Global association for indigenous manufacture of critical technology systems in submarine construction program of Indian navy

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Abstract

Indian Navy has embarked upon an ambitious fleet expansion and modernisation program The Indian Ocean region remains a key maritime policy driver for India. Indian Prime Minister Narendra Modi declared during the International Fleet Review at Visakhapatnam, India in February 2016, that the Indian Ocean Region remains his government's priority. Prime Minister Modi further underlined the need for a "modern and multi-dimensional Navy".

Indian Navy has already established itself as a 'Builders' Navy' with a majority of its warships being built indigenously. India has launched itself in the select league of few nations capable of building an Aircraft Carrier and a Nuclear Submarine. Its nuclear submarine building programme is well underway in a series production model. The first indigenously built Aircraft Carrier, INS Vikrant, is planned for induction in the Indian Naval Fleet in year 2018. Indian Navy has already started concept design of the second indigenous aircraft carrier, INS Vishal. Therefore, it can be concluded that the surface ship construction programme of Indian Navy is fairly mature. However, a submarine plays a vital role in sea denial and sea control roles of a nation. Therefore, in pursuance of the role laid down in the Maritime Security Strategy Document, published by the Indian Navy in year 2015, Indian Navy is also laying equal emphasis on indigenous submarine construction

Indian Navy has planned a fully indigenous submarine construction programme, christened P75 (I). The P75 (I) project will see fully indigenous design with technology transfer from a global technology leader. With an outlay of about INR. 60000 Cr (USD 10 Billion), this programme has attracted global submarine building nations in offering their technologies for this programme. Further, Indian Navy is laying due thrust on indigenous development of critical technologies involved in this programme.

The P75 (I) project throws open opportunity in indigenous development of new technology equipment for P75 (I). The aim of this paper to dwell upon some of the technologies that can be offered to Indian Navy for its indigenous submarine construction programme P75 (I) in a model involving 'Globalisation and International Trade'. The paper will outline a roadmap for manufacturing high technology equipment and systems within the country for this project.

Introduction

The first decade of the 21st century has witnessed sweeping changes and considerable turbulence in the Indian Ocean Region (IOR) in areas of India's national interest. India has made major strides in her developmental goals during this period and its role as a responsible player on the global stage towards promoting peace, stability and development, has been recognized in the international arena. Therefore, the Indian Navy has a key role to play in meeting the maritime components of these challenges, which have been increasing in both scale and scope in recent years.[1]

The International Fleet Review (IFR) in February 2016, hosted by India's Eastern Naval Command at Visakhapatnam, underlined Indian Navy's growing ambitions and prowess. Indian Prime Minister Narendra Modi declared during the IFR that the Indian Ocean Region

remains his government's priority. Prime Minister Modi further underlined the need for a "modern and multi-dimensional Navy". [2]

To fulfill the role entrusted to it of playing a strategic role in IOR, Indian Navy embarked upon an ambitious fleet expansion plans in the first decade of this century. Further, the Indian Navy moved from 'Buyers' Navy to Builders' Navy a long time ago when it established its indigenous warship design and construction capabilities way back in 1990s with the induction of Delhi Class Guided Missile Destroyers built at Mazagon Dock Ltd. (MDL), Mumbai.[3]. Around same time, Indian Navy set up a dedicated submarine design directorate and commenced preliminary design of a nuclear submarine with 'technology transfer model' from Russia. The first submarine 'INS Arihant', commissioned into Indian Navy in year August 2016, saw mostly the adaptation of Russian Design. However, Indian Navy laid due thrust on development of equipment and systems indigenously. A large number of systems going into this submarine are supplied by Indian manufacturers. Indian Navy has continued its drive of attaining self-reliance and increasing levels of indigenisation are witnessed in the follow on submarines of this programme.

Parallelly, to bolster its ageing submarine fleet, Indian Navy concluded a contract with a French company, DCNS, to construct Scorpene class submarines. INS Kalvari (S50) is the first of the Indian Navy's six Kalvari-class submarines being built in India under Scorpene programme. It is a diesel-electric attack submarine which is designed by DCNS (French naval defence and energy company) and being manufactured at Mazagon Dock Limited in Mumbai. The construction of lINSKalvari started on 1st April 2009. The project encountered delays and the submarine, launched on 6th April 2015, is expected to be commissioned in June 2017.[4]The balance five submarines are planned for induction into service by year 2020.

Although the Scorpene class submarines are built within the country, its design as well as major equipment fit is French. Further, there is no concept of enhanced indigenisation levels in follow on submarines of this class. It may be noted that there is a mandatory requirement of increasing indigenisation in successive vessels of the same class in the shipbuilding programmes of the Indian Navy. Even the Arihant class submarines are witnessing increased indigenisation levels with each follow on submarines. But, Indian Navy was not able to achieve significant indigenisation levels in Scorpene programme due to certain performance and warranty/ guarantee related issues raised by French designers in indigenous equipment. Even though the issues were trivial, Indian Navy could not make the French Designers accept Indigenous equipment and systems.

