

Research on Naval Asymmetric Anti-Submarine Warfare

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Abstract :

1.The 2008 and 2009 National Defense Reports had both emphasized on the "asymmetric warfare capabilities" as one of the important developments of our future military. Along with the development of anti-vessel missiles and recon system, submarines no longer require to engage closely with escort vessels but can initial attack out of visual range.

2.Due to the decrease of our national defense budget each year and the increase of PLA's military expense, we should consider changing our usual pattern of building our military force. Since we cannot compete with PLA's military expense, we need to utilize our limited budget and focus on developing asymmetric anti-submarine capabilities in certain areas in order to bring out the efficiency in combat.

3.By developing asymmetric anti-submarine capabilities such as gaining passive acoustic analysis abilities, setting up PLA vessels sound prints database, constructing underwater testing facilities and surveillance system, developing non-acoustic submarine detection technology, and developing five hundred tons offshore domestically made submarines, we can be more efficient in combat.

Keywords: Asymmetric Warfare, Anti Submarine Warfare

A.Preface

According to November 30th, 2009's U.S. National News report, PLA Navy seems to feel the pressure of having better quality than better quantity in their modernization of submarine forces. Nonetheless PLA manages to keep improving its quality. Their newest submarines are as quiet as American ones.¹ Since the leak of Chi Mak 2 happened, the relevant U.S. Nuclear submarine acoustic quieting technology and the copy of Russian Kilo class submarine acoustic quieting technology ³ had led great improvement in their noise reduction. In October 26th, 2006, a Shang class submarine deliberately pass through 5 miles away from the Eagle carrier in Okinawa. In June 11th, 2009, a PLA submarine had collided with a U.S. Shield destroyer's sonar around Subic bay in Philippine. Its most modernized submarine's acoustic quieting capability has come close with the Russian ones and is hard to pick up by other vessels' sonars. Besides, in the 2008 and 2009 National Defense report all emphasized the importance of asymmetric combat abilities as our crucial future military development. Under the circumstance that the gap of our force against enemy is becoming greater and our national defense budget is limited, it is only by developing asymmetric warfare capabilities can we improve our anti-submarine capabilities effectively.

B.The Myth of Standard Anti-Submarine Combat

Along with the development of anti-vessel missiles and recon system, submarines no longer require to engage closely with escort vessels but can initial attack out of visual range. Plus, the Taiwan waters have complicated environment. Our navy used to rely on old U.S. anti-submarine tactics⁴, and PLA's improved submarine missile attack⁵ and acoustic quieting capability have made detecting and attacking submarines more difficult. Since the enemy is more stealth than us, the usual "direct protection" and "indirect protection" would face serious underwater anti-vessel missile attacks, which makes the anti-submarine protection combat becomes a moving target⁶. Even though we introduced P3C anti-submarine aircraft and new vessels, the lack of submarine, air-supremacy, and anti-missile capability, our anti-submarine capability is still limited. Therefore, due to the decrease of our national defense budget each year and the increase of PLA's military expense, we should consider changing our usual pattern of building our military force. Since we cannot compete with PLA's military expense, we need to utilize our limited budget and focus on developing asymmetric anti-submarine capabilities in certain areas in order to bring out the efficiency in combat.

C.Developing Asymmetric Anti-Submarine Capability

The following part will be discussing how to develop asymmetric anti-submarine capability in the concept of enemy, self, air, ground, water, and how to gain advantage in the battlefield.

1. Develop passive acoustic analysis abilities, and build up a database for PLA ships voice-prints.

The original navy command center's anti-submarine command center started to develop acoustic database since 1995 in order to allow the sonars applying their

best effects. From 1995 to 2004 that the navy command center been laid off, the acoustic sound print database and acoustic analysis capabilities were completed in early phase. Another project that designed in 2004 and executed in 2005 is the plan to develop "vessels acoustic signal analyze system"⁷(shown in illustration 1) through national defense technology and academic cooperation; and the project with Academia Sinica to develop "vessels sound prints database identify and match system". Yet, due to the withdrawn of the unit, the project was rejected, and the ability to utilize the acoustic analysis system was completely gone.

