing the size of atomic warheads, thus improving range, and in solid rocket fuel making it more reliable, responsive, and safe. The Massachusetts Institute of Technology developed an inertial guidance system, which eliminated the need for radio guidance and the need for a second submarine to guide the missile to its target area. Inertial guidance also brought a significant improvement in accuracy.

The Navy's development of the nuclear-powered ballistic missile submarine, or SSBN, took place concurrently with development of the Polaris. The advent of the SSBN in America was undertaken with a real sense of urgency due to the threat of a Soviet first strike. The first SSBN was originally laid down as a fast attack submarine (SSN) of the *Skipjack* class in 1958, three years after the Soviets conducted their first successful surfaced test launch of an SLBM. The vessel's partially constructed hull was cut across the middle to make room for a 40m-long section containing two rows of eight launch tubes to house 16 Polaris A1 missiles and other associated equipment.

In a little over a year and a half, USS *George Washington* (SSBN 598) went from a nearly completed nuclear-powered SSN to being commissioned into service at the very end of 1959 as an SSBN. She successfully test-launched a Polaris A1 in July 1960 and began her first strategic deterrent patrol in November 1960. Before USS *George Washington* returned from her maiden 67-day patrol, the second SSBN, USS *Patrick Henry* (SSBN 599) set sail on December 30, 1960 on its first strategic deterrent patrol. Thus began the rapid SSBN building program known as "41 for Freedom," the timing was profoundly fortuitous.

Cuban Missile Crisis

In October 1962, President Kennedy was informed that the Soviet Union had been staging SS-4 medium-range nuclear ballistic missiles in Cuba, which led to the tense Cuban Missile Crisis. For 13 days, from the 16th to the 28th of October, 1962, the whole nation feared that a nuclear exchange with the Soviet Union could begin at any moment. It is arguably the closest we have ever come to nuclear war.

At the time the standoff began, there were already nine U.S. SSBNs in commission, six of which were known to be on station in the Norwegian and Mediterranean Seas, one of which had departed on patrol on October 10th, and another that was preparing to depart.[6] No doubt Soviet Premier Nikita Khrushchev was aware of the more than 100 Polaris missiles lurking beneath the surface within reach of major Soviet cities, which must have factored into his decision to remove Soviet missiles from Cuba. In addition, USS *Tunny* (SSG 282), USS *Barbero* (SSG 317), and USS *Grayback* (SSG 574) were on station near the Soviet Pacific coast carrying eight Regulus I missiles.

Polaris A2

Well before the Polaris A1 became operational in 1960, the Navy knew that it was an evolutionary step toward getting a sufficient sea-based strategic deterrent in place. Even before the Polaris A1 went on patrol, the Navy and Lockheed Missiles & Space Co. began development of its successor, the Polaris A2. The A2 was first successfully test launched from a submerged submarine, USS *Ethan Allen* (SSBN 608), in October 1961, and it became operational in June 1962.

The Polaris A2 met the Navy's original desired range of 1,500 NM and was more accurate and more reliable due to improved electronics. The five *Ethan Allen*-class submarines were designed to carry the Polaris A2, which was almost a meter longer than the A1 but with the same diameter. As with the Polaris A1, the Navy didn't stop development with the A2. Just two years after the A2 became operational, newer U.S. SSBNs began deploying with the Polaris A3.

Polaris A3

The first successful Polaris A3 test launch from a submerged submarine took place aboard USS *Andrew Jackson* (SSBN 619) in October 1963, and the first A3 patrol began in September 1964 aboard USS *Daniel Webster* (SSBN 626).

While the Polaris A3's name implies that it was an improved A2, that's not entirely accurate. The Polaris A3 was really a new missile design that had to fit into the A2 launch tubes. The A3 offered a greater range of 2,500 NM, significantly expanding SSBN operating areas and enabling full coverage of the European/Asian continent with the first Polaris patrols in the Pacific. USS *Daniel Boone* (SSBN 629) conducted the first Polaris patrol in the Pacific beginning in December 1964.

Aside from its greater range, the Polaris A3 was the first missile to have multiple reentry vehicles (or bodies) (MRVs). The first A3s each carried a single nuclear warhead. Beginning in the 1970s, the A3 carried three separate and smaller nuclear warheads.[7] These would be ejected over the target area to improve target coverage and reduce the effectiveness of missile defenses. The three smaller warheads delivered greater destruction than the single large-yield warhead while maintaining the missile's original throw weight.

While the first five SSBNs comprising the *George Washington* class were never retrofitted to carry the Polaris A2, they were retrofitted to carry the A3, with conversions taking place between 1966 and 1971. The last A3 was removed from service in October 1982.

Beginning in the late 1960s, the U.S. government became concerned that the Soviet Union would begin moving strategic assets into hardened underground bunkers to protect them from U.S. missiles. To counter this, the Navy and Lockheed Missiles & Space Co. began development of a penetrator warhead to breach the bunker before detonating and an upgraded missile to deliver it. The A3 was not accurate enough for this task, so work began on an upgrade to the A3. As different warhead and re-entry body options were considered, the nomenclature for this new missile changed, from A3A to B3 to C3 and finally, in January 1965, to a new name altogether: Poseidon.

41 for Freedom

The *George Washington* was the first of 41 SSBNs, referred to as the 41 for Freedom, authorized from 1957 through 1963, the last of which, USS *Will Rogers* (SSBN 659), was commissioned into service in 1967. The first five SSBNs, comprising the *George Washington* class, were modified *Skipjack*-class SSN designs lengthened to accommodate the missiles. The *Ethan Allen* class was the first class of submarine designed from the outset to be an SSBN. As missile technology continued to advance and new missiles were developed, earlier boats were backfitted to carry the newer missiles.

Poseidon

The Poseidon C3, as it became known, was a half meter wider than the Polaris, but it still had to fit into the Polaris launch tubes. The Polaris launch tubes had a liner that could be removed to accommodate the larger missile. What really distinguished the Poseidon is that it had multiple independently targetable re-entry vehicles (MIRVs), enabling a single missile to hold multiple targets at risk.

The Poseidon C3 was first tested in 1968, and the first test launch from a submerged submarine took place in 1970 aboard USS *James Madison* (SSBN 627). USS *James Madison* set sail on the first Poseidon patrol in March 1971. Poseidon incorporated substantial improvements in accuracy and resistance to countermeasures over previous missiles, but its principal advantage was its targeting flexibility. Poseidon could deliver multiple warheads on multiple targets in multiple widely spaced target groupings ("footprints"). Greater accuracy allowed smaller warheads to be employed while achieving the target effects of larger, less accurate warheads.

Although the Department of Defense was working on a far more accurate, stellar-inertial, guidance system during the Poseidon's development in the latter half of the 1960s,[8] it decided not to use this on the Poseidon. Had Poseidon's accuracy been improved significantly, it could have been viewed by the Soviets as a first-strike weapon capable of destroying Soviet missiles and related military targets.[9] The DoD's position was that Poseidon SLBMs would be strictly for second-strike retaliation after a Soviet first strike.[10] The missile's small improvement in accuracy[11] over the Polaris A3 was more than sufficient for that task.

The last Poseidon was offloaded in September 1992. Stellar-inertial guidance fully matured in the 1970s for use in Poseidon's successor, the Trident.

Trident I

The Soviet Union lagged behind the United States in missile and submarine technology and development. The Soviets were deploying liquid-fueled missiles aboard submarines until 1980 when they deployed their first solid-fueled missile, the R-31 "Snipe" (NATO designation SS-N-17), which had a range of 2,100 NM.[12] What they lacked in technology, however, they made up for in the number of nuclear bombs, land-based intercontinental ballistic missiles (ICBMs), and SLBMs produced through the 1970s and 1980s. In the words of Marxist doctrine, "Quantity has a quality all its own." The Navy's answer to this Soviet nuclear build-up was the Trident SLBM.

The first version was the Trident I C4. The Navy and Lockheed Missiles & Space Co. commenced development in 1973, and the missile became operational in 1979. It was developed in conjunction with a new class of ballistic missile submarine to carry it, the *Ohio* class. Six *Lafayette*-class[13] and six *Benjamin Franklin*-class boats, however, were backfitted between 1976 and 1981 to carry it as well. Each *Ohio*-class boat can carry up to 24 missiles, eight more than previous SSBNs. The *Ohio*-class launch tubes were made 3m longer than the Poseidon launch tubes to accommodate a larger missile that was then in the planning stages, which was the Trident I's successor. The Trident I first went on patrol aboard USS *Francis Scott Key* (SSBN 657) in October 1979.

The Soviet Union greatly improved its anti-submarine warfare capabilities during the 1970s, thanks in no small part to the spy John Walker. Trident I's 1,500 NM increase in range over the Poseidon, however, meant that Trident-armed submarines had far more ocean in which to operate and still be able to reach their targets, thus making them harder to locate. The increase in range was due to technological advances in microelectronics and propulsion, the use of lighter-weight graphite epoxy materials, and something called an aerospike.

The third-stage rocket motor was placed between the missile's eight warheads in the nose fairing to make more space for other components, thus spreading the warheads farther from the missile's axis. Combined

Photo courtesy of Lockheed Martin Missile and Space

Aerodynamic effect created by Aerospike.

Trident II D5 (left) and Trident I C4 (right) with Aerospikes extended.

with the unchanged launch tube height in the backfitted *Lafayette*-class and *Benjamin Franklin*-class boats, this necessitated a wider, flatter nose, which increased drag. To compensate, the aerospike was added to the missile's tip. After the first-stage rocket motor ignited, the aerospike extended from the nose of the missile. At the tip of the spike is a small disc that, at supersonic speed, creates an inclined shockwave behind it. This provides a lower-pressure area for the missile to move through. The effect improved range by making the missile aerodynamically more slender, thus reducing drag by about 50 percent.[14]

Also housed in the Trident's nose was the new and more accurate stellar-inertial guidance system. The stellar portion included a sensor to conduct a star sighting. This capability keeps SLBMs independent of external positioning signals (e.g., GPS). Stellar-inertial guidance improved the Trident I's accuracy more than two-fold over the Poseidon.

When USS *Mariano G. Vallejo* (SSBN 658) returned from her last patrol on April 2, 1994, it marked not only the last patrol of the 41 for Freedom boats, but also the last patrol of the *Benjamin Franklin*-class boats backfitted to carry the Trident I. The last Trident I patrol ended after 26 years of service with the return of USS *Alabama* (SSBN 731) (G) from its 67th patrol on September 2, 2005. The Trident I had been deployed on the first eight *Ohio*-class boats until the Trident II became operational.

