

American Submariners Inc.  
4370 Twain Ave.  
San Diego, CA 92120-3404



## *The Silent Sentinel* *August 2018*



### *Our Creed and Purpose*

To perpetuate the memory of our shipmates who gave their lives in the pursuit of their duties while serving their country. That their dedication, deeds, and supreme sacrifice be a constant source of motivation toward greater accomplishments. Pledge loyalty and patriotism to the United States of America and its Constitution.

In addition to perpetuating the memory of departed shipmates, we shall provide a way for all Submariners to gather for the mutual benefit and enjoyment. Our common heritage as Submariners shall be strengthened by camaraderie. We support a strong U.S. Submarine Force.

The organization will engage in various projects and deeds that will bring about the perpetual remembrance of those shipmates who have given the supreme sacrifice. The organization will also endeavor to educate all third parties it comes in contact with about the services our submarine brothers performed and how their sacrifices made possible the freedom and lifestyle we enjoy today.



Radio Gang, USS Lafayette SSBN-616(G), Circa 1975  
[your Sentinel Editor is the scroungy looking lout in the front on the left side]

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### The Silent Sentinel via Email

To all of my Shipmates and families who currently receive our Great newsletter via the mail who would like it sent via email or continue to receive it via mail, please fill out the form and mail it to the base or myself. We are trying to cut the cost of the newsletter down from \$3700 to about \$1900 a year. By receiving the Silent Sentinel via email will cut down the printing and mailing cost. The other plus to receiving it via email is you can save it on your computer and not have the paper lying around the house.

*A subscription to the Silent Sentinel newsletter will be available to surviving family members via internet email, at no charge, upon notification of the Membership Chairman. If a printed hard-copy is preferred, via US Post Office delivery, an annual donation of \$5.00 will be requested to cover costs.*

NAME: \_\_\_\_\_

ADDRESS: \_\_\_\_\_

CITY/STATE/ZIP: \_\_\_\_\_

EMAIL: \_\_\_\_\_

TELEPHONE: \_\_\_\_\_

Would like the SILENT SENTINEL emailed: YES \_\_\_\_\_ NO \_\_\_\_\_

USSVI Base Commander  
c/o VFW Post 3787  
4370 Twain Ave.  
San Diego, CA 92120-3404

*DUE TO LOGISTICS CONSTRAINTS, ALL INPUTS FOR THE SILENT SENTINEL MUST BE IN MY HAND NO LATER THAN **ONE WEEK** AFTER THE MONTHLY MEETING. IF I DO NOT RECEIVE IT BY THIS TIME, THE ITEM WILL NOT GET IN. NO EXCEPTIONS! MIKE*

## *August Meeting*

**Our monthly meeting is held on the second Tuesday of the month at VFW Post 3787, 4370 Twain Ave., San Diego. Our next meeting will be on *14 August 2018*. The post is located one-half block West of Mission Gorge Road, just north of I-8. The meeting begins at 7 p.m. The E-Board meets one hour earlier at 6 p.m.**

*Check us out on the World Wide Web  
[www.ussvisandiego.org](http://www.ussvisandiego.org)*

## **BINNACLE LIST**

*Frank Walker and Juanita Williams*

## *Submarine Losses in August*

Originally Compiled by C J Glassford



### **USS Bullhead (SS-332)**

Lost on August 6, 1945 with the loss of 84 crew members in the Lombok Strait while on her 3rd war patrol when sunk by a depth charge dropped by a Japanese Army plane. Bullhead was the last submarine lost during WWII.

### **USS Flier (SS-250)**

Lost on August 13, 1944, with the loss of 78 crew members while on her 2nd war patrol. Flier was transiting on the surface when she was rocked by a massive explosion (probably a mine) and sank within less than a minute. 13 survivors, some injured, made it into the water and swam to shore. 8 survived and 6 days later friendly natives guided them to a Coast Watcher and they were evacuated by the USS Redfin (SS-272).

### **USS S-39 (SS-144)**

Lost on August 13, 1942 after grounding on a reef south of Rossel Island while on her 3rd war patrol. The entire crew was able to get off and rescued by the HMAS Katoomba.

### **USS Harder (SS-257)**

Lost on August 24, 1944 with the loss of 79 crew members from a depth charge attack by a minesweeper near Bataan while on her 6th war patrol. Harder had won a Presidential Unit Citation for her first 5 war patrols and CDR Dealey was awarded the Congressional Medal of Honor posthumously. Harder is tied for 9th in the number of enemy ships sunk.

**USS Cochino (SS-345)**

Lost on August 26, 1949 after being jolted by a violent polar gale off Norway caused an electrical fire and battery explosion that generated hydrogen and chlorine gasses. In extremely bad weather, men of Cochino and Tusk (SS-426) fought to save the submarine for 14 hours. After a 2nd battery explosion, Abandon Ship was ordered and Cochino sank. Tusk's crew rescued all of Cochino's men except for one civilian engineer. Six sailors from Tusk were lost during the rescue.



***San Diego Base, United States Submarine Veterans Inc.  
Minutes of Meeting - 10 July 2018  
At VFW Hall, 4370 Twain Avenue, San Diego CA 92120***

1907 - Base Commander Warren Branges called the meeting to order.

Conducted Opening Exercises - Pledge of Allegiance lead by Chief of the Boat Bob Bissonette

Acting Chaplain David Ball lead the opening prayer.

Acting Chaplain David Ball conducted Tolling of the Boats for boats lost in the month of July.

Junior Vice Commander Manny Burciaga recognized Past Commanders, dignitaries and guests. Guest Brad Styer was introduced. Brad served on USS Gudgeon, at SUBTRAFAC, on USS Blueback and on USS McKee.

Base Secretary Jack Kane announced 19 members and 2 Guests present. One member arrived later.

Base Treasurer Joe Peluso presented the Treasurer's report. The four scholarship checks were mailed. Only one has been cashed. A copy of the Report will be filed with these minutes.

Minutes of the June meeting were published in the Sentinel. These minutes will be published in the Sentinel.

Base Commander Warren Branges called for Committee Reports

Binnacle List - Base Commander Warren Branges reported Frank Walker and Juanita Williams on Binnacle.

Parade Committee - Base Commander for Joel Eikam. Next Parade is Poway on 8 September at 1000.

Membership Committee - Chairman Ray Febrache. No Report. Ray not in attendance

Scholarship Committee - Committee Chairman Paul Hitchcock not in attendance

Storekeeper - Paul Hitchcock not in attendance.

Breakfast Committee - Chair Base Commander Warren Branges. The next breakfast is 29 July 2018. We need servers for that morning. Fred Fomby will honcho the affair as Base Commander and COB will be out of town.

52 Boat Memorial - Chair Base Commander Warren Branges- The next All Flags Day will be 21 September (POW/MIA Day). We will put up flags at 0700 and take them down at 1700. We are inviting the Point Loma Association to participate.

Float Committee - Chair David Kauppinen - No Report.

Eagle Scout Program - Co Chairs Nihil Smith and Glenn Gerbrand. Five more Eagle Scout Courts of Honor are in the works. Nihil and Glenn will advise as times and places are confirmed.

1940 - Base Commander called for a break. 50/50 Raffle held.

1950 - Unfinished Business

NATIONAL ELECTIONS will be held from 16 August 2018 through 15 October 2018. Ballots are available on the National Website and in the current issue of American Submariner. Candidates are:

National Commander, Wayne Standerfer. National Senior Vice Commander Jon Jaques. National Junior Vice Commander Steve Bell. National Treasurer Paul Hiser. National Secretary Ray Wewers. Western Region Director Jim Denizen. Several Constitution and ByLaw changes will be on the ballot. Please read up on them and make sure you vote. The Election will be held using the old software/URL. The new website will be put up after the elections. We will have a computer setup to vote during the August meeting.

Southern California SUBVETS Picnic will be held at Naval Base Point Loma on Saturday 14 July. We need volunteer escorts to bring people on to the base. We have a rally point setup just outside the main gate. If you have access to the base please stop by and escort your shipmates on to the base. Submarine Tours will be 0900 and 1300. Both tours are nearly fully booked. Only four spots are left for each tour. Let the Base Commander know if you have anyone to add to either tour.

NAVY MUSEUM in ALPINE. The planned trip/meeting will is scheduled for 1000 on 15 September 2018. We will have the Base Meeting followed by a picnic and tours for Terry Ulmers MOPAR Park Navy Tribute Facility. Base Secretary Jack Kane will provide more information at the next meeting.

STORAGE FOR BASE GEAR. We are still looking for a storage area for Base Gear. If you know of any storage area that would be willing to give "in kind" or drastically reduced rate storage see the Base Commander.

#### 2030 - New Business

ASSOCIATE MEMBERS. National has lifted the moratorium on signing Associate Members. If anyone knows of a prospective Associate Member let the Commander and Membership Committee Chair know. It was moved, seconded and passed (with a minimum of dissenting grunts) that the Base will sponsor Juanita Williams as an Associate member of USSVI San Diego Base.

ADVERTISEMENT IN NATIONAL CONVENTION BROCHURE. It was moved, seconded and passed to have SAN DIEGO BASE take out a full page ad in this year's Convention Brochure. The ad will focus on promoting visits to the 52 Boat Memorial in San Diego. Cost of the ad will be \$250. Donations were taken and over half the cost was covered. The Base will pay any remaining cost. The Base Commander will work out the details.

WELLNESS CHECKS. - The Base Commander asked for volunteers to help with establishing a Wellness Check Program for SAN DIEGO Base members. Hampton Roads Base has started a similar program. We can use their program outline to develop a program in San Diego. The program would entail periodic phone calls and/or home visits as warranted. If you are interested in helping with this see The Base Commander.

USS THRESHER MEMORIAL AT ARLINGTON NATIONAL CEMETERY. The USS THRESHER Memorial Association is fund raising to establish this memorial. If you are interested see their website at: <http://threshermemorial.org>.

#### 2020 - Good of the Order

PATRIOT RIDER CEREMONIES - Fellow Submariner and Guest Brad Styer invited all to attend the weekly Memorial Service hosted by Patriot Riders each Tuesday morning at 0800 on Miramar National Cemetery. Each week the Riders memorialize a veteran interred at the Cemetery.

2018 NATIONAL CONVENTION will be the Caribbean Cruise from Fort Lauderdale October 27 - November 3, 2018. Information and registration forms at the National Website (<http://ussviconvention.org/2018/>). 500 members are signed up. The following boats will hold reunions on

the cruise: SS-241 Chivo, SS-484 Odax, SSN-585 Skipjack, and SSBN-619 Andrew Jackson. Final cutoff for signups is 15 July 2018. If you want to attend and miss the deadlin see the Base Commander.

SAN DIEGO BASE CHRISTMAS PARTY - 8 December 2018 - We will have the same menu as last year.

OUTYEAR CONVENTIONS are: 2019 Austin TX, 2020 in Tucson (needs final vote at next Convention), 2021 Orlando at the Rosen Shingle Creek. Many Base Members highly recommend seeing the Museum of the Pacific (Fredericksburg TX) as part of the festivities in Austin 2020.

HELL BELOW - Is a new series about Submarines available on Smithsonian Channel.

SILENT SERVICE TV SERIES - Is available for download at olgoat.com.

SCORPION MEMORIAL - Junior Vice Commander Manny Burciaga gave a report on his attendance at The Scorpion Memorial Service in Norfolk VA. Over 500 Family members and friends attended. Chief of Naval Operations gave the keynote address. 2018 marks the 50th Anniversary of the Loss of Scorpion. The Navy Times write-up covering this ceremony can be seen at:  
[http://www.navy.mil/submit/display.asp?story\\_id=105770](http://www.navy.mil/submit/display.asp?story_id=105770).

SHIPMATE JIM POPE has documentation of the WAR IN THE PACIFIC available for perusal. Jim shared his the story of his meeting ADM Nimitz in the 1950's.

The Meeting was adjourned at 2045

/s/ Jack E. Kane

Jack Kane, Secretary

Sailing List for 10 July 2018

Members

Bob Bissonette

Warren Branges

David Ball

Bob Farrell

Joel Eikam

David Martinez

Chris Stafford

Jack Kane

Joe Peluso

Matt Baumann

Chris Sultana

Bill Earl

Jim Pope

Dennis Mortensen

Nicholas Dirkx

Ed Farley

Russ Stoddard

Manny Burciaga

Mert Weltzien

Phillip J. Richeson

Guests

Jessie Chang Farley

Brad Styer

## ***Silent Sentinel EXCLUSIVE!***



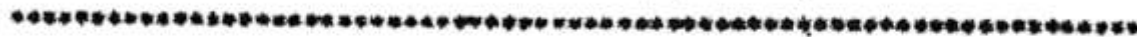
***Judith and Gary Murphy have graciously consented to allow the Silent Sentinel to republish their collection of USS Whale, SS-239, ship's newspaper, "THE RAG," from the WW-II era! Gary's father, Rex Murphy, served as Whale's Engineering Officer. The Silent Sentinel will now include a copy of The Rag in each issue. The Murphy's and I hope that you will find it an interesting reading experience. The first issue is dated March 13, 1943. Whale is on her third war patrol and has just arrived in the waters nears Tanapag Harbor, Saipan, in the Marianas.***



FIFTH EDITION

MARCH 13, 1963

"YESTERDAY HAS GONE, TODAY IS NO GOOD,  
BUT\*\* TOMORROW IS OURS". (WE HOPE)



FLASH!!!!

