

Is the Submarine Arm Losing its Punch?

*Sataluri Govind**

The explosions that gutted INS Sindhurakshak during the early hours of 14 August 2013 caught the imagination of an entire nation that watched the brief footage¹ of the catastrophic event on their television sets. Barring some minor accidents which resulted in structural damage, this is the most tragic incident involving loss of lives in the 46 year history of the submarine arm.² It not only sent shock waves through the defence establishment but also raised several questions concerning depleting submarine force levels, aspects of safety, and the absence of credible search and rescue (SAR) and salvage capabilities. In addition, there are connected issues related to maintenance, refits and modernization programmes, which have a bearing on their operational availability. An attempt is made in this article to examine these issues and let the reader draw his/her own conclusions.

FORCE LEVELS

Submarines, right from their inception, are the chosen platforms to carry the battle to the enemy doors. The effect that the submarine has in any conflict can be gauged from the sinking of the Argentine cruiser 'Belgrano' during the Falklands War, which resulted in the Argentine Navy being confined to its territorial waters.

Traditionally, submarines—both nuclear and conventional—have been deployed for strategic deterrence as well as on offensive and defensive missions with an emphasis on a sea denial role. However, they also undertake other tasks such as intelligence gathering, insertion

* Sataluri Govind is a submariner who retired as Commodore from the Indian Navy.



of Special Forces, precision attacks, and providing anti-submarine warfare (ASW) support to surface forces in select areas. The number of operational submarines that a navy needs to maintain will therefore be dictated by the perceived threats, its area of operations, and the range of missions to be undertaken. However, the force levels that are required to ensure the minimum number of operational units would also need to take into account those undergoing long maintenance refits as well as certain reserves. Taking into account that the Indian Navy's (IN) area of operations encompasses the Indian Ocean Region (IOR), one could safely assume that it needs a force level of around 18–20 conventional submarines to effectively undertake all the missions. Let us now take a look at the submarine holdings of India.

INDIA

India is the only country outside the P5—the permanent members of United Nations (UN) Security Council—to have operated a nuclear-powered submarine. Therefore, the launch of INS Arihant³ on 26 July 2009 and the onboard nuclear reactor going critical⁴ on 10 August 2013 represent major milestones in the history of the Indian submarine arm. It is assumed that another couple of years will be required for the submarine to complete all harbour and sea trials to become fully operational. This is a nuclear ballistic missile launch platform⁵ (SSBN) giving India assured second-strike capability in case of a nuclear war. This also forms the third leg of the nuclear triad and there is a requirement of at least three more of the class to follow, going by the United Kingdom (UK) or French *modus operandi*. The range and sophistication of the missiles with which these 'Boomers'⁶ would be armed will have a great bearing on their operational radius and strategic capability. While this class of submarine forms the 'core' of our maritime capability to protect the nation's vital interests, it strictly comes under the 'strategic' category and out of the purview of conventional war.

The IN leased a Charlie-class nuclear-propelled submarine (SSN), christened INS Chakra, from the erstwhile Soviet Union from 1988 to 1991. Having lost the expertise of operating nuclear submarines thereafter, the IN has once again embarked on yet another lease programme of an Akula-class submarine from Russia. The Nerpa—an Akula-class submarine (SSN)—was rechristened as INS Chakra and inducted⁷ into the Indian Navy in April 2012, on lease from Russia for a period of 10 years. There are unconfirmed reports of India trying to acquire another SSN⁸ on a 10

year lease, following similar procedure as that adopted for INS Chakra. There is no doubt that the IN needs at least four SSNs to undertake various missions, including providing protection to expeditionary forces.

