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Security Tech Brief

March 2022: Poseidon

Oceanic Multipurpose System Status-6, Kanyon

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- Poseidon is a submarine-launched uninhabited underwater vehicle (UUV) currently under development by the Russian military with a projected deployment in 2027.
- Poseidon will be powered by a compact nuclear reactor and will likely be armed with a 2-megaton nuclear warhead, although both a larger nuclear or a conventional warhead are possible.

Possible Military Roles

1. A strategic role in securing a second strike capability even if an opponent develops highly sophisticated ballistic missile defenses.
2. A tactical role as an anti-ship weapon to be used against aircraft carrier formations.
3. A testing role for underwater nuclear propulsion systems for future UUVs.

Key Questions

- How autonomous is Poseidon? Should Poseidon be understood as a large nuclear-armed torpedo or as a complex UUV that could roam the oceans for months waiting for an order to attack?
- Can Poseidon be recalled after launch?
- Will there be different Poseidons (nuclear, conventional or no payload) and how could this affect inadvertent escalation pathways?
- How large is the potential for accidents?

Technical Details

Size: Ca. 25 meters long with a diameter of 1.5 to 2m.

Range: intercontinental, practically unlimited

Depth: up to 1000 meters

Speed: likely 70 knots (110 km/h)

Number: Total of 30 Poseidon systems distributed among four submarines according to Russian media reports.

Platforms

Belgorod (Project 09852)

Specially modified to be able to carry Poseidon systems. Launched in 2019 and currently undergoing sea trials. Will likely carry six Poseidon systems.

Khabarovsk (Project 09851)

Poseidon's first designated carrier, still under construction. Will likely carry six Poseidon systems. Launch has been delayed several times.

TBA

TBA

Two more carriers are planned. Likely based on the Khabarovsk.

Sarov (Project 20120)

Specially modified to act as Poseidon's main test platform. Possibly modified as far back as 2007.

Zvezdochka 600 (Project 20180)

Auxiliary vessel possibly involved in Poseidon's tests.

Akademik Aleksandrov (Project 20183)

Entered service in 2020, possibly to replace the Zvezdochka 600. Could be used to facilitate a seabed-launched version of Poseidon, sometimes called 'Skif'.

What makes Poseidon stand out?

Poseidon is a nuclear-armed, submarine-launched uninhabited underwater vehicle (UUV) powered by a small nuclear reactor, which is currently being developed by the Russian military.[1] While Poseidon is often described as an UUV, it is still unclear how autonomously it could operate once deployed. Is this a single-use weapon or an autonomous underwater vehicle able to traverse the oceans on its own? It is clear that the system's nuclear-power propulsion would give it practically unlimited range. This includes the possibility of targeting the U.S. coast from Russian waters. Additionally, its nuclear power source makes it faster than almost any existing underwater weapons system, with speeds likely able to reach up to 70 knots (up to 130 km/h).[2] For comparison, U.S. Virginia Class nuclear-powered submarines travel at around 25 knots and conventional torpedoes at 50 knots. As the system is uninhabited, Poseidon can also travel deeper than most crewed submarines at a depth of 1000 meters. Given these characteristics, the proposed system would be very difficult to intercept with traditional anti-submarine measures. In short, if used as a nuclear-armed torpedo, Poseidon would be the world's only strategic nuclear weapon designed to detonate underwater. If used as a UUV, it would be the world's first nuclear-armed as well as the first nuclear-powered uninhabited underwater vehicle.

Is Poseidon real?