Booking facilities and harbor privileges were denied the U. S.S. WHALE at Saipan today. The Japanese gave no reason what so ever for this action. "So Sully" being their only comment.

A formal protest will be lodged with the Saipan shipping and Naval authorities in the very near future. That is, in the form of high explosives. (We hope). The rat-ti-tat-tat----- of deck guns and, if worse comes to worse, we could threaten them with a mouth of Englen's super smelly show. (what show)

It has been rumored about, that the reason for this action was due to the presence, aboard the above named ship, one, Fran Martini, Noted spreader of propaganda and infamous rumors. Of course only time can tell what course of action will be taken.

A valve, which mint in service to anyone for nothin' at the present time, is being placed in the jaws of the forward engine house vice so's youse guys which likes to turn valve wheels open and shut can play. Keep your hooks off of the various valves spread through out the engine houses. Plizze!

It has been noticed recently that a strange looking individual with some fuzz in the shape of a third eyebrow or a "mouse" located under his snout locker, has been proudly strutting from the manuvering room to the crews quarters only in order to attract attention to this unwise growth. This person wears the markings of a first class electrician mate, and has the typical marks of the "ring" all about his box-car like skull. Is better known in fighting circles as "canvas back or to his ship mate as mattru a back".

While busily engaged in mindin' mine own business one evening not so long ago, I happened to see a certain stake-hole person, diligently scrubbin' a pair of scivvies not his own. Now, these scivvies belonged to a person of low intellect, cause, in the first place anyone with any knowledge of the workings of the ways of the world, will tell you that people just don't go around washing scivvies of other person excepting maybe the unmentionables worn by the opposite sex, which is sometimes washed by the guys which is puttin' out the gleams. Also, these drawers which belonged to a guy of maybe Wap, Griik, or Spik nationality, were very unclean and had hash-marks to show for time in service.

What we want to know is; Those scivvies was bein' washed by who, where, when and WHY!

Did you know that:

In the days of the privateer, buccaneer, or pirate, ear piercing was a common practice. Large gold rings being worn in the ears as a mark of beauty. This was in the days when the male of the species tried his damndest to pass as a female. Milk, lace, powdered wigs, and perfume also made up his attire. But, to get back to ear piercing, often times the ear became dangerously infected shortly after being pierced, and the lobe or all of the ear had to be removed. It was nothing to see a brawny seaman with a port of starboard list due to the fact that one of his ears had been lopped off.

In Christianity a man can have one wife. This is called Monotony.

Someone plizze note-----

page 2

FLASH---FLA H---SUPER FLASH---

Late news bulletin via radar, U.S. S. WHALE.....

Late this afternoon, Japanese authorities sought to temper their previous denial of port and harbor facilities for the U.S.S. WHALE. By suggesting the above named ship furnish a twenty man working party. The uniforms to be white suit pants and flat hats, to facilitate the loading and unloading of ships now in the harbor. It has been pointed out by the powers that be of the U. S.S. WHALE, that twenty men would be a difficult group to furnish, with a requested exclusion of Fran Martini and food destroyer Englen. No doubt the nipers are aware of our shortage of men and flat hats and make these provisions, impossible provisions only to save face.

It has been suggested by the powers that be of the U.S.S. WHALE if the nip ships would put to sea, said ships would be speedily unloaded with as little trouble as possible to both sides. In this unloading, the nips can expect wholehearted cooperation, from the officers and men of the U.S.S. WHALE. Upon completion of unloading, the U.S.S. WHALE will return to the foot of GEORGIA st. U.S.A. and the nips can go to Hell or, wherever it is where nips go, with the compliments of the crew.

We feel sure that this arrangement will bring about a better feeling between the Japanese and members of the WHALE crew.

NOTICE.....NOTICE.....NOTICE....

You too, can learn to blow the sea head in one easy lesson. Be not ashamed, we all had to learn once. See any qualified man aboard, he'll be only to glad to show you how. A word to the wise is sufficient.

Electrician mate Thompsons fumbling, stumbling, mumbling passage through the boat, has brought about a clearer understanding of that old adage; "Men that go down to the sea in ships".

A man is an animal split half way up and walks on the split end.---or a J.J. the Fitz.

A certain primary professor asked of his pupils to give five reasons as to why they liked Mother's milk the best.

Little Johnnie, whose old man is a sailor raised his hand and replied;

In the first place it's best for ya,

In the second place it's absolutely grade A-1 fresh,

In the third place it aint no trouble to carry on picnics,

And in the fourth and fifth place, it's in a place where the cats cant get at it and it comes in such cute little containers. ---Ling Po.

Three girls were discussing the type of fellows they would like to marry.

The first, said that she preferred a banker because he could buy her everything that she wanted.

The second said that she preferred a travelling salesman. He could take her to every place that she desired to go.

The third sweet young thing, said that she desired a sailor. If he wasn't thinking about it, he was talking about it. If he wasn't talking about it, he was doing it. Which is about all that really matters in life anyhow.

The heads and washrooms of the boat will be closed daily from 0630 to 0900 cleaning purposes. Take head.

Capt in of the head.



# NEWS OF THE DAY!

WHO IS THE  
REAL GUY  
BEHIND THE  
KAG!



JUST WAIT UNTIL THE  
BOYS GET A GOOD LOOK AT  
ALL THIS GOLD!!

## Current News

*“Plataginet, I will; and like thee, Nero,  
Play on the lute, beholding the towns burn” (Henry VI, Shakespeare)*

### **Russian Submarine Activity Largest Since Cold War: top US Navy admiral** **Lucas Tomlinson, Fox News, August 8**

Pentagon and NATO brass have issued fresh warnings about increased Russian naval activity in the North Atlantic and Mediterranean Sea, with the top U.S. Navy admiral saying this week Russian submarine operations are currently at levels not seen since the Cold War.

That’s one reason the Navy plans to stand up a new command later this month to deal with the return of an old foe.

Tuesday night provided the latest example of Russia’s new show of force. A British Type 45 guided-missile destroyer escorted two Russian warships through the English Channel.

The Royal Navy posted video of HMS Diamond alongside the Russian destroyer Severomorsk and cruiser Marshal Ustinov in the English Channel. Interactions like this have become so common, the Royal Navy has warships standing 24-hour alert in port.

The incident took place one day after Defense Secretary Jim Mattis met with his British counterpart, Gavin Williamson, at the Pentagon. It marked the second time the same British warship had responded to approaching Russian Navy warships, according to the warship’s commanding officer.

This week, the U.S. Navy’s highest ranking officer, Adm. John Richardson, chief of naval operations, told VOA Russian submarine activity in the North Atlantic is "more than we've seen in 25 years."

But a day later, Mattis downplayed the perceived threat from the Russian Navy.

“We always keep an eye on the submarines at sea and I prefer not to say any more than that,” Mattis told reporters on the Pentagon steps ahead of Williamson's visit.

A recent Russian missile test provided another example of Russia’s resurgence at sea.

Two months before the Helsinki summit, a Russian ballistic missile submarine launched four long-range nuclear missiles in rapid succession from off the coast of Russia in the White Sea, each with a range of 6,000 miles – putting Washington, D.C. in range. U.S. spy satellites took note of the test, which marked the first time Russia had fired this many missiles at once from its newest class of ballistic missile submarine.

Observers said tensions are high right now between Moscow and Washington, despite the summit in Helsinki last month. On Wednesday, the U.S. said it would impose sanctions on Russia over a nerve agent attack.

“I think Russia is signaling to us that the Bear is back. We are likely to see more of this intimidating, threatening operations on the part of the Russian fleet,” said Peter Brookes, a senior fellow for national security affairs at the Heritage Foundation. “This is an expression of President Putin's foreign policy and it’s directed towards the United States.”

U.S. officials are concerned special Russian submarines can tap into undersea cables.

Days ahead of the landmark summit between Cold War foes, President Trump signaled a willingness to ease tensions despite his top intelligence officials accusing Russia of meddling in the 2016 election.

“Maybe we will get along with Russia,” the president said at a news conference on July 12. “I think we probably will be able to.”

A week after the Helsinki summit, Trump told CNBC if things didn’t work out, “I’ll be the worst enemy he's ever had,” speaking about Russian President Vladimir Putin.

Since Russian forces deployed to Syria three years ago, Russian submarines in the Mediterranean have at times launched missiles to help crush the rebellion battling the Assad regime.

The increased Russian threat is one of the reasons the U.S. Navy is bringing back the 2nd Fleet later this month in Norfolk, Va. to keep tabs on the Russians in the Atlantic.

It had been deactivated in 2011.

## **A Sinking Feeling: America's New Stealth Missile Submarine Has a Problem**

**Dave Majumdar, *The National Interest*, August 7**

The U.S. Navy and shipbuilder General Dynamics Electric Boat have run into a snag on the Columbia-class Ohio Replacement Program (ORP) nuclear-powered ballistic missile submarine (SSBN) program.

Faulty welds have been found in several missile tubes made by subcontractor BWXT, Inc., according to a new report from David Larter at Defense News. It is unclear what the impact will be on the \$122.3 billion Columbia-class program. Additionally, the defects could impact Block V Virginia-class attack submarines equipped with the Virginia Payload Module (VPM) missile tubes as well as the British Dreadnought-class SSBNs, which also share a common missile compartment with the Columbia.

The U.S. Naval Sea Systems Command and General Dynamics Electric Boat are currently investigating what went wrong. But while the impact from the welding problem is unclear, there are indications that the faults are not systemic and no other vendor has had similar issues thus far.

“The Navy/GDEB team is working to bound the scope of the problem and engineering assessments are ongoing to assess and determine remediation for the identified issues,” Naval Sea Systems Command spokesman Bill Couch told Defense News. “Initial reports indicate that the other vendors do not have the same issue, and they continue to produce missile and payload tubes.”

“Work at BWXT, Inc. has been temporarily halted while the Navy and General Dynamics Electric Boat figure out what went wrong. All BWXT welding requiring volumetric inspection has been halted until the investigation is complete,” Couch said.

It is not clear how long the investigation will take to complete or how long it will take to implement any fixes.

The faulty welds are a source of uncertainty for a program that has no margin for error. General Dynamics Electric Boat has to finalize the design and start construction of the first submarine in fiscal year 2021 in order for Columbia to make her first deterrence patrol in October 2030, just after the first of the Ohio-class SSBNs have to be retired as they reach the end of their service lives. That means components such as the common missile compartment (CMC) have to be ready well before the shipyards need to insert those components into the Columbia’s hull when construction starts. Indeed, the Navy awarded contracts to start building the CMC in 2016.

Unlike with the Virginia-class attack submarine, Electric Boat will be the sole prime contractor and will be responsible for delivering all twelve Columbia-class boats to the Navy. However, while Electric Boat will be responsible for eighty percent of the work on the Columbia-class, Huntington Ingalls Newport News—the only other shipyard capable of building a nuclear submarine—is heavily involved in the design and build phase. Newport News has a total responsibility for about twenty percent of the boat’s design and construction. Dividing up the work in this manner will help to preserve the nation’s critical nuclear submarine engineering and manufacturing skills.

In an attempt to minimize costs, the Navy drew upon as much technology from the Virginia-class as possible—though the fact remains that the Columbia-class is extremely expensive. However, there are some major differences between the two designs—especially towards the stern of the vessel. The Columbia is designed to have greatly improved survivability compared to any previous American submarine design. The Navy emphasized stealth and survivability because of the boat’s critical nuclear deterrence mission—the Columbia has to be survivable through 2080 in order to guarantee America’s nuclear deterrence.

## **Russia Creates ‘Eternal’ Nuclear Reactor for new Submarines**

**Staff, *Meritime Herald*, August 7**

According to a subsidiary of the Russian nuclear corporation Rosatom, a new “heart” of nuclear reactors for atomic submarines has been created and tested for the first time in Russia, a facility that can function throughout the life of the submarine without the need to refuel nuclear fuel.

The so-called “active zone” is the “heart” of the reactor. It contains the nuclear fuel and it is precisely in that the chain reaction occurs. The new technology of the subsidiary OKBM Afrikantov means that Russian submarines will not need refuelling.

According to the former commander of the Northern Fleet, Admiral Vyacheslav Popov, the creation of the “eternal” reactor has enormous importance for the Russian Navy’s combat readiness.