Till the late 1990s, the IN had a healthy force level of eight Sindhughosh (Kilo/877EKM), five Vela (Foxtrot) and four Shishumar (SSK)-class submarines. At this juncture, the government approved the 30 year submarine-building plan⁹, which envisaged the construction of a fleet of 24 submarines. Phase I of this plan envisages building, simultaneously, six submarines each under 'Project 75' and 'Project 75-I', based on Western and Eastern technology respectively, by the year 2012. This was to be followed by construction of 12 submarines of an indigenous design in Phase II covering the period 2012–30. The rationale behind constructing six submarines each with Western and Eastern technology was to overcome the inherent dangers of relying upon a single source for long-term logistic support. Further, it was intended to enable the indigenous design by marrying the best concepts of both Western and Eastern technologies through transfer of technology (ToT) and, in the process, attain self-sufficiency in submarine construction.

The submarine construction plan failed to take off as per the timelines and many reasons are attributed for this inordinate delay: the apparent lack of funds; an internal debate on whether the IN should go all-out nuclear (like the United States [US], the UK and French navies) or retain a mix of conventional and nuclear submarines (like the Russian and Chinese navies); or simply the lack of a long-term perspective plan. Whatever be the reasons for the delay, the contract for building six submarines of French 'Scorpene' class⁹ was only signed in 2005 and the Project 75-I is still doing rounds in the South Block¹⁰ for reasons best known to the powers that be.

Consequent to the decommissioning of the five Vela-class submarines and the gutting of Sindhurakshak, the IN presently has a fleet of 13 conventional submarines consisting of nine Sindhughosh and four Shishumar-class submarines. All these submarines have been inducted commencing mid-1980s and some of them have been upgraded with modern sensors as well as missile launch capabilities. Generally, the life of these platforms is around 30 years and as 11 of these submarines were commissioned between 1986 and 1991, they are nearing the end of their average service life, which is an issue of concern. Even though the 'Scorpene' class submarines were supposed to be inducted from 2012 onwards, there has been a delay and the first one is likely to enter service

in 2016, with one submarine following every year thereafter.¹¹ Even if the request for proposal (RFP) for Project 75-I is issued¹² in 2013, barring a miracle, there is no way that the contract would be signed before 2016. Since the first two submarines are supposed to be procured through outright purchase, these two may be commissioned by 2022. Even at that juncture, the submarine strength would still be nowhere near the requisite numbers.

The reduction in submarine force levels is a cause for concern since it implies an inability to undertake the full spectrum of missions. It also needs to be viewed in the context of the rapid strides being taken by both Pakistan and China in building up their underwater capabilities. Further, our dithering approach in implementing an indigenous submarine construction programme stands out in stark contrast to the Chinese naval expansion plans, which can best be tackled by enhancing our sea denial capability.

PAKISTAN

Let us take a look at the submarine strength of the Pakistan Navy (PN) in the first instance as it is not only our immediate neighbour but for whom India represents its greatest threat. After the unexpected missile attack on Karachi harbour and installations in the 1971 war, the PN has avowed to never let such an incident recur. In order to keep the strong marauding Indian Fleet at bay, the PN has rightly decided to enhance its sea denial capability.

Accordingly, it has acquired three Agosta 90-B submarines from France to be equipped with Air-Independent Propulsion (AIP) systems. The third of the class, 'PNS Hamza', which was assembled at the Karachi shipyard¹³, has been fitted with the French 'MESMA' (Module d'Energie Sous-Marine Autonome) system and the first two, 'PNS Khalid' and 'PNS Saad', are to be retrofitted with the AIP system during their scheduled long refits. The extended underwater endurance ranging from 14 to 20 days, based on the usage of limited ethanol and liquid oxygen reserves onboard, are more than adequate in the limited-duration war context scenario with India. These submarines are capable of firing the Harpoon missiles and are armed with the latest German heavy-weight torpedo (HWT), Sea Hake. There are conflicting reports¹⁴ about the Pakistan naval plans for acquisition of three U-214/six Yuan/Song-class submarines with a generous aid package from the German/Chinese governments, respectively.