Given the speculations surrounding Poseidon and its seemingly orchestrated accidental reveal during a 2015 Russian television broadcast, many pundits have wondered whether the weapon system is part of a propaganda scheme.[3] Nevertheless, the current consensus among experts suggests that Poseidon is a real system for which the Russian military has already devoted significant resources, even if many important details are still unknown.[4] U.S. intelligence reports that Poseidon has been trialed at least 11

[1] While nuclear-armed torpedoes for naval combat are nothing new, there has never been a nuclear-powered torpedo. Russian media reports sometimes refer to two historical precedents: the battery-powered, nuclear-armed torpedo T-15 and the 'idea' of Andrei Sakharov, a Soviet nuclear physicist, to develop a nuclear-powered and nuclear-armed torpedo in the 1960s. According to Sakharov himself, Soviet naval leaders rejected his idea and the T-15 torpedo, designed to target U.S. naval bases, was never deployed. For more information on Sakharov's 'idea' see his memoirs: Andrei Sakharov, *Memoirs* (New York: Alfred A. Knopf, 1990), 221–22; For more information on the T-15, see: Norman Polmar and Kenneth J. Moore, *Cold War Submarines: The Design and Construction of U.S. And Soviet Submarines* (Washington D.C.: Potomac Books Inc., 2004), 72–76; Norman Polmar, "Armaments and Innovation - the Big Torpedo," *Naval History* 32, no. 1 (2018), https://www.usni.org/magazines/naval-history-magazine/2018/february/armaments-and-innovation-big-torpedo.

[2] The only exception would be a supercavitating torpedo. Edward Geist and Dara Massicot, "Understanding Putin's Nuclear "Superweapons"," *SAIS Review of International Affairs* 39, no. 2 (2019): 107, https://doi.org/10.1353/sais.2019.0019; Such a weapon has only been developed and deployed by the Soviet and later Russian navy. For more information on the 200-knot rocket-propelled VA-111 Shkval torpedo see: Polmar and Moore, *Cold War submarines*, 303–4.

[3] David Axe, "Russia Is Building Four Special Submarines to Haul Its Weird Doomsday Drone," *Forbes*, January 21, 2021, https://www.forbes.com/sites/davidaxe/2021/01/21/russia-is-building-four-special-submarines-to-haul-its-grotesque-doomsday-drone/?sh=3729cbf93703; Steven Pifer, "Russia's Perhaps-Not-Real Super Torpedo," *Brookings*, November 18, 2015, https://www.brookings.edu/blog/order-from-chaos/2015/11/18/russias-perhaps-not-real-super-torpedo/; For reports about the 'leak' see: *BBC News,* "Russia Reveals Giant Nuclear Torpedo in State TV 'Leak'," November 12, 2015, https://www.bbc.com/news/world-europe-34797252; Igor Sutyagin, "Russia's Underwater "Doomsday Drone": Science Fiction, but Real Danger," *Bulletin of the Atomic Scientists* 72, no. 4 (2016), https://doi.org/10.1080/00963402.2016.1194617.

[4] See for example: Nick P. Walsh, "Russia Is Amassing Unprecedented Military Might in the Arctic," *CNN*, April 5, 2021, https://edition.cnn.com/2021/04/05/europe/russia-arctic-nato-military-intl-cmd/index.html.

times. The assessment estimates that Poseidon will enter service in 2027.[5] Russian media reports also refer to 2027 as a possible launch date.[6]

According to analysts, the clearest evidence that the Russian military is developing some version of Poseidon is the visibility of infrastructure necessary to test the system. Since Poseidon greatly outmeasures a regular torpedo, the Russian navy cannot simply load it onto existing submarines. Rather, they must use specially-built or modified submarines to test and eventually field Poseidon. The testing role appears to have fallen to the Sarov (Project 20120) submarine. Originally envisaged as a Kilo class attack submarine in the late 1980s, the *Sarov* appears to have been heavily modified before she was finally launched in 2007. These modifications appear to allow her to test Poseidon prototypes; tests she may have been carrying out since 2008.[7]

The Russian navy also appears to be developing a new class of nuclear-powered submarines as carriers for Poseidon: the Khabarovsk (Project 09851) and two additional Khabarovsk-inspired submarines. Each of these submarines will likely hold six Poseidon systems.[8] Since the *Khabarovsk's* launch has been repeatedly postponed, the uniquely built Belgorod submarine will be Poseidon's first operational carrier.[9] Launched in 2019 and scheduled to enter service in 2022, the 184-metres long nuclear-powered *Belgorod* is the world's longest and possibly "least understood" submarine.[10] Operated by the secretive "Main Directorate of Deep-Sea Research" (GUGI), the *Belgorod* appears to fulfil several roles.[11] It will join Russia's nuclear arsenal by carrying six Poseidon systems. Yet, it will also host a deep-diving nuclear-powered submarine under its hull, carry an autonomous underwater vehicle and engage in spy missions.[12]

