

WARSHIP RETRO-FITMENT: A ROAD MAP FOR TRANS NATIONAL ENGAGEMENT IN INDIAN OCEAN REGION

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The objective of this paper is to present the concept: 'Use India's edge in providing low cost engineering solutions, to make India a hub in Indian Ocean region for Naval Ship Repairs' (henceforth referred to as retro fitment i.e.:- complete change of propulsion /machinery/sensors). The advantages of a vast skill pool and lower costs can greatly leverage the Indian Navy's footprint among Navies of IOR and become a tool for international co-operation. As a spinoff of such a policy, the players in the warship repair market will become more competitive and ship repairers will find a bigger foothold in the international defense industry.

KEY WORDS

Ship-repair, Retro-fitment, Midlife-Update, Warship, International Co-operation, System Re-Engineering.

INTRODUCTION

The *shipbuilding-industry* and *Indian Navy* pursue the common goal of achieving *maritime-dominance*¹, this calls for pooling of *national resources, human manpower* and *material*. In a nation-state, the uses of these three elements are inextricably linked, because to secure these resources it is necessary for society to channelize its efforts. Thus, the resources that ship repair industry or Indian Navy is able to obtain, is a function of the premeditated institutional/sovereign support it generates for each other².

In India as well as the navies of Indian Ocean Region (IOR), the need to opt for retro-fitment of warships is driven by the urgent need to bridge capability-gap for benign / constabulary role of a navy. The faster method of getting a replacement is by retro-fitment of new generation equipment on an earlier generation vessel to increase the platforms' Availability, Reliability and Maintainability (ARM). The three major costs that go into ship building program are namely; cost of first of class, unit cost of production and *through life cycle cost*³. The decision to retrofit a ship or not, is based on the third factor i.e.: *through life cycle cost*. Retrofitting is a prudent solution, when the cost of maintaining an older generation vessel through its residual life, outweighs the cost of replacing its machinery with a newer and more reliable one. Retro-fitment of an old naval ship due for its midlife-update, uses a solution led (bottom up) approach, instead of requirement led (top down) approach⁴. This bottom up concept causes drastic shrinkage in budget and time, leading to early operational availability of a refurbished warship with new technology.

SCOPE FOR RETRO-FITMENT

Shipbuilding activity is higher in the value chain and less labour intensive, therefore shipbuilding business is largely dominated by the developed nation. On the other hand, developing

countries like India have a natural advantage due to lower wages in the ship repair business. The work of warship repair entailing retro-fitment is an activity, that requires not only an experienced workforce with insight into nuances of warship, but also support from peripheral industries capable of offering innovative engineering solutions at affordable cost. The business for retro-fitment / system re-engineering can be broadly classified into four different sub streams:

- The refurbishment of complete air-conditioning, ventilation (HVAC) and habitability. This is essential for keeping pace with improvement in living standards of crew. It is also required to cater for increased heat load generated by additional electronic sensors, added with passage of time on an old ship.
- The propulsion package and auxiliary equipment require change for reducing support cost of maintaining outdated technology. In addition, revision in rules for environmental pollution and safety regulations norms impresses the equipment change upon a ship from time to time.
- Re-vamping of the antiquated instrumentation used as Man Machine Interface (MMI) for equipments. (e.g.: By inserting Integrated Platform Management System technology). This measure for sensor up gradation is dictated by requirement of automation and added benefit of reduction in operating personnel.
- The rapid advance in technology requires upgrading of Navigation aid and sensors. The impetus for this change is more because of the constant review of threat perception or change in nature of adversary itself.

INDIAN SHIPBUILDING INDUSTRY

Shipbuilding shares a common industrial base with ship repair industry. Hence, the basic premise for arguing this papers vision 'To make India a hub for retro-fitment of warships in IOR' is derived on the strength of the promising growth as well as latent potential of the shipbuilding industry. As per reports⁵ during the 10th Plan period the growth in shipbuilding industry of India has been 72%, with an average rate of 15% growth per year. Hence, growth of shipbuilding in India has gone up from 4.5% to 15% per year in 10th Plan period. In the meanwhile, India's share in

the world market has gone from an insignificant low of 0.1% in the beginning of 10th Plan to 1.3% in 2006. The shipyards between them have 20 dry docks and 40 slipways with an estimated capacity of 281,200 DWT for shipbuilding usage. The major port trusts between them have 13 dry docks and 01 floating dock; there idle capacity can also be gainfully used for ship repair industry. The defence expenditure's share in the Rs 1800 crore / annum ship repair industry is Rs 100 crore approximately (Conservative estimates). This account for Indian Navy and Coast Guard ships repairs. This market share for repair in defence industry is only going to grow because, India as a regional power is aiming for an armada of 140 warships for Navy and additionally 130 vessels for the Coast Guard by 2022⁶. This growing armada, which is bought or constructed by navy from many parts of the world. Nevertheless, the ships ultimately need to be maintained on Indian shores itself, through out its entire life cycle.