The U.S. Navy in their purpose of monitoring submarines noise underwater to identify them ally or foe, come up with a method to record and analyze the diagram of submarines noise, the so-called Lofar: Low Frequency Analyzing And Recording). The system can recognize submarines noise and identify them. Up to this date, the sound prints are still the main evidence for U.S. Navy to identify unknown targets underwater. Our military still has not developed a professional sound analysis and PLA's vessels sound prints. It is suggested to utilize the current "vessels acoustic signal analysis system"⁸ in Naval Education, Training and Doctrine Development Command and coordinate it with the previous owned vessels sound prints tapes to develop sound prints analysis capabilities, and train specialized personnel. By doing so, it can help the improvements of our vessels sound signal system and the construction of our database to support our fleet in antisubmarine combat. And by cooperating with experts in sound analysis and system design, we can prepare the initial stage of improving vessels sound signal analysis system and the construction of underwater sound analysis laboratory, and in the end have a underwater sound analysis laboratory and vessels sound and environment noise database. (The concept is as in illustration 2)

2.Establish underwater testing facility and surveillance system, improving detecting and anti-submarine abilities.

The history of underwater surveillance could go back to 1951, the first U.S. LOFAR system was installed on Eleuthera island of British West India Bahamas. The sound array received the noise of submarines and sent it back to the shore, then the LOFAR analyzer would study the gathered information. Because of the success of this system, U.S. Navy continued to install more LOFAR system in other water areas, leaving submarines that pass by no place to hide. It was called Project Caesar. These bases were called under-water sound surveillance system.⁹

In early years we were teamed up with Academia Sinica and U.S. Army to build a under-water sound surveillance system named Project Dragon Eyes, in order to monitor PLA's water and under-water activities in the pacific ocean.¹⁰ However, the project was terminated for certain reasons, which led to our loss of ability to monitor PLA submarines. Under the current National Defense policy of "defend with strength and stop with effect" and "quality more than quantity", we can first try to establish our underwater test facility in the ways of U.S. AUTEC underwater testing facility. Through underwater test facility, we can know the actual range of detection and search, coordinating tactical maneuvers, and combine them with personnel trainings. This could improve our anti-submarine combat abilities immensely. It can also coordinate with the establishment of facilities like electronic combat training grounds, building up an united overall water training testing ground. This can cut down great cost of training personnel and budget, also improving relative training efficiency. When Academia Sinica received the technology transfer from U.S. Navy's under-water cable test ground, we can then build our under-water sound surveillance system, providing navy wide range, all weather instant submarine detection and warning abilities. Not only can this reduce our numbers in naval search force, but also reduce casualties of vessels and improve survival rate in combat.

3.Develop none acoustic detection submarine technology.

Since 1960s, because the mute technology of submarines has improved and reduced the noise to 35dB, the detect range of sonar has drastically changed from 13-16 km to 2.2 km.¹¹ And the improvements of PLA's submarine mute technology and its change of tactical maneuvers (attack with anti-vessel missiles in long range, hovering maneuvers, and low-speed crawling), has made our sonars harder to detect them. Thus, we are in desperate needs to develop none acoustic detection submarine technology in order to enhance our performance in detecting enemy

submarines.¹² From the previous research, when submarines sailing underwater, its turbulence and Kelvin Waves (as shown in illustration 3) can be picked up by SAR visuals.¹³ This result has been confirmed by our scholars, and go on further to develop SAR automatic images processing methods and software.¹⁴ Since the advancement of modern satellite image technology that provides massive image intelligence and information, its detection area is way bigger than traditional detection equipments (sonars, magnetic anomaly detectors). Therefore, developing and utilizing image analysis system to support detecting activities of submarines via satellite or Air SAR, with instant, rapid and convenient ways, and support navy anti-submarine combat with SAR image analysis, are the crucial elements of our future development in non-acoustic detection technology.

4. Develop the ability to manufacture 500 tons offshore domestically-made submarines

In 2001, the Bush administration authorized the deal of selling 8 diesel-electric submarines that worth 3 billion dollars. Yet, 9 years has passed and there are no further actions. Under the current Obama administration policy of maintaining good relationship with PLA and stabilizing cross-strait relationship, we might be better off seeking our own development rather than waiting for help. The Marine Shipbuilding Development Center had conducted a research based on designing and manufacturing domestic submarines before. Due to the arms sales policy of submarines and the risk of failure is unbearable, our submarine technology is still at halt. Moreover, the retirement of relevant experts had bring loss to our research capacities. Under such circumstances, developing offshore submarines has a lower threshold in technology, and it's less sensitive in arms sales problems. We can conduct strategic alliance and technology transfer based on the arms sales pattern of the Stegosaurus-class submarines.