Trident II

Continued improvements led to the next generation of missile, the Trident II D5, the backbone of today's U.S. strategic deterrence forces and one leg of the nuclear triad. Further use of lighter graphite epoxy and filament-wound Kevlar led to a further increase in payload capacity. This, in addition to retaining the aerospike, gave the larger missile greater throw weight and range than the Trident I. Improved accuracy also provided better performance against hardened targets.

Development of the Trident II began in October 1983. The Navy conducted eight Production Evaluation Missile (PEM) test flights. PEMs 1 and 3, early in the testing phase, were failed launches. From December 1989 to March 2016, however, the U.S. and UK navies have conducted 160 successful Trident II D5 test flights. This record of success is unsurpassed by any other large-diameter rocket program. The first successful test launch

Photo by Lockheed Martin

Weapons of the Fleet Ballistic Missile Submarine Fleet, (left to right): Polaris A1, Polaris A2, Polaris A3, Poseidon, Trident I, and Trident II.

from a submerged submarine occurred on August 2, 1989 aboard USS *Tennessee* (SSBN 734). The three most recent of these Trident II test launches—test launches 158, 159, and 160—were conducted March 14-16, 2016 by an SSBN assigned to Submarine Group 10 out of Kings Bay, Ga. You can read about test launches 156 and 157, which occurred on November 7 and 9, 2015, in this issue in the article titled, "USS *Kentucky*, the Long Journey of Returning to Strategic Service."

The new missile became operational on March 29, 1990, with 24 Trident II D5s aboard USS *Tennessee* as she left port for her maiden strategic deterrence patrol. This was nine months after the Polish elections that signaled the beginning of the end of the Cold War and five months after the fall of the Berlin wall.

While the Trident II is capable of carrying its MIRVs over 4,000 NM to their targets, the New START treaty limits the number of warheads deployable by the Navy to 1,550, which would mean an average of four or five MIRVs per SLBM.

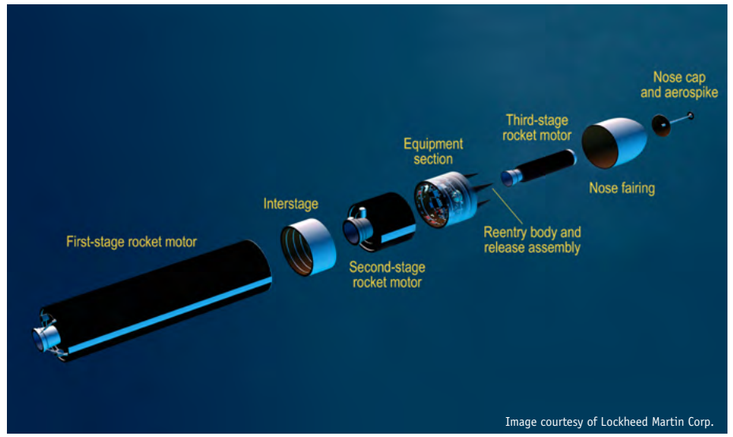
Strategic Arms Treaties

In November 1969, U.S. and Soviet negotiators met in Finland to discuss limiting the number of nuclear weapons in each nation's arsenal. These became known as the Strategic Arms Limitation Talks, or SALT. The SALT Treaty (later called SALT I) and the Anti-Ballistic Missile (ABM) Treaty were signed two and a half years later in May 1972. At issue were two technologies of primary concern: MIRV warheads and ABM capability.

When negotiations began, the Soviets were more advanced in ABM technology and had deployed an ABM system around Moscow, and the United States was rapidly developing MIRV warheads. The Soviets were concerned that MIRV capability would both render their cities and ballistic missiles vulnerable to a U.S. first strike that would overwhelm their ability to intercept the incoming warheads. The United States was concerned that Soviet ABM technology could be advanced enough to intercept all or most of its MIRVs, which would negate its superior submarine-based advantage. If the Soviets were confident in their ability to intercept incoming warheads, the United States feared that the Soviet Union could initiate a first strike with impunity.

The ABM Treaty limited each side to no more than 100 interceptor missiles and launchers located at no more than two deployment areas.[15] The Interim Agreement on the Limitation of Strategic Offensive Arms (SALT I) froze the number of nuclear ballistic missiles, both land-based and aboard submarines.

Later in 1972, follow-on negotiations began to replace the interim SALT I agreement with a longer-term and more comprehensive agreement, known as SALT II. SALT II established numerical limits on the total number of strategic nuclear delivery vehicles with additional numerical limits on MIRVs. Delivery vehicle refers to heavy bombers,



Exploded view of Trident II D5 Ballistic Missile

ICBMs, and SLBMs. SALT II was signed by President Jimmy Carter in 1979, but it was never ratified by the Senate. Both sides, however, voluntarily met some of the agreement's terms.[16]

The follow-on agreement to SALT II was the result of the Strategic Arms Reduction Talks, or START, begun in 1982 and signed in 1991. Whereas SALT I and II focused on limiting strategic weapon systems, START would seek to actually begin reducing their numbers in three phases. By the end of the third phase in 2001, each side would have to reduce its number of attributable warheads from about 11,000 to no more than 6,000 and its number of delivery vehicles to no more than 1,600. Attribution refers to the number of warheads that may be on any of the three types of delivery vehicles. No more than 4,900 of the 6,000 warheads permitted could be mounted on deployed ICBMs and SLBMs at any time. START also limited the number of MIRV warheads resulting in no more than eight warheads attributable to an SLBM. START expired in December 2009.

START was to be followed by START II, negotiations for which got underway in 1992. START II would have banned all MIRVs in ICBMs and halved the number of warheads each side could deploy, but it never entered into force. The Senate approved it in 1996, but the Russians repeatedly delayed Duma approval due to its frustration with U.S. involvement in the Persian Gulf and the Balkans. The day following U.S. withdrawal from the ABM Treaty on June 13, 2002, Russia ceased its efforts to bring START II into force.[17]

A month before both sides ceased efforts on START II in 2002, the Strategic Offensive Reductions Treaty (SORT), also known as the Moscow Treaty, was signed by both the United States and Russia. SORT, which entered into force in June 2003, would limit the number of operationally deployed nuclear warheads to between 1,700 and 2,200 per side by December 2012. The parties also agreed that the terms of START would remain in force. SORT was superseded by the New START Treaty (NST) in February 2011.[18]

NST is the current strategic arms reduction treaty in force between the United States and Russia. The Senate ratified NST in December 2010 and the Duma in January 2011. It went into force on February 5, 2011, replacing START and superseding SORT, and will expire 10 years later. NST limits each side to no more than 1,550 deployed warheads on up to 700 deployed delivery vehicles and no more than 800 total delivery vehicles. Of those 1,550 warheads on the U.S. side, approximately 70% are planned for SLBMs. U.S. plans are for no more than 240 deployed SLBMs at any given time. These reductions are about 30 percent lower than the levels set by SORT. These reductions must be accomplished by February 2018.[19]

While the reduction in the number of *Ohio*-class SSBNs from 18 to 14 due to the conversion of four to SSGNs, the number of Ohio Replacement submarines slated at 12, reduction of the number of launchers per SSBN from 24 to 20, and the reduction in the number of warheads may appear to reduce our deterrence posture, they don't as long as both sides reduce their nuclear forces accordingly.

Life Extension of the Trident II

Today the Navy and the nation have in the Trident II a reliable SLBM that does everything required of it and is limited by treaty, not capability. It may at some point be limited by age, however. Trident IIs were expected to have a service life of 25 years,[20] and they have reached that point. The Navy's first Ohio Replacement SSBNs are expected to begin service in the early 2030s, but they will be carrying Trident IIs that first came online 40 years prior with warheads that were expected to have a service life of 10 years. To ensure that these missiles were kept safe, reliable, and effective, the Navy began the D5 Life Extension (LE) Program (D5 LE).

D5 LE was begun in 2002 to identify and replace aging Trident II missile components, some with upgraded components based on new technology. The goal of D5 LE is to ensure that the fleet of Trident II SLBMs remains operational for another 25 years, into the first decade or so of the Ohio Replacement submarines' patrols. Sometime after the first Ohio Replacement submarine is commissioned, the Navy may consider replacing the Trident II with a new missile.[21]

SSBN Conversions to SSGN

Although START II was agreed to in 1992, it was never ratified. Both parties nevertheless verbally agreed to abide by its terms, one of which was a limit in the number of SSBNs to 14.[22] To avoid decommissioning four of the 18 SSBNs to meet this requirement, the first four of the Navy's *Ohio*-class SSBNs—USS *Ohio* (SSBN 726), USS *Michigan* (SSBN 727), USS *Florida* (SSBN 728), and USS *Georgia* (SSBN 279)—underwent conversions between 2002 and 2007 to SSGN configuration.[23]

In addition to retaining their capability to fire Mk 48 ADCAP torpedoes, the modern SSGNs were designed to be multi-mission platforms. The two forward-most launch tubes became lockout chambers and docking stations for the Advanced SEAL Delivery System or Dry Deck Shelters for Special Operations Forces missions. The other 22 launch tubes can now accommodate mission-specific equipment or canisters that each hold seven Tomahawk cruise missiles for a maximum of 154 per boat.

USS *Florida* successfully launched an unmanned undersea vehicle (UUV) from a modified Trident launch tube in 2003.[24] General Dynamics' Electric Boat Division has developed the Universal Launch and Recovery Module (ULRM) for use on the four SSGNs as well as with the Virginia Payload Module. The ULRM can launch and retrieve UUVs and deploy other payloads. ULRM prototype testing on SSGNs is scheduled to begin later this year.

The Only Constant Is Change

As the U.S.-Soviet arms race was gathering steam, the U.S. Navy, under the leadership of a handful of prescient and extraordinarily capable men, quickly outpaced America's Cold War adversary with technological advances in missile and submarine design and rapid building programs such as the 41 for Freedom. Despite the sense of tranquility that came with the collapse of the Soviet Union, thus ending the Cold War, and the last commissioning of an SSBN taking place in 1997, U.S. Submariners have remained vigilant, keeping the watch, as life went on stateside without much thought given to the need for maintaining our strong strategic deterrent.

Leading up to 2000, the United States faced a decreasing number of challenges from nation-states. Beginning in 2000, America saw a sharp rise in asymmetric threats from non-state actors, against which a nuclear deterrence force has little deterrent effect, further reducing the apparent need for a strong strategic deterrence force. With alarming suddenness, however, America now finds itself again facing challenges from nuclear-capable major power nation-states. With all the proverbial lines in the sand being drawn and redrawn, making for a shifting and uncertain future, it would seem that, despite whatever appearances may suggest to the contrary, maintaining a strong deterrence capability and posture is the wise course.