In an interview to *The Diplomat*, 9 October 2013, Haris Khan, a senior analyst at PakDef Military Consortium, an independent Tampa-based think tank, is reported to state that since 2001, the Pakistan Atomic Energy Commission (PAEC) has been working on KPC-3, a project 'to design and manufacture a miniaturized nuclear power plant for a submarine'. It further states that PAEC and the National Engineering and Scientific Commission (NESCOM) have been working on a miniaturized plutonium warhead, a naval version of the Babur land attack cruise missile, which will further enhance Pakistan's deterrent capability.¹⁵ Whatever be the truth, it is amply clear that Pakistan knows where and how to contain the might of the Indian Navy and is accordingly building up its capabilities.

CHINA

China, on the other hand, has set its sights high and does not regard India as a threat. However, taking into account China's global power ambitions, it is safe to assume that India should be wary of their submarine threat in our areas of operation. The Peoples Liberation Army Navy (PLAN) has embarked on a modernization programme which aims to transform it from a coastal brown-water navy to a high seas blue-water navy. A US Congressional research report of March 2012,¹⁶ commenting on the Chinese modernization efforts, states that while on the exterior it purports to deny access to the US forces coming in aid of Taiwan, other goals could include asserting its claims on disputed maritime territories, protecting sea lanes of communications, displacing the US influence from the Pacific and asserting itself as a major world power. It also quotes a 2009 Office of Naval Intelligence (ONI) report which states that 'since the mid-1990s, the PRC has emphasized the submarine force as one of the primary thrusts of its military modernization efforts'.¹⁷ It is logical to conclude that this move is intended to contain the freedom of the American fleets operating specially in the South China Sea, Japan Sea and other sea areas around Taiwan.¹⁸

It is estimated that due to this focussed approach, the Chinese have been building and commissioning more than two submarines on an average per year. Indications are that at this rate, the Chinese submarine fleet would stabilize around 80 modern boats in the next five to seven years. The modernization of the Chinese submarine fleet includes the construction of new Type 094 Jin-class SSBNs, Type 095-class and Type 093 Shang-class SSNs as well as Type 041 Yuan-class conventional

submarines based on reverse engineered designs of Kilo class and 636-class Russian submarines. While the Jin-class submarines, to be fitted with the JL-2 Intercontinental Ballistic Missile (ICBM), would cover various targets across the Pacific Ocean, they can also cover majority of the targets on the Indian subcontinent. The Type 095-class and Shang-class SSNs can be expected to be deployed in the IOR through which a majority of the Chinese energy needs pass and pose a serious threat to our maritime capability to safeguard our national interests.

SEARCH AND RESCUE (SAR) AND SALVAGE

Submarine accidents are not uncommon and some of them have been quite catastrophic. The 'USS Thresher' was the first nuclear submarine to be lost at sea on 10 April 1963, with a loss of 129 lives,¹⁹ during routine 'Deep Dive Trials'. This mishap occurred due to a short circuit in an electrical panel which caused emergency shutdown of reactor and the inability to blow the ballast system disabled by ice, following which the submarine exceeded test depth and was crushed by the pressure. This resulted in the US Navy adopting the 'SUBSAFE' programme to ensure safety of systems and training of crew. The IN has a similar 'Certification Programme' conducted on all submarines after major refits and modernization. Another incident of such a magnitude relates to the sinking of K-141 'Kursk' of the Russian Navy on 12 August 2000, with 118 lives lost,²⁰ during a routine torpedo attack. It is believed that an explosion due to leakage of a torpedo propellant, hydrogen peroxide, caused the incident. Both these prove that such accidents can occur at any time with the whole crew onboard at their action posts. Both countries had a credible SAR capability at the time of accident, but still ended up losing lives. India does not have this capability as yet, and this was highlighted yet again in the aftermath of the Sindhurakshak incident. That the event had occurred in the IN's backyard and not at sea has only exposed our inadequacies in dealing with an incident of such magnitude. Before going any further, one must understand the concept and necessity of submarine SAR in the overall sense, and its relevance in this instance.