The two submarine construction projects mentioned above, have given India the wherewithal to build submarines in a completely indigenous way, as has been followed for construction of warships. Therefore, with this backdrop and driven by Prime minister Modi's 'Make in India' initiative, Indian Navy announced its intent of building six submarines christened P 75 (I) in an Indian shipyard, probably a private yard. The project has been allocated funds to the tune of Rs. 64,000 Crore. The winning Indian shipyard will be totally responsible for the entire programme and is free to scout for technology globally in areas where it lacks in-house expertise.[5]

Submarine Building Technologies

A submarine is a lethal weapon with its ability to prowl undetected underwater. At the same time, submarine is a sitting duck when on surface. Therefore, a submarine is designed to remain underwater for as long a duration as possible. Further, submarine should be capable of operating at deeper depths to avoid detection by shipborne underwater sensors 'SONAR'. Therefore, ideally, a submarine is more effective if it can remain at deeper depths indefinitely. But there are technological limitations for a submarine to remain submerged for longer durations. The conventional propulsion systems using diesel engines need oxygen for operation. Therefore, a submarine uses large battery banks to run propulsion motors and other systems & equipment when underwater. The submarine surfaces only for charging battery as oxygen is required for running its generators, and in turn, charging the batteries. Once the batteries are charged, submarine dives

again. Nuclear reactors do not need oxygen and, therefore, a nuclear submarine can remain underwater for longer durations. Second factor forcing a submarine to surface is human. Oxygen is needed continuously for submarine crew. When submerged, the air inside submarine is purified. But there is a limit to purifying the trapped air and periodically submarine is required to surface to refresh the air inside it.

World over, researchers are working on technologies that can enable submarine to remain deeper and stay underwater for longer durations. A nuclear submarine is not preferred due to following: -

- Prohibitive costs
- Risks involved with nuclear power operating in confined spaces under tremendous pressures

Therefore, the natural choice is ability to design a conventional submarine that can operate at deeper depths remaining underwater for a longer time. The key technologies are as follows: -

- Steel for the pressure hull to withstand higher pressures at higher depths
- A propulsion system capable of operating independent of Air (called Air Independent Propulsion (AIP)

Indian Navy's P75 (I) project specifications also lay down stringent requirements in these aspects of submarine operations. Indian Navy identified the above technologies and have formulated its requirements centered on these. The qualifying shipyards must acquire above technologies either indigenously or globally for technically qualifying for this project.

Another crucial challenging area for Indian industry is propulsion motors of a submarine. Any Indian manufacturer able to produce submarine propulsion motors within the country, most likely in collaboration with a global technology leader, will have a huge commercial advantage and will, therefore, be the preferred partner of the winning shipyard of P75 (I) project. Needless to state, this will give tremendous boost to 'Make in India' initiative of the country, in addition to having several technological offshoots in civilian industry.

The option of ab-initio research into defence technologies is time consuming and, therefore, ruled out. Further, Indian Navy will discourage outright buying the technology and remaining dependent upon a foreign supplier for life cycle support. Therefore, the natural choice is adaptation of global collaborative approach and manufacturing the equipment & systems in the country. Therefore, there is a strong case ofglobaoisation in these vital areas.

Therefore, it is of vital importance that the Indian industry gear up to manufacture suitable steel, AIP and propulsion motor under a collaborative model. The Indian manufacturer will manufacture the equipment in India with hand holding by a global technology leader

Indian Navy, L&T and 'Globalisation'

For Indian Navy, 'Globalisation' has been the keyword in its fleet modernisation and expansion programmes. The 70s and 80s saw induction of a number of small, medium vessels and frontline Destroyers inducted from USSR. While USSR and, subsequently, Russia remained the main global power of support, Indian Navy expanded its collaboration with western countries also. Today, collaboration with Israel has also touched a high mark. Induction from equipment from other western countries also continued.

In the recent past, the country has seen a spurt in relations with USA in critical technology areas, including Defence. Indo-US strategic relations are being spearheaded at the highest levels in the past couple of years by none other than Indian Prime Minister, Mr. Narendra Modi and US President, Mr. Barak Obama. Christened as 'Sanjha Suraksha', this cooperation is viewing strategic actions towards world peace.[6]

The EAIC (Electrical & Automation Independent Company) Marine Business of Larsen & Toubro (L&T) has been associated with Indian Navy for more than decade in import substitution, The EAIC Marine Business has establishedindigenous capability for manufacturing equipment &

systems within the country. Towards this goal, L&T adopted globalisaton model and associated with technology leaders worldwide in acquiring the know-how to build the equipment indigenously. The partnership model ensured win-win commercial terms for all the stakeholders, viz. global partner, L&T and Indian Navy. Some of the technologies, indigenised for the Indian Navy using this model are listed below.