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[5] Amanda Macias, "Russia's Nuclear-Armed Underwater Drone May Be Ready for War in Eight Years," *CNBC*, March 25, 2019, https://www.cnbc.com/2019/03/25/russias-nuclear-armed-underwater-drone-may-be-ready-for-war-in-2027.html.

[6] *TASS*, "Russian Navy to Get Poseidon Nuclear Underwater Drones by 2027 - Source," May 12, 2018, https://tass.com/defense/1003964.

[7] H. I. Sutton, "Sarov-Class Submarine," *Covert Shores (Blog)*, February 22, 2019, http://www.hisutton.com/SAROV-Class_Submarine.html.

[8] Hans M. Kristensen and Matt Korda, "Russian Nuclear Weapons 2021," *Bulletin of the Atomic Scientists* 77, no. 2 (2021): 99, https://doi.org/10.1080/00963402.2021.1885869; H. I. Sutton, "Khabarovsk-Class-Submarine," *Covert Shores (Blog)*, November 20, 2020, http://www.hisutton.com/Khabarovsk-Class-Submarine.html.

[9] Xavier Vavasseur, "Russia's Khabarovsk Submarine to Be Launched in Fall 2021 - Naval News," *Naval News*, April 19, 2021, https://www.navalnews.com/naval-news/2021/04/russias-khabarovsk-submarine-to-be-launched-in-fall-2021/; Similar to the Sarov submarine, the Belgorod submarine was not originally designed to carry something like the Poseidon system. Laid down in 1992 as an Oscar II class submarine, construction was suspended several times until the Russian MOD declared in 2006 that it longer needed the Belgorod. However, in 2012 construction resumed with the intention to finish the Belgorod as a 'special-mission' submarine requiring significant modifications. *Izvestia,* "«Посейдон» В Лодке: Субмарину Готовят К Испытаниям Ядерных Роботов ("Poseidon" in a Boat: Submarine Being Prepared for Nuclear Robot Tests)," February 11, 2021, https://iz.ru/1123160/anton-lavrov-aleksei-ramm/poseidon-v-lodke-submarinu-gotoviat-k-ispytaniiam-iadernykh-robotov.

[10] H. I. Sutton, "Russia's New Super Submarine, Belgorod (K-329)," *Covert Shores (Blog)*, June 29, 2021, http://www.hisutton.com/Belgorod-Class-Submarine.html; Kyle Mizokami, "Russia Launches Belgorod, the World's Longest Submarine," *Popular Mechanics*, April 24, 2019, https://www.popularmechanics.com/military/navy-ships/a27243915/russia-launches-belgorod-the-worlds-longest-submarine/; *TASS, "*Russian Navy to Receive Special-Purpose Sub with Nuclear-Armed Drones in Summer — Sources," January 26, 2022, https://tass.com/defense/1393205.

[11] GUGI is a specialist force, which is separate from the Russian Navy and reports directly to the Ministry of Defense. It primarily serves as an intelligence and special mission organization. GUGI operates a number of specialized submarines and surface research ships such as the Yantar. These ships are often associated with Russia's 'seabed warfare' capability: for example, mapping and potentially manipulating (destroying or planting listening devices) underwater communications cables. For more information see: Kathleen H. Hicks et al., "Undersea Warfare in Northern Europe" (CSIS, 2016), https://www.csis.org/analysis/undersea-warfare-northern-europe, 12; Michael Kofman, "Fire Aboard as-31 Losharik: Brief Overview," *Russia Military Analysis (Blog)*, July 3, 2019, https://russianmilitaryanalysis.wordpress.com/2019/07/03/fire-aboard-as-31-losharik-brief-overview/.