Navy personnel will soon bear on their collective shoulders nearly three-quarters of the nation's strategic deterrence assets. U.S. Submariners on the *Ohio*-class boats—the first two of which have entered the Ohio class' own life-extended period—currently have the nation covered. As our nation's survivable and effective at-sea strategic deterrent, the Trident II D5 weapon system is out there day after day to quietly prevent major power war and provide extended deterrence to our non-nuclear-capable allies.

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by MCS Amanda Gray, Submarine Group Nine Public Affairs

The Long Journey of Returning to Strategic Service—

USS KENTUCKY

It was a perfect Saturday off the coast of Southern California. The Blue crew of the *Ohio*-class ballistic missile submarine USS *Kentucky* (SSBN 737) eagerly waited to fire the Trident D5 missile. This launch was the culmination of months of training and preparation. The blue sky and calm seas created ideal conditions for mariners, and many pleasure craft were in the area taking advantage of the weather. Sailors sat at their battle stations for hours, waiting to be told that the area was clear for launch, and the launch window was closing quickly. It was starting to look like they wouldn't be able to fire when, finally, with two minutes left, the crew was able to put its training to the test.

"The window opened and the guys executed flawlessly. The missile shot was a culminating event of sorts for a ship that had just completed a years-long refit," said Cmdr. John Hale, *Kentucky*'s Blue crew commanding officer.

A submarine's return to strategic service, following an extended maintenance period in the shipyard, is an exciting time for the crew. This was no different for the Blue and Gold crews of *Kentucky*, who completed a 40-month Engineered Refueling Overhaul (ERO) last summer. The time from leaving the shipyard to the first strategic deterrence patrol is crucial for the life of the boat, its crew, and for the sea-based leg of the nation's nuclear triad.

"I view the process of returning *Kentucky* to strategic patrols to be among the most important elements of maintaining a credible nuclear deterrent program for the United States," said Rear Adm. David Kriete, commander, Submarine Group Nine (CSG 9). "No other country in the world can do what we are about to complete with *Kentucky*; which is refueling a nuclear-powered submarine and returning it back to the strategic deterrent mission for another 20 years of patrols. That is why getting this ship back to service has been our number one priority."

The *Kentucky* crew worked alongside hundreds of shipyard workers at Puget Sound Naval Shipyard (PSNS) to complete the comprehensive overhaul, which included routine maintenance, system updates and upgrades, alterations, and refueling the boat's reactor. This planned maintenance will extend the life of the submarine for another 20 years.

The keel for *Kentucky* was laid December 18, 1987. Since its commissioning, *Kentucky* has completed 91 strategic deterrent patrols.

"By the time the engineered overhaul started in 2012, 25 years after the keel was laid, the boat had been worked hard," said Cmdr. Jeffrey Smith, who was *Kentucky*'s commanding officer in the shipyard and is now the Engineering and Readiness Officer at CSG 9. "It was well-maintained by its crews, but the overhaul is necessary to get the ship ready for another two decades of service. In a sense, the Engineered Refueling Overhaul was a rebirth for both the ship and the crew. We looked at the whole process as a recommissioning."

The boat entered dry dock on Jan. 5, 2012. During the first year, conditions were set for shipyard maintenance. The work days were long but manageable, and the crew's spirits were high. By 2014, the end of the shipyard period was in sight. The crew worked 12 to 14 hours a day for the final nine months of the overhaul.

"The crew constantly worked well with the shipyard and persevered," said Smith. "The end of an availability is one of the hardest things that a crew can go through. The transition from a shipyard deep maintenance period to an operational mindset can be a challenge. You have to test and re-certify all the systems that were offline or disassembled during the overhaul while building your operational skills in parallel."

USS *Kentucky* at Puget Sound Naval Shipyard for Engineered Refueling Overhaul

Kentucky departed PSNS April 9, 2015 and started the critical step of returning to sea after a refit period. The first step to returning to strategic service was sea trials, which began as soon as the boat left the shipyard. This week-long testing period at sea is designed to prove the submarine's seaworthiness and test the limits of the boat. The crew operates the boat at the limits of speed, depth, and angles, all while operating in a navigationally challenging environment. Afterward, *Kentucky* returned to Naval Base Kitsap-Bangor on April 20, 2015, marking the official completion of the ERO.

"Once the submarine completes sea trials, that is when they really start gearing up to return to strategic service," said Cmdr. John Correll, CSG 9's training and readiness officer. "After sea trials, they start operational training in the trainers at Trident Training Facility (TTF). The crews have to demonstrate their proficiency and go through several requirements to become a strategic asset again."

Kriete and Correll wanted to evaluate whether or not the existing training guidance was effective. They discovered a training imbalance for Sailors in the shipyard because they were not able to use the trainers during the ERO as routinely as operational submarines.

"I actually just revised the Training Guidance for Major Availabilities because we discovered that the learning curve for crews coming out of the shipyard for their Demonstration and Shakedown Operations (DASO) was so steep that it was hard to get them to the level of proficiency that they needed to attain," Correll said. "Now the crews in the shipyard will be able to use the TTF trainers more often to maintain their skills."

After sea trials were completed, the requirements for the crew continued to grow. They spent each day training and preparing for upcoming inspections and certifications.

"When I took command of the ship, I think the crew was excited to be doing something new. I am not sure if the crew really understood that coming out of the shipyard meant that the work was just really beginning, because it takes a Herculean effort to get a boat out of ERO," said Hale. "The focus after leaving the shipyard is operating the ship at sea, so we had one week in port, and then we were underway for six weeks to hone our skills in operating the ship at sea. Training on an operational ship was what the crew needed after being in the shipyard for so long."

The boat split from being one crew to two during a ceremony on June 9, 2015 in preparation for the upcoming DASO. The decision on manning each crew was carefully made by the commanding officers and executive officers, balancing talent distribution between each crew along with consideration for personnel rotation dates. Once the crews split, they began rotating between the in-port and at-sea training cycles.

Gold crew commanding officer, Cmdr. Brian Freck, and the Gold crew took responsibility of the submarine at sea first. They successfully completed their at-sea command and control certification and boat familiarization before turning the boat over. Hale and the Blue crew took command of the boat to commence the firing portion of the DASO.

"The physical certifications following an ERO are pretty much completed by the end of sea trials," said Smith. "All of the equipment is put back together and the ship is operational. However, the Trident D5 weapons system is an incredibly complex beast. Unlike other missions, there is no margin of error. The strategic deterrence mission must be 100 percent perfect all the time."

Before returning to strategic service, *Kentucky* had to successfully complete three major certifications. The first was the Command and Control Exercise, which demonstrated the crew's ability to execute the mission and accomplish the tasking. The second major certification was DASO, which certified both the operational readiness of the Strategic Weapons System and the crew's readiness to operate it. Finally, there was the nuclear weapons acceptance inspection, which showed whether the crew can keep the weapons safe and secure.

"We did very well with the command and control exercise and, during the at-sea portion of DASO, we were evaluated as well ahead of where everyone expected us to be for operating the weapons systems, but where we did struggle the most was in the in-port portion of the DASO," said Hale.

The DASO process took approximately four months to complete. Navy's Strategic Systems Programs oversaw the DASO certification process, while Commander, Submarine Squadron 17, Commander, Submarine Squadron 19, CSG 9, TTF, and Commander, Submarine Force Pacific Fleet provided additional support and oversight. The highlight of DASO is the firing of the Trident D5 missile, but days of training and testing prepare the crew for the event.

"I was in a very junior division, we only had one fleet returnee and one chief, so we had been training for the missile launch for months," said Electronics Technician Seaman Kevin Nguyen, assigned to Blue crew. "It was great to finally get to sea and see the fruits of our labor put to the test. We got up early and spent most of the day waiting at our stations. Most of us thought that it wasn't going to happen. Then it was time and the boat shook a little. Then it was over. It was really neat though seeing it all over the news and being able to tell my family that I was on the boat that shot that missile."

"It was really neat though seeing it all over the news and being able to tell my family that I was on the boat that shot that missile."

The DASO test included plans to fire two missiles, which took place on two separate days.

"It was a gloomier day, there was a rain storm pulling in and it was a Monday, so there were no pleasure craft," said Hale. "So when the window to fire was supposed to open at noon, we were able to fire the missile one second after noon. It went out without a hitch and there were no pictures or fanfare. There was a calm professionalism and I felt like that second missile was for my guys; that missile was for *Kentucky*."

Throughout the difficult process of returning to strategic service, it can be difficult to keep motivation and morale high among the crew. Smith used clear communication, family movie nights and picnics, command physical training, and time off. While the boat was underway, *Kentucky* Blue's chief of the boat, Master Chief Sonar Technician Charles Barton, said that they had the ability to do things like swim calls and topside barbeques to help lift spirits. These are activities that the crews aren't usually able to do during strategic deterrence missions, so allowing the Sailors to break the demanding training schedule by doing something fun was rewarding.

"I am extraordinarily proud of what my crew did," said Barton. "We had a number of junior guys that had never been on a patrol. We got underway and the fact that our guys knew what they needed to do and that they did it well speaks volumes to their abilities. We were basically building *Kentucky* culture from the ground up."

Following the firing portion of the DASO, the crews swapped and Gold crew had its turn to demonstrate its capabilities at sea. Gold crew went through the exact same process as the Blue crew, except for firing a missile.