Submarine SAR is generally associated to incidents/accidents at sea. As evident from above-mentioned examples, a submarine can flounder and sink at sea due to a variety of reasons. In case this happens in an area where the depth of water is more than the 'crushing depth' of the pressure hull (as in the case of 'USS Thresher'), it will implode and has no chance of rescue. However, if the depth of water is less than the crushing

depth but the submarine has suffered major structural damage like what happened to the 'Kursk', then the chances of effecting rescue is entirely dependent on the state of surviving personnel. Therefore, SAR is possible if the sunken submarine is lying in waters less than its crushing depth and has not suffered major structural damage.

SAR involves locating the sunken submarine, assessing the profile and condition of escape hatches, which is followed by mating with a 'Rescue Bell/ Chamber' or the 'Deep Submersible Rescue Vehicle (DSRV)'. Next is the transfer of personnel from the damaged submarine into the rescue vehicle and, finally, bringing them up to the rescue ship for decompression on surface. The general norm for successful rescue of the personnel is 72 hours from the time of sinking, with locating the submarine being the key. All these actions are extremely hazardous, involve complicated operations, and require specialized equipment. Individual rescue suits are also available for the crew to escape from the submarine, if the situation so permits. Salvage of the sunken submarine happens thereafter to determine the cause of accident and constitute remedial measures to prevent recurrence.

In the case of *Sindhurakshak*, which sank in waters of depth no more than 15 metres, the rescue system was not necessary to evacuate the personnel. However, what was required was to ascertain the state of personnel onboard and to undertake an examination to see if the submarine had suffered major damage that inhibited/restricted evacuation of personnel. Certainly, the health of trapped crew members would have been checked by resorting to tapping signals or through a telephone line provided in the 'indicator buoy'. However, from the status reports²¹ that were released regarding difficulties in gaining access to the compartments for rescue of personnel as well as the futile attempts to dewater the submarine, one can deduce that it suffered severe damage to the pressure hull which flooded the complete submarine and hindered easy access to compartments. Further, the state of bodies that were recovered suggests that the severity of explosions and resultant fire were so great that there was no chance for rescue.²² Had this incident occurred at sea, it would have seriously tested our capabilities even for the initial stages of SAR operations while waiting for the US rescue system to arrive, under an existing arrangement.²³ However, since it happened in harbour, the only thing that remains in the sequence of operations is salvage of the submarine for investigation purposes as well as to decide on its future.

HEALTH AND SAFETY ISSUES

The survival of a submarine depends on its radiated noise levels which are directly related to the efficient functioning of onboard equipment and machinery. Its ability to undertake the range of missions depends on the type of armament as well as the sensor suite fitted onboard. Therefore, timely maintenance activities as well as measures to ensure that the onboard weapons and sensors are calibrated/modernized at regular intervals guarantee the health of the submarine and enable it to be a viable fighting platform. In the case of *Sindhurakshak*, which had just returned from Russia after a refit-cum-modernization activity, the loss is all the more painful because of it being a fully battle-worthy platform.²⁴

There is a related issue that is a cause for concern: a majority of the submarines are sent to Russia to undergo such a major overhaul and modernization. No doubt that the submarines which go back to the builder's yard get a good refit and become as good as new. However, it not only underlines the fact that we do not have the wherewithal to undertake such maintenance activities but also that we have never attempted to establish such facilities at our end. Lack of such maintenance facilities results in onset of slow degeneration of health of onboard fitted systems more than other equipment and machinery. On the contrary, we have two SSK submarines built at the Mazgaon Dock Limited (MDL) and based on the experience gained, the refit-cum-modernization activities for this class of boats have been carried out here itself. So, the lesson to be learnt here is that we should be building submarines in the country itself because it enables building up of expertise and the vendor base that is so critical in maintaining the health of these frontline ships.

Safety is a mantra that is drilled into every officer and sailor of the IN right from the day of induction into the service. This is re-emphasized a hundred-fold when they voluntarily join the submarine and aviation branches. It is rightly so because any mistake or lapse on their part would not only cause damage to a costly platform, resulting in its non-availability for a certain time, but may also result in loss of life which is almost impossible to replace at short notice.

