

The Role of Emerging Countries with Nuclear-missile Carrying Capabilities on Strategic Stability

Angela Di Fulvio

difulvio@illinois.edu - <https://nmlab.npre.illinois.edu/>

11 November 2020

ACDIS Seminar Series

Submarine strategic stability

- An increasing number of countries can acquire or expand sea-based capabilities.
- Violent contact between ballistic missile submarine (SSBNs) may occur even in peace time.
- Submarine stealth depends on technology and geography.
- Emerging technologies could undermine submarine-launched ballistic missiles (SLBMs) stealth and hence survivability.





USS *Annapolis*, a *Los Angeles* class nuclear powered attack submarine, launches a Tomahawk missile. PO1 RONALD GUTRIDGE/DVIDS

Submarine-launched ballistic missiles carry about half of the US deployed strategic warheads

Submarine modernization

“The 12 Columbia subs will eventually carry 70 percent of the nation’s nuclear weapons, so any gap between the Ohio retirements and new Columbias could have a serious impact on the nuclear triad.” Breaking Defense

General Dynamics Electric Boat awarded \$9.5 billion by U.S. Navy for Columbia-class submarines

November 05, 2020



RECENT NEWS

[General Dynamics Electric Boat awarded \\$9.5 billion by U.S. Navy for Columbia-class submarines](#)

[General Dynamics Awarded \\$4.4 Billion Department of Defense Enterprise Cloud Contract](#)

[General Dynamics Reports Third-Quarter 2020 Results](#)

SHARE THIS ARTICLE/EVENT:



ELECTRIC BOAT

Past and Current Stability

- 800 **deployed and nondeployed** ICBM and **SLBM launchers** and nondeployed heavy bombers equipped to carry nuclear armaments.
- 700 **deployed** ICBMs, deployed SLBMs, and deployed heavy bombers equipped to carry nuclear armaments.
- Maximum 1,550 deployed warheads on deployed ICBMs, deployed SLBMs, and deployed heavy bombers equipped for nuclear armaments (each such heavy bomber is counted as one warhead toward this limit);.



Russia's nuclear triad

- Russia is clearly determined to maintain the components of its nuclear triad
- "Although the nature of military threats is changing, it is the nuclear triad that remains a key guarantee of Russia's military security and, if one takes a broader look, of global stability," V. Putin, Nov 10, 2020
- In April 2019, Russia launched the Project 9852 Belgorod, a submarine that can launch the Status-6 torpedo



RUSSIAN NEWS AGENCY

10 NOV, 08:55

Nuclear triad makes attempts at blackmailing Russia futile, says Putin

The president said that some of Russia's weapon systems were far ahead of those at the disposal of other leading military powers



© Ministry of Defence of the Russian Federation

Pakistani “credible minimum deterrence”

- The **Pakistan** Navy five diesel-electric submarines and three MG110 mini submarines.
- In 2016, Pakistan finalized a deal with China to loan eight attack submarines (2023).



French Agosta-70 submarine *Ouessant* at Brest in 2005

AEROSPACE AND DEFENSE JANUARY 9, 2017 / 7:05 AM / UPDATED 4 YEARS AGO

Pakistan fires 'first submarine-launched nuclear-capable missile'

By Reuters Staff

2 MIN READ



ISLAMABAD (Reuters) - Pakistan fired its first submarine-launched cruise missile on Monday, the military said, a show of force for a country that sees its missile development as a deterrent against arch-foe India.

Indian Navy

- The Indian fleet includes fourteen diesel powered submarines and two nuclear powered submarines.
- In 2017, India started building six new Scorpène class vessels in partnership with a France's Naval Group.
- The official Indian policy is to keep nuclear warheads de-mated from actual missiles.
- The INS Arihant carries 12 Sagarika (K-15) SLBMs with a range of around 700 km and nuclear-capable Nirbhay cruise missiles.
- India and Russia signed a deal in 2019 for a lease of an Akula class for 10 years to India (2025).



INS Arihant stationed at the naval warehouse in Visakhapatnam in 2014. |
Photo Credit: [Reuters](#)

New missiles for the 75th party anniversary in the DPRK

North Korea Unveils New Weapons at Military Parade

North Korean leader Kim Jong Un has warned that his country would fully mobilize its nuclear force if threatened as he took center stage at a military parade that unveiled what appeared to be a new intercontinental ballistic missile and other weapons.

By Associated Press, Wire Service Content Oct. 10, 2020, at 10:49 p.m.