[12] The Belgorod will most likely carry the 70-metre long Losharik (Project 10831) submarine, which could be capable of diving to extreme depths; up to 6000m. In service since 2003, a fire broke out on the submarine in 2019 killing fourteen crewmembers. See: H. I. Sutton, "Spy Submarine: Russia's as-31 Losharik," *Covert Shores (Blog)*, July 18, 2021, http://www.hisutton.com/Spy%20Sub%20-%20Project%2010831%20Losharik.html; Sutton, "Russia's New Super Submarine, Belgorod (K-329)"; James Glanz and Thomas Nilsen, "The Deadly Losharik Submarine Fire and Russia's Secret Undersea Agenda," *The New York Times*, April 20, 2020, https://www.nytimes.com/2020/04/20/world/europe/russian-submarine-fire-losharik.html; Kofman, "Fire aboard AS-31 Losharik: Brief Overview"; For more information on the Harpsichord AUV see: H. I. Sutton, "Harpsichord AUV," *Covert Shores (Blog)*, March 30, 2019, http://www.hisutton.com/Harpsichord_AUV.html.

There have also been rumors that the Russian military is working on a seabed-launched version of Poseidon, sometimes called 'Skif'.[13] This would allow Poseidon to operate without a host submarine, which is susceptible to being tracked and destroyed before the system can be launched.[14] If Poseidon is stationed on the seabed, it could wait until receiving an order to launch; however, this would require utilizing special surface ships to retrieve Poseidon on and from the seabed. The special-purpose ship Zvezdochka 600 (Project 20180) has been associated with helping test Poseidon.[15] In 2020, another special-purpose ship, the Akademik Aleksandrov (Project 20183), entered service with further modifications that could facilitate a seabed-launched variant of Poseidon.[16] Poseidon also requires infrastructure on land: satellite images show construction efforts, possibly connected to Poseidon's development in Severodvinsk, on the White Sea, where the submarines *Sarov* and the *Belgorod* are based.[17] The Poseidon launch tubes can be seen on satellite images taken of the Severodvinsk naval base in August 2021.[18] In 2021, CNN also reported that storage bays for Poseidon are being built around Olenya Guba on the Kola Peninsula near Russia's Northern Fleet headquarters.[19]

Potential Military Roles

Why would Russian leadership develop such a system? While expert consensus purports that this weapon appears to secure preemptively Russia's second-strike capability should an opponent develop a highly sophisticated missile defense system, Russian media reports and official MOD statements have described Poseidon as a multi-purpose system, thereby indicating additional roles.[20] A key question, that will ultimately shape Poseidon's potential role(s) is how autonomous the system can operate. Does Poseidon operate like a single-use *weapon* that is launched from a submarine and then travels directly to a pre-programmed city without any further communication with Russian headquarters? Or can Poseidon operate like an *autonomous underwater vehicle* able to travel around the oceans on its own while in regular contact with Russian command until it gets the order to attack?

[13] H. I. Sutton, "Poseidon Torpedo," *Covert Shores (Blog)*, February 22, 2019, http://www.hisutton.com/Poseidon_Torpedo.html.

[14] H. I. Sutton, "Video Suggests Russia's Poseidon Nuclear-Powered Drone Has a Seabed-Launched Version," *Forbes*, November 17, 2019, https://www.forbes.com/sites/hisutton/2019/11/17/video-suggests-russias-poseidon-nuclear-powered-drone-has-a-seabed-launched-version/?sh=297f43ab5b6c.

[15] Atle Staalesen, "Navy Gets New Vessel for Secret Underwater Operations in Arctic," *The Barents Observer*, April 14, 2020, https://thebarentsobserver.com/en/2020/04/navy-gets-new-vessel-secret-russian-underwater-operations-arctic.

[16] Sutton, "Video Suggests Russia's Poseidon Nuclear-Powered Drone Has A Seabed-Launched Version"; H. I. Sutton, "Akademik Aleksandrov," *Covert Shores (Blog)*, February 2, 2020, http://www.hisutton.com/Akademik-Aleksandrov.html.

