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Beyond the jargon on AUKUS

A Nuclear Submarine 101

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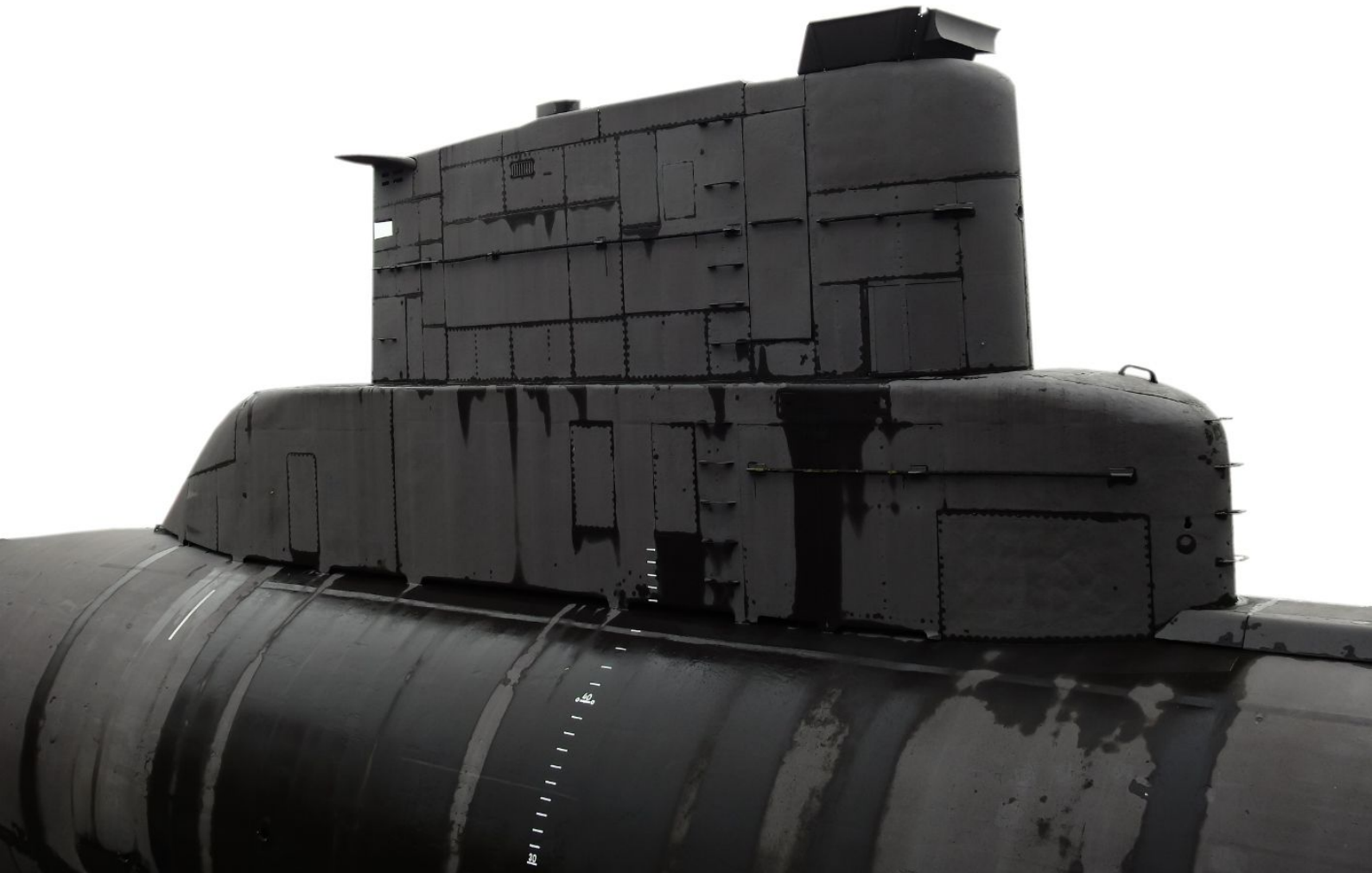

In this written interview, **Vice Admiral RN Ganesh (Retd)**, adjunct faculty with the National Institute of Advanced Studies (NIAS) Bengaluru; former Director General of the Indian Nuclear Submarine Programme; and former Commander of the Indian Navy's Andaman and Nicobar Command, responds to questions posed by **Siddharth Anil Nair**, Researcher, IPCS.

1 What is the difference between a nuclear-powered submarine (SSN) and a nuclear submarine?

The term 'nuclear-powered' means that the submarine in question derives its energy for propulsion from nuclear reactors. It may not necessarily be carrying nuclear weapons. This emphasis is important because the common perception is that a nuclear submarine must by definition be armed with nuclear weapons: i.e., be a nuclear-armed submarine. Nuclear weapons pre-date nuclear propulsion, and the early nuclear-armed submarines were in fact diesel-powered.

2 What additional technologies must be considered in the underwater application of nuclear power?

There is no difference between the power plant design of a surface ship and that of an SSN. However, certain other technologies are necessitated because of the submarine's hostile operating medium.

Any overboard discharge, particularly from the reactor cooling systems, has to be highly pressurised since the discharge is against the sea pressure right up to its maximum diving depth. This has led to tremendous research and development in materials such as steel and rubber, and particularly in special applications such as valve technology. A submarine's space constraints also call for a huge effort in miniaturisation. Of particular importance is the accessibility of equipment and systems. As a result, layout design has become a specialisation in itself.