Every officer and sailor who joins the submarine arm undergoes initial theoretical training, followed by practical sea training. Subsequently, an 'Exam Board' is conducted to test their knowledge and skills before certifying them competent to undertake tasks independently onboard. The commanding officer (CO) as well as the 'second-in-command (executive officer)' have to undergo prescribed qualifying courses which are quite

rigorous before being entrusted with corresponding responsibilities. Even the sailors undergo regular courses as part of their promotion requirements. There is a yearly 'Assessment Check' carried out to ensure proficiency of personnel, which could be turned into 'surprise tests' to maintain highest professional standards. However, availability of adequate operational units is necessary to ensure assimilation and build-up of requisite skills by all personnel. Further, the IN has to address the issue of shortage of personnel while ensuring the highest safety requirements.

Every submarine is put through a series of examinations at regular intervals which test both men and material onboard. There are laid down drills and standard operating procedures (SOPs) concerning armament, machinery, systems and equipment that are practised rigorously to ensure highest safety standards. Notwithstanding these, accidents and incidents do occur onboard ships, submarines and aircraft. Each and every one of them gets thoroughly investigated by professionals to ascertain attributability of blame as well as to institute remedial measures to prevent their recurrence. Majority of the accidents/incidents take place because of technical malfunction or material failure, which may not be easily predictable or have an extremely low probability of occurrence. Of course, some are attributable to human error too. In the case of *Sindhurakshak*, one has to wait and see the investigation report to comment if any infringement of safety norms had taken place. It would be a disservice to the departed crew as well as the professional competence of the submarine arm to apportion blame where it is not due.

CONCLUSION

Submarines are the ideal platforms that provide both strategic and tactical deterrence. Considering India's national interests and maritime responsibilities, a mix of nuclear and conventional submarines is necessary. Therefore, raising and nurturing such a potent force needs strategic vision and long-term planning. Looking back at the acquisition and maintenance profile of the submarine arm thus far, it is amply clear that there is no time to loose and much ground to cover.

There are indications that in addition to the present 'Arihant', at least three more SSBNs with improvements are on the anvil. However, these boats need to be equipped with longer-range missiles and multiple independent re-entry vehicle (MIRV) capability to achieve desired strategic interests. Presently, we have one SSN on lease which may be augmented with one more to cater for the present needs. However, we

need at least four SSNs of our own in the long run for which construction plans must be put in place right now. The present lease arrangements could be extended till such time we start building them in the country. In these two cases, we are looking at time horizons of 20–25 years of build cycles which would be repeated to maintain requisite numbers. Therefore, the present partnership of Larson & Toubro and Ship Building Centre (SBC) at Visakhapatnam needs to be continued and fortified so that we attain self-sufficiency in construction as well as provision of life cycle support facilities of the nuclear boats.

In the case of the reducing numbers of conventional submarines, it is still not too late for the IN and the Ministry of Defence to take a wake-up call and put in place a robust submarine-building strategy. Towards this end, a two-pronged approach is recommended. On one hand, it envisages continued construction of six more ‘Scorpene’ boats with AIP under repeat order clause of ‘*Defence Procurement Procedure (DPP) 2013*’. This will ensure continued build-up of expertise, keep the construction lines going till such time ‘Project 75-I’ actually takes off on ground, and also ensure development of an extensive vendor base. Simultaneously, it recommends buying out the design of the submarine and constructing 12 submarines under ‘Project 75-I’, instead of wasting precious time and resources in developing an indigenous design. Such a strategy requires commitment of huge sums of money, which could be spread over a span of 15–20 years, but shows long-term vision for the indigenous development of submarine-building capability in the country. Over the last 40 years, the country has progressed from building ships of a foreign Leander-class design to the latest indigenous Delhi class of ships. It is time to implement the same resolve in building submarines and from the experience gained in construction and outfitting, we could evolve our own designs and undertake export of the boats to friendly countries.