[17] H. I. Sutton, "New Satellite Images Hint How Russian Navy Could Use Massive Nuclear Torpedoes," *USNI News*, August 31, 2021, https://news.usni.org/2021/08/31/new-satellite-images-hint-how-russian-navy-could-use-massive-nuclear-torpedos.

[18] See this tweet from H.I. Sutton: https://twitter.com/covertshores/status/1441684022522830857?lang=en

[19] Walsh, "Russia is amassing unprecedented military might in the Arctic."

[20] For an alternative view that Poseidon might be a first strike weapon, see an analysis by Lieutenant Commander Joshua M. M. Portzer of the U.S. navy who makes the argument that Poseidon could be used in a surprise attack against a U.S. naval base, such as Norfolk or San Diego, which would "catastrophically cripple" the U.S. navy. Joshua M. M. Portzer, "Kanyon's Reach: Rethinking the Nuclear Triad in the Autonomous Age," *U.S. Naval Institute*, July 2020, https://www.usni.org/magazines/proceedings/2020/july/kanyons-reach-rethinking-nuclear-triad-autonomous-age.

A strategic role as a second-strike weapon

When Putin introduced Poseidon alongside other new nuclear delivery systems in March 2018, he spoke at length about how U.S. missile defense systems will eventually "result in the complete devaluation of Russia's nuclear potential".[21] He then presented the new weapon systems as Russia's response to U.S. missile defenses.[22] Rather than trying to defeat existing missile defense systems, Poseidon circumvents them altogether by travelling underwater.[23]

However, as a strategic weapon, Poseidon has certain weaknesses. First, the destructive effect of an airburst nuclear missile would likely be greater than an underwater Poseidon explosion.[24] Second, Poseidon can only target coastal cities and not, for example, ICBM (intercontinental ballistic missile) fields further inland. Third, while Poseidon is very fast for an underwater vehicle, it is very slow compared to other nuclear delivery methods. An ICBM takes about 40 minutes to reach the U.S. when fired from Russia.[25] Poseidon would need days to reach the U.S. coast when launched from Russian waters.[26] Additionally, Poseidon may attempt to minimize noise and avoid detection by declining to move at its top speed, thus increasing its travel time.[27] It could arrive days after an initial nuclear exchange has already ended. This is why some analysts describe Poseidon as a deep-second-strike or third-strike weapon.[28] Unsuited for damage limitation or de-escalation, it does not offer much strategic value. Instead, it offers revenge. Should the U.S. manage to destroy most of Russia's nuclear arsenal, develop a sophisticated missile defense system to intercept remaining Russian weapons, disable Russian satellites and decapitate the Russian leadership, Poseidon might *still* be on its way to U.S. cities.

Does the Russian military need such a strategic weapon to inflict great damage on the U.S.? In 2018, then-U.S. Defense Secretary James Mattis told reporters that Poseidon would not change the strategic nuclear balance since Russia already has the capability to target U.S. cities with nuclear-armed missiles.[29]

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[21] Beside Poseidon, Putin introduced four other nuclear-capable weapon systems in his March 2018 address to the Federal Assembly: the hypersonic glide vehicle *Avangard*, the air-launched ballistic missile *Kinzhal*, the nuclear-powered ground-launched cruise missile *Burevestnik* and the intercontinental ballistic missile *Sarmat*. For more information see: Samuel Bendett et al., *Advanced Military Technology in Russia: Capabilities and Implications*, Research paper / Russia and Eurasia Programme (London: Chatham House, 2021), https://www.chathamhouse.org/sites/default/files/2021-09/2021-09-23-advanced-military-technology-in-russia-bendett-et-al.pdf, 23–34; Vladimir Putin, "Presidential Address to the Federal Assembly" (March 01, 2018), http://en.kremlin.ru/events/president/news/56957.

[22] Putin, "Presidential Address to the Federal Assembly."