- DPRK submarine fleets includes 64 to 86 submarines (one diesel-electric ballistic missile submarine known as the Gora-class).
- North Korea's submarines are used for espionage and infiltration.
- The Gora relies on diesel-electric engines and lacks an Air-Independent Propulsion system, the submarine can only remain submerged for a few days.

Differences in SLBM survivability

- Permissive Action Links or 'PALs' are devices designed to prevent the unauthorized use of nuclear weapons.
 - “Whether it's India or Pakistan or China or Iran, the most important thing is that you want to make sure there is no unauthorized use. You want to make sure that the guys who have their hands on the weapons can't use them without proper authorization.” — Harold Agnew, former director of Los Alamos National Laboratory
- Adversary nuclear submarines often come very close to violent collisions by engaging in mock attacks.
- Traditional ultrasound detection would not be able to detect submarines, even if noisier than the U. S. SSBNs, as long as they do not go through chokepoints to get within range of their missiles' targets.

Risk of conflict escalation

- “an extremely dangerous, but exhilarating, running game . . . that American and Soviet ships have been playing with each other for many years during the Cold War”
Admiral Elmo Zumwalt
- Similar “exercises” may have caused several submarine accidents.
- “greatest source of loss for submarines was a flood (21%) followed closely by collision (18%)”
Tingle, 2009

BBC news

Abhinandan: Captured Indian pilot handed back by Pakistan

🕒 1 March 2019

Kashmir tensions



Wing Commander Abhinandan Varthaman was handed over to Indian officials near a border crossing with Pakistan

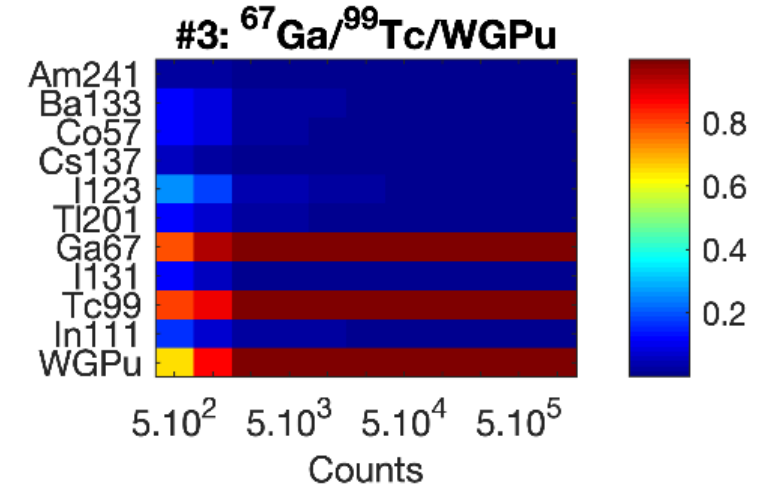
Pakistan has freed an Indian fighter pilot captured after his plane was shot down in Pakistan-administered Kashmir.

The most survivable nuclear weapons?

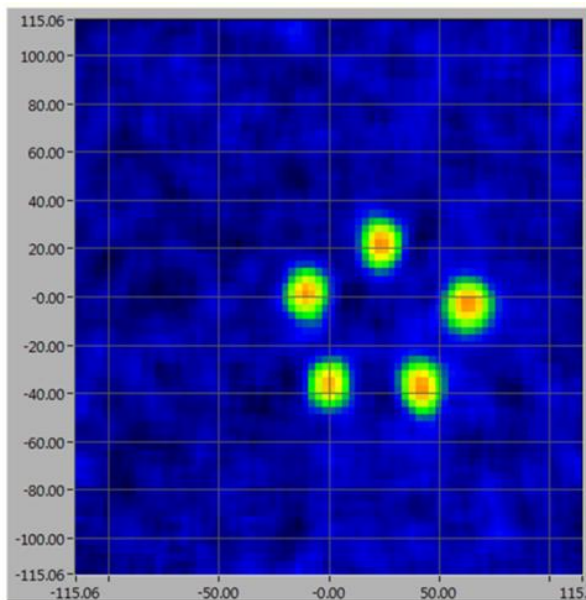
- “Silent Service” can stay submerged for months and move undetected while on patrol.
- Russian and submarines technologies are not secure from U.S. detection in the open ocean and are kept in confined areas (Bastion strategy).
- Survivability depends on technology and geography.
- Noisy submarines, while not crossing choke points to get within target range may be undetected by ultrasound systems.