“With such a reactor [which does not require refuelling] the efficiency coefficient of the submarine increases several times,” Popov said.

In the list of fourth generation submarines are those of the Borei and Yasen project.

In addition, it was stated that Russia could help South Korea build a nuclear reactor for oceanic ships based on the RITM-200 reactor, which will be installed in the brand new Russian atomic icebreakers.

“In November 2017, during the meeting in Nizhny Novgorod, representatives of the Korean Institute of Atomic Energy Research (KAERI) reported that the Korean side currently considers the possibility of developing the concept of a new reactor with the power from 150-200 megawatts to ocean vessels based on the design of the RITM-200 reactor, “says the Rosatom subsidiary report.

“The Russian side said it was ready to cooperate with the Korean side in the fabrication of a ‘turnkey’ nuclear reactor if Korea sends its official request for cooperation to Russia and has the necessary approval from the government corporation Rosatom,” he adds. the document.

The RITM-200 is a nuclear reactor developed by the company OKBM Afrikantov intended to be installed in nuclear breakers and floating atomic stations.

## **France's New Nuclear-Powered Stealth Submarine Is a Killer. Here Is All We Know.** **Zachary Keck, National Interest, August 6**

The second new capability on the SSNs is the ability to insert small teams of special forces onto land, which could come in handy in France’s counterterrorism operations in places like North Africa. In addition, the vessels are reportedly being built to accommodate unmanned underwater vehicles (UUVs) in the future.

France has ordered a new nuclear-powered attack submarine.

Following a May 2 ministerial investment meeting presided over by Armed Forces Minister Florence Parly, Paris announced that it was purchasing a fifth Barracuda nuclear attack submarine, Defense News reported . The decision came after the French Navy Chief of Staff Adm. Christophe Prazuck told parliament last October that he expected the fifth submarine to be ordered sometime in 2018.

In addition, the draft 2019–2025 military budget plan that was released in February 2018 included funding for six Barracuda submarines. The six submarines in the class are expected to be named Suffren, Duguay-Trouin, Tourville, Dupetit-Thouars, Duquesne and De Grasse. The lead boat of the class, Suffren, is scheduled to be delivered to the French Navy sometime in 2020, three years after it was initially slated to be ready.

Work on the Barracuda-class began all the way back in 1998, according to Global Security, a defense information website. The design phase of production began four years later in June 2002. In late 2006, the French Defense Ministry awarded the state-owned defense firm DCN (which was later renamed DCNS and is now called Naval Group) a 7.9 billion euro (\$9.3 billion under current exchange rates) contract to build the submarines. The company Areva was given responsibility for the nuclear components of the submarines. The reactor is expected to be derived from the one France’s Navy uses on its Charles de Gaulle aircraft carrier. Unlike most naval reactors, France’s do not use highly-enriched uranium because the navy purchases the fuel from the commercial market.

The Barracuda vessels will also have the same SYCOBS combat management system as was used in Le Terrible, the last ship of the Le Triomphant -class nuclear ballistic-missile submarines (SSBN). According to the website Naval Technology : “The combat system integrates active and passive sensors, electronic, optronic and optical sensors and data processing, signal processing of downloaded external tactical data, the launch and control of torpedoes, missiles and countermeasures, external communications and navigation. The communications suite includes satellite and extra-long-frequency acoustic links.”

When completed, the Barracuda-class SSNs are expected to replace France’s existing force of four Rubis submarines as well as the two newer Amethyste-class submarines. The new subs are expected to displace around 5,300 tons when submerged, which is roughly twice as much as the Rubis submarines. Despite being much larger than their predecessors, the former program manager for the Barracuda has said that the newer submarines only require sixty sailors, ten less than France’s older vessels. The newer subs will also have a length of 99.5 meters, a beam around 8.8 meters, and a diving depth of around 350 meters. They will also be able to cruise at speeds approaching twenty-five knots while submerged.

As far as weaponry, the submarines will have four 533mm torpedo tubes and eighteen to twenty additional torpedo or missile tubes, with armaments depending on mission. The former program manager also said that the submarines can be equipped with the “F21 Torpedo, Exocet SM39 Block 2 Mod 2 Anti-ship missile, MdcN (naval cruise missile), [and] FG29 mines.” He also said the new submarines “constitute a revolution or several revolutions in the submarine forces,” rather than merely an evolution. By this he appeared to mean the level of automation of the Barracudas, which help reduce the staff size.

Still, the new submarines will also bring two new types of capabilities as far as France is concerned. First it will have a land-attack capability in the form of a sea-launched missile being developed based on the air-launched cruise missile that Paris calls the Scalp EP and Britain refers to as the Storm Shadow. According to Naval Technology : “The missile has long-range precision attack capability against targets at ranges up to 1,000 km. Scalp has inertial guidance which is continuously updated in flight with digital terrain matching and GPS (global positioning system). An imaging infrared seeker and automatic target

recognition provide terminal guidance.” The same source notes that “the missile is being developed for both submarine torpedo-tube ejection and surface ship vertical launch.”

The second new capability on the SSNs is the ability to insert small teams of special forces onto land, which could come in handy in France’s counterterrorism operations in places like North Africa. In addition, the vessels are reportedly being built to accommodate unmanned underwater vehicles (UUVs) in the future.

Despite not being in operation yet, the Barracuda has already been generating interest abroad. First, Australia selected a conventionally powered version of the submarine called the Shortfin Barracuda as the replacement for its Collins-class subs. In doing so, it beat out the much more established German Type 216 and Japanese Soryu-class subs. More recently, South Korea has been eyeing as the Barracuda as a model to follow should it decide to build nuclear-powered submarines. One advantage of the Barracuda for South Korea is that, as noted above, it will not require highly enriched uranium.

## **Towed-Array Sonar Systems For Navy Submarines**

**John Keller, Military and Aerospace, July 31**

Undersea sonar designers at L-3 Chesapeake Sciences Corp. in Millersville, Md., are building the U.S. Navy's next-generation towed-array sonar to enable Navy submarines to detect, track, and classify quiet, modern submarine threats in open ocean and littoral waters.

Officials of the Naval Sea Systems Command in Washington announced a \$26.6 million order to L-3 Chesapeake on Monday to build TB-29X towed arrays for Navy submarines.

The TB-29X is the future generation reliability improvement to the TB-29A. It is a 416 channel thin line towed array with an equivalent acoustic performance capability to TB-29A. The TB-29X is a thin line towed array passive sonar receiver that has the same form factor as the TB-29 array, yet offers increased capability, greater reliability and reduced obsolescence.

Towed array sonar uses hydrophones towed on a cable trailing behind a submarine or a surface ship; it can be miles long. It's designed to keep the array's sensors away from tow vessel noise to improve its signal-to-noise ratio and its ability to detect and track faint contacts like quiet nuclear- and diesel-powered submarines and seismic signals.

Effective use of towed array sonar systems limit a vessel's speed, and crews must take care to protect the cable from damage. Current towed-array systems also are complex designs and need to be upgraded to maintain reliability while deployed, while stowed, and while reeling the array in and out of submarines and other marine vessels.

Related: Lockheed Martin to build towed-array sonar systems for Navy undersea surveillance of submarines

Compared with existing towed arrays, the L-3 Chesapeake TB-29X offers significant reduction in sensor power, internal component diameter, bend radius, and production costs.

The TB-29X submarine thin-line array is designed to reduce complexity, lower power, and improve robustness to withstand in-situ operations and stresses of handling systems.

Its performance telemetry, acoustic sensors, and electronics are designed to provide a ubiquitous solution across the spectrum of submarine, surveillance, and unmanned towed arrays. This multi-mission commonality for these high-volume and unique components provides cost savings from procurement to life cycle support.

On this contract L3 Chesapeake Sciences will do the work in Liverpool, N.Y.; Millersville, Md.; and Ashaway, R.I., and should be finished by November 2019.

## **Russia Working on New 'Cephalopod' Underwater Attack Drone**

**Kyle Mizokami, Popular Mechanics, July 30**

Russia is working on a new armed underwater drone designed to kill enemy submarines. The unmanned Cephalopod drone packs small, lightweight torpedoes capable of fatally wounding enemy submarines on the high pressure, underwater battlefield.

According to undersea warfare expert HI Sutton, Russia has been working on the Cephalopod “killer underwater drone” since 2015, when its existence was revealed alongside the Poseidon nuclear apocalypse torpedo. Cephalopod was understandably overshadowed by the 100 megaton weapon, but in its own way is a threat to Western military might.

“We've known of the Cephalopod program since 2015 but until recently we didn't know much about it,” Sutton, the authority behind the Covert Shores submarine blog and the World Submarine Recognition Guide, told Popular Mechanics. “Slowly a picture is emerging that Cephalopod is a submarine-killing undersea drone.”

“It is very large for an unmanned undersea vehicle, larger probably than the US Navy's Large Displacement Unmanned Undersea Vehicle (LDUUV). It has a single curving propeller, called a screw, which is very similar to those used on full sized submarines. This suggests that Cephalopod is designed for long endurance and stealth rather than maneuverability. But it does

have thrusters that may allow it to hover. Other Russian undersea drones use several small thrusters arranged to give excellent maneuverability.”

Cephalopod is armed with MTT 324-millimeter lightweight torpedoes. Lightweight torpedoes such as the MTT are typically anti-submarine torpedoes, carried by sub-hunting surface ships and helicopters. Lightweight torpedoes have smaller warheads (to puncture the pressurized hull of submarines) and a shorter range.

Russia’s submarine fleet is aging faster than it can be replaced, and an uncrewed drone like Cephalopod could take on missions usually assigned to crewed submarines. One possible role for Cephalopod is to escort Russia’s ballistic missile submarines, protecting them from Western attack submarines. Cephalopod could also protect naval facilities and ports, or operate in restricted waters such as the Baltic Sea.

“Unmanned underwater vehicles are transforming naval warfare. We do not know whether the Russians are building Cephalopod but either way it shows their thinking. With its torpedoes and large sonar it is clear that Cephalopod is intended to play an active role in battle.” Sutton said. “It could target shipping but it’s small torpedoes are more of a threat to submarines.”

## **COMMENTARY: China Is Studying Russia's Robot Submarines— and Is Building One of Their Own**

**Lyle J. Goldstein, *The National Interest*, July 30**

These are surely interesting times for those tasked with watching Chinese military modernization. Ideas once considered far-fetched, such as a Chinese aircraft carrier or anti-ship ballistic missiles (ASBM), now seem rather normal. New and capable Chinese platforms, ranging from the Type 055 cruiser to a highly anticipated next-generation long-range bomber, are certain to have an impact on the balance of power in the western Pacific in the coming decades. Additionally, every few months Beijing seems to roll out a new type of missile, with more and more impressive capabilities.

In this series of articles, your Dragon Eye has tried to keep a focus on developments in the undersea realm, since that is an area of strategic competition where the U.S. competitive edge has seemed to be most secure. Given that assumption, the latest bombshell, appearing in the South China Morning Post on July 23 will be making some waves on the Potomac and well beyond. Relying apparently on an interview with the director of marine technology equipment at the Shenyang Institute of Automation, the article claims that the Chinese Navy is now building “a series of extra-large unmanned underwater vehicles, XLUUVs.”

As that impressively detailed article is in English and readers may peruse it on their own, here we will just briefly review some highlights. The South China Morning Post article uses the term “robotic submarines” or “AI subs,” suggesting that these vessels are indeed substantially larger than the unmanned underwater vehicles (UUVs) that many nations, including China, are known to have been working on. Among the missions that the new Chinese unmanned submarines will take up include “... reconnaissance ... mine placement ... [and] even suicide attacks against enemy vessels.” The article mentions that they can set up ambushes for enemy vessels at “geographical chokepoints.” They could “work with manned submarines as a scout or decoy to draw fire and expose the position of an adversary. If necessary, they can ram into a high-value target.” Furthermore, these “giants” will be capable of receiving instructions from ground-based control centers and “will start with relatively simple tasks,” when they are fielded in the early 2020s. Among the most interesting, if ambiguous sentences, in the piece is the statement: “Their energy supply comes from diesel-electric engines or other power sources that ensure continuous operation for months.”