[23] H. I. Sutton, "Countering Russian Poseidon Torpedo," *Covert Shores (Blog)*, August 15, 2018, http://www.hisutton.com/Countering_Russian_Poseidon_Torpedo.html; Kyle Mizokami, "How Can We Stop Russia's Apocalypse Nuke Torpedo?," *Popular Mechanics*, August 16, 2018, https://www.popularmechanics.com/military/weapons/a22749605/how-can-we-stop-russias-apocalypse-nuke-torpedo/.

[24] Brad Bergan, "The Weapon That Eradicates Cities by Creating 'Radioactive Tsunamis'," *Interesting Engineering*, July 6, 2021, https://interestingengineering.com/poseidon-nuclear-weapon-radioactive-tsunamis-russia; Dave Mosher, "A New Russian Video May Show a 'Doomsday Machine' Able to Trigger 300-Foot Tsunamis — But Nuclear Weapons Experts Question Why You'd Ever Build One," *Business Insider Australia*, July 24, 2018, https://www.businessinsider.com.au/russia-doomsday-weapon-submarine-nuke-2018-4.

[25] Michael Kofman, "Emerging Russian Weapons: Welcome to the 2020s (Part 2 – 9M730?, Status-6, Klavesin-2R)," *Russia Military Analysis (Blog)*, March 6, 2018, https://russianmilitaryanalysis.wordpress.com/tag/status-6/.

[26] This also raises the question whether Poseidon can be recalled after it has been fired. For more on this problem see: Michael C. Horowitz, Paul Scharre, and Alexander Velez-Green, "A Stable Nuclear Future? The Impact of Autonomous Systems and Artificial Intelligence" (2019), https://arxiv.org/pdf/1912.05291, 23–24.

[27] Steve Hall, *The Russian Poseidon Nuclear AUV: SUT Webinar on July 13, 2020* (Society for Underwater Technology (SUT)), https://www.youtube.com/watch?v=nr2KlsBeCGU.

[28] Hanna Notte et al., "Russia's Novel Weapons Systems: Military Innovation in the Post-Soviet Period," *Nonproliferation Review*, 2021, 18, https://doi.org/10.1080/10736700.2021.1946271.

[29] *The Guardian*, "Russia Says It Has Successfully Launched Powerful New Missile," March 11, 2018, https://www.theguardian.com/world/2018/mar/11/russia-hypersonic-kinzhal-missile-launch.

However, experts have pointed out that Poseidon might be a "hedge" [30] against future U.S. missile defenses or an "underwater insurance policy".[31] Still, improving existing systems would have been "infinitely cheaper" writes Michael Kofman.[32] As a result, there seem to be additional factors, which help explain the support for developing such an expensive system: for example, a potential use against naval formations.[33]

A tactical role as an anti-ship weapon

In July 2018, the Russian MOD specified that Poseidon "will enable the Russian Navy to fight carrier-led and surface action groups [...] and strike coastal infrastructure facilities at an intercontinental distance".[34] In other words, Poseidon also appears to have an anti-ship role to counter U.S. naval dominance.[35] However, targeting moving aircraft carrier groups and/or SSBNs would be more difficult than targeting coastal cities for example.[36] If used in this capacity, Poseidon would either need to communicate with Russian command to stay on target or be able to track its mark independently by using passive sonar for example. Both options are not an easy feat without risking detection.[37] Consequently, some analysts remain skeptical about Poseidon's anti-ship capabilities.[38] Poseidon might hence not be used as a UUV itself, but it could be used to test miniaturized nuclear reactors that could power UUVs in the future.[39]

[30] See for example comments made by Steve Fetter, University of Maryland, and Frank von Hippel, Princeton University: Bergan, "The Weapon That Eradicates Cities by Creating 'Radioactive Tsunamis'."

[31] Comments by Kingston Reif from the Arms Control Association. See: Axe, "Russia Is Building Four Special Submarines To Haul Its Weird Doomsday Drone."

[32] The Russian military is also improving current systems. Kofman, "Emerging Russian Weapons: Welcome to the 2020s (Part 2 – 9M730?, Status-6, Klavesin-2R)."

[33] Notte et al., "Russia's novel weapons systems: military innovation in the post-Soviet period," 18–19.