Technologies enabling verification

Radiation portal monitors

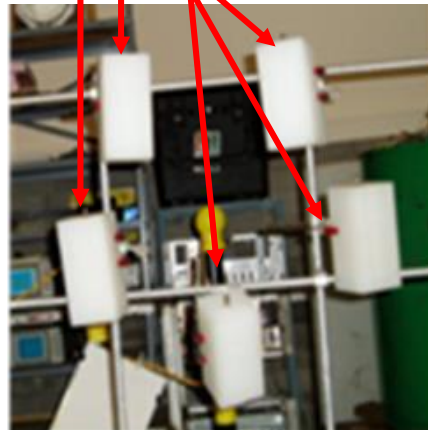


Altmann, Y., Di Fulvio, A., Paff, M.G. *et al.* Expectation-propagation for weak radionuclide identification at radiation portal monitors. *Sci Rep* **10**, 6811 (2020).



Istvan Dioszegi, UM, 2017

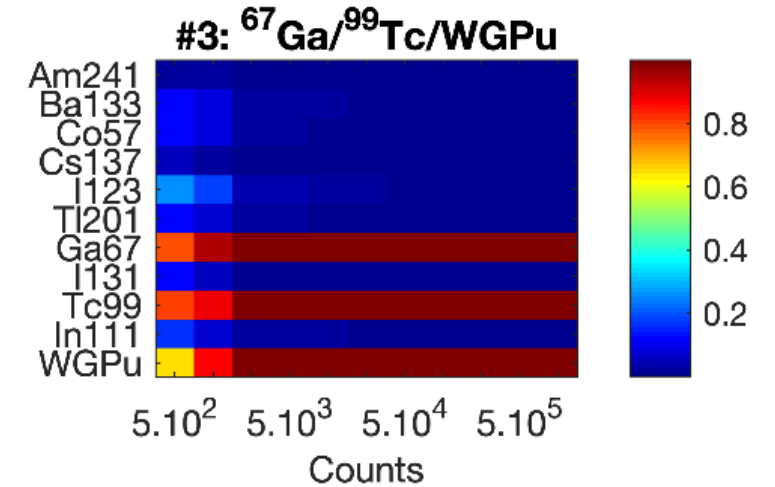
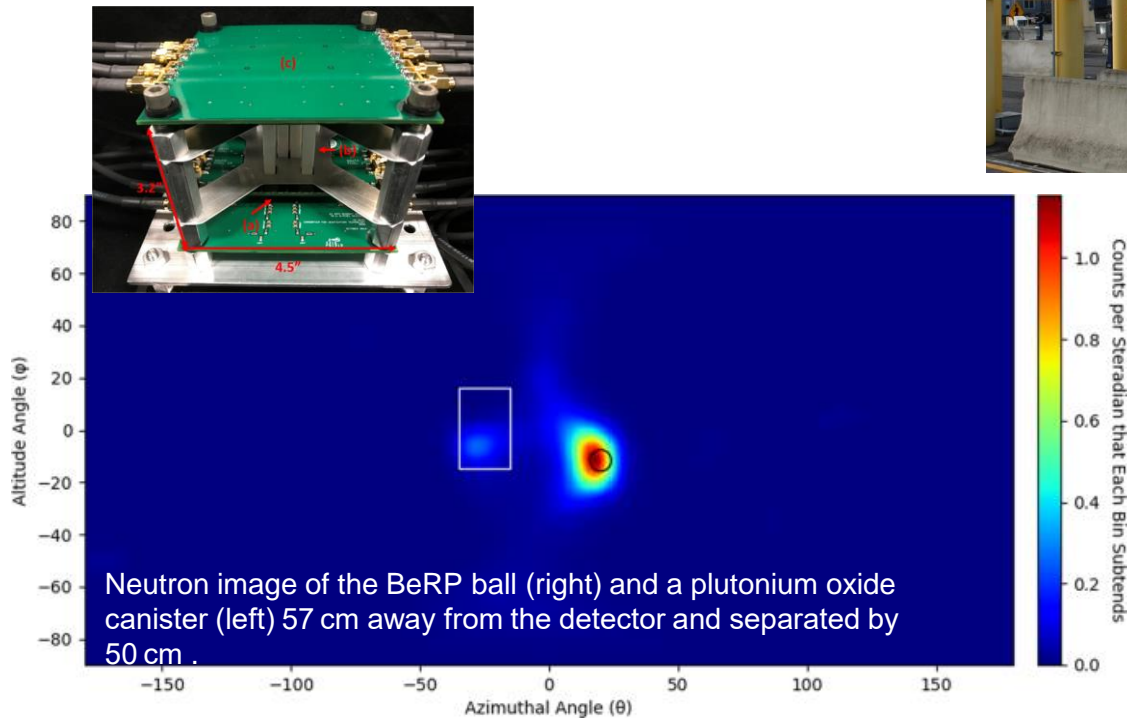
Sources