TRYST WITH WARSHIP RETRO FITMENT

The technology that goes into a ship 'to move' her is changing at a rapid pace. The hull structure of a naval vessel has adequate residual life even at about 30 yrs of its life stage; this is due to advances in metallurgy. Whilst the main propulsion and weapon sensor are being out-manuevered by newer technology in about 15 years⁷. The total cost of ownership (TCO) of these old systems for purpose of maintenance, upkeep and support can outweigh the operational exploitation extracted from a non-reliable platform prone to repeated breakdown. Indian Navy has gained valuable in-house experience in retro-fitment of new systems on older ships. This was possible due to availability of technical expertise within country that can create the interface for meeting the re-engineering requirements of Indian Navy's warships. Over the turn of century, Indian Navy has proactively pursued modernization and tapped the potential for indigenization. It results have started trickling in the form of series of modernization projects. Wherein Navy retrofitted its Seaward Defense Boats with Deltic engine to MTU engine. Then a Landing Ship Tank vessel with Polish engine was successfully retrofitted with KOEL Engine and now an ASW Patrol craft with radial engine has been retro fitted with new generation MTU engine.⁸ The success story of weapon sensor up gradation to new generation Israeli Barak missile and the Indo-Russian-Brahmos missiles on older generation ships has been acclaimed and written by industry defense observers.⁹

Cost cutting measures are adopted by all navies when a viable alternative for maintenance of minimum force level is available. For example, presently USS Bunker Hill [CG-52] is being retrofitted at cost of US\$ 31 million from steam ship to an electric propulsion platform over 09 months. There is a shift in pattern, of ships being resurrected now. Similar ships in past era would have been, slogged until they were a non-viable or simply de-commissioned. The point to note is that even the US navy despite its economic might; it now opts for complete change of ship's propulsion package and does not scrap the hull. They use them as a prototype platform to tryout new technology, before introducing this new technology on the first of class of a new

project under production.¹⁰ In addition, the other major factor, which is an incentive for retro-fitment of old ship is that, 35 to 60 percent of U.S. ship cost is labour-related. By comparison, labour constitutes only 20–30 percent of the cost of Asian-built ships. Workers in U.S. shipyards receive an average of US\$18.08 per hour, whereas the hourly wage in Chinese shipyards averages less than US\$1.00; South Korean yards, US\$8.32; and Italian yards, US\$16.89.¹¹ Therefore, it makes economic sense to revitalise an old ship with good hull for patrol or peacekeeping role. It saves the cost of new hull fabrication by eliminating the time for pre-launch hull construction activity.

Difference in Commercial ships and Warships

Naval vessels is designed and built to perform at its maximum capability, across a wide range of demanding conditions. Only a handful of builders throughout the world engage in this demanding and highly specialized task. Therefore, naval vessels command premium prices compared with commercial vessels. The often-quoted benchmark for difference between commercial ships and warship is the higher coefficient of *Compensatory Gross Tonnage (CGT)*. A British study¹² shows that a Type-23 warship and auxiliary combat vessel with GRT of 4812 ton and 28812 ton respectively has a CGT factor of 8.15 and 2.65 respectively. This is higher than the most complex passenger liners of equal weight and size. The magnitude of *system complexity* for warships is the square of the value for a passenger vessel of similar tonnage. This is additionally multiplied by the *Customer Factor*, which is measured with a base of 1.00 for normal commercial contract, it is 1.06 for naval auxiliaries and a typical combatant ship has a factor of 1.12 to be loaded on to the tonnage of work. These co-efficient factored for meeting the additional complexities of warship, are required to be priced into a major re-engineering project.