It is perhaps not coincidental that this revelation follows after months of intensive writing in the Chinese defense press about Russia’s “Status-6” large-size UUV that is both nuclear-powered and also apparently armed with a massive nuclear warhead. The intention here is not to suggest that the Chinese and Russian programs are directly related. Indeed, there seem to be rather distinct differences based, at least in part, on their respective goals. Nevertheless, Chinese commentary regarding Russia’s Status-6 [状况-6] could perhaps help to reveal certain “coming attractions” from Beijing’s robotic submarine program. A brief note in the January 2018 edition of the Chinese Navy magazine Navy Today [当代海军], described Russia’s Status-6 as a “doomsday [世界末日]” weapon. The March 2018 edition of the naval magazine Naval and Merchant Ships [舰船知识] offered a schematic drawing of the Russian weapon for its Chinese readership. Besides citing the weapon’s extraordinary range (10,000km), depth (1,000m) and speed (100 knots), that schematic also notes that the Status-6 carries a nuclear warhead with the explosive power that is “twice the force of the ‘Tsar’ hydrogen bomb [‘沙皇氢弹’的两倍],” which was the largest nuclear explosion ever witnessed by humanity. The illustration depicts a Type 09851 Khabarovsk-class (Belgorod) submarine that is configured to carry six of these ominous weapons. Along with the exceedingly debilitating radiation poisoning that would accompany the use of the weapon, the graphic also projects that the weapon is designed to create a “500 meter tsunami [500米海啸]” that would obliterate shore targets, including obviously port cities. Also quite disturbing is a July 2018 note in the

Global Times [环球时报] that vividly illustrates with Russian-language diagrams how Status-6 is equally effective against surface ship targets [надводная цель], as against a shore targets [береговая цель], thus forming an “assassin’s mace weapon against aircraft carriers [航母杀手].”

Yet, Chinese defense media did not just start writing about this unique Russian weapon system in 2018. Quite to the contrary, a somewhat detailed analysis already appeared in China Defense Report [中国国防方报] in late 2015. And a rather specific report also appeared in fall 2016 (issue no. 209) in the Chinese magazine Weapon [兵器]. That report had provided a full picture of the development process for the T-5 Soviet nuclear torpedo, including detailed diagrams of test results (not available at link regrettably) and differentiating between various tests undertaken at Novaya Zemlya Island [新地岛] in the fall of 1957. That particular article may imply a very close Chinese study of the Soviet development of naval tactical nuclear weaponry, especially torpedoes.

A more recent and related Chinese-language article from the magazine Ordnance Science and Technology [兵工科技] from spring 2018 (no. 8) also deserves a moment of reflection. The title of that article about Russian UUVs, mini-sub, and torpedoes may indeed convey the trend: "Going toward Nuclear Power [走向核动力]." That article does explain that "given technological breakthroughs in the miniaturization of nuclear reactors over the last few years, that the nuclear propulsion question has not been difficult to resolve [以及近年来在核反应堆小型化技术上的突破核动力技术不难解决]." This analysis appraises the Status-6 and suggests that its speed (reaching 100 knots) is "quite shocking [非常惊人]." The article posits that the most likely explanation is that Status-6 relies on Russia's hyper cavitation drag reduction technology [超空泡减阻技术]. Much of the rest of that article is devoted to explaining the likely significant impact of hyper cavitation technology on the future of naval warfare.

It is unknown whether the Chinese robotic submarines mentioned in the South China Morning Post article will employ either nuclear reactors or hyper cavitation technology. Nor is it clear, as indicated in the introduction, that Beijing and Moscow are cooperating in this ultra-sensitive area of technological development. Although China, like Russia, has been extremely perturbed by U.S. development of missile defenses, there is no direct evidence (as of yet) to suggest that China is seriously considering employing UUVs or robotic submarines as "doomsday devices" in the Russian style. Still, these possibilities cannot be ruled out either. As current American foreign policy appears to apply strategic pressure against both Russia and China simultaneously, there should be no particular surprise in learning that Beijing and Moscow could well be exploring ever greater military synergies, including in the undersea domain.

## **Coming Soon: North Korea's Nukes Could Go Underwater**

**Sebastien Roblin, National Interest, July 29**

In the summer of 2018 a flurry of reports confirmed that North Korea has continued construction of a second ballistic-missile submarine, designated the Sinpo-C by intelligence analysts after the shipyard in eastern North Korea. South Korean representative Kim Hack-yong told the Wall Street Journal that South Korean intelligence officials had reported activity and new materials around the construction site of the submarine. For context, Kim is a member of a conservative party which is skeptical of President Moon Jae-in’s diplomatic outreach to Pyongyang.

The Sinpo-C is estimated to displace more than 2,000 tons and have a beam of 11 meters, making it the largest vessel in the Korean People’s Navy. The KPN operates roughly 70 submarines, technically giving it one of the largest submarine fleets on the planet—but most of the submarines are very small types incapable of sailing far from the Korean Peninsula.

The existence of the new submarine had first been publicized in October 2017 by Ankit Panda of the The Diplomat based on U.S. military intelligence reports passed on by government sources. Then in November the website 38North published detailed satellite photos showing new construction and testing activity at Sinpo, including 7-meter diameter components which may be segments of the pressure hull. Multiple submarine ejections tests were observed earlier that year, including a failed launch in September that reportedly killed one Korean according to Japanese newspaper Asahi Simbun. Then in 2018, a launch tube likely for a new type of Pukkuksong Submarine Launched Ballistic Missile (SLBM) was seen installed on a test facility.

This is only the latest report confirming the unsurprising reality that North Korea is covertly proceeding with the development of nuclear warheads and delivery systems despite vague promises made at the summit between President Donald Trump and Kim Jong-un to denuclearize. For example, late in June five intelligence agents told NBC in June that North Korea is actually accelerating its production of enriched uranium, while seeking to conceal the extent of its program. The nuclear weapons, and the rocket technology to deliver them, are extremely expensive investments by Pyongyang, and the Kim dynasty is unlikely to give them up entirely because they are seen as guarantors against a U.S. attack.

The new submarine would be a successor to the Gorae (“Whale”) or Sinpo-B, first identified from satellite photos in 2014. The 1,700-ton submarine is believed to have been inspired by the older Soviet Golf-class submarine, several of which were transferred to North Korea for scrapping. The 68-meter long vessel is thought to be intended primarily for testing rather than operational deployment.

A launch tube is visible in the Gorae’s sale (or conning tower). This configuration makes it easier to fit in vertically launched ballistic missiles without having to build a larger hull, but limits the payload to just a few missiles—or even just one. A crew photo released by North Korea implies a complement of seventy to eighty personnel.

More challenging to develop than the submarine itself would be its Pukkuksong-1 (or KN-11) submarine-launched ballistic missiles (SLBM), which can be fired from underwater (see this photo ). The name itself means “North Star” or “Polaris,” which probably-not-coincidentally happens to be the name of the United States’ first operational SLBM.

A special raft was even built to test launch the SLBM, and multiple test firings were observed . Experts estimate that the 9-meter long missile, painted white with snubby black tips, can strike targets up to 750 miles away, and would surely be armed with a nuclear warhead. There’s even a photo of Kim Jong-un observing a Pukkuksong launch.

Though North Korea initially tested a liquid-fuel rocket apparently inspired by the Soviet R-27 SLBM, the Pukkuksong-I ended up being a two-stage solid-fuel rocket. Though heavier, solid fuel rockets can be fired on very short notice compared to liquid fuel rockets which need to be gassed up prior to launch (the fuel can’t be left in the tanks as it is highly corrosive) and pose major safety hazards—traits that place their survivability versus a first strike in question.

However, designing solid fuel rockets is technically very challenging as the fuel must be built into the casing and air bubbles, warps and cracks can easily lead to catastrophic failures. In fact, the Pukkuksong-1 was considered such a breakthrough on this front that a land-based Pukkuksong-2 variant was developed.

The reports of a new Sinpo-class submarine coincided with suggestive photos released by North Korea of an inspection by Kim Jong-un. One photo has a display to the right detailing plans for a succeeding Pukkuksong-3 missile. Another shows off a rocket which appears to have an advanced wound-filament casing. In general, expert speculate the Pukkuksong-3 would be a lighter rocket due to use of composite materials, allowing for greater striking range.

## **U.S. Submarines Will Soon Carry Tactical Nuclear Weapons**

***Kyle Mizokami, Popular Mechanics, July 26***

The U.S. Navy’s fleet of ballistic missile submarines will soon carry tactical nuclear weapons, as Congress prepares to fund development of a new, low-yield nuclear warhead. The submarines, which form a functional invulnerable retaliatory force in case of surprise nuclear attack, will soon be able to launch missiles with less powerful tactical nuclear weapons. Not everyone is sold on the new weapon, which critics charge is unnecessary and could lower the threshold for nuclear war.

The U.S. Navy’s fourteen Ohio nuclear ballistic missile submarines provide a powerful deterrent to surprise nuclear attack. The submarines embark on lengthy deterrence patrols, hiding in the world’s oceans, effectively a moving cache of nuclear weapons that an adversary would find extremely difficult to destroy. As long as the subs are at sea, the U.S. maintains the ability to counter a surprise attack with a counterattack of its own.

Every four years, the sitting presidential administration conducts a review of U.S. nuclear forces. The 2018 Nuclear Posture Review, commissioned by President Trump, calls for replacing some of the existing nuclear warheads on the Ohio-class submarines with low-yield warheads. The goal is to have the ability to strike urgent, time sensitive targets virtually any place on Earth.

Each Ohio submarine carries twenty Trident D-5 missiles, and each missile is outfitted with an unknown number of W76-1 nuclear warheads. (The U.S. keeps the number of submarines at sea and warheads per submarine intentionally ambiguous, although we know Washington has pledged to never deploy more than 240 missiles at sea at any one time.) Now it appears at least some of those warheads will be replaced with the W76-2, which has a much smaller explosive yield.

The Administration argues that the U.S. may need to strike quickly strike targets with tactical nuclear weapons. An example might be a nuclear-armed missile sitting on a North Korean missile launch pad. Most tactical nukes are aircraft delivered bombs, and could take the better part of a day to ready and then reach their target. A tactical nuke delivered by a submarine-launched ballistic missile, on the other hand, could be delivered in less than an hour.

How small a warhead yield are we talking about? That’s a good question. The existing W76-1 warhead has an explosive yield of 100 kilotons (for reference, the Hiroshima bomb was 16 kilotons.) The B61-12 tactical nuclear gravity bomb has a “dial-a-yield” mechanism that allows for yields of .3 (or just 300 tons of TNT), 1.5, 10, and 50 kilotons. The W76-2 would likely have a yield similar to the B61-12’s low end.

Critics, on the other hand, believe the new warhead is unnecessary and dangerous. They believe that the W76-2 is a solution in search of a problem, noting that sudden “bolt from the blue” crisis that suddenly demands a tactical nuclear weapon placed on



a target in less than an hour is very unlikely. They believe that existing tactical nuclear weapons would be forward deployed near a potential crisis, making them available more quickly than commonly believed.

The new weapon also comes under fire for being needlessly escalatory. The United States has an overwhelming amount of conventional firepower, which critics of the new weapon argue can just as effectively destroy a time-sensitive threat. Using a tactical nuclear weapon could be just plain unnecessary. Furthermore, unless nukes have already been used in the conflict, the use of the new warhead would cause the the United States to cross the nuclear threshold first, inviting adversaries to use their own nukes against U.S. and allied forces.

Congress is preparing to fund development of the W76-2, to a tune of \$65 million. The process won't involve building any new weapons--instead the government will convert existing W76-1 warheads into low yield versions. Meanwhile, the controversy as to whether the weapons are needed and ultimately dangerous to U.S. national security rages on.

## **China's Advanced Submarines Are 'Breaking Records'**

**Dave Majumdar, National Interest, July 26**

While Russia is the most technologically sophisticated undersea warfare threat faced by the United States Navy, there is one area where the threat from Beijing exceeds the one posed by Moscow.

China has successfully developed and fielded diesel-electric submarines with Air Independent Propulsion (AIP) technology, unlike Russia, which has thus far failed to develop a comparable analogue for its future Project 677 Lada-class vessels. Indeed, Beijing's conventional AIP submarine units have been breaking their own records in recent months.

"China's first submarine unit using air-independent propulsion (AIP) technology recently broke a number of records set by the Chinese navy," reported the People's Liberation Army and Central Military Commission's China Mil site, citing a report from the Chinese Ministry of Science and Technology's Science and Technology Daily in a recent posting.

"Records such as the longest sailing distance, maximum submergence depth and sinking target ships under boundary conditions were all broken by the unit."

As the Pentagon's 2017 report to Congress on the Chinese military notes, the People's Liberation Army Navy (PLAN) has a sizable force of AIP boats that can be armed with advanced anti-ship cruise missiles.

"China continues to commission advanced, anti-ship cruise missile (ASCM)-capable submarines," the report notes .

"Since the mid-1990s, it has built 13 SONG-class SS units (Type 039) and 17 YUAN-class diesel-electric air-independent power attack submarines (SSP) (Type 039A), with a total of 20 YUANs projected for production by 2020."

Beijing is well prepared to expand its submarine fleet and has built up its industrial capacity to grow its fleet rapidly.

"China's shipbuilding industry appears capable of producing three Yuan-class submarines a year; two at Wuchang and a third at Jiangnan, if required," reads a 2017 report from the International Institute for Strategic Studies .