Degaussing System - Collaboration between L&T and TUS, France

L&T and Thales Underwater Systems (TUS), France, collaborated in areas of magnetic stealth of a warship. L&T identified TUS and entered into an association with it in year 2005 to develop in-house capability for design & manufacturing 'Degaussing Equipment' in the country. Today L&T is fully capable of supporting Indian Navy with in-house resources in areas of magnetic stealth. This is classic example of global cooperation.

Ship Control System - Collaboration between L&T and Servowatch, UK

L&T embarked upon transfer of technology from a UK based technology leader, Servowatch Systems, in year 2007. Subsequently, L&T acquired Servowatch and. today, Servowatch is a cent percent subsidiary of L&T. L&T is supporting Indian Navy in areas of ship control systems with compete in-house capability. Another classic case of globalisation.

Scope of the Study

- Identify Indian companies, organisations, research agencies and Academia having expertise in areas of submarine technologies. The areas are Propulsion Motor, Air Independent Propulsion (AIP) system and high strength steel.
- Interact with Indian Navy and Ministry of Defence, being major stakeholders in the entire exercise, for modalities for undertaking development projects.
- Carry out a detailed feasibility study to elaborate upon the following steps: -
    - Market research in identifying global partners
    - Estimation of financial outgo and funding methodology. This is a crucial step.
    - Develop a financial model that will ensure profitability to all the stakeholders, the principal technology partner and Indian industry players
- Carry out detailed study on impact of these technologies on Indian economy.
- Identify avenues for further research and employment generation as the technology areas are new and have a potential for skilled youth in areas of design, manufacturing as well as undertaking further and focused research.

Objectives of the Research Paper

- Elaborate upon the need for undertaking manufacturing within the country for the warship and submarine equipment to support Indian Navy's Indigenisation drive in line with Make-in-India initiative.
- To elaborate upon the need for developing vital submarine technologies listed above within the country so as to achieve true indigenisation in P75 (I) project.
- Understand the significance of Globalisation Approach in indigenous development of the above technologies

Research Methodology

The research methodology will involve mix of Exploratory and Descriptive Research. The steps involved are as follows: -

- Carry out a thorough literature survey in associated technical and financial areas of submarine motors
- Carry out survey of Indian industry with an aim to identify established high power motor manufacturing set-up

- Identify global technology leaders and interact for collaboration in areas of propulsion motors and AIP
- Interact with CII, Ministry of Defence and Indian Navy in identifying potential collaboration partners, within the country as well as globally
- Evolve a financial model for technology transfer from global technology leader
- Evolve a roadmap for indigenous manufacture of propulsion motors and equipment of AIP within India

Discussion points

While the authors intend to undertake details research study for defining a roadmap for indigenous development of submarine technologies listed above, the immediate discussions points are as follows: -

- Motor technology with induction of new technologies viz. permanent magnet motors, linear motors, use of super conductors in motors, motors operating at higher voltage (up to 6.6 Kilo-Volts), high power motors up to 15 Mega-Watts and associated power management systems
- AIP technologies and possibility of global association for manufacturing within India
- High strength steel and forging/ welding technologies for manufacturing pressure hull of a deep water submarine in India

Limitations

- Research study will have to start from scratch as not adequate literature is available
- Significant funding requirement
- Support from Ministry of Defence and Indian Navy in achieving collaboration between Indian Industry and foreign technology leader

Conclusion

Indian Navy has achieved indigenous design and warship building capability catapulting the country in a league of select few nations capable of building aircraft carrier and nuclear submarine. However, a lot is to be achieved in in-country manufacturing of warship equipment. Make-in-Indian initiative has evoked enthusiastic response in taking up indigenous manufacturing of high technology equipment within the country. DPP-2017 has laid emphasis on providing level playing field to the private sector in defence manufacturing. The logical step now is in achieving global collaboration for creating capability within the country in critical defence technology areas so as to help achieving Life Cycle Support from within the country. It makes financial sense as well. Collaborative approach is the only way forward in this direction as has been demonstrated by the EAIC Marine Business of L&T in indigenisation of ship control system and magnetic stealth equipment for the Indian Navy. Indigenous development of submarine technologies in consonance of the built schedule of the P75 (I) project following globalisation model is the need of the hour. It will help the country in achieving total indigenisation in the critical technologies of submarine building. The technological off shoots of the research study will have impact in a number of technology areas. Last, but not the least, the developed technologies have significant export potential

Recommendations

Indian Industry should undertake urgent capability building in areas of technologies for supporting P75 (I) programme indigenously. It may need establishing a consortium of Indian Industry, Research agencies and Academia, duly supported by a Global Technology Leader. The technologies should be developed in line with the build schedule of P75 (I) submarine programme. It has significant export potential and will give the country a strategic edge in naval warfare and establishing Sea Control and Sea Denial capability across not only Indian Ocean but also Pacific Ocean.

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