Difference in Shipbuilding and Retro-fitment

The retro-fitment of ships is a labour intensive activity. It is a 'Craft-production' process vis-a-vis 'Mass-Production' or 'Lean-Production' methods used in shipbuilding industry today. The Focus in re-engineering work is on a single item rather than batch or queue synchronized flow. But an overall mastery of craft can reduces cost and increases efficiency in re-engineering work. The warship retro-fitment business strategy caters for customization and not economy of scale. Adaptability and innovation drives the niche segment of industry for retro-fitment. Hence, the challenge is to complete retro-fitment project successfully without cost and time escalation. Else, the project's viability over buying a new ship is lost. A well-executed retro-fitment project is a great confidence building measure on part of the ship repairer; it reflects his understanding about the intricacies / needs typical to a naval customer.

SCENARIO IN IOR

The criticality of the sea-lanes from the Persian Gulf to the Straits of Malacca is evident from the fact that, of the US\$ 200 billion worth of oil passing through the Strait of Hormuz annually, US\$ 70 billion of oil passes through the Straits of

Malacca, mainly bound for China, Japan and South Korea. Therefore, the amount of naval patrolling activity by maritime nations of this region is only going to increase, driven more by need for protecting trade than by any imminent hostility. Sir Julian Corbett, the British maritime strategist wrote: "Yes, it is true that the primary purpose of the fleet is to win the 'Big Battle'. But in the meanwhile, the great dramatic moments in history have to be worked for, and the first pre-occupation of the fleet is to interfere with the enemy's military, economic and diplomatic purposes." So even if bigger Navies of the world are shrinking. India, Pakistan, Sri Lanka, Singapore, Thailand, Malaysia all has expansion plans in IOR. We also need to factor in the supply of second hand ships from the larger navies like ours to littoral navies of the region. These old ships need to be refurbished / retro-fitted before offering as a reliable and cheaper alternative to other countries. To cite the latest case of this trend; An American warship USS McInerney (FFG-8) a 32 years old guided missile frigate after refurbishment at a cost of US\$ 65 million will be handed over to Pakistan.

In the Indian Ocean Region with the exception of India and perhaps China. The shipbuilding clusters of Singapore, Dubai, Malaysia, Japan or Korea will be not too keen to do business in a low volume trade for retro-fitment of warships. Nevertheless, the economic boom in Asia is going to witness growing aspirations for maritime projection and protection by all smaller nations. They all will seek out low cost solutions to build, as well as maintain their navy. It is herein that Indian shipbuilding industry can dovetail its low cost potential with the Indian Navy's experience with retro-fitment projects. This is compounded with the navy's strength of indigenous design expertise in shipbuilding at Directorate of Naval Design¹³. This combination of industry and Navy can play a significant role in furthering India's interest with the Navies' of countries in IOR. India should reach out and offer low cost and innovative re-engineering products i.e.: retro-fitment of old or second-hand warships. India should also enter this market like China, which has stepped into a similar role for increasing its reach with other regional navies. Research¹⁴ has shown that proximity of repair yard to the customer (in this case the regional navy) and pricing accounts for 61 % reason for giving a ship's repair contract. This factor is very high, unlike shipbuilding that gives the aforesaid discussed factors a mere 12 % weight age in the decision making process for awarding a contract.

China Factor

China has followed the other East Asian countries in the late 1980's to create the third largest shipbuilding industry. Korea (36%), Japan (24%) and China (17%) command almost 77% of world shipbuilding market totalling around US\$ 200 billion. The growth of Chinese shipbuilding industry is now becoming a challenge to almost all major shipbuilding nations. China is planning to become the leading shipbuilding nation with an aim to corner more than 30% global share by 2015.¹⁵ India is probably the only country that will be able to match the Chinese prices with its relatively low labour costs and industrial base for manufacture of equipment. For instance, the Chinese ship repair

& conversion reached RMB 24 bn in 2006, which represents a 40% annual increase and constitutes 10% of the global market. Also Chinese shipyard pricing is about US\$ 1200 to \$ 1400 per tonne of plate renewal, which compares well to high of US\$ 5000 to \$ 10,000 in Singapore¹⁶. A comparison with the ship repair facilities of China has been carried out to bring out the fact that the Indian ship repair industry has still a long march forward and unless suitable measures are taken to increase efficiency as well as government support / subsidy. This industry is in danger of getting out run by other players for work in maritime defence industry.