Thermal and fast neutron imagers

Technologies enabling verification

Radiation portal monitors



Thermal and **fast** neutron imagers

Steinberger, W.M., Ruch, M.L., Giha, N., Di Fulvio, A., Marleau, P., Clarke, S.D., Pozzi, S. A. Imaging Special Nuclear Material using a Handheld Dual Particle Imager. *Sci Rep* **10**, 1855 (2020).

Conclusions

- Countries other than NATO and Russia are gaining access to nuclear-missile carrying capabilities
- The strategic stabilizing effect of nuclear submarines should be reconsidered because:
 - Availability of nuclear armed submarines could contribute to conflict escalation
 - Submarine safety greatly varies among countries
 - Stealth depends on technology and deployment location
- Technology exists that could contribute to enabling future agreements, e.g., on mutually exclusive patrol zones.

References

- Arkin, W. M., & Kristensen, H. M. (n.d.). Enduring Misconceptions of Strategic Stability: The Role of Nuclear Missile-Carrying Submarines. Retrieved from https://fas.org/category/nuclear_weapons/
- Brixley-Williams, S., & Naughton, C. (2016). Impact of Emerging Technologies on the Future of SSBNs. Retrieved from https://basicint.org/wp-content/uploads/2018/06/Pugwash_SSBNs_ConferenceReport_v8.pdf
- Congressional Research Service. (2020). *Arms Control and Nonproliferation: A Catalog of Treaties and Agreements*. Retrieved from <https://crsreports.congress.gov>
- Cote, O. R. (2019). Invisible nuclear-armed submarines, or transparent oceans? Are ballistic missile submarines still the best deterrent for the United States? *Bulletin of the Atomic Scientists*. <https://doi.org/10.1080/00963402.2019.1555998>
- Glasser, R. D. (1992). Enduring Misconceptions of Strategic Stability: The Role of Nuclear Missile-Carrying Submarines. *Journal of Peace Research*. <https://doi.org/10.1177/0022343392029001003>
- Kristensen, H. M., Norris, R. S., & Diamond, J. (2018). Pakistani nuclear forces, 2018. *Bulletin of the Atomic Scientists*. <https://doi.org/10.1080/00963402.2018.1507796>
- Lewis, J. G., & Tertrais, B. (n.d.). The Finger on the Button: The Authority to Use Nuclear Weapons in Nuclear-Armed States. *James Martin Center for Nonproliferation Studies*.
- Mian, Z., Ramana, M. V., & Nayyar, A. H. (2019). Nuclear Submarines in South Asia: New Risks and Dangers. *Journal for Peace and Nuclear Disarmament*. <https://doi.org/10.1080/25751654.2019.1621425>
- Panda Ankit. (n.d.). US Confirms Fielding of New Low-Yield Nuclear Warhead on Submarine-Launched Ballistic Missiles. Retrieved from <https://thediplomat.com/2020/02/us-confirms-fielding-of-new-low-yield-nuclear-warhead-on-submarine-launched-ballistic-missiles/>
- Shutton, A. (n.d.). China And Russia In Mysterious New Submarine Project. Retrieved August 28, 2020, from <https://www.forbes.com/sites/hisutton/2020/08/27/china-and-russia-in-mysterious-new-submarine-project/#11a74c671629>
- Singer, C. (2017). *Is a Naval Nuclear Arms Race with China Inevitable*.
- Tingle, C. 2009. "Submarine Accidents A 60-Year Statistical Assessment." Professional Safety, September.
- U.S. and China Are Playing 'Game of Chicken' in South China Sea. (n.d.). Retrieved from <https://www.nytimes.com/2018/11/08/world/asia/south-china-sea-risks.html>
- US, Russia swap accusations after high seas 'game of chicken.' (n.d.). Retrieved from <https://asiatimes.com/2019/06/us-russia-swap-accusations-after-high-seas-game-of-chicken/>



PHYSICISTS COALITION FOR NUCLEAR THREAT REDUCTION

www.aps.org/policy/nuclear

Questions? |