"With the successful construction of at least 17 hulls, estimates of a total of 20 Yuan-class boats in service by 2020 seem to be entirely reasonable, offering the prospect of modest fleet expansion should the PLAN seek it. However, such expansion would require the training of additional crews, as well as keeping all of the remaining Ming-class hulls in service despite their age, high-noise levels and relative lack of capability."

The Pentagon report takes the view that the Chinese submarine fleet will be expanding very rapidly in the coming years.

"The PLAN places a high priority on the modernization of its submarine force," the report states.

"It currently possesses five nuclear-powered attack submarines (SSN), four nuclear-powered ballistic missile submarines (SSBN), and 54 diesel-powered attack submarines (SS). By 2020, this force will likely grow to between 69 and 78 submarines."

The IISS report takes a much more measured view, stating instead that the Chinese submarine fleet will improve qualitatively but it likely remain about the same size as today's fleet.

"In light of the continuing presence of legacy submarine platforms in the fleet, the PLAN is likely to continue to use its submarine-production capacity to replace these older vessels in the near term," the IISS report notes.

"This focus on improving quality rather than expanding quantity will limit the PLAN's requirement for heavy investment in extra personnel and infrastructure, although the 72nd Flotilla's Mings may need to be retained at Xiachuan Dao until its berths can be upgraded to accept newer submarine designs. Much like today, the operational fleet in 2020 is likely to be around 58 boats."

The IISS assessment is likely closer to reality than the Pentagon's. The Defense Department often grossly inflates threats in order to secure funding for its pet programs. In the case of the Chinese submarines fleet, the U.S. Navy has used its estimates of the sheer size of Beijing's force to help justify to Congress why it needs many more Virginia-class attack submarines than its previously stated requirements even as the service acknowledged the relative technological backwardness of PLAN vessels. Indeed, the U.S. Navy has increased its stated requirement for attack submarines from 48 to 66 boats in recent years as demand has skyrocketed. It is true that the U.S. Navy needs more submarines, but that is due to a shrinking fleet that has met the increasing global demands placed on the sea service than any threat from China by itself.

## **Western Navies Are Worried About Russia's Submarines, And The US Navy Is Placing An Order For More Sub-Hunting Gear** **Christopher Woody, Business Insider, July 24**

Intensifying submarine activity in the waters around Europe has led the US Navy to request millions of additional dollars to buy submarine-detecting sonobuoys, according to an Omnibus funding measure the Pentagon requested from Congress earlier this month.

The Navy has asked Congress to allot \$20 million to buy more air-dropped sonobuoys that can detect submarines and transmit data back to surface ships and aircraft.

Supplies of such buoys have fallen critically short after an "unexpected high anti-submarine warfare operational tempo in 2017 [which] resulted in unexpected high expenditure rate of all type/model/series," the Omnibus says, according to Breaking Defense.

US and NATO officials have repeatedly warned about increased Russian submarine activity in the seas around Europe over the past several years.

US warships have tracked Russian subs in the eastern Mediterranean, where British subs have also reportedly tangled with their Russian counterparts. Russian submarines have transited the area to reach the Russian navy's Black Sea fleet base and to support the regime of Bashar Assad in Syria, where a years-long civil war has been a "test bed" for new Russian submarine capabilities.

Interest in submarine and anti-submarine warfare is growing around the world— one 2015 study predicted global demand for sonobuoys would grow by 40% through 2020, with most of the interest in passive sonobuoys that can listen for submarines without being detected.

Other sonobuoys on the market include active sonobuoys, which send pings through the water to produce echoes from targets, and special-purpose sonobuoys that collect other data for radar and intelligence analysts.

Late last year, US Naval Air Systems Command announced a \$219.8 million order for up to 166,500 sonobuoys of various types for anti-submarine warfare from defense firm Erapsco. In January, the firm received another contract for \$9.6 million for engineering support for the service's active sonobuoys.

Sonobuoys are air-launched, mostly from MH-60 Sea Hawk helicopters and P-8A Poseidon maritime patrol aircraft by aircrews trained to array them into patterns designed to detect and track passing submarines.

Russia's sub fleet is currently far smaller than its Soviet predecessor, but the boats it has added are increasingly sophisticated. The US Navy and its European partners can still field more advanced subs, but they have seen their fleets shrink and their anti-submarine capabilities wane in the years since the Cold War.

Both sides have devoted more attention to anti-submarine warfare.

During the last half of 2017, Russia partnered with China to carry out naval drills, including complex submarine and anti-submarine exercises, in the Baltic Sea and in the Pacific Ocean.

NATO navies and their partner forces have carried out similar exercises, including Sea Breeze 2018 in the Black Sea, during which a Turkish submarine played the role of the adversary force, and Dynamic Mongoose 2018, which brought subs, ships, and aircraft from eight countries to the North Atlantic off the coast of Norway between June and July to work on their "warfighting skills in all three dimensions of Anti-Submarine-Warfare in a multinational and multi-threat environment," NATO said in a release.

## **Beijing Plays Down Media Hype About Unmanned Subs** **Staff, Asia Times, July 24**

The Chinese military on Tuesday slammed speculation in the foreign media about the development of an unmanned submarine fleet to take on Western naval powers in the South China Sea as "overblown and confrontational."

China's large unmanned submarines, now nearing the end of construction with deployment expected in the early 2020s, would be much bigger than existing unmanned underwater vehicles and be able to perform missions including reconnaissance, mine placement and even "suicide attacks" thanks to breakthroughs in artificial intelligence, according to the South China Morning Post, which called them "autonomous, robotic AI subs" in a report published on Sunday.

"The robotic subs are aimed particularly at the United States forces in strategic waters like the South China Sea and western Pacific Ocean," the report said, citing Chinese researchers involved in the ambitious project. The researchers are from the Chinese Academy of Sciences' Shenyang Institute of Automation and are stationed at a massive surface drone boat testing center in the coastal city of Zhuhai in southern Guangdong province.

“[These subs] will go out, handle their assignments and return to base on their own. They may establish contact with the ground command periodically for updates, but are by design capable of completing missions without human intervention.

“Their cargo bay is reconfigurable and large enough to accommodate a wide range of freight, from powerful surveillance equipment to missiles or torpedoes. They make decisions constantly on their own: changing course and depth to avoid detection; distinguishing civilian from military vessels; choosing the best approach to reach a designated position and even ram into a high-value target if necessary,” said researchers.

But the Beijing-based Global Times noted that China was one of many countries developing unmanned subs, a tacit admission of the existence of the AI sub project. The paper added, citing an unnamed Chinese naval expert, that “even if one had reached the experimental phase, it was still far from actual deployment.”

The Global Times also targeted foreign media reports, which “echoed rhetoric of the China threat theory” and claimed the foreign media was “trying to create a confrontational atmosphere between China and the US.”

Beijing’s usual line is that its research and development of cutting-edge weaponry is for self-defense only and is not targeted at any specific country.

Still, observers say China has a head start in drone technology, as seen in displays in which a flock of drones talk to each other to form complicated patterns while airborne. There is also their militarized versions for reconnaissance and assault that China has been actively pitching for sales overseas. The Chinese claim the technologies can be replicated from air to underwater and used on such things as AI subs.

State media has also been trumpeting the new depths its indigenous manned or unmanned submersibles like the Jiaolong series have gone to in the South China Sea and Indian Ocean. Xinhua reported that the Jiaolong’s unmanned counterparts, the Qianlong and Hailong, could also go solo underwater for months.

Some believe that China’s progress in industrial automation backed by a number of industrial-military conglomerates with expertise in aero-defense and shipbuilding and its capabilities to put technologies and prototypes into swift, mass production also means its fleet of experimental unmanned subs could have already been roaming underwater for some time. But experts have their doubts.

## **China Military Develops Robotic Submarines To Launch A New Era Of Sea Power** **Stephen Chen, South China Morning Post, July 23**

China is developing large, smart and relatively low-cost unmanned submarines that can roam the world's oceans to perform a wide range of missions, from reconnaissance to mine placement to even suicide attacks against enemy vessels, according to scientists involved in these artificial intelligence (AI) projects.

The autonomous robotic submarines are expected to be deployed in the early 2020s. While not intended to entirely replace human-operated submarines, they will challenge the advantageous position established by Western naval powers after the second world war. The robotic subs are aimed particularly at the United States forces in strategic waters like the South China Sea and western Pacific Ocean, the researchers said.

The project is part of the government's ambitious plan to boost the country's naval power with AI technology. China has built the world's largest testing facility for surface drone boats in Zhuhai, Guangdong province. Military researchers are also developing an AI-assisted support system for submarine commanders. As the South China Morning Post reported earlier this year, that system will help captains make faster, more accurate judgments in the heat of combat situations.

The new class of unmanned submarines will join the other autonomous or manned military systems on water, land and orbit to carry out missions in coordinated efforts, according to the researchers.

The submarines will have no human operators on board. They will go out, handle their assignments and return to base on their own. They may establish contact with the ground command periodically for updates, but are by design capable of completing missions without human intervention.

But the researchers also noted that AI subs had limits, especially at the early stages of deployment. They will start with relatively simple tasks. The purpose of these projects is not to replace human crews entirely. To attack or not to attack, the final decision will still be in the hands of commanders, the researchers said.

Current models of unmanned underwater vehicles, or UUVs, are mostly small. Their deployment and recovery require another ship or submarine. They are limited in operational range and payload capacity.

Now under development, the AI-powered subs are "giants" compared to the normal UUVs, according to the researchers. They station in dock as conventional submarines. Their cargo bay is reconfigurable and large enough to accommodate a wide range of freight, from powerful surveillance equipment to missiles or torpedoes. Their energy supply comes from diesel-electric engines or other power sources that ensure continuous operation for months.

The robotic submarines rely heavily on artificial intelligence to deal with the sea's complex environment. They must make decisions constantly on their own: changing course and depth to avoid detection; distinguishing civilian from military vessels; choosing the best approach to reach a designated position.

They can gather intelligence, deploy mines or station themselves at geographical "chockpoints" where armed forces are bound to pass to ambush enemy targets. They can work with manned submarines as a scout or decoy to draw fire and expose the position of the adversary. If necessary, they can ram into a high-value target.

Lin Yang, marine technology equipment director at the Shenyang Institute of Automation, Chinese Academy of Sciences, confirmed to the South China Morning Post this month that China is developing a series of extra-large unmanned underwater vehicles, or XLUUVs.

"Yes, we are doing it," he said.

The institute, in China's northeast Liaoning province, is a major producer of underwater robots to the Chinese military. Lin developed China's first autonomous underwater vehicle with operational depth beyond 6km. He is now chief scientist of the 912 Project, a classified programme to develop new-generation military underwater robots in time for the 100-year anniversary of the Chinese Communist Party in 2021.

Naval drill row signals rough seas ahead for China-US military ties Lin called China's unmanned submarine programme a countermeasure against similar weapons now under intensive development in the United States. He declined to elaborate on technical specifications because the information was "sensitive".

"It will be announced sooner or later, but not now," he added.

The US military last year made a deal with major defence contractors for two prototype XLUUVs by 2020. The US Navy would choose one prototype for the production of nine vehicles.

Lockheed Martin's Orca system would station in an area of operation with the ability to establish communication to base from time to time. It would return home after deploying payloads, according to the company's website.

"A critical benefit of Orca is that Navy personnel launch, recover, operate, and communicate with the vehicle from a home base and are never placed in harm's way," the company said in a statement announcing the system.

Technical details on Orca, like its size or operational endurance, are not available. The company did not respond to the Post's queries.

Boeing is developing the other prototype, basing it on its Echo Voyager, a 50-ton autonomous submarine first developed for commercial uses like the mapping of the sea floor.

The Echo Voyager is more than 15 metres long and 2.6 metres in diameter, according to Boeing. It can operate for months over a range of 12,000km, more than enough to sail from San Francisco to Shanghai. Its maximum speed reaches 15km an hour.

The vessel needs to surface periodically as its batteries need to be recharged by air-breathing diesel engines. It can dive to 3km while carrying up to eight tons of cargo, Boeing said.

Russia has reportedly built a large underwater drone capable to carry a nuclear weapon. The Status-6 autonomous torpedo could cruise across large distances between continents at high speed and deliver a 100-megaton warhead, according to news accounts.

The Chinese unmanned submarine would not be nuclear-armed, according to a researcher involved in a separate programme in China.

The main advantage of the AI subs is that they can be produced and operated on a large scale at a relatively low cost, said the researcher, who requested anonymity because of the sensitivity of the issue.

Traditional submarines must attain a high level of stealth to increase the chance of survival. The design has to consider other things including safety, comfort and the mental health of the crew to ensure human safety. All these elements add costs.

In the 1990s, an Ohio-class submarine for the US Navy cost US\$2 billion. The research, development and purchase of the first 12 of its new Columbia-class submarines, scheduled for delivery in the early 2020s, is more than US\$120 billion.