China for example has 176 dedicated ship repair yards in addition to 316 shipbuilding yards (India in comparison has only one registered dedicated repair-yard i.e.: Western India Shipyard Ltd). In India there are only 35-ship repair units (SRU) registered with the Director General of Shipping of which a mere 07 SRUs have been given permanent approval as SRUs. This state of affair in the country is not encouraging, because this is one industry, which is a useful engine for creation of jobs, across all categories of work force from skilled to unskilled. The ship repair industry is highly competitive, the lay-up time for repairs is critical and completion of repairs on time is of paramount importance. Therefore, those yards that have a history of completing the repair work in the shortest time are preferred. A reference benchmark of productivity in terms of CGT is that, China has steel renewal capacity of 250 tons/day as against 5 tons at best in India. However, shipbuilders in China are also facing challenges such as, shortage of ship design capacity, a relatively weak marine equipment industry, and a fierce battle to attract and retain talented staff, all of which will be a hindrance to continued growth for china also.

COOPERATIVE ENGAGEMENT POLICY

The private and defense yards have their order books full which is indicative of booked resources for slipway and dry-dock as well. So the question whether we as a nation can handle the additional needs of other navies in the entire IOR? This paradox can be answered. The moot proposal of this paper is not about hull construction and design; it is about retro-fitment and system re-engineering on an older hull platform. The concept being propagated calls for a foreign ship re-engineering to be executed by Indian ship repairer. This will be done as per design input and pre-production planning documents generated by Directorate of Naval Design of Indian Navy, or the design bureau of Defense Public-sector Undertaking i.e.: M/s MDL, M/s GRSE.¹⁷

What eats into the time frame of a shipyards' planned production are the prelaunch docking activities. Therefore, a re-engineering work of an old warship without extended dry docking phase will surely be welcome by many yards. This will not only use their excess capacity, but also give them a foothold in the warship repair industry. Ship retro-fitment is a business that is insulated from the boom and slump cycle of commodity / shipbuilding. The scope of work we envisage goes beyond the routine hull maintenance, but require refurbishing 20-year-old machinery

and 10-year-old outdated electronic system with insertion of new technology.¹⁸ The best way for Indian industry to find a foothold in regional navies is to offer complete turnkey basis contract for retro fitment of old hull structure with new packages to other Indian navy first then as a nation put our best foot forward to other regional players in IOR.

CHALLENGES FOR SHIP REPAIR INDUSTRY

Sensing the big opportunity in shipbuilding, local builders in India have already lined up investments worth Rs 18,500 crore over the next five to seven years.¹⁹ These investments are expected to come from new entrants into this field such as L&T, Pipavav Shipyard Ltd, Adani Group and existing private players such as ABG Shipyard Ltd and Bharati Shipyard Ltd. This is very different from earlier years when shipbuilding in India was dominated by a few state-owned shipyards. With this in mind, the planned investments by private firms are targeted at building capacities that can cater to even LNG and CNG carriers, these carriers are intricate and complex in construction. Therefore, there is no reason, why the challenge of warship retro-fitment firstly for Indian defence industry and then for the other customers in the IOR region cannot be shouldered by Indian Shipbuilding industry²⁰. The challenges and benefit to the industry are discussed below:

Shop Floor Integration

Not every shipbuilder that builds both naval and commercial ships in the same facility can attain the productivity of a pure commercial shipbuilding facility. Nonetheless, all the dual-purpose shipbuilder will see benefits to their commercial work from their military shipbuilding experience. Among the benefits, that military practice can draw from commercial experience is knowledge of purchasing and cost-reducing practices through modern shipbuilding methods. From military experience, the commercial side of the yard can learn about arrangement of tight, complicated compartments; management and control of complex projects; and higher-quality requirements and in particular, high-technology products which meet the navy's requirements. Firms that do build both military and commercial ships are usually building military auxiliaries, not combatants that are very much similar in size and complexity to commercial ships. Hence, each yard's facilities, workforce, processes, and experiences are optimised over time for its own market segment. A lesson on this process can be learnt from the Japanese/ Korea shipbuilding industry, which appears to have achieved some success in mixing commercial and military production.

Contract Management

Overall, contracting with a navy as a customer world over is much more complex than with a commercial customer. This is evident from the large number of standard and specification documents that accompanies a solicitation. Contracting with military customers is more time consuming and requires more personnel resources than contracting with commercial customers. The principal reason for this disparity is that:

- Large numbers of government personnel attend contractual meetings.