Finally, like other conventionally-powered submarines, the reactor and its peripheral machinery are designed to make as little noise as possible. Heavy machinery such as generators, propulsion turbines, and main recirculating and cooling pumps are mounted on cradles. These cradles are insulated from the hull to minimise radiated noise that would otherwise make the submarine susceptible to detection. Silencing and prevention of hull noise therefore is a major and often limiting factor in the design of all submarine machinery.

3 Do nuclear-powered submarines provide advantages over their conventionally-powered counterparts?

Yes. The most significant impact of nuclear technology has undoubtedly been the lifting of battery-imposed restrictions. Conventional submarines are dependent on batteries that require periodic charging (at least once in 2-3 days). The need for battery charging forces the submarine to rise to periscope depth, raise its snorkel mast, and operate the main diesel generators. Depending on battery age, this could take a modern submarine several hours to bring it to full charge. The enforced time spent at snorkelling depth exposes a submarine to ship and aircraft radars. This is a major vulnerability. In the absence of batteries, there is no need for periodic running at periscope depth to take in air for running the diesel generators, thus adding to the platform's stealth.

The other key advantage is speed. While on patrol, the conventional submarine's overall speed and the time it spends at maximum speed are limited. Their low speeds force them to lie in wait for the enemy outside the latter's harbours, or in defensive mode, outside friendly ports. SSNs are free to operate at any speed that tactical considerations permit, and their endurance enables their deployment several thousand kilometres from base. They can, in fact, intercept warships anywhere at sea; trail a carrier battle group for an indefinite period; and carry out an attack at an operationally dictated time.

Finally, an SSN generates its own oxygen by electrolysis of seawater, and makes unlimited fresh water for the submarine and its crew. This has made it possible to increase submarine size and improve living conditions on board, which has the operational spin-off of better submarine patrol endurance.

An SSN, with its mobility and speed, can pose a threat to a potential adversary over a large area. Knowledge of the presence of a nuclear submarine can be a deterrent against an adversary's deployment of surface units in the area.

4 How would the Australia-UK-US (AUKUS) technology transfer take place?

'Transfer of technology' is a popular phrase but it is extremely misleading. 'Purchase of technology' is more accurate. Such transfers take place only when the receiver is willing or

is compelled to pay the high price demanded, or the supplier seeks some other benefit, often political.

India benefited a great deal from technology from the USSR. That was in the years of 'friendship and cooperation'. Things could be changing now with New Delhi's apparent tilt towards the US, and Russia's increasing cooperation with the Chinese. Still, however strong the relationship, no prudent country offers its top-drawer technology to another, because there is no permanence in international relations, except in rare cases like the US-UK relationship.

The AUKUS case is totally different: this is a pact originated by the supplier to further its strategic agenda, and to secure an ally close to its area of strategic interest. Australia has been suddenly taken into the US-UK fold and will presumably receive special treatment. The transfer in this case is not likely to follow familiar patterns, because the 'transferrer' will play a major (and decisive) role in the application of the technology that is being transferred. So whatever the agreed terms and conditions are, it can have no similarity to any other transfer nor be treated as an exemplar of such a transaction.

5 How long could the first Australian SSN take to be commissioned?

An Australian SSN is still some ways off. Several things have to take place before a country is ready to even berth and maintain a nuclear submarine. This will take years, and the impact will not be felt for about a decade. As per the AUKUS declaration, the US and the UK will establish nuclear submarine-building capabilities in Australia. Infrastructure creation is the first step. Not only the crew, but engineers, ship repair, and maintenance personnel ashore have to be trained.

In the meantime, neither Washington nor London have spare submarines to give to Canberra. The US' own submarine-building programme, specifically the Virginia-class that is intended to replace the Los Angeles boats, has proceeded rather slowly according to reports. Even if the US decides to transfer an SSN in the near future, it will take an already trained submarine crew about a year to adapt to this new technology. Finally, no details have been disclosed about how the proposed creation of a nuclear submarine fleet will take place.

6 What would Australian SSNs mean for geostrategic dynamics in the Asia-Pacific region vis-à-vis China?

An Australian submarine being deployed by itself is not relevant to China—it matters little whether the nationality is American, British, or any other. What does matter is that the SSN's time-on-task (period a unit is engaged in a mission) will increase by several weeks because of Chinese bases' relative proximity to probable patrol areas. It is thus the number of submarines deployed, and their time-on-task, that may concern China. The US and UK could have achieved the same results by basing their own SSNs in Australia. What AUKUS has done is send a clear signal that there is a tight alliance among the three states, and that the US will get all the support it needs from it.

China would be concerned with the quantum of force deployed by adversaries. This would essentially include any Australian unit (as and when it materialises) as part of the units that are undoubtedly already deployed. The Chinese reaction to an increase in volume would be to intensify its own reconnaissance patrols, stay updated on deployment areas and patterns, and build databases for operational planning. Their main problem would be limited SSNs: they have about six in active service and an equal number under construction. The AUKUS development may accelerate their SSN programme.

Just as an increase in the number of hostile nuclear missiles in the East China Sea and Western Pacific will be an unwelcome development for China, that same calculation would be valid for SSNs.

7 How could an AUKUS submarine impact the military balance of power in the Indian Ocean Region?

The balance of power will be unchanged. It will always be skewed in favour of the US and its allies because of their immense resources and superior technology. Injecting more nuclear submarines in the arena will only tilt the balance further towards the US side. Further, China lacks large-scale warfighting experience, especially in sea and aerial warfare.

For these reasons, Beijing will not embark on a frontal conflict that can escalate even within the conventional domain. For smaller and shorter skirmishes, the Chinese will have initial superiority because of the geographic proximity of their bases. This is particularly relevant to air power. This superiority however will soon be neutralised by US sea-based counter air operations.