In contrast, the budget of the entire Orca programme is about US\$40 million, according to Lockheed Martin.

An AI sub "can be instructed to take down a nuclear-powered submarine or other high-value targets. It can even perform a kamikaze strike," said the researcher, referring to the suicide attacks some Japanese fighter pilots made in the second world war.

"The AI has no soul. It is perfect for this kind of job," the researcher added.

Luo Yuesheng, professor at the College of Automation in Harbin Engineering University, a major development centre for China's new submarines, contended that AI subs would put the human captains of other vessels under enormous pressure in battle.

It is not just that the AI subs are fearless, Luo said, but that they could learn from the sinking of other AI vessels and adjust their strategy continuously. An unmanned submarine trained to be familiar to a specific water "will be a formidable opponent", he said.

AI submarines are still at an early stage, Luo noted, and many technical and engineering hurdles remain before they can be deployed in open water.

Hardware on board, for instance, must meet high standards of quality and reliability, since no mechanics will be on board to fix a broken engine, repair leaking pipes or tighten a screw, he said.

The missions of unmanned submarines will also likely be limited to specific, relatively simple tasks, Luo said.

"AI will not replace humans. The situation under water can get quite sophisticated. I don't think a robot can understand or handle all the challenges," he added.

## **How India's submarine strength matches up to its neighbours China, Pakistan**

**Staff, Indian Express, July 22**

As per a report by Naval Analyses, India has 15 conventional submarines (SSKs), two nuclear-powered submarines (SSBs) with nuclear-tipped ballistic missiles (SSBNs) and one nuclear-powered submarine (SSN) INS Chakra.

When it comes to undersea naval fleet, Indian Navy's submarine strength is way ahead of its neighbours Pakistan and Bangladesh, but pales in comparison to China. As per a report by Naval Analyses, India has 15 conventional submarines (SSKs), two nuclear-powered submarines (SSBs) with nuclear-tipped ballistic missiles (SSBNs) and one nuclear-powered submarine (SSN) INS Chakra.

In terms of both quantity and technological advancement, China's submarine fleet drastically outperforms India's. The Dragon has a total of 78 submarines, which include six advanced JIN-class SSBNs armed with missiles with a range of 7,200 km. Besides, China has 14 nuclear-powered submarines and 57 conventional ones.

China's fast-expanding strategic footprint in the Indian Ocean Region has been India's bugbear and to counter the threat, New Delhi has been scurrying to establish naval bases overseas. In February, India signed a pact with Seychelles to establish naval infrastructure. During his visit to Oman, Prime Minister Narendra Modi signed a Memorandum of Understanding, securing access to the key Port of Duqm for military use and logistical support.

With two-thirds of the global oil, half of the container traffic and a third of the cargo traffic passing through it, the IOR holds a special significance for the entire world and India and China are trying to create a strategic influence.

Arch rivals Pakistan has only five diesel-electric submarines at its disposal and is on course to induct eight more stealth submarines from China. Bangladesh, on the other hand, has only two conventional submarines.

In the East Asian region, apart from China, Japan has the maximum number of submarines at 20, even though none of them are nuclear powered. In fact, North Korea is the only other country in the region to have submarines with ballistic missiles. The Kim Jong-un led nation has two SSBs and 15 conventional submarines.

In the South-East Asian region, Vietnam has the largest submarine fleet at six, followed by Indonesia (5), Malaysia (2) and Singapore (4). Surprisingly, none of them are nuclear-powered or have nuclear-tipped missiles.

## **Hunley Crew Didn't Use Life-Saving Feature After Sinking, Research Finds**

**Drew Tripp, ABC4 News (Charleston ABC Affiliate), July 18**

New analysis shows the doomed crew of the Confederate H.L. Hunley submarine didn't use a potentially life-saving built-in feature the night the vessel sank in the Charleston Harbor.

Why they didn't, and ultimately why the submarine sank, remains a mystery.

Researchers on the Hunley Project announced their findings Wednesday, revealing the submarine's crew didn't use an integrated safeguard allowing them quickly to drop thousands of pounds of weight from the sub so it could return swiftly to the surface.

The weight was stored in so-called keel blocks, heavy weights centered along the bottom of the submarine which kept the Hunley upright.

Hunley researchers say the eight cast-iron keel blocks, some weighing more than 500 pounds, were designed so they could be detached from the ship to cut weight during an underwater emergency.

The revelation Hunley crew members didn't detach the keel blocks doesn't jibe with a popular theory about why the sub sank and its crew perished after successfully torpedoing and sinking the Union sloop USS Housatonic, the night of February 17, 1864.

Historical records show the Hunley crew likely timed its four-mile approach of the Housatonic to coincide with the outgoing tide. This was to minimize effort for the crew, which manually powered the ship with hand cranks, experts say.

Many believe the Hunley crew after sinking the Housatonic dove to the bottom to await the incoming tide so the crew could employ the same energy saving strategy in reverse for its return.

However, some suggest the Hunley became stuck on the harbor's muddy bottom, which is why it never resurfaced. The ability to detach the keel blocks was for exactly such a scenario, yet there's no evidence the crew even attempted to do so, Hunley researchers say.

It's still unclear why the Hunley crew didn't or couldn't detach the keel blocks. Studies of the crew's remains have shown no injuries or signs of distress offering clues, either, Hunley researchers say.

"If they somehow got stuck, they likely would have attempted to drop some of the heaviest keel blocks to help rise back up to begin the journey back to land," Hunley Project researchers wrote in Wednesday's announcement. "However, the blocks were found fastened in place, meaning they did not attempt to use this emergency function. For some reason, the crew did not think it would help or were unable to start this emergency procedure."

The Hunley's keel blocks have been preserved, and are being prepared for display at the Warren Lasch Conservation Center in North Charleston where the submarine is kept, researchers say.

The night it sank the Housatonic in an effort to break a Union blockade of the Charleston Harbor, the Hunley became the world's first successful combat submarine.

Historical records show the submarine's crew signaled to shore they were on the way back home shortly after the attack.

The ship and crew vanished without a trace. Why has not been determined in the 154 years since the sub sank, or since it was recovered in August 2000.

## **Baptism At Sea For First Women To Join Ranks For France's Nuclear Submariners** **Staff, South China Morning Post, July 19**

The nuclear fleet's lengthy missions in tightly enclosed quarters meant that it was the last part of the French navy to open up to women sailors

Drinking a bowl of seawater followed by a glass of champagne, four French officers stood out during the traditional "baptism" to mark their inaugural submarine patrol: the first women to join a crew in the country's nuclear-powered fleet.

"I'm proud to have become part of the submarine family," said Harmonie, a 27-year-old security specialist on *Le Vigilant*, after returning from her first 10-week mission on the sub.

"I'm ready to go out again," she added.

France has become just the third country to bring women sailors aboard its nuclear-powered subs, which operate much longer and isolated missions than traditional vessels, after the US and Britain.

And officials hope the four women will inspire others to join them.

"The navy needs recruits. Today women make up 15 per cent of its ranks, they're an asset for us and we want to keep recruiting them," said Captain Christian Houette, commander of the four nuclear-powered, nuclear-armed subs in France's dissuasion force, based on the Ile Longue peninsula near the western city of Brest.

The nuclear subs were the last element of the French navy to exclude women, reflecting concerns about the sacrifices required for long missions, as well as difficulties in adapting personnel quarters in such tight spaces.

"Some crew members were a bit reluctant, with questions that were largely practical, they wanted to know if it would disrupt their routines: sleeping quarters, bathrooms..." said Mathieu, second-in-command on the *Vigilant*.

Like most crew members, he could give only his first name in line with navy rules.

Officials also had to take into account the concerns of sailors' wives, Mathieu added, diplomatically.

"In the end, their integration has been extremely smooth. Having proved their qualifications, these women have earned their place aboard in the same way as any other sailor."

The *Vigilant* packs in 110 people whose only contact with the outside world is a 40-word message from family members once a week.

The sub keeps radio transmissions to a strict minimum and only the captain knows the destination and other details of each mission - stealth and secrecy are the watchwords for France's underwater nuclear arsenal.

"The thing that's different, compared to a ship, is the one-way link to the outside," Camille, a 29-year-old recruit, said on the deck of the *Vigilant*.

"Two and a half months underwater is possible, and it's exhilarating!"

She and the three other women underwent two years of specialised training for their posts.

Pauline, the vessel's 31-year-old doctor, had to develop her surgery and dentistry skills to avoid any emergency evacuations which would compromise the mission.

"It definitely makes you a little nervous, because you're the only doctor onboard and there's a lot riding on your shoulders," she said.

Since they were officers, they already had individual cabins, and besides their own shower, no special arrangements were needed.

But getting women on France's other nuclear-powered submarines is not on the cards, since they are much smaller vessels which would be harder to reconfigure for mixed crews.

The country's next generation of attack subs, however, are being designed with both men and women in mind.

“We’re going to progress gradually, taking the time to take the changes into account and draw conclusions,” Houette said.

And climbing the ranks could prove daunting for female officers hoping to reconcile career and family, since there’s little chance of obtaining any long-term base posting.

“On submarines, interruptions in the operational command track of more than a year or two are problematic,” said Houette.

The project is nonetheless moving forward, with the next patrol with female crew members set for the autumn.

## **Why Russia Fears Sweden’s Deadly Submarines**

**Sebastien Roblin, National Interest, July 16**

Another important feature is a special ‘multi-mission’ portal for deploying special forces and underwater vehicles, a much-in demand feature for contemporary submarines. Situated between the torpedo tubes in the nose, the portal can also be used to recover the AUV-6 underwater drone, which can be launched from the torpedo tubes. The A26 would typically belly down on the ocean floor when employing the portal—a maneuver which could also aid it in escaping detection.

For decades, submarines came in two discrete flavors: traditional diesel-electric submarines that need to surface every day or two to recharge their noisy, air-breathing diesel engines, and nuclear-powered submarines that could quietly hum along under the sea at relatively high speeds for months at a time thanks to their nuclear reactors.

The downside to the nuclear-powered variety, of course, is that they cost many times the price of a comparable diesel submarines and require nuclear propulsion technology, which may not be worth the trouble for a country only interested in defending its coastal waters. A diesel submarine may also run more quietly than a nuclear submarine by turning off its engines and running on batteries—but only for a very short amount of time. Still, there remains a performance gap in stealth and endurance that many countries would like to bridge at an affordable price.

One such country was Sweden, which happens to be in a busy neighborhood opposite to Russian naval bases on the Baltic Sea. Though Sweden is not a member of NATO, Moscow has made clear it might take measures to ‘eliminate the threat,’ as Putin put it, if Stockholm decides to join or support the alliance. After a Soviet Whiskey-class submarine ran aground just six miles away from a Swedish naval base in 1981, Swedish ships opened fire on suspected Soviet submarines on several occasions throughout the rest of the 1980s. More recently, Russia has run an exercise simulating a nuclear attack on Sweden and likely infiltrated Swedish territorial waters with least one submarine in 2014.

Back in the 1960s, Sweden had begun developing a modernized version of the Stirling engine, a closed-cycle heat conversion engine first developed in 1818. This was first used to power a car in the 1970s, then the Swedish ship-builder Kockums successfully retrofitted a Stirling engine to power a Swedish Navy A14 submarine Nacken in 1988. Because the Stirling burns diesel fuel using liquid oxygen stored in cryogenic tanks rather than an air-breathing engine, it can quietly cruise underwater at low speeds for weeks at a time without having to surface.

Kockums went on to build three Gotland-class submarines in the late 1990s, the first operational submarines designed with Air-Independent Propulsion systems. The Gotland became famous for sinking a U.S. aircraft carrier in a 2005 military exercise; its characteristics and operational history are further described in this earlier article. Stirling AIP technology has subsequently been incorporated into numerous Japanese and Chinese submarines, while Germany and France developed more expensive fuel-cell and steam-turbine based AIP submarines instead.

Sweden, meanwhile, converted her four late-80s vintage Västergötland diesel-electric submarines between 2003 and 2005 to use Stirling AIP engines—refits which involved cutting the submarines in two and stretching them out from forty-eight to sixty meters! Two of these submarines were re-designated the Södermanland-class, while the other two were sold to Singapore. The latter Archer-class boats are climatized for operations in warmer waters and boast improved navigation and fire control systems.

Enter the A26: Sweden’s Ghostly Super Sub of the Future—On Paper

Sweden intends to retire its Södermanland boats between 2019 and 2022. Since the 1990s, Kockums had been bouncing around a concept for a next-generation AIP submarine designated the A26 to succeed the Gotland-class, but encountered numerous setbacks. Stockholm canceled A26 procurement in 2014, and at one point there was even a raid by the Swedish government attempting to confiscate blueprints from the German parent firm Thyssen-Krupp which was confronted by company security.