- A large number of government specialists are dedicated to each topic, whereas in the commercial world, personnel tend to be multidiscipline.
- Government contracting is by detailed technical specification definition, detailed joint cost analysis, and the government approval process.
- In work for the government, more documentation is required than for commercial transactions.
- The fact that warships are more complex than commercial ships also contributes to the length and expense of contracting for government customers.

Pre-Production Planning

A new entrant ship repairer has to guard against the tendency to buy-in cheap into a warship repair contract and give ambitious deadlines. Since defense, work is always shrouded behind veil of secrecy. The contractor can default on his work because of inadequate past experience or data regarding system intricacies unique to a warship. A prudent ship repairer has to cater and anticipate for the under mentioned situations:

- Accurately assess initial requirements before committing to long lead, high capital equipment orders
- Perform as much design work as early in the process as possible. Ideally, before bidding a project, to ensure the ship can be retrofitted profitably at the price quoted
- Manage complexity, including sophisticated onboard systems and the interdependent work of multiple sub-contractors and the yard itself.
- Eliminate rework while maximising the re-use of design elements from other projects under construction.
- Ensure the accuracy of design documents and bill of materials (BOM)
- Provide original equipment manufacturer with sufficient design data

Pooling of National Resources

If warship repair is to flourish in subcontinent as a well-oiled self-sustaining industry by a pre-mediated design and not by happenstance. Then the intellectual, work force and national resources have to be pooled through co-coordinated effort. This calls for integration of best, cheapest and fastest shipbuilding processes in field of design, production and assembly/outfitting across the nation. The exchange of vendor database and legacy codes for engineering system drawings between the different design bureaus will bring down costs further. Encouragement for setting up of new shipyards and modernization of existing shipyards including dry docks is the need of the hour.²¹ India has large ancillary industry setup, steel production capacity, and skilled work force with strong IT back up also. It therefore gives an ideal opportunity for international marine-equipment manufacturers to participate in India's ship repair sector. World repute ancillary manufacturers based out of India are the lifeline required to sustain shipbuilding /ship repair industry here. In addition, as a ship has hundreds of different type of equipment and machinery, this provides an ideal breeding ground for a host of smaller support industry too. A state orchestrated exercise

needs to be taken up, to identify key ancillary industry essential for ship repair and ensure their cluster growth around shipyards.

LESSONS FROM THE WEST

However, ship repair is an activity that is centered in Asia and East Europe. The experiences of America and European Union need to be emulated for an economically viable shipbuilding or repair industry.

Tiers in American Industry

The facilities and shipyards that construct, convert and repair United States (US) navy's warships comprise a mix of public and private yards. There are five public naval shipyards, which currently perform repairs of warships and the Coast Guard. The private shipyards of the commercial shipbuilding industry are a multitier business. They consist of 18 different first-tier shipyards having construction facilities for large vessels. The second-tier yards, producing ships of less than 122 meters in length, number several dozen. The Six major shipyards, operated by the three big 'system integrators' produce majority of U.S. Navy's warships. These large shipyards are like general contractors; they combine the products of hundreds of specialists into a single ship. The shipyards in the second tier; generally integrate fewer complex systems in order to construct smaller warships, as well as a wide range of auxiliary crafts. The US shipbuilding industry's real strength lies at the base of the production pyramid. The numerous subcontractors and suppliers (they might be called third- and fourth-tier companies) that do the actual outfitting and assembly onboard ship. These tier three contractors understand the nuances and demanding regimes of a warship. This tier two executes the subcontract for the installation of propulsion, power generation, and habitability and control systems for military vessels and three firms.²²

India as nation needs to develop a similar, second and third tiers of shipbuilding conglomerate that is of an excellence of world-class. It is only possible by marrying the experience of the Public-Sector shipyards and the new management / production philosophies of the budding private yards. This exercise will lead to widening the base, for a productive and quality conscious ship repair industry. The nation needs these tier two and tier three shipyards, which can be called for execution of major retro-fitment of warships. Only a successful shipyard in such a venture can aspire to move up the value chain from ship retro-fitment project to building auxiliary vessel for navies in IOR and then finally bidding for frontline warships. An endeavour of this nature will also create a strategic depth for the country's navy beyond the Defence Public Sector Undertakings.