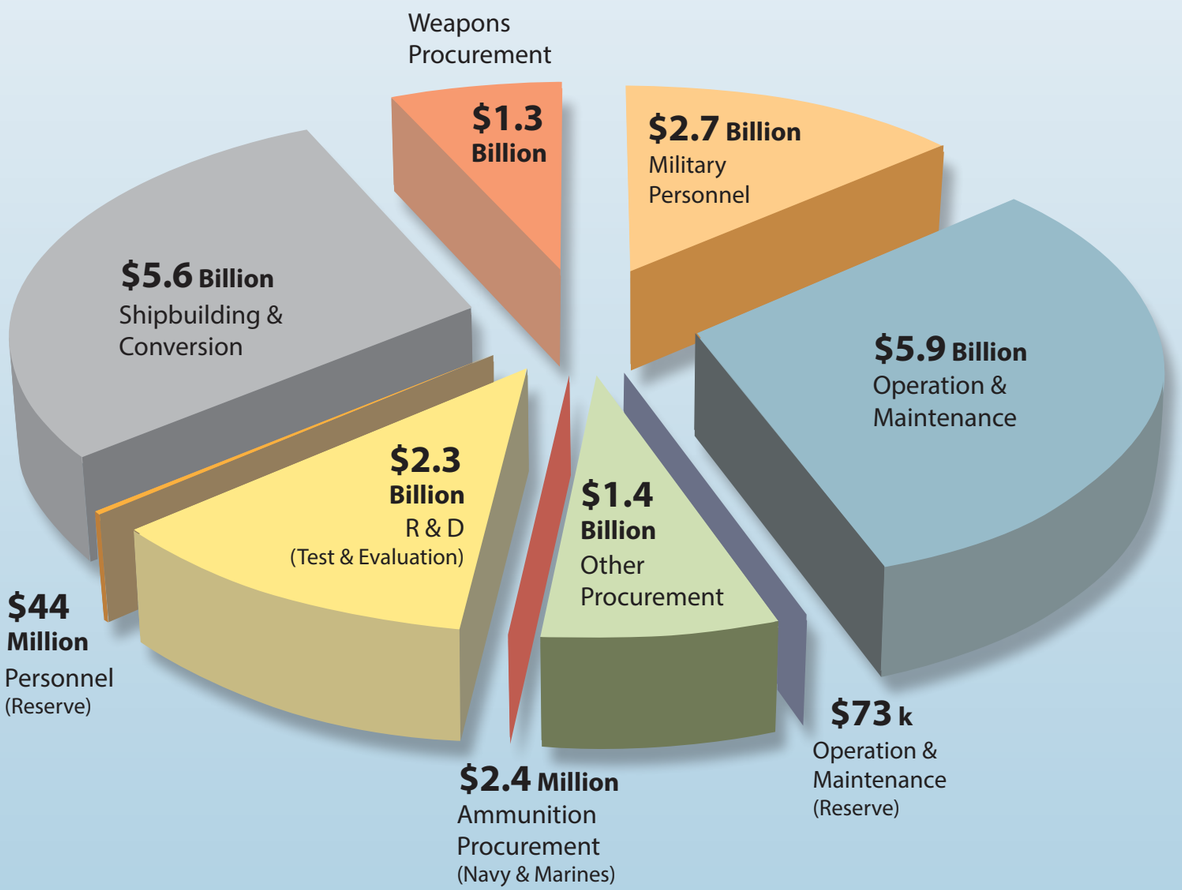
"The crew does nearly all of the work to get themselves back to return to service, but the additional support of the TTF Intermediate Maintenance Facility, and CSG9 to provide the training and the maintenance necessary to return to service has been extremely important," said Capt. Mark Schmall, commodore, Submarine Squadron 17.

Boats like *Kentucky* will eventually be replaced by the Ohio Replacement, the next generation of ballistic missile submarines. The program is still in development, and the new boats won't make the first patrol until 2031. Extending the boat's life through refueling and a maintenance overhaul allows the Navy to meet the nation's strategic deterrence demands while the Ohio Replacement design is developed. In the end, extensive work like the ERO would not be possible without the teamwork of many organizations.

"The crew worked really hard to successfully complete every task and challenge that was placed in front of them," said Hale. "These guys volunteered to come out and serve their country and they might not have known exactly what that would mean, but they come to work, and they do their jobs, and they work hard, and I am so proud of what they do."

by Lt. Cmdr. Jeff Gammon

OPNAV N97's Investments Continue Undersea Superiority



In March 2015, then Chief of Naval Operations, Adm. Jonathan Greenert testified before Congress on details of the Navy's portion of what became the Department of Defense's budget for next fiscal year, FY16. Along with all other federal spending requests, this makes up the overall President's Budget for Fiscal Year 2016 (PB16). As the summer months quickly approached, congressional committees began their line-by-line review and debates over this defense spending plan, which ultimately became law through passage of both the National Defense Authorization Act and Department of Defense Appropriations Act for 2016.

As the resource sponsor, Rear Adm. Charles Richard, Director of Undersea Warfare Division (OPNAV N97), has a total obligated authority (TOA) of just over $19 billion to staff, train, and equip the Submarine Force to meet current and future needs. To some, this may seem like a lot, but the Submarine Force's budget makes up only about 12% of the Navy's $161 billion and about 3% of the Department of Defense's $605 billon budget. That is a huge return on investment considering that $19 billion goes into building two *Virginia*-class attack submarines per year and funds the Navy's portion of nuclear deterrence that is responsible for more than half of the nation's accountable nuclear warheads (will increase to 70% under New START treaty).

Almost as important as the amount of money is the "type" of money, or accounts, that this $19 billion is spread across. Each type has its own rules as to what the money can be used for, how long it is available for use, and how much, if any, can be moved from one program to another. The primary types of money that make up OPNAV N97 funds are: Military Personnel and Reserve Personnel (MPN & RPN), Operations & Maintenance Navy and Operations, Maintenance & Repair (OMN & OMNR), Weapons Procurement (WPN), Shipbuilding and Conversion (SCN), Research, Development, Testing and Evaluation, Navy (RDTEN), and Other Procurement (OPN).

Military Personnel, Navy (MPN & RPN) – $2.7 Billion

MPN is used for pay, allowances, individual clothing, subsistence, interest on deposits, gratuities, permanent-change-of-station travel, and expenses of temporary duty travel between permanent duty stations for members of the Submarine Force on active duty. RPN is for those serving in reserve submarine billets. The amount N97 will spend on MPN and RPN is directly related to overall end strength authorized and accounts for nearly 14% of the TOA in FY16.

Operations & Maintenance, Navy (OMN) – $5.9 Billion

OMN is for expenses, not otherwise provided for, necessary for the operation and maintenance of the Navy and the Marine Corps. N97 is a supporting resource sponsor and shares funding responsibility with other OPNAV entities for ship maintenance, activations and inactivations, as well as the operation and maintenance cost for communication equipment, cruise missiles, Trident II ballistic missiles, torpedoes, and their associated systems. At 31%, OMN accounts for the largest portion of N97's TOA.

Weapons Procurement, Navy (WPN) – $1.3 Billion

WPN is for construction, procurement, production, modification, and modernization of missiles, torpedoes, other weapons, and related support equipment including spare parts and accessories.

For FY16, the Navy received $60 million to restart procurement of MK 48 heavyweight torpedoes to overcome a 30% inventory shortfall. This restart procures 145 Mod 7 torpedoes over the next five years with fleet deliveries beginning in 2020, following three years of design, testing, and recertification. Additionally, another $63 million is budgeted to procure, certify, and deliver 81 Mod 7 Common Broadband Advanced Sonar System (CBASS) kits to upgrade current MK 48 torpedoes in inventory. These needed hardware and software upgrades are required to keep pace with evolving global threats and provide a basis for future capability upgrades.

N97's WPN also received nearly $1.1 billion to support upgrades to Trident II ballistic missile guidance and missile electronic systems. These upgrades support the life extension of the Trident D5 missile, ensuring that it remains a viable and reliable weapon system for both the *Ohio*-class and Ohio Replacement.

N97 is also a shared resource sponsor for the Tomahawk cruise missile with N96 (Surface Warfare Division). N97 funds a portion of $185 million requested for FY16 to procure 100 Tomahawk missiles.

The remainder of N97's WPN portfolio is shared with the other OPNAV resource sponsors to fund various other smaller procurement programs that support the weapon systems of the Navy.

Shipbuilding and Conversion, Navy (SCN) – $5.6 Billion

SCN is for expenses necessary for the construction, acquisition, or conversion of naval vessels. N97's SCN account funds *Virginia*-class new construction and Moored Training Ship (MTS) conversions.

In FY16, $3.3 billion was received to complete the funding for SSN 796 and SSN 797, with an additional $2.0 billion going toward the advanced procurement of long-lead items for future *Virginia*-class SSNs. This funding strategy, in combination with the multi-year procurement (MYP) contracts, allows the Navy to deliver the *Virginia*-class at the most affordable rate. In April 2014, the Navy awarded the contract for 10 Block IV boats, resulting in over $5.4 billion in savings as compared to traditional single-ship contracts.

Continuing to build *Virginia*-class SSNs at a rate of two per year is critical to mitigate the SSN inventory shortfall as the Submarine Force structure falls below the 48 SSN minimum requirement from 2025-2041 due to the high rate of *Los Angeles*-class SSNs being decommissioned. Bottom line, the *Virginia*-class program continues to deliver whole warfighting capabilities ahead of schedule, within budget, and with increased quality.

N97's SCN also requested $138 million toward the conversion of USS *San Francisco* (SSN 711) into one of two new MTSs. Along with the conversion of USS *La Jolla* (SSN 701), the USS *San Francisco* will replace the *Sam Rayburn* (MTS 635) and *Daniel Webster* (MTS 626) as the next-generation MTSs for the Nuclear Power Training Unit in Charleston, S.C.

Research, Development, Test and Evaluation, Navy (RDTEN) – $2.3 Billion

RDTEN is for expenses necessary for basic and applied scientific research, development, test and evaluation. N97 funds many different research and development (R&D) accounts. R&D not only assures that our Submarine Force remains on the leading edge of technology to pace the evolving threat of our potential adversaries, but it also reduces production cost and mitigates risk associated with incorporating new technologies or platform designs.

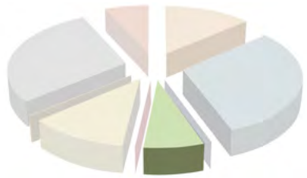
Of the different RDTEN accounts that N97 funds, the largest are for the R&D for the Ohio Replacement, the Navy's No. 1 programming priority. With a combined $1.4 billion received, these accounts fund Ohio Replacement whole ship design to include the Common Missile Compartment, other combat systems, hull, mechanical and electrical (HM&E), and propulsion technologies. This R&D minimizes follow-on unit cost and ensures the design maturity (~83%) to mitigate risk of building a ship 2.5 times *Virginia*'s size in about the same time (~7 yrs).

In FY16, the Navy is also receiving $168 million in R&D for the Virginia Payload Module (VPM). VPM will add a new hull section aft of the sail (manned portion of the boat) that would contain four large-diameter (87-inch) payload tubes with multiple all-up round canisters, leveraging the existing common componentry and lessons learned from the Block III Virginia Payload Tube design and the SSGN conversion program. This will provide up to 28 additional Tomahawk Land Attack Missiles per boat and will mitigate the 60% drop in undersea strike capacity when all four SSGNs retire, and provide volume for future payloads including other missile, unmanned systems, and Special Operations Forces support. VPM affordably enhances the Navy's underwater precision strike capability and capacity by delivering greater than three times the strike capacity at less than a 15% increase in cost per SSN.

R&D is not just for future platforms. $123 million in R&D will be used in FY16 for continued improvements to the *Virginia* class. This includes continued development of concepts and technologies for Reduced Total Ownership Cost, HM&E redesign for Blocks IV and V, and development of acoustic performance improvements such as the Large Vertical Array and enhanced hull coating treatments.

"As the resource sponsor for our undersea systems, N97 is committed to delivering what the fleet needs while balancing competing priorities in this fiscally challenging environment to ensure that we maintain our undersea dominance."

The rest of N97's requested RDTEN funds go toward several other R&D efforts including torpedo ($42 million) and weapon system ($107 million) modernization, *Los Angeles*-class and *Ohio*-class modernization ($110 million), engineering technologies ($101 million), and submarine HM&E and combat system technologies ($87 million).



Other Procurement, Navy (OPN) – $1.4 Billion

OPN is for the procurement, production, and modernization of support equipment and materials not otherwise provided for in other accounts. N97 owns and is the shared resource sponsor for many different programs that fall under OPN.

A large portion of N97's OPN accounts go toward supporting the nuclear enterprise. $296 million will go toward the procurement of nuclear reactor components and about $277 million toward the support of our strategic missile systems.

In FY16, N97 has requested $215 million for SSN/SSBN acoustics to keep all classes of submarines acoustically superior through the Acoustic Rapid COTS Insertion (A-RCI) program that modernizes and sustains approximately 8-12 SSNs per year and 2-3 SSBNs per year through bi-annual software Advanced Processing Builds (APBs) and bi-annual hardware Technical Insertions (TIs). This funding line also funds procurement and sustainment of towed arrays and the Low Cost Conformal Array on the Block III *Virginia*-class, replacing the traditional spherical array.

$96 million requested in FY16 will support submarine combat control systems. This money procures new AN/BYG-1 hardware and software kits to transition legacy combat control systems, such as Block 1C on the *Ohio* class, to the TI/APB process. This also funds the continued sustainment of AN/BYG-1 systems through hardware and software enhancements.

Similarly, $80 million will go to sustain and modernize the Submarine Force's electronic warfare systems to include procurement of the AN/BLQ-10 Electronic Warfare Support and Improved Communication Acquisition/Direction Finding (ICADF) systems and modernization kits for the legacy AN/WLR-8 Electronic Surveillance Measures (ESM) and the legacy AN/BRD-7 direction finding systems.

The remainder of N97's OPN accounts runs the gamut of different things. Just a few examples include the procurement and/or support of periscopes ($63 million), submarine batteries ($23 million), and *Virginia*-class-specific support equipment ($36 million).

As the resource sponsor for our undersea systems, N97 is committed to delivering what the fleet needs while balancing competing priorities in this fiscally challenging environment to ensure that we maintain our undersea dominance.

by Lt. Doug McKenzie, Nuclear Power Training Unit

Located only a few miles from the first successful submarine attack in history lies one of the most challenging shore duty stations in the Navy. Originally conceived as a radical new way of training nuclear propulsion plant operators by using a converted *Lafayette*-class SSBN, Nuclear Power Training Unit Charleston (NPTU CHS) continues to improve and is currently breaking ground on a host of innovative changes to its training program.

NUCLEAR POWER TRAINING UNIT:

A Rewarding Assignment to Meet the Demands of the Nuclear Navy

Prior to the arrival of the Moored Training Ship (MTS) 635 (the ex-USS *Sam Rayburn* (SSBN 635)) on February 1, 1986 from its conversion in the now defunct Charleston Naval Shipyard just down river, the entirety of the Navy's nuclear trained personnel completed their certification at one of the civilian operated prototype plants across the country. The Naval Reactors Facility in Idaho Falls operated three plants, NPTU Ballston Spa, N.Y. operated four, and one additional plant was located in Windsor, Conn. Of these three sites, only Ballston Spa continues to train Sailors today, operating the Modified Advanced Fleet Reactor (MARF) and S8G (submarine, eighth generation, General Electric) / AFR (Advanced Fleet Reactor) plants.

Nuclear Power Training Command is just down the road from NPTU in Charleston.

Constituting a large capital and maintenance investment, these plants served both as technological development and testing platforms for new designs and had the added benefit of offering a land-based location to certify Sailors for nuclear duty. The MTS model departed from this method, instead re-purposing a Navy-owned and operated (and already paid for) asset for dedicated use as a training platform. NPTU Charleston started with one MTS, a support barge, a parking lot, and floating classrooms. Now there are 970 Navy and civilian personnel operating the two oldest reactor plants in the world and certifying an average of 1,200 nuclear operators per year.

Sea-going commands and forward-deployed units form the tip of the Navy's cutlass. The NPTUs form the often ignored hilt, the handle that allows the might of the Navy's 10 aircraft carriers and 75 submarines to be safely wielded around the world. The highly trained operators that NPTU produces are a critical component in the Naval Nuclear Propulsion Program's unmatched 6,700reactor-years of safe operation. The program has a long history of nuclear success and is continuing to improve its training model with a major capital investment that will again transform the way we train our Sailors.

Investing in the Future

NPTU Charleston broke ground in February 2015 on a $157 million facility expansion that will accompany two new *Los Angeles*-class-based training ships. The new facilities will house additional classrooms, training areas, much needed office space, dining areas, and an auditorium and repair spaces. Second only to the ships themselves, the high-fidelity Engine Room Team Trainers will provide a functional 33-foot section of an S6G engine room that will augment the new boats and provide unprecedented flexibility to staff and students. Together with 18 other task trainers, this new technology will reduce cycling and wear of the reactor plants and allow for more training to continue while the boats are shut down for scheduled maintenance or repairs.

This capacity is more than just essential; once the new MTS 701 (ex-USS *La Jolla*) and 711 (ex-USS *San Francisco*) arrive to augment MTS 626, Charleston will be the sole location (NPTU CHS co-located with Nuclear Power School) for nuclear training in the Navy while Ballston Spa shuts down to refuel the S8G/AFR plant in 2020. This two-year period will see the student population swell to 2,800 per year with an associated increase in Navy staff to 1,340; nearly twice its current level. As a result, many Sailors will find themselves with orders to Charleston to be a part of the most important asset on site, staff instructors.

The expansion of NPTU Charleston will provide greater training opportunities for generations of nuclear trained officers and enlisted.

Rewarding Duty

It's no secret that NPTU CHS instructor duty is very challenging. There is a rotating shift schedule that, except for the four days off every fifth week, makes it seem a lot like being on a ship. The ships are old, and old equipment frequently breaks or just wears out, even after 50 years of planned maintenance. The corporate knowledge of repairing S5W (submarine, fifth generation, Westinghouse) systems has also decayed. The MTSs are so long retired that the few remaining people qualified on them, many now shipyard personnel, are retiring from their second careers! There are also the challenges of teaching young Sailors, who are like an endless stream of younger siblings. As soon as they're getting competent, they're off to sea and replaced with someone who's never been down the hatch before. So why should Sailors want orders to NPTU?

It is the crossroads of the Nuclear Navy. Soon every nuclear-trained Sailor will pass through its doors. Staff members here have the opportunity to affect the personal and professional lives of all future nuclear Sailors. All of us can remember a teacher or instructor that made a positive difference in our lives by staying late to work with us or giving positive encouragement after a failed exam or difficult event. These relationships are a way of "paying it forward," and Sailors can have an immediate impact on the quality and attitudes of Sailors in the fleet.

NPTU is and has always been full of top personnel. Two former Officers in Charge went on to achieve flag rank, one as COMSUBPAC, and countless go on to submarine commands. The Commanding Officer, Capt. R.E. Hudson, was aboard MTS 635 as a Shift Engineer and Material Officer in the mid-90s. Command Master Chief Donald Zeigler is serving his third tour aboard NPTU. Assignment requires screening by Navy Personnel Command and NAVSEA 08 along with a competitive ranking at Nuclear Power School and top-half class ranking at NPTU as a student. Some other shore duties also have these requirements, but none has the opportunities for professional success that NPTU has. Nothing will better prepare you for the next level if you choose to return to sea or make you stand out to civilian employers than serving at NPTU. Were you unable to finish your Engineering Watch Supervisor qualification because your boat was in the yard for refit? You can qualify and stand watch on the MTS. Maybe you had a successful divisional Chief Petty Officer tour but, because you were more junior, you were less involved with the personnel matters of the Engineering Department. When you serve as Leading Crew Chief, you are the EDMC of the crew and will encounter the full range of departmental issues, from career counseling to extra military instruction. The same goes for junior officers. You can effectively experience a good portion of your Department Head tour by leading a 50-person crew in plant operations and training.

Students receive valuable hands on training from instructors using mock-ups of individual components for systems onboard nuclear plants.

There are other, more tangible benefits as well. The Navy is offering one-time bonuses for Sailors volunteering for instructor duty at NPTU. The best offer, available to Shift Engineers, is the choice between a guaranteed homeport for their Department Head tour or 12-month sabbatical to pursue a graduate degree. There is simply nothing in the military that comes close to this offer.

NPTU is a learning organization that is evolving for the better; it's not the command you knew as a student. Facing the challenge of expanding student classes, aging plants, and rotating shift work, NPTU is innovating. Beginning in 2013, the command piloted a Maintenance Assistance Team (MAT) composed of Sailors selected from each crew who were specialized in plant repairs and maintenance. The effort of the MAT Sailors speaks for itself: the first on-time completion of a trimester shutdown in five years. The new model was expanded to the MTS 635's final Pierside Extended Maintenance Availability and was so successful that it's being adopted by NPTU Ballston Spa. The chief benefit of the MAT is that it frees up the crew from trying to coordinate and brief maintenance and repairs and allows them to focus on what they are best equipped to do: operate the plant and train students. A host of other changes are implemented or under development based on combined civilian and military staff member focus groups. A Sea-Returnee Off-Crew (SROC) is dedicated to helping staff qualification for new arrivals; the exam and continuing training programs have been re-imagined to improve effectiveness and reduce the burden.

NPTU Charleston is both a challenging and rewarding duty station with a mission that demands the very best personnel the Naval Nuclear Propulsion Program has to offer. Its staff members form a vital link between the fleet and the training pipeline that passes on the at-sea skill set to the next generation. It provides unmatched opportunity for professional development for further Navy service or transition to civilian life and is situated in one of the nicest cities in the country. It is slowly gaining the recognition it deserves for having a dynamic and evolving command that works constantly to train the best operators and improve quality of life for its Sailors.

Anyone interested in getting more information on what NPTU has to offer should visit their web site at www.netc.navy.mil/centers/nptu.

The charm of Charleston

Beautiful, historic Charleston is located near the middle of South Carolina's coast at the point "where the Ashley River and Cooper River meet to form the Atlantic Ocean." It is the state's second largest city with a population of 127,999 (2013).

Originally called Charles Town in honor of England's King Charles II, its nickname is "The Holy City" due to the many churches visible in its skyline. Founded in 1670, Charleston is defined by its cobblestone streets, horse-drawn carriages, and pastel pre-Civil-War-era houses, particularly in the bustling French Quarter and Battery areas. The Battery promenade and Waterfront Park both overlook Charleston Harbor, while Fort Sumter, a Federal stronghold where the first shots of the Civil War rang out, is visible across the water.

Charleston was ranked the best city in the United States three years running and fifth-best in the world according to Condé Nast. With mild weather, beaches, barrier islands, and the Intracoastal Waterway, it's an outdoor and sportsman's paradise. A low cost of living allows you to enjoy an endless array of historical events, festivals, open air markets, concerts, restaurants, and outdoor sporting activities. Combine all this with genuine Southern hospitality and a very pro-military community and you have possibly the best duty station in the country. The only drawback is that there are no longer submarines stationed here for a follow-on tour.

Volunteers Restore USS Pampanito (SS 383) to her former Glory

For restoration experts such as Rich Pekelney, particularly those that engage in the painstaking task of restoring historical maritime vessels that have spent decades in one of the most corrosive environments in the world—the sea—the job can be a mixture of historical research, exhaustive documentation, parts scavenging, and even metalworking and coating.

Such was the case for USS *Pampanito*, a World War II submarine museum and memorial on Fisherman's Wharf in San Francisco that hosts over 100,000 visitors a year. The boat is owned and operated by the Maritime Park Association, a non-profit that is working to restore the *Balao*-class fleet submarine.

"The primary goals are to get its condition as close to summer 1945 as we can, while at the same time preserving as much of the historic fabric as possible, says Pekelney, who, in addition to being a volunteer restoration expert, is a member of the Board of Trustees of the Maritime Park Association. "We owe it to future generations to preserve our history, and USS *Pampanito* is part of the history of the submarines."

According to Pekelney, when USS *Pampanito* was donated to the museum by the Navy and opened in 1981, there were no guns on the boat. However, in 1945 the submarine had a 5-inch, 25 caliber wet-mount gun for shore bombardment and anti-ship combat, along with several other smaller guns.

The Maritime Park Association was able to acquire a stripped version of the same gun from the Navy that had been originally used on USS *Piranha* (SS 389). These are rare weapons, with only 11 in varying states of preservation surviving today.

The gun, however, was in very rough shape at the time. It was de-milled, rusty, vandalized, and incompletely reassembled. It was also missing a variety of parts including covers, bolts, seats, gears, handles, and fittings.

Although the gun will never be able to be fired, the effort focused on restoring the weapon's training (movement left/right) and elevating (movement up/down) capability to preserve historical accuracy.

After approximately 75 years, however, the training and elevating gears and other components were completed seized and frozen due to paint in the bearings, hard old grease, dirt, bad gear mesh, corrosion, and possible material creep.

Workers use the Flex-Hone to restore *Pampanito*'s big gun.

"This gun, as far as we can tell, has not been operated or trained or elevated in decades, probably since the time of war," says Pekelney.

Because the gun was designed to be submerged with the submarine, hard bronze sleeve bearings were used throughout instead of traditional roller bearings. As part of the project, dozens of bronze sleeve bearings had to be cleaned by a sanding/honing process and, in some cases, small amounts of material removed to allow smooth operation.

Initially, Pekelney engaged in a laborious and time-consuming hand-scraping and sanding process to restore the bearings. He also tried expanding spring-loaded hones that, although somewhat effective, wore out quickly and did not keep the sleeve bearings absolutely round. In search of a better solution, he sought the advice of Charlie Butcher, a 40-year master diesel mechanic.

"[Butcher] pulled out a Flex-Hone and told me not to fool with anything else," says Pekelney.

The Flex-Hone Tool is characterized by the small, abrasive globules that are permanently mounted to flexible filaments. It is available in many sizes, abrasive types, and grits. "With the Flex-Hone there is good control over how much material is removed, and the holes remain concentric," says Pekelney, adding that for the museum environment it was important they preserve as much original material as possible. "I was able to clean up these bearings pretty quickly. The hones have saved a huge amount of time compared to hand scraping."

"The tool enabled me, an inexperienced machinist, to repair bearings that otherwise would have required journeyman help, and do so with very little risk of damage," adds Pekelney.

The hard work performed by the team helped bring USS *Pampanito* back to her former glory for all who visit her.

For more information, contact Brush Research Manufacturing, Inc., Phone: (323) 261-2193; Web site: www.brushresearch.com.

SailorsFirst

Navy COOL Mobile App Now Available

Sailors can now access several tools and resources found on Navy Credentialing Opportunities Online (COOL) via their mobile devices with a new Navy COOL application that launched Jan. 28.

The Navy COOL app, available for both Android and iOS/Apple devices, is designed to help Sailors, both enlisted and officer, to find information on credentialing, career development, and civilian crosswalks related to their military occupation.

"This new app provides an expanded capability for Sailors to help them translate the skills they've learned on the job into civilian credentials, career growth opportunities and related civilian occupations," said Keith Boring, Navy COOL program manager. "The app is a great complement to our newly redesigned website and provides extra features that I think Sailors will find handy to have at their fingertips."

Besides credentialing information, the app provides enlisted members with Learning and Development Roadmaps (LaDRs), which are rating-specific online guides that explain in detail what Sailors need to succeed at specific points in their career. Additional app features include snapshots of related civilian occupations and United Services Military Apprenticeship Program (USMAP) trades, along with generic joint service transcripts associated with each enlisted Navy rating.

Rating Information Cards also provide summary information such as school locations, training time, qualifications and working environment. These and the other features within the app are particularly useful for recruiters and career counselors, especially when they are on the go, as they advise potential recruits and Sailors of professional options available to them.

For enlisted Sailors and veterans who are not using Navy COOL to fund credentialing exams and fees, the app also provides a gateway to Department of Veterans Affairs GI Bill funding options.

The Navy COOL app is a bring-your-own device (BYOD) tool designed to work on personal devices outside of the NMCI domain. Users can download the Navy COOL app from the Apple store and Google Play store at no cost.

To find the free Navy COOL app, search "Navy COOL" in app stores or in your web browser.

New OPSEC App is Out

The Navy has released its new mobile Operations Security app designed to make annual training requirements more accessible to Sailors. Sailors can not only complete required training on the OPSEC app, but also access related resources and policies. The app gives Sailors an alternative to completing their required GMT.

The OPSEC app features:

Policy/Guidance: Includes Joint, DoD, Navy and Marine Corps Policies; Navy Tactics, Techniques, and Procedures; Marine Corps Warfighting Publication; and handbooks.

Training: Features links to three computer-based training modules, as well as information on courses offered by the Naval OPSEC Support Team Norfolk and other OPSEC agencies.

Products: Training videos/links on a multitude of OPSEC topics.

Assessments: Information and resources to assist OPSEC program managers on how to conduct OPSEC assessments at their command.

Favorites/FAQs: Highlight parts of the App the user finds most valuable.

To find the free Navy OPSEC app, search "Naval OPSEC" in the app stores or your web browser.

Navy Updates Maternity Leave Policy

Following the Jan. 28 announcement by Secretary of Defense Ash Carter establishing a DoD-wide 12-week maternity leave policy, the Navy released its guidance in NAVADMIN 046/16.

This new policy applies to all Sailors in the active duty component and those Reserve component members serving on mobilization orders for a continuous period of at least 12 months.

Since the Navy had implemented an 18-week maternity leave policy in 2015, Sailors who became pregnant or gave birth on or before March 3, 2016, will be granted up to 18 weeks of maternity leave. The date of pregnancy will be determined by a privileged medical care provider.

Those who become pregnant after March 3, will be entitled to 12 weeks of non-chargeable maternity leave. Sailors must take this leave consecutively and immediately following a child's birth or release from hospitalization (whichever is later).

Unit commanders and medical providers may continue to grant convalescent leave based on individual Sailors' fitness for duty; this policy does not constrict convalescent leave in excess of 12 weeks where a health professional/medical authority deems such leave warranted.

Besides changes to maternity leave, DoD is working to expand both paternity leave and adoptive leave for service members.

It will ask for legislation from Congress to expand the current 10-day paternity leave offered to service members to a 14-day, continuous leave.

Authority will also be sought from Congress to change the current three-week leave policy for adoptive leave for one parent to include both parents of a dual military couple by authorizing the second military parent two weeks of leave.

Welcome Home!

Brandon Wright of the *Ohio*-class ballistic-missile submarine USS *Maine* (SSBN 741) was welcomed home by family at Naval Base Kitsap-Bangor, following a routine strategic deterrent patrol.

SailorsFirst

Submarine School Graduates

Twelve Sailors of "ADCAP Class 16030" graduated from Machinist Mate (Weapons) 'A' School Friday, March 25, 2016.

MMW1 (SS) Nicholas Soltysiak was class instructor.

MMWFN Abree Candelaria received the Torpedoman Plaque as Class Honorman.

Machinist Mate (Weapons) 'A' School is a 10-week enlisted apprentice training school providing basic knowledge and skills at the entry level in the MM (Submarines) rating in Shipboard 3-M, Mechanical Skills, Three-Inch Launcher operation, Explosives, Torpedo Tubes and MK 48 ADCAP torpedoes and Tomahawk cruise missiles.

USS *Miami* Class Joins the Fleet

Seventy-one Sailors of "Class 16160" USS *Miami* (SSN-755), graduated from Basic Enlisted Submarine School, Friday, March 18.

FT1 (SS) James Vanlaar, FT1 (SS) Chris Watson, and FT2 (SS) Bryan Bennett were class instructors.

SN Michael Woodhead was Class Honor Graduate with a 97.75 Grade Point Average.

FA Joshua Knapp received the Navy Core Values Award for best exemplifying the standards and expectations of a United States Navy Sailor.

MM3 James Carlier was recipient of the Submarine Heritage Award.

FR Grey Wreford, FR Matthew Sanford, SR Najher Ray, EM3 Tyler Kantorczyk, EM3 Kevin Fail, EM3 Alexander Walter, MM3 Jeremiah Weets, MM3 Lance Carter, SN Douglas Young, ITSC Angela Koogler, ET3 Michael Jones, SN Richard Cassube, FR Jose Diaz, SN Brian Smith, SR Tevin Banks, SA Joshua McLaughlin, and SN Juan Lugo joined SR Ryan Witkop as Graduates with Distinction.

Basic Enlisted Submarine School is a six-week introduction to the basic theory, construction and operation of nuclear powered submarines. In preparation for an assignment, Sailors receive instruction on shipboard organization, submarine safety and escape procedures.

41st Military Culinary Arts Competitive Training Event

The *Los Angeles*-class fast-attack submarine USS *Asheville*'s (SSN 758) Culinary Specialist 2nd Class Marlon O. Haughton, hailing from Montego Bay, Jamaica, represented the Navy with nine other Sailors, in the 41st Military Culinary Arts Competitive Training Event (MCACTE) in Fort Lee, Virginia March 5 - 11. Twenty-two teams from around the world competed in seven culinary catagories to demonstrate culinary excellence and professionalism. Haughton was awarded silver medals in the Nutrition and Team Table catagories and the bronze medal in the Live Cooking category.

The Nutrition category tested the ability to present a meal using the nutrional guidelines and recommendations from the United States Department of Agriculture (USDA) and the Academy of Nutrition and Dietetics (AND).

The Team Table category proved to judges the team's creative talent to create four different types of finger foods, a buffet platter, three-course meals and a five-course menu.

Live Cooking challenged each team to demonstrate their abilites to run a simulated restaurant and serve 45 customers a three-course meal.

CNO Identifies Core Attributes for Navy Leaders

In his latest podcast, Chief of Naval Operations Adm. John Richardson discussed what he describes as the Navy 'core attributes.'

Building on the Navy's core values, the attributes of **integrity**, **accountability**, **initiative**, and **toughness** serve as guiding criteria for decisions and actions by leaders up and down the chain of command.

Below are highlights from the podcast:

Q: *What is the purpose of identifying these core attributes?*

A: Militaries in general and navies in particular are most effective when operating with decentralized command structures. We expect that when commanders and their teams get their orders, they will deploy and execute their mission. The key is trust and confidence, both up, down, and across the chain of command. So, if we're going to have trust and confidence, which is absolutely essential to decentralized command, it stands that we have an agreed upon set of attributes that allow us to achieve behavior consistent with those values.

Q: *Can you describe each of these attributes?*

A: Integrity - I see integrity as having two dimensions. One is personal integrity, where each of our core values aligns with honor, courage, and commitment. We also have to extend beyond ourselves and actively strengthen our shipmates' integrity as well. That's the individual dimension. There is an institutional dimension of integrity, and our behaviors as an organization need to be consistent with the values that we profess.

Accountability - One of the things that I truly love about being in the Navy is that we are a mission-focused force. We set aggressive goals and stretch goals, and we hold ourselves accountable to achieve those goals. As part of our practice we are going to build in an assessment strategy so we can measure our progress toward our goals. And we have to be our own worst critics and make adjustments as required so that we can achieve those ends that we set about achieving.

Initiative - This goes toward each of our Sailors, particularly our leaders, exercising their authority to the fullest extent possible. This is absolutely fundamental to being effective in decentralized operations. Furthermore, even down to the most junior Sailor, we've got to recognize that the best idea or the best question might come from the most junior person in the group, so we've got to have a good sense of respect for that, and not let our structure or our seniority get in the way of someone else demonstrating initiative and coming forward with a good idea or a thoughtful question.

Toughness - This is a fundamental attribute to any military force or any team. Really, it's just our ability to take a hit, recover and keep going. To do this, we have to tap all our sources of strength. Whether that's the strength provided by rigorous training, the strength provided by encouragement from our shipmates and the fighting spirit of our people, the strength provided by our families reaching out to us—there are many many sources of strength and inspiration. In the end we don't give up the ship, and that's a measure of our toughness and resilience.

The CNO's full podcast can be found online and on iTunes.

***UNDERSEA WARFARE* Magazine has created this new section in recognition of the enlisted Submariner—but we want you to get involved in the success of this effort. We would like you to send us "Community Outreach," or "Liberty" photos, and/or "Homecoming" photos of families being re-united as the crews return.**

Send your submissions to the Military Editor via email to: underseawarfare@hotmail.com

Qualified for Command

Lt. Cmdr. Matthew Beach
COMSUBRON 15

Lt. Cmdr. Adam Bush
USS *Annapolis* (SSN 760)

Lt. Jay Davis
COMSUBRON 17

Lt. Cmdr. Thomas Dotstry
COMSUBRON 20

Lt. Cmdr. Joseph Ferrari
USS *Louisiana* (SSBN 743) (G)

Lt. Cmdr. Douglas Hagenbuch
COMSUBDEVRON 5

Lt. Cmdr. Michael Hartzell
COMSUBRON 15

Lt. Cal Kimes
USS *Michigan* (SSGN 727) (G)

Lt. Cmdr. Alfred Long
COMSUBRON 17

Lt. Cmdr. Kenneth Morris
USS *Kentucky* (SSBN 737) (G)

Lt. Cmdr. Jeremy Parm
COMSUBRON 15

Lt. Cmdr. Tad Robbins
COMSUBRON 7

Lt. William Sopp
USS *Tennessee* (SSBN 734) (B)

Lt. Cmdr. Jack Shis
COMSUBRON 11

Lt. Cmdr. Aaron Stutzman
COMSUBRON 19

Lt. Cmdr. Abraham Wadsworth
COMSUBRON 17

Qualified in Submarines

Lt. Patrick Amundson
USS *Pennsylvania* (SSBN 735) (B)

Lt. j.g. Kevin Aukee
USS *Jimmy Carter* (SSN 23)

Lt. j.g. James Aylluard
USS *Tucson* (SSN 770)

Lt. Joseph Beach
USS *Seawolf* (SSN 21)

Lt. Theodore Bracken
USS *Pennsylvania* (SSBN 735) (G)

Lt. j.g. Lindsay Brock
USS *Wyoming* (SSN 742)

Lt. j.g. Phillip Brown
USS *Texas* (SSN 775)

Matthew Busta
USS *Santa Fe* (SSN 763)

Lt. j.g. Andres Caicedo
USS *Columbia* (SSN 771)

Lt. j.g. Joshua Carrigan
USS *Minnesota* (SSN 783)

Lt. j.g. Richard Cerge
USS *Key West* (SSN 722)

Lt. j.g. Nicholas Chaung
USS *Asheville* (SSN 758)

Lt. j.g. Jae Choi
USS *Nevada* (SSBN 733) (G)

Lt. Michael Dahlgren
USS *Seawolf* (SSN 21)

Lt. j.g. John Dowd
USS *John Warner* (SSN 785)

Lt. j.g. Nathan Ellis
USS *West Virginia* (SSBN 736) (B)

Lt. j.g. Joshua Flugaur
USS *Pennsylvania* (SSBN 735) (B)

Lt. Andrew Garber
USS *Maine* (SSBN 741) (G)

Lt. j.g. Michael Garcia
USS *Asheville* (SSN 758)

Lt. j.g. Adam Gortz
USS *Henry M. Jackson* (SSBN 730) (B)

Lt. j.g. Jarad Hancock
USS *Jimmy Carter* (SSN 23)

Lt. j.g. Clinton Hawkins
USS *Maine* (SSBN 741) (G)

Lt. j.g. Ross Hieatt
USS *Jimmy Carter* (SSN 23)

Lt. j.g. Tyler Howell
USS *Maine* (SSBN 741) (G)

Lt. j.g. Wesley Johnson
USS *Key West* (SSN 722)

Lt. j.g. Anthony Kardelis
USS *Alabama* (SSBN 731) (B)

Lt. j.g. Keith Lokkins
USS *Maine* (SSBN 741) (B)

Lt. j.g. Brian Lucas
USS *Rhode Island* (SSBN 740) (B)

Lt. Jesse Marder
USS *Maine* (SSBN 741) (G)

Lt. j.g. Brian McGarvey
USS *Henry M. Jackson* (SSBN 730) (B)

Lt. j.g. Matthew McIntyre
USS *Henry M. Jackson* (SSBN 730) (B)

Lt. Nicholas Mehalic
USS *John Warner* (SSN 785)

Lt. j.g. Mark Miller
USS *John Warner* (SSN 785)

Lt. j.g. Rebecca Norris
USS *Louisiana* (SSBN 743) (G)

U.S. Navy photo

NNSY Completes USS *Maryland*'s Engineered Refueling Overhaul

Norfolk Naval Shipyard successfully completed USS *Maryland*'s (SSBN 738) engineered refueling overhaul (ERO), Feb. 24.

In addition to being refueled, nearly all of the ship's systems were overhauled or modernized. Modernization work included replacement of distilling plants with a reverse osmosis unit, installation of an upgraded 500 kilowatt motor generator, electric power plant work, and LAN upgrades.

The project team met several key milestones on this overhaul, including setting a new best for the shipyard in safety performance on an SSBN availability, achieving record performance in the period from completion of hot operations to the start of its power range test program, and a record performance on propulsion plant testing.

Lt. j.g. Kyle Oleary
USS *John Warner* (SSN 785)

Lt. Joshua Otremba
USS *Michigan* (SSGN 727) (B)

Lt. j.g. Joseph Panikulam
USS *Hawaii* (SSN 776)

Lt. j.g. Nicholas Papetti
USS *Pennsylvania* (SSBN 735) (G)

Lt. j.g. Eowyn Pedicini
USS *Louisiana* (SSBN 743) (G)

Lt. j.g. Rafail Perez
USS *City of Corpus Christi* (SSN 705)

Lt. j.g. Justin Piche
USS *Maine* (SSBN 741) (B)

Lt. Damien Porter
USS *Jimmy Carter* (SSN 23)

Lt. j.g. Allen-Wesley Powell
USS *Nevada* (SSBN 733) (G)

Lt. j.g. Steven Prendergrast
USS *Alaska* (SSBN 732) (G)

Lt. j.g. Tyler Putnam
USS *Scranton* (SSN 756)

Lt. j.g. Stephen Ramey
USS *Tennessee* (SSBN 734) (B)

Lt. j.g. Christopher Ricks
USS *Jimmy Carter* (SSN 23)

Lt. Christopher Roche
USS *John Warner* (SSN 785)

Lt. j.g. Joshua Rodebaugh
USS *Maine* (SSBN 741) (G)

Lt. j.g. Cody Rome
USS *Louisville* (SSN 724)

Lt. j.g. Zachary Roth
USS *Jimmy Carter* (SSN 23)

Lt. j.g. Joseph Ryan
USS *Henry M. Jackson* (SSBN 730) (B)

Lt. j.g. Christopher Saindon
USS *Alaska* (SSBN 732) (G)

Lt. j.g. Joshua Sale
USS *Hawaii* (SSN 776)

Lt. j.g. Dylan Shay
USS *Pennsylvania* (SSBN 735) (B)

Lt. j.g. Nathaniel Smith
USS *Alabama* (SSBN 731) (B)

CNO Releases 'A Design for Maintaining Maritime Superiority

Chief of Naval Operations Adm. John Richardson released 'A Design for Maintaining Maritime Superiority' Jan. 5, a document that addresses how the Navy will adapt to changes in the security environment and continue to fulfill its mission.

The term 'design' refers to the document's built-in flexibility, recognizing the rapid rate of change occurring in both technology and the maritime domain.

"This guidance frames the problem and a way forward, while acknowledging that there is inherent and fundamental uncertainty in both the problem definition and the proposed solution," said Richardson.

"As we move forward, we'll respect that we won't get it all right, and so we'll monitor and assess ourselves and our surroundings as we go. We'll learn and adapt, always getting better, striving to the limits of performance."

The CNO's design reaffirms the Navy's mission, describes the strategic environment, and identifies four lines of effort, each with corresponding objectives to guide the actions of the Navy and its leaders.

The four lines of effort are the following:

- Strengthen Naval Power at and from Sea
- Achieve High Velocity Learning at Every Level
- Strengthen our Navy Team for the Future
- Expand and Strengthen our Network of Partners

The document also details four 'Core Attributes' that serve as guiding criteria for command decisions in decentralized operations: integrity, accountability, initiative, and toughness.

To read 'A Design for Maintaining Maritime Superiority' go to: www.navy.mil/cno/docs/cno_stg.pdf

Lt. j.g. Eric Thomas
USS *Kentucky* (SSBN 737) (G)

Lt. j.g. Joseph Walter
USS *Asheville* (SSN 758)

Lt. j.g. Monte Willett
USS *Wyoming* (SSBN 742) (G)

Lt. j.g. Ryan Willis
COMSUBDEVRON 5

Lt. j.g. Anthony Wood
USS *Kentucky* (SSBN 737) (G)

Lt. Chad Woolridge
USS *Jimmy Carter* (SSN 23)

Supply Corps Qualified in Submarines

Ens. Dara Faraday
USS *Wyoming* (SSBN 742) (B)

Lt. j.g. Amy Hutchings
USS *Wyoming* (SSBN 742) (G)

Lt. j.g. Colleton Miller
USS *Bremerton* (SSN 698)

Qualified Nuclear Engineering Officer

Lt. j.g. Juan Acosta
USS *Key West* (SSN 722)

Lt. Tyrell Arment
USS *Maryland* (SSBN 738) (B)

Lt. j.g. Matthew Arsenault
USS *Olympia* (SSN 717)

Lt. j.g. Derek Bailey
USS *Louisville* (SSN 724)

Lt. j.g. Matthew Barnes
USS *Alaska* (SSBN 732) (B)

Lt. j.g. Theodore Bracken
USS *Pennsylvania* (SSBN 735) (G)

Lt. j.g. Lindsay Brock
USS *Wyoming* (SSBN 742) (G)

Lt. j.g. Phillip Brown
USS *Texas* (SSN 775)

Lt. John Buono
USS *Scranton* (SSN 756)

Lt. Paul Carpenter
USS *Hampton* (SSN 767)

Lt. Joshua Carrigan
USS *Minnesota* (SSN 783)

Lt. j.g. Daniel Chapman
USS *Florida* (SSGN 728) (B)

Lt. Savith Chauhan
USS *Jacksonville* (SSN 699)

Lt. j.g. James Compton
USS *Alexandria* (SSN 757)

Lt. j.g. Benjamin Currin
USS *Helena* (SSN 725)

Lt. j.g. Michael Dreiss
USS *Greeneville* (SSN 772)

Lt. j.g. Matthew Drewnowski
USS *Henry M. Jackson* (SSBN 730) (B)

Lt. Taylor Ebert
USS *Houston* (SSN 713)

Lt. j.g. Samuel Eng
USS *Virginia* (SSN 774)

Lt. Adam Erickson
USS *Topeka* (SSN 754)

Lt. j.g. Erik Evans
USS *La Jolla* (SSN 701)

Lt. j.g. Travis Evert
USS *North Dakota* (SSN 784)

Lt. j.g. Mark Gaines
USS *Key West* (SSN 722)

Lt. j.g. Kristopher Gallagher
USS *Oklahoma City* (SSN 723)

Lt. Joshua Hightower
USS *Hampton* (SSN 767)

Lt. j.g. Warren Juba
USS *Chicago* (SSN 721)

Lt. j.g. Daniel Kapral
USS *Dallas* (SSN 700)

Lt. j.g. Spiros Karousos
USS *Nebraska* (SSBN 739) (B)

Lt. j.g. Bryan Keck
USS *Pasadena* (SSN 752)

Lt. Michael Martin
USS *Pittsburgh* (SSN 720)

Lt. Christopher Medford
USS *California* (SSN 781)

Lt. j.g. Brendan Milliken
USS *Buffalo* (SSN 715)

Lt. j.g. John Minahan
USS *Alaska* (SSBN 732) (B)

Lt. j.g. Daniel Montgomery
USS *Alexandria* (SSN 757)

Lt. j.g. Rebecca Norris
USS *Louisiana* (SSBN 743) (B)

Lt. j.g. Kyle Oleary
USS *John Warner* (SSN 785)

Lt. j.g. Jason Palanko
USS *Oklahoma City* (SSN 723)

Lt. Peter Pappalardo
USS *Topeka* (SSN 754)

Lt. j.g. Michael Plummer
USS *New Mexico* (SSN 779)

Lt. j.g. William Queen
USS *Mississippi* (SSN 782)

Lt. Eric Randall
USS *Pennsylvania* (SSBN 735) (G)

Lt. Titus Reed
USS *San Francisco* (SSN 711)

Lt. j.g. John Reidy
USS *Greeneville* (SSN 772)

Lt. j.g. Sam Riahi
USS *Helena* (SSN 725)

Lt. j.g. David Rodriguez
USS *Pennsylvania* (SSBN 735) (G)

Lt. Jason Romeo
USS *New Mexico* (SSN 779)

Lt. Lawrence Schumaker
USS *Florida* (SSGN 728) (B)

Lt. Joshua Seagrave
USS *Providence* (SSN 719)

Lt. j.g. Steven Seda
USS *Jacksonville* (SSN 699)

Lt. j.g. Dylan Shay
USS *Pennsylvania* (SSBN 735) (B)

Lt. j.g. Noah Singer
USS *Nevada* (SSBN 733) (G)

Lt. j.g. Michael Solon
USS *Texas* (SSN 775)

Lt. j.g. Aaron Stalford
USS *Georgia* (SSGN 729) (G)

Lt. j.g. Patrick Trabert
USS *Albuquerque* (SSN 706)

Lt. j.g. Nicholas Vasquez
USS *Maine* (SSBN 741) (G)

Lt. j.g. Gregory Wendzicki
USS *Albany* (SSN 753)

Lt. j.g. Monte Willett
USS *Wyoming* (SSBN 742) (G)

Washington Christening Ceremony

On a crisp, sunny March afternoon, in front of a crowd of approximately 2,000 people, Elisabeth Mabus christened the USS *Washington* (SSN 787). The *Washington* will be the 14th *Virginia*-class submarine built by Newport News Shipbuilding and General Dynamics Electric Boat.

USS *Washington* pays homage to the 42nd state and to the 35 Medal of Honor recipients dating back to the Civil War, and she is expected to be commissioned late 2016.

MARCH 16, 2016

USS *Batfish* (SS 310)
Muskogee, Okla.

Prior to her December 27, 1942 keel-laying, SS 310's name was changed from USS *Acoupa* to USS *Batfish* for a small fish resembling the stingray. She was launched on May 6, 1943 by Portsmouth Naval Shipyard and commissioned on August 21, 1943, with Lt. Cmdr. W.R. Merrill in command.

From December 11, 1943 to August 26, 1945, *Batfish* completed seven war patrols and is credited with having sunk 15 ships for a total of 37,484 tons and damaging three others in the western Pacific theater. *Batfish* received the Presidential Unit Citation, a Navy Cross, four Silver Stars, and nine battle stars for her WWII service.

Batfish left Pearl Harbor on her first war patrol on December 11, 1943, four days after the second anniversary of the Japanese attack there. Cruising off Honshu, Japan, she damaged two freighters and sank the cargo ship *Hidaka Maru* before arriving at Midway on January 30, 1944.

Returning to sea on February 22, 1944, she patrolled for 53 days and saw no action before returning. On her third patrol, leaving Pearl Harbor on May 26, 1944, *Batfish* partrolled off the southern coast of Japan where she she sank a Japanese training vessel and two cargo ships before surfacing and sinking a trawler and its escort vessel with deck gun fire.

On her fourth patrol, she sank the Japanese destroyer *Samidare*. It was the sixth patrol, however, that achieved lasting fame for the submarine. In 76 hours, *Batfish* attacked and sank three Japanese submarines *RO-55*, *RO-112* and *RO-113*. No other submarine has since matched this feat.

USS *Batfish* made her final patrol in 1945. After shelling the coast of Japan, she rescued three downed American aviators and returned to Midway on August 22, 1945.

Batfish returned to the United States after the war and was placed out of commission in reserve at Mare Island Navy Yard on April 6, 1946.

On March 7, 1952, she was recommissioned and on April 21 assigned to Submarine Division 122 in Key West, Fla. to carry out training duty, operating between Key West and Caribbean ports.

A year later she was towed to New Orleans for use as a moored naval reserve training vessel until stricken from the Navy list in 1969.

In February 1972, *Batfish* was transferred to the Oklahoma Maritime Advisory Board and towed up the Arkansas River to Muskogee. There, she was placed in a dry berth and opened to the public as a memorial to Oklahoma combat Submariners.

Visitors to the Muskogee War Memorial Park can explore WWII history by touring the *Batfish* or a self-propelled howitzer, cannons, missiles, and a variety of other military artifacts for viewing.