Project 75-I, in the present state, envisages outright purchase of two boats from the original equipment manufacturer (OEM) and construction of 3+1 in India at MDL and Hindustan Shipyard Limited (HSL) respectively. However, our past experience with HSL involving refits of submarines has not been satisfactory and building huge infrastructure for constructing one submarine is a waste of precious resources. Prudence demands that we build on the expertise that is accruing at MDL with a series construction plan rather than allow it to wither away as was done after the last SSK was built. MDL has signed shareholder agreements (SHA) for setting up joint ventures (JVs) with private shipyards—M/s

Pipavav Defence & Offshore Engineering Co. Ltd (PDOECL), Mumbai, and M/s Larsen & Toubro—for construction of surface warships and conventional submarines, respectively,²⁵ which implies availability of adequate production facilities. It is strongly felt that construction of hulls at the private yards, followed by outfitting works at MDL, would reduce build times and ensure establishment of maintenance facilities as well as vendor base to cater for life cycle support. Therefore, there is a need to review and redraft the contours of 'Project 75-I' in the long-term interests of the country rather than letting it go through the motions of an acquisition programme.

Finally, in the scenario of an ever-increasing submarine threat from Pakistan and China in our areas of operation vis-à-vis sizeable force depletions in the Indian submarine arm, the question that needs to be asked is: 'How serious are we in building and conserving a potent force like the submarines?' Building such capabilities takes time to fructify and non-availability of adequate platforms has an adverse effect not only on training of crews but also on the operational tasking to be achieved. All statements made in the aftermath of Sindhurakshak's tragedy clearly indicate that we only react to situations rather than being proactive. It is high time that we developed a credible indigenous submarine force on the lines similar to the Integrated Guided Missile Development Programme (IGMDP), in the interest of national security, rather than being short-sighted and caught on the wrong foot in any eventuality in our own areas of operation.

NOTES

1. Video of explosion onboard available at NDTV, 14 August 2013, available at <http://www.ndtv.com/video/player/news/watch-viideo-of-explosion-on-ins-sindhurakshak/286797>, accessed 6 November 2013.
2. Unnithan, Sandeep, 'INS Sindhurakshak Tragedy: Navy's Submarine Arm Suffers a Big Blow with the Loss of an Operational Vessel', *India Today*, 16 August 2013, available at <http://indiatoday.intoday.in/story/ins-sindhurakshak-navy-submarine-suffers-big-blow-operational-vessel/1/299838.html>, accessed 6 November 2013.
3. Press Trust of India, 'India's First Nuke Submarine INS Arihant Launched', NDTV.com, 26 July 2009, available at <http://www.ndtv.com/article/india/india-s-first-nuke-submarine-ins-arihant-launched-6326>, accessed 6 November 2013.
4. Press Trust of India, 'Giant Stride for Country, Says PM on Nuclear Reactor INS Arihant', *The Hindu*, 10 August 2013, available at <http://www.thehindu>.