[34] *TASS*, "Russia Launches Trials of Poseidon Underwater Drone That Can Carry Nuclear Warheads," July 19, 2018, https://tass.com/defense/1013969.

[35] Notte et al., "Russia's novel weapons systems: military innovation in the post-Soviet period," 19.

[36] For a short analysis of Poseidon's suitability against moving targets see: Hall, *The Russian Poseidon Nuclear AUV*; For the argument that Poseidon's primary purpose is to target U.S., British and French SSBNs see: Peter Pry, "Are U.S. Submarines Vulnerable?," *RealClearDefense*, May 30, 2019, https://www.realcleardefense.com/articles/2019/05/30/are_us_submarines_vulnerable_114464.html.

[37] Jill Hruby, "Russia's New Nuclear Weapon Delivery Systems: An Open-Source Technical Review" (Nuclear Threat Initiative (NTI), Washington D.C., 2019), 33; Hall, *The Russian Poseidon Nuclear AUV*.

[38] Kofman, "Emerging Russian Weapons: Welcome to the 2020s (Part 2 – 9M730?, Status-6, Klavesin-2R)"; Sutton for example asks why the Russian navy would choose to develop an entire new class of specially modified submarines, if Poseidon could just be launched from a pier at a Russian naval base. H. I. Sutton, "Poseidon Demystified," *Covert Shores (Blog)*, January 21, 2019, http://www.hisutton.com/Poseidon_demystified.html; For a short overview on the technical challenges surrounding complex UUVs see: Franz-Stefan Gady, "Australia's Future Submarine Fleet and Uninhabited Undersea Systems," *IISS*, September 23, 2021, https://www.iiss.org/blogs/analysis/2021/09/australias-future-submarine-fleet-and-uninhabited-undersea-systems.

[39] Nuclear power could enable UUVs to overcome two major obstacles for UUVs: low speed and low endurance. See: Geist and Massicot, "Understanding Putin's Nuclear "Superweapons"," 107–8.

Destructive Effects

Warhead

- Estimates for Poseidon's yield range from two megatons to 100 megatons.[40] Putin stated that Poseidon would carry a "massive nuclear ordnance".[41] In 2018, TASS reported a yield of two megatons.[42] In 2019, Christopher A. Ford, then U.S. assistant secretary of state for International Security and Non-Proliferation, claimed that Poseidon could carry a "multi-megaton" warhead.[43]
- Most experts deem two megatons to be the most realistic estimate although a larger warhead cannot be ruled out. The origins of the 100-megaton reference are unclear.[44]

Tsunami Effects

- It is unclear whether an exploding Poseidon could trigger tsunamis. Generally, the energy released by a nuclear detonation is "a drop in the bucket" compared to the energy of naturally occurring tsunamis according to Gregg Spriggs, a nuclear-weapons physicist at the Lawrence Livermore Laboratory.[45]
- U.S. studies that explored explosion-induced waves found a "relatively inefficient wave making potential".[46] A 1996 report by the Defense Nuclear Agency described shallow water explosions as "extremely inefficient with respect to wave generation ability". Only 5% of the explosion's energy is translated into waves.[47]

Environ-mental Impact

- Unlike an airburst weapon, a detonated Poseidon would produce significant local fallout that could quickly spread depending on wind directions.
- The Poseidon system likely already poses a contamination risk in peacetime. Given the system's small size, its nuclear reactor is unlikely to have much shielding to absorb radiation coming from the reactor.[48] This means that the system is essentially radioactive.[49] "We are ecologically worried", the head of Norwegian intelligence told CNN in 2021, adding that radiological accidents have already occurred.[50]

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[40] One Russian paper claimed a yield of 200 megatons. A translation of the paper provided by Steve Rosenberg, the BBC Moscow correspondent, adds that a professor cited in the paper claimed, "if Europe behaves badly, send a sub with 200 megatons & let rip when needed". Interestingly, the picture printed in the paper does not actually show Poseidon but the Harpsichord autonomous underwater vehicle which was featured in the same Russian MOD video as Poseidon. See Rosenberg's tweet at: https://twitter.com/BBCSteveR/status/1084734689972236288

[41] Putin, "Presidential Address to the Federal Assembly."