In World War II, the German U type submarines were merely 700 tons, yet, they posted great threat to the British Navy. They had to send out mass amount of escort ships to defend the threats from submarines. This is the stealth advantage of submarines. The U.S. Arms sales used to follow the pattern of selling us better weapons than the ones we developed by ourselves¹⁵. In this case, we need to consider the critical importance "doing our own research" and "domestically-made submarines", thus, we could gain more advantage in arms sales and enable our manufacturing technology to upgrade.

In the future when we are in combat with no air or water superiority, using submarines to intercept enemy's amphibious assault will be the only safe choice. At this point, the numbers of submarines will be crucial to whether the anti-submarine and interception missions can be successful. Rather than buying 8 Stegosaurus-class submarines, we should try to build over twenty five hundred tons offshore submarines. By the same amount of budget, we can own a large amount of offshore submarines (such as Germany's Type 206A four hundred and fifty tons submarines), and combine them with quality surveillance system and "wolf pack tactics". We can then intercept the enemy amphibious assault at the open sea¹⁶ according to President Ma's goal, and based on the smaller size of offshore submarines and its less cross-sectional area and noise, they can enter freely to all sea ports and increase their chance of survival in battlefield. This will give us the effect to deter the enemy and create a partial asymmetrical combat advantage.

D. Conclusion

Over the past decade, the PLA submarines development advancement has raised the concern from U.S. Military to do relevant research. After the PLA's newest third generation Aurora-class nuclear submarines and PLA's 093A diesel-electric submarines have finished, it would bring great threat to U.S. or Japanese navy even with their superior anti-submarine system and underwater surveillance system.

Regarding to ourselves, our water superiority and anti-submarines designs are weaker, in face with the PLA's type 093 nuclear submarines and the Jin class submarines that have the same mute ability as Kilo class submarines and with AIP system onboard, we probably need to focus more on moving our policies forward. Since the submarine mute technology has improved greatly, the traditional anti-submarine detection and search range and rate will be lower. It is crucial to utilize non-acoustic anti-submarine detection (such as Air SAR, SAR satellites, multi-spectral images) to establish "battlefield intelligence processing and

analyzing" and "underwater surveillance system". This can help amending the insufficient part of traditional sonar detection. Also, building enough offshore submarines is also critical to our future asymmetrical anti-submarine combat development.

1. William Matthews, "China's Subs Getting Quieter But Still Louder Than Older Russian Submarines", *Defensenews*, 30 November 2009, p1.

2. Power Paragon Chief Engineer Chi Mak has leaked the new noise reduction technology to PLA, which can effectively reduce the noise by 70% .

3. The improved Shang class submarines have equipped hull coatings that are common seen on modern submarines (due to the research they did on the acquired Kilo class submarines). The coatings allow the submarines to isolate its own noise and reduce the wave strength of enemy sonars. This made the improved Shang class submarines gain a great deal of acoustic quieting capability.

4. Cheng-En Li, Chi-Fang Chen, Ke-Shin Liang., "Ocean Environment's impact on sonar detection efficiency and anti-submarine tactics.", *Navy Professional Journal*, Volume 42, No.5, October, 2008, P.97.

5. Shih-Chin Li, "Research on PLA's Submarine Units' Development in Maritime Strategic Viewpoints." *Navy Professional Journal*, Volume 42, No.2, April, 2008, P.80.

6. Li-Te Chang, "Our Military Regular and Asymmetric Anti-Submarine Capabilities.", *Asia-Pacific Defense Magazine*, January Issue, January, 2010, P46.

7. Yun-Hui Liu, Chi-Ping Tu, Chih-Hao Chou., "Vessels Acoustic Signal Analysis System Development.", *National Defense Technology Academic Research Report*, December, 2005.

8. Refer to note 7.

9. Kun-Lin Chiang, "Acoustic Database Instruction Manual and System Documents", March, 1994, p3-p4.

10. Refer to note 6, p49.

11. Vadm. George Emery., C.O. SUBFORLANT, 1994.

12. Chih-Chung Kao., "Research on Non Acoustic Anti-Submarine Detection Via Satellite Image to Detect Underwater Targets.", *National Defense Technology Research Plan Application*, September, 2007, p1.

13. Potter, John R, "Challenges of Seeing Underwater - a Vision for Tomorrow", <http