- com/sci-tech/science/giant-stride-for-country-says-pm-on-nuclear-reactor-ins-arihant/article5009098.ece, accessed 6 November 2013.
5. 'SSBN Arihant Class Submarine', *India–Naval Technology*, available at www.naval-technology.com/projects/arihant-class/, accessed 6 November 2013.
 6. Boomer is the colloquial name for SSBN.
 7. Special Correspondent, 'INS Chakra Inducted into Navy', *The Hindu*, 4 April 2012, available at <http://www.thehindu.com/news/national/ins-chakra-inducted-into-navy/article3280078.ece>, accessed 6 November 2013.
 8. Pandit, Rajat, 'India Likely to Acquire Another Nuclear Powered Submarine from Russia on Lease', *The Times of India*, 21 October 2013, available at http://articles.timesofindia.indiatimes.com/2013-10-21/india/43249261_1_ins-chakra-nerpa-ins-arihant, accessed 6 November 2013.
 9. Chand, Naresh, '24 Submarines in 30 Years?', *SP's Naval Forces*, available at <http://www.spsnavalforces.com/story.asp?mid=30&id=6>, accessed 6 November 2013.
 10. Pandit, Rajat, 'Tangled in Red Tape, India's Submarine Fleet Sinking', *The Times of India*, 9 June 2013, available at http://articles.timesofindia.indiatimes.com/2013-06-09/india/39849014_1_project75india-submarines-russian-kilo-class, accessed 6 November 2013.
 11. Pandit, Rajat, 'Submarine Shock: Antony Fast-tracks Projects', *The Times of India*, 26 August 2013, available at http://articles.timesofindia.indiatimes.com/2013-08-26/india/41454337_1_submarines-air-independent-propulsion-project-75india, accessed 6 November 2013.
 12. Siddiqui, Huma, 'RFP for \$11.8 Billion Indian Navy Submarine Project Soon', *The Financial Express*, 9 August 2013, available at <http://www.financialexpress.com/news/rfp-for-11.8billion0indian-navy-submarine-project-soon/1153163>, accessed 7 November 2013.
 13. 'Pakistan Submarine Import and Export Behaviour', 29 July 2013, available at <http://www.nti.org/analysis/articles/pakistan-submarine-import-and-export-behavior/>, accessed 7 November 2013.
 14. DeSilva-Ranasinghe, Sergei, 'Pakistan's 21st Century Naval Modernisation Programme', *Future Directions International*, 9 May 2012, available at <http://www.futuredirections.org.au/publications/south-west-asia/37-south-a-west-asia-swa/516-pakistans-21st-century-naval-modernisation-programme.html>, accessed 7 November 2013.
 15. Detsch, Andrew, 'Pakistan's Oversized Submarine Ambitions | Flash Points', *The Diplomat*, 9 October 2013, available at the <http://thediplomat.com/2013/10/pakistans-oversized-submarine-ambitions/>, accessed 7 November 2013.
 16. O' Rourke, Ronald, 'China Naval Modernization: Implications for U.S. Navy Capabilities—Background and Issues for Congress', RL33153, 30

- September 2013, available at <http://www.fas.org/sgp/crs/row/RL33153.pdf>, accessed 7 November 2013.
17. Ibid.
 18. Ibid.
 19. Sharp, David, 'USS Thresher Sinking: Impacts of Deadliest Submarine Disaster in U.S. History Remembered 50 Years Later', 5 April 2013, available at http://www.huffingtonpost.com/2013/04/05/uss-thresher_n_3020543.html, accessed 7 November 2013.
 20. Potts, J.R., 'The Mighty Kursk was Lost to an Accidental Internal Torpedo Explosion during a Russian Military Exercise', 9 May 2013, available at http://www.militaryfactory.com/ships/detail.asp?ship_id=K141-Kursk, accessed 7 November 2013.
 21. Press release by Indian Navy on 'Fire Accident onboard INS Sindhurakshak on 14 Aug 2013', available at <http://indiannavy.nic.in/press-release/fire-accident-onboard-ins-sindhurakshak>, accessed on 7 November 2013.
 22. Singh, Harmeet Shah and Shah, Khushbu, 'Navy Divers Recover 5 Bodies from Indian Submarine Sindhurakshak', CNN, 19 August 2013, available at <http://edition.cnn.com/2013/08/17/world/asia/india-submarine-disaster/>, accessed 7 November 2013.
 23. Pandit, Rajat, 'Indian, US Navies to Undertake Submarine Rescue Operations Deep under Water', *The Times of India*, 22 October 2012, available at http://articles.timesofindia.indiatimes.com/2012-10-22/india/34652873_1_rescue-fly-away-kit-submarine-rescue-dsrv, accessed 7 November 2013.
 24. Shukla, Ajai, 'Russian Experts Denied Access to Sunk INS Sindhurakshak', *Business Standard*, 20 September 2013, available at http://www.business-standard.com/article/specials/russian-experts-denied-access-to-sunk-ins-sindhurakshak-11309200004_1.html, accessed 7 November 2013.
 25. Available at www.mazagondock.gov.in/newssite2010/pdfs/msg/press-releases, accessed on 7 November 2013.