Export Oriented European Industry

In Europe, Germany, France, and Russia dominate the military export market. The export market in terms of money is largely for frigate market. SSKs, which make up about half the market and frigates another third. However, in terms of volume of trade, the OPV quantify approximately double the frigate and SSK numbers and thus accounts for a somewhat more important need of the developing countries. This market is dominated by

demand for small ships because the buyers are interested only in coastal or regional defence and not for tasking that are for a blue-water in nature. Only about ten countries have a blue-water navy, and seven of these can build their own ships. Almost all the money in the military ship export business is in smaller ships of less than 5,000 tons, and to be more specific for vessels with less than 3,000 tonnage. It is this basic no-frills version of warship, which if available in international market within the budget / purse of developing nation, are purchased world over as well as by smaller countries in IOR.²³

The Indian shipbuilding industry needs to look at this international market for supporting and repair at affordable cost an aging vessel that has been exported from Europe to countries in Asia. These vessels have a market potential for innovative re-engineering / technology insertion beyond guarantee period of support. The emphasis of these retrofit is with a focus on Availability, Reliability and Maintainability (ARM) of marine equipment. The cost of an old combatant ship for re-engineering should not be driven high by over playing the factors like, Susceptibility, Vulnerability and Recoverability (SVR). These feature of SVR available at a premium price, are more apt for a newly constructed command and control platform vessel and not for retrofitted patrol craft.

CONCLUSION

Though ship repair industry has a long history of subsistence in our country, it has not made a niche in the IOR so far. It is an industry that uses many skills and resources and is critical to success of national and global economy too. As a maritime nation, India cannot overlook the potential offered by retrofitment sector within the gamut of ship repair industry. A strong ship repair base in the country and its strategic significance as a second line of defense to support Navy and Coast Guard cannot be undermined.²⁴ However only a reputable and professional conglomerate will be trusted by India or any other friendly nation to hand over their national assets like warship for re-engineering project. Indian shipyards has the competitive advantage of low labor costs, availability of trained and skilled manpower pool and proximity to market / customers in form of a vast number of sea-faring coastal nations. These are all the factors required for getting success in this business along an important and busy shipping lane of IOR.

In India, whilst there has been success in the field of ship breaking industry that is also as labour intensive. The ship repairing industry can also replicate the success story provided it utilizes its inherent competitive advantages to the maximum and move up the value chain to repair of warships also. However in order to win over the confidence of any naval customer, shipyards will need government support largely. Since a warship's repair is an activity that transgresses from the area of a pure 'Commercial venture' into the realm of a 'National security issue'. So unlike a commercial ship, in case of a repair of a warship, *'Where a job is done geographically, matters more than who is doing that job'*. A project for foreign ship repair cannot fructify without the industry, Indian Navy and

government working in unison / tandem. In return, the national security posture and the Navy will benefit from a ship repair industry that is more competitive in the global market. This industry can reduce costs for the navy as customers, get foreign revenue in government exchequer and create an economically viable public-private industry. However, the work on warship is not a seamless integration with the commercial industry. It requires a continuous review of functions, to ensure that the navy continues to engage in those activities that the commercial sector cannot provide. Given the present environment, a determination as to which sector is truly more efficient and effective is impossible. However, the DPSU and Naval dockyards do provide vital services in terms of weapon sensors, Electronic warfare, communication that private yards cannot provide in a timely fashion today. These critical competencies must be maintained with Navy.²⁵ Only a concerted multi-pronged approach to adopt best practices in design, procurement and production will yield best results for the Indian shipyards. The aim is to match ship repair performance with that of Korean or Chinese yards. India must emerge as a bigger player and be ready to take the place yielded by the costlier shipyards in the western world that out-price themselves in building and repairing Low cost warships for littoral role.

It is envisaged that in the long run, warship retro fitment can act as a strong enabler in defense ties in the Indian Ocean Region. Growth of shipyards into large conglomerates in Japan and Korea and establishment of variety of marine equipment manufacturers there is the culmination of the farsighted vision of the respective Governments. 'Today India's concept of strategy exceeds a preoccupation with regional political tensions. India's maritime security requirements within the regional and global playfield, find competition for markets as well as resources. We are a modern industrial nation by definition and by corollary a vibrant maritime nation too'.²⁶ Hence, a viable market exists for expansion of ship repair industry in aiding Indian Navy's need for fast and affordable warship retro-fitment. Thereafter the spreading of its footprint across other Navies of IOR for similar retro-fitment solutions is the next logical step. This scenario of India, as epicenter for low cost solution of retrofitting foreign warships will be an apt material expression of for achieving strategic maritime goal of transnational co-operation by means of constructive engagement.

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