Since then, Kockums has been purchased by the Swedish firm Saab. Finally, in June 2015, Swedish defense minister Sten Tolgfors announced Stockholm was finally committing to procure two A26s at a price equivalent to \$959 million—less than a fifth the unit cost of a nuclear-powered Virginia class submarine of the U.S. Navy.

The A26 has also been marketed abroad at various times to Australia, India, the Netherlands, Norway, and Poland, but so far without success, due to competition from French and German AIP submarine-makers and an apparent reluctance from smaller European states to commit to submarine purchases at this time.

Kockums claims the A26 will achieve new levels of acoustic stealth thanks to a new 'GHOST' (Genuine Holistic Stealth) technology which involves acoustic damping plates, flexible rubber mountings for hardware, a less reflective hull with a lower target strength, and degaussing to lower the submarine's magnetic signature. Supposedly, the A26's hull will also be unusually resilient to underwater explosions.

The Swedish firm has unveiled concept art depicting a submarine with a 'chinned' sail, X-shaped tail fins for greater maneuverability in rocky Baltic waters, and four 533-millimeter torpedo tubes can fire both heavyweight torpedoes, back up by two 400-millimeter tubes, all of which would use wire-guided torpedoes. The vessel's four Stirling engines apparently allow allowing for higher sustainable underwater cruising speed of 6 to 10 knots.

Kockums has emphasized the new designs' modularity, which should lower development costs for specialized variants, such as one configuration accommodating up to eighteen Tomahawk land-attack cruise missiles in a vertical launch system. This is a feature likely meant to appeal to Warsaw, which would like cruise-missile equipped submarines.

Another important features is a special 'multi-mission' portal for deploying special forces and underwater vehicles, a much-in demand feature for contemporary submarines. Situated between the torpedo tubes in the nose, the portal can also be used to recover the AUV-6 underwater drone, which can be launched from the torpedo tubes. The A26 would typically belly down on the ocean floor when employing the portal—a maneuver which could also aid it in escaping detection.

Kockums is now marketing three different versions of the A26. The 'medium' model intended for Swedish service would measure 63-meters long and displace roughly 2,000 tons surfaced. It would typically have a crew of around twenty-six, and a maximum endurance of forty-five days, including eighteen to thirty days (sources differ) submerged, generally sustaining a speed of 10 knots. This endurance, including a typical range of 6,500 miles, should give it capability for operations in the Atlantic Ocean—in contrast to the Gotlands which are not designed for transoceanic deployments.

There is also a smaller 51-meter 'Pelagic' version for short-range patrols, and an Extended Range model stretched to eighty meters long and displacing 4,000 tons that might appeal to operators in the Pacific Ocean due to its 10,000-mile range and 50-day endurance.

Sweden's two A26s should be completed between 2022 and 2024, at which point it will be possible to gauge whether they can meet their ambitious performance parameters. In general, advancements to AIP submarines are allowing countries across the globe to acquire capable short and medium-range submarines at an affordable price.

## **Navy Looks To Eliminate The Shakes From Its Submarines**

**Scott Wyland, Stars and Stripes, July 13**

In the Navy's ongoing quest to build a more stealthy submarine, service-funded research is close to yielding a new method for boat builders to test how much vibrational noise a sub will emit before it ever touches water.

The University of Connecticut research team's method sounds simple at first - much of it centers around studying a pair of modified, shaking tables - but years of complex math and advanced physics have gone into creating precise measurements for how much an individual submarine component will shake.

After seven years and \$1.6 million in funding from the Office of Naval Research, the researchers say the method will help submarine builders incorporate simpler, less expensive details into the design phase of the boats.

The research comes as the U.S. submarine fleet shrinks, due to the retirement of aging Los Angeles-class submarines from the Cold War era, while demand for submarine missions from U.S. combatant commanders around the world remains high. The Navy is building two Virginia-class submarines annually, but the 2019 30-year shipbuilding plan calls for an additional 16 to be built beyond that rate, in line with the White House's stated goal of a larger Navy.

Meanwhile, Navy officials say Russia is deploying its submarines more often and China has rapidly modernized its undersea program.

The Navy already uses sound-dampening technologies like polymer-rubber tiles and quieter propulsion to prevent detection by other navies, but in the undersea world, even tiny noises can tip off an adversary.

"The more quiet they can be, the better," said Rich Christenson, a civil and environmental engineering professor who advises the university's graduate students working on the project.

Christenson and his students add parts to the two shaking tables, which seismic engineers normally use to test how a structure will hold up to an earthquake.

The tables are hooked to a computer that tells them to jiggle the parts at the same rate as if they were installed in a submarine operating underwater.

A big challenge is devising the complex numerical models for the computer to run the simulations, Christenson said, adding that the team must consider how the water interacts with the submarine's structure.

Simulations are extremely exacting, he said, with movements as fine as 1/100 of an inch.



The precision required as they formulate algorithms for a slew of components is part of what makes the lab work so time-consuming, Christenson said.

"A lot of this stuff hasn't been done before," he said. "It's always something different, which is fun."

If the team determines a vibrating part is too loud, it looks at possible remedies.

A solution might be to add springs and dampers to equipment or thicken the padding between a component and the floor, Christenson said.

These are inexpensive fixes that can be a bigger, more costly hassle to implement after the submarine is assembled, he said.

Making these simple adjustments in design also could allow a builder to use off-the-shelf components instead of customized ones.

Electric Boat, a subsidiary of General Dynamics and one of the Navy's two primary submarine builders, has expressed interest in the testing, Christenson said.

Christenson first got the idea for the vibrational testing by talking to graduate students who were Electric Boat engineers, he said.

Electric Boat and Naval Research officials declined to comment, saying they couldn't discuss new submarine innovations in the works.

The immediate goal is to create a basic test that the university can publish in a journal and builders can adapt for their own testing, he said.

"Hopefully without too much effort, they can convert it to something very useful to them," Christenson said.

## **Ecopetrol Tests Its First Unmanned Submarine Vehicle In Caribbean Waters** **Staff, BNamericas, July 12**

Ecopetrol piloted the 'Pionero 500', its first remotely operated submarine vehicle (ROV), in the Colombian Caribbean waters, which will allow us to expand our knowledge of the seabed and its associated ecosystems, information that will be key to the development of exploration and production projects Offshore (offshore).

Pioneer is a submarine that has the capacity to operate 500 meters deep. It has high resolution video cameras, LED lights, underwater positioning system, a remote operation console, temperature and depth sensors and devices for taking images and solid and liquid samples.

This underwater vehicle was designed and built within the framework of the " Strategic Program for the development of robotic technology aimed at oil exploration of the Colombian seabed" , between the Pontificia Bolivariana University-UPB of Medellín, the National University Headquarters Medellín-UNALMED , Colciencias and Ecopetrol.

Pioneer 500 is the result of seven years of research, including the conceptualization of the project until the development of the prototype, which was put to the test between July 5 and 12 in some locations near Cartagena, specifically in front of Barú, in the Colombian Caribbean. The submarine was transported aboard the ARC Roncador of the General Maritime Directorate (Dimar).

Owned by Ecopetrol, Pioneer 500 will serve to strengthen the capacity and qualification of Colombian engineers for the management of cutting-edge technology in marine exploration, as well as to acquire valuable information on issues of marine archeology, oceanographic measurements and inspection of submerged structures, among other.

The tests were made within the framework of the event "Use, application and appropriation of technological tools for the coastal Colombian marine territorial ordering" that was carried out in Cartagena.

In the same way, together with the Engineering Academy of the United Kingdom, a call for the Newton - Caldas Fund was designed, through which Ecopetrol supports two initiatives. One related to the geotechnical characterization of the seabed in the Colombian Caribbean and is coordinated by the EAFIT-University of Leeds, and a second to develop methodologies for the ordering of maritime activities in the Colombian seas and developed by the UPB and the University of Newcastle.

These projects are examples of collaborative work between universities, companies and the State, in order to know one of the least explored natural scenarios in Colombia and thus understand it, conserve it and take advantage of its opportunities.

## **Why Washington State Is A Key Testing Ground For The Navy's Underwater Drones** **Julianne Stanford, The Kitsap Sun, July 8**

**KEYPORT, Wash.** — For the past 100 years, Keyport has been home to one of Navy's primary efforts to research, develop and test torpedoes, which earned the small, waterfront community the moniker of "Torpedo Town, U.S.A."

Now, Keyport's Naval Undersea Warfare Center is becoming the modern testing ground for a new type of technology that silently operates in the depths — unmanned undersea vehicles, which are known as UUVs.

Those unmanned undersea vehicles are essentially “pre-programmed, small submarines,” said Cmdr. Scott Smith, commanding officer of the Navy’s newly formed Unmanned Undersea Vehicle Squadron 1.

The squadron’s UUVs range from 10-inch torpedo-shaped tubes to large submersibles more than 80 inches in diameter. Many of the UUVs used at Keyport are commercially available, from companies like Bluefin Robotics or Riptide Autonomous Solutions.

The squadron has been tasked with developing the tactics, techniques and procedures that will shape how the Navy will use the unmanned undersea vehicles.

Eventually, the Navy will use UUVs for a variety of missions. Today, they are capable of reducing the risk to divers in the water and extending sensory capabilities for underway submarines, Smith told the Kitsap Sun.

“We’ll use UUVs in those areas that are too dangerous to put a manned vessel, and on the other side, we’ll use UUVs where it’s just too mundane for a long-term mission to keep a sailor out there,” Smith said.

“Those are really the two places I see UUVs working, but we’ll never replace the manned systems. In my mind, we’ll always need submarines out there doing what submarines do.”

The Navy currently doesn’t operate unmanned undersea vehicles from submarines, but Smith foresees a potential for rapid growth with the platform.

“Five years down the road,” Smith said, “I’d like to see two UUVs on every submarine in the fleet.”

The squadron has already tested its expertise and training with a few real-world situations. It has helped to recover a lost item in Sinclair Inlet that fell over the side of a patrol boat. It assisted the Royal Canadian Mounted Police track down a misplaced piece of equipment in the Nanoose Range near Vancouver Island, British Columbia.

In another instance with significantly higher stakes, a team of six of the squadron’s sailors deployed in December to assist with the international search and recovery efforts of the Argentinean navy’s lost submarine, A.R.A. San Juan, in the south Atlantic Ocean. The submarine disappeared Nov. 17 with 44 crew members aboard.

Although efforts to locate the submarine’s whereabouts have been unsuccessful, the crew was able to provide assistance in the early days of the search efforts with the UUVs’ capability to perform side-scanning sonar, which uses sonar echoes to create images of large areas of the seafloor.

In the past year, the squadron has grown from 28 sailors with a handful of operational UUVs to 35 sailors and more than a dozen UUVs. By next fall, Smith said the squadron’s manpower will almost double in size and, by fiscal year 2023, it is projected to quadruple from its current size.

With that growth, Smith said the Navy is interested in adding billets that could bring subject matter experts to the squadron, such as meteorologists who could analyze sea conditions for operational planning or operational specialists from the surface community.

“We recognize there’s going to be UUV operations from all facets of the Navy and we don’t want to stovepipe ourselves just into submarines,” Smith said.

Unlike its aerial counterparts, once an undersea drone is launched, it can’t be controlled by an operator on the ground. That means before launch, a UUV’s entire mission protocol has to be coded in advance of getting underway.

“Once they go underwater, you can’t control them with any type of Wi-Fi or signals,” Smith said. “Within about 2,000 yards, you can do acoustic; you can put beeps and bops into the water with very, very small messages, to tell them to come up to the surface or to tell them to abort.”

Operations typically start with a mission briefing early in the morning, and their execution can take anywhere from 15 minutes to 30 hours.

For the most part, the UUV’s size determines the length of time it can be in the water and what type mission it will be sent on.

“We’re limited by power. So if you want a long duration, long stay time with a heavy use payload, you’re not going to get that from a small one,” Smith said.

While underway, smaller UUVs are typically used to gather imagery, survey sea conditions or extend the sensor reach of sub. Larger unmanned undersea vehicles can take on more complex missions, such as acting as an independent sensor on its own mission.

Getting the UUV into the water is the easy part, but at the end of the mission, recovery can prove to be more difficult, Smith said.

“Once you find the UUV, you have to get close enough that you can snare it or hook it without getting too close to damage the side of the boat,” Smith said.

Smaller ones typically require a two-man lift. Medium ones require a specialized trailer — Smith calls it a modified boat trailer. Sailors in immersion suits escort the UUV into the trailer.

After recovering the UUV, crews bring back the data they collected.

For some of the squadron’s sailors, being a part of the work to develop the Navy’s UUV policies has been a key part of their career.

“It’s exciting, something I’ve just heard whispers of, and now to be able to be hands-on with it is really exciting,” said Electronics Technician 1st Class Andrew Hanashiro.

Hanashiro, who has been with the squadron for four months, said the best part of working with the UUVs is to get them out on the water the water for training.