[42] TASS, "Source: Russian Poseidon Underwater Drone Capable of Carrying 2 Megatonne Nuclear Warhead," 05/17/2018, https://tass.com/defense/1004722.

[43] Christopher A. Ford, "Law, Morality, and the Bomb," *Arms Control and International Security Papers* I, no. 22 (2020): 9, https://www.state.gov/wp-content/uploads/2020/11/T-Paper-Series-22-Humanitarian-Law-sr508.pdf.

[44] For a short twitter thread exploring the origins of the 100-megaton warhead, see Alexander Graef's (a researcher at the Institute for Peace Research and Security Policy (IFSH) twitter thread. Available at: https://twitter.com/alxgraef/status/1415668993902268421

[45] Mosher, "A new Russian video may show a 'doomsday machine' able to trigger 300-foot tsunamis — but nuclear weapons experts question why you'd ever build one."

[46] W. G. van Dorn, Bernard Le Mehaute, and Li-San Hwang, "Handbook of Explosion-Generated Water Waves" (Office of Naval Research, 1968), https://apps.dtic.mil/sti/pdfs/AD0845485.pdf, xiii.

[47] Bernard Le Mehaute and Shen Wang, "Water Waves Generated by Underwater Explosions," Technical Report (Defense Nuclear Agency, Alexandria, VA, 1996), https://apps.dtic.mil/sti/pdfs/ADA304244.pdf, 206.

[48] H. I. Sutton, "Russia's New Super Weapons May Be Cause of Radiation Leak," *Forbes*, July 1, 2020, https://www.forbes.com/sites/hisutton/2020/07/01/russias-new-super-weapons-may-be-cause-of-radiation-leak/?sh=48e6741c5f8c; Hall, *The Russian Poseidon Nuclear AUV*.

[49] For more information on the consequences should the miniaturized nuclear reactor inside Poseidon explode see: Hwang Il-Soon and Kim Ji-Sun, "The Environmental Impact of Nuclear-Powered Autonomous Weapons," in *The Impact of Artificial Intelligence on Strategic Stability and Nuclear Risk*, ed. Lora Saalman II (SIPRI, 2019), 86–90.

[50] Walsh, "Russia is amassing unprecedented military might in the Arctic."

Recommended Further Reading

On Poseidon and its possible delivery platforms:

1. Covert Shores - a blog focused on open intelligence analysis for everything surrounding underwater warfare run by H.I. Sutton.

2. Hall, Steve. The Russian Poseidon Nuclear AUV: SUT Webinar on July 13, 2020. Society for Underwater Technology (SUT). https://www.youtube.com/watch?v=nr2KIsBeCGU.

Other Russian 'superweapons':

1. Hanna Notte, Sarah Bidgood, Nikolai Sokov, Michael Duitsman & William Potter (2021) Russia's novel weapons systems: military innovation in the post-Soviet period, The Nonproliferation Review. https://www.tandfonline.com/doi/full/10.1080/10736700.2021.1946271

2. Geist, Edward, and Dara Massicot. "Understanding Putin's Nuclear "Superweapons"." SAIS Review of International Affairs 39, no. 2 (2019): 103–17. https://muse.jhu.edu/article/751650

3. Bendett, Samuel, Mathieu Boulègue, Richard Connolly, Margarita Konaev, Pavel Podvig, and Katarzyna Zysk. Advanced Military Technology in Russia: Capabilities and Implications. Research paper / Russia and Eurasia Programme. London: Chatham House, 2021. https://www.chathamhouse.org/sites/default/files/2021-09/2021-09-23-advanced-military-technology-in-russia-bendett-et-al.pdf.

4. Hruby, Jill. "Russia's New Nuclear Weapon Delievery Systems: An Open-Source Technical Review." Nuclear Threat Initiative (NTI), Washington D.C., 2019. https://www.nti.org/analysis/articles/russias-new-nuclear-weapon-delivery-systems-open-source-technical-review/

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