“I just have stars in my eyes every time I see these vehicles,” he said.

Electronics Technician 1st Class Eric Maculanlan has been with the squadron for more than four years. He was on the cusp of deciding to get out of the Navy when he learned about the possibility of working with the UUVs.

“It was new to me. It sounded like something fun to do,” he said. “It’s a lot different aspect and view of the Navy and what happens in the Navy other than being on a submarine with operational life.”

Last fall, the Navy decided to formally establish the squadron, and it began operating on Oct. 1.

The squadron is a part of Submarine Development Squadron 5, which is the operational command that oversees the Seawolf-class nuclear-powered fast attack submarines USS Seawolf, USS Connecticut and USS Jimmy Carter.

Keyport is the natural place to locate the new command, said Capt. Doug LaCoste, commanding officer of NUWC Keyport.

“The goal is that (they’ll be able to) leverage some of the knowledge that Keyport has in recovering these UUVS that we call torpedoes, which we’ve done for decades,” LaCoste said.

In one instance, one of the squadron’s undersea vehicles crushed its nose cone after colliding with an uncharted rock out in the water near Keyport during a training exercise.

Without the shore installation’s assistance, it would have taken months to obtain a replacement nose cone from the manufacturer and get the UUV back in working order. Instead, the UUV was back in business a few days later after Keyport was able to 3D print a replacement nose cone in about a day, Smith aid.

Smith said the installation’s proximity to the water makes it an ideal place for testing the squadron’s tech.

“We can pick a UUV right up and you and I can carry it out to the water right out there and put it in,” he said.

The squadron is housed in Keyport’s Barb Hall, which is named after the legendary World War II-era Gato-class submarine USS Barb.

The Barb is credited with an impressive wartime record, with 12 war patrols. The sub sank five Japanese warships and damaged or sank 34 merchant ships. Most notably, the submarine is credited with “sinking” an enemy supply train after crew members snuck ashore Japanese soil and set up explosive charges on the train track.

“The idea is that the Barb did new and different things, things that were outside of the box,” LaCoste said. “That’s the idea of bringing UUVRON here.”

As the squadron’s size and mission grows, LaCoste said Keyport was looking forward to continuing to support the Navy’s development of the technology.

“It’s going to grow, and what I want to do is to be ready for the growth,” LaCoste said. “As UUVRON develops the tactics to be able to operationally use UUVs, we need to have the infrastructure, we need to be able to test them out here locally and provide feedback.”

With that expansion, Smith said it was important for the squadron to continue to build upon Keyport’s reputation as a considerate neighbor to those who live in the community around the installation.

“We want to make sure everyone on the water knows what we’re doing and make sure that we’re respectful to the recreational boaters right to be out on the water,” Smith said. “I think that’s important for people to know that the military cares and my sailors certainly do.”

## **Russia's Submarine Force Is Getting Stronger. How Worried Should We Be?**

**Justin Mohn, National Interest, July 7**

Moscow's moves toward submarine modernization are absolutely cause for attention but are hardly unanswerable leaps forward which Western nations are powerless to thwart.

Since the 2011, Russia has been pursuing an ambitious plan of modernization for its armed forces on land, sea and air. After a period of neglect during the 1990s, Russia is preparing to challenge its competitors beneath the waves once again by including its submarine fleet in this renaissance.

Depending on the author, however, these efforts have been characterized by Western observers as either deeply alarming or of little concern at all. However, an analysis of these capabilities in the context of Russian priorities makes clear this investment is meant to secure Russia’s ability to carry out traditional roles which would have been familiar to the Soviet Navy, and while obstacles have prevented Russia from realizing the entirety of their ambitions an increasingly well-trained and well-equipped fleet will add significantly to the concerns of NATO and partner navies who had largely abandoned antisubmarine warfare as a discipline following the end of the Cold War.

Background:

Following the breakup of the USSR and the creation of the Russian Federation production of new submarines, completion of ongoing projects, and regular fleet training all stagnated. Deterrent sorties by ballistic missile submarines became increasingly rare; in 2002 no such sortie was conducted at all. These issues came to a head when the submarine Kursk was lost in the Pacific with all hands in 2000, and a board of inquiry blamed faulty equipment and lax training for creating an environment ripe for disaster.

Such a public example of the poor state of the navy, NATO expansion, and U.S. interventions in the Middle East and Africa provided the impetus for a general military modernization plan with the submarine fleet being a key focus of the effort. Work on partially finished hulls resumed, and development of cutting-edge designs which had been stalled after the Cold War was restarted with the equivalent of \$78 billion USD in funding for new naval ships, many of them new submarines. This program would serve the dual purpose of restoring the Russian Navy as a force at sea and address the risks posed by aging ballistic missile and attack submarines being retired and scrapped without replacements.

#### **Refitted Submarine Classes:**

Several current Russian submarine types are expected to undergo upgrades to extend their service lives. The Nuclear Threat Initiative (NTI) points out that navy's period of decline has been helpful, as resources need not be spent maintaining an entire fleet of aging designs and can be instead spent only on the best retrofit candidates. Several Oscar- and Akula-class submarines are slated for modernization, with some of the Akula's being retrofitted to fire the Kalibr cruise missile and thereby increase the fleet's land-attack capability. The venerable Kilo-class diesel submarines are also being retrofitted to continue serving until new nuclear-attack submarines and next generation Air Independent Propulsion (AIP) submarines are available, with six advanced examples of the class being ordered for the delivery to the Pacific Fleet for 2020.

#### **New Submarine Classes:**

In terms of new shipbuilding Russia is again concentrating its efforts on building boats which are more technologically advanced and heavily armed, a move characterized by Magnus Nordenman as rejecting the Soviet Union's focus on quantity in favor of a more Western-style focus on very high quality. The Lada-class diesel submarine is the successor to the highly regarded Kilo-class. Though smaller than its predecessor, it possesses a lower acoustic signature, more powerful propulsion system, and an automated combat control system which cuts down on crew demands. Naval Technology reports that the Russians currently plan to build eight of these submarines. Though the navy planned to equip this class of submarines with an AIP system which would have dramatically increased its underwater endurance and decreased its acoustic profile, the development of the system has yet to bear fruit and the first three boats in the class were launched without it. The Borei-class boats represent Russia's new fourth-generation ballistic missile submarine, though early examples of this type were completed using portions of incomplete Akula III-class submarines. Although the Russian Navy had initially envisioned pursuing an advanced Borei-B class, these plans have been shelved in favor of purchasing six additional Borei-A class boats. This would bring the orders for the class to a total of fourteen boats. As with the Borei-class lead vessels, the early Yasen-class attack submarines were completed using portions of incomplete vessels from the 1990s. As a nuclear attack submarine, these boats will serve to disrupt enemy SLOC and defend the ballistic missile submarines when they are posted to their launch positions. Additionally, they will be outfitted with nuclear-capable Kalibr-missiles allowing them to fill a land-attack role. As many as five additional boats have been ordered for delivery by 2023.

Looking over the horizon, Russian planners are putting significant stock in the creation of their new Husky-class nuclear submarine. Still in its conceptual stages, NTI assesses Russia intends to have a more concrete design by the end of summer 2018 with a desire to complete construction of the first examples of the class sometime in the 2020s. Described by NTI as a "Joint Strike Submarine," the boat is expected to be modular with plans for an attack submarine and guided-missile submarine variant, as well as a potential ballistic-missile submarine variant. Russia hopes this would provide a cheap alternative to their expensive, specialized modern classes and also prove a cost-efficient way to ensure a steady supply of boats as older classes reach the end of their service life. Kaufman argues the Russian experience in building the early Yasens and Boreis give them the capability to realize the majority of their goals for this class. Design work was also recently completed on the Project Kalin next-generation diesel submarine, which will build on the Lada-class advances and may field AIP technology.

#### **Operational Developments:**

More than simply new boats, reports indicate that the Russian Navy is engaging in a concerted effort to give crews the training and expertise necessary to use fleet assets to the greatest possible effect. Russian submarines increased their patrols by 50 percent in 2014 and then doubled that number in 2015. Russian navy chief Admiral Vladimir Korolyov reported that his submarines had spent more than three thousand days at sea in 2016, meeting the operational standard set by the Soviet Navy. These operations have not been confined to mere exercises or training cruises. In a surprise move in 2017 a modified Kilo-class sub, the Krasnodar, executed a cruise missile strike on Syrian opposition forces even as it was tracked by a group of NATO vessels. Finally, British news sources recently reported that Russian submarines successfully chased a British Astute-class submarine away from its station, preventing it from participating in a strike against the Assad regime's chemical weapons program.

#### **Analysis and Conclusions:**

Common narratives addressing Russian naval ascendancy either focus on the seemingly stunning capability of these new subs or the significant challenge posed to Russian ambitions by the aged state of their current fleet. Either carried to an extreme is a mistaken impression. Russia neither aspires to dominance of the global-world order nor can it afford to allow its fleet to once again fall into a state of neglect and inactivity. It is likely that Russia will remain committed to an aggressive shipbuilding program and training/exercise schedule for its submarine fleet, but it is also likely that Western powers can take appropriate steps to ensure the balance of undersea power remains in their favor through this period of modernization.

Analysts like Steve Micallef clearly believe that current Russian naval strategic priorities are to maintain and defend a nuclear deterrent as part of a full nuclear triad, protect the Russian coastline, project a Russian presence globally, and threaten NATO SLOC in the event of conflict. These priorities require a strong submarine force more than any mix of surface ships. An effective nuclear deterrent must simultaneously be capable of strategic surprise and be able to survive a first strike. Surface ships are easy to monitor and thus more vulnerable to a preemptive strike. Russian nuclear submarines, by contrast, can operate and fire from positions of stealth over extended periods of time. They have also traditionally patrolled areas difficult for NATO forces to access, with their passages guarded by combined air, surface, and undersea assets. Russian coastal defense doctrine has also prioritized undersea attacks from its earliest days, believing that these assets are less likely to be swept from the sea by a superior Western force than surface vessels. Finally, submarines provide a level of global-power projection appropriate to Russia's means and goals. As described above, the submarine force has publicly demonstrated Russian capabilities on several occasions, though in ways which also would have allowed them to mask any ongoing problems. If the Krasnodar's missile attack had failed, the submarine could have simply sailed away while accomplishing the goal of alarming NATO policymakers who would have been mystified by the operation. By contrast, when surface ships fail it is difficult to disguise their shortcomings, as when Russia's only operational carrier had to be towed by a tug during a recent cruise. A failure to field an effective submarine force would leave all these strategic objectives critically underserved and is unacceptable to Russian policymakers after high profile failures in the 1990s and 2000s.

Skeptics of Russian submarine modernization note that unless they fully meet their most optimistic goals for shipbuilding and capability development, the Russian Navy will not be able to maintain fleet numbers as many boats are reaching the end of their service life. Approximately 75 percent of all submarines currently in service are over twenty years old. It is certainly true that Russia has set a high level of ambition given their capabilities and present challenges. A desire to focus on domestic spending and poor oil sales have forced cuts in the Russian defense budget and a commensurate downward revision of both the number and type of new surface ships included in the overall modernization program. That said, Russia need not field a massive submarine fleet to achieve its limited goals. Russia's government has not indicated that it lacks an understanding of its own limitations, resorting to strong language and military restraint when faced with the loss of a plane to Turkish interceptors, coalition strikes in Syria, and the United States' abandonment of the nuclear deal with Iran. Between newly produced ballistic missile submarines and existing submarines scheduled for upgrades, even a fraction of the remaining Borei-A orders would be a sufficient nuclear deterrent to meet their needs. The Krasnodar's strike and, if true, reports regarding the interception of a British submarine during the 2018 strikes in Syria speak to the capability of even old Russian subs to threaten NATO forces in likely operating environments. Additionally, the degradation of NATO ASW capability means that what subs are produced will face a more permissive operating environment than in previous years, at least in the near-term.

While building a strong fleet is not an insurmountable challenge for Russia, it is important not to overstate the threat posed by their actions. As a group, NATO's members still maintain and are seeking to recapitalize their submarine, surface, and land-based antisubmarine forces. While these combined forces are a shadow of what they once were during the Cold War, enormous investment would be required to build enough submarines to establish overwhelming superiority over the alliance's naval power. Recent decreases in the Russian defense budget would limit Russia's ability to pursue any overall superiority. Though the Russians have demonstrated a willingness to privilege their undersea fleet over their surface fleet in recent budget cuts, they have not sought to make submarines an overriding priority at the expense of other domestic and military programs. To the extent that Russian activities create a permissive environment for continued Western sanctions, or that market forces hamper Russian revenue collection, it is likely that future cuts will continue to limit their naval shipbuilding ambitions. Russia's moves toward submarine modernization are absolutely cause for attention but are hardly unanswerable leaps forward which Western nations are powerless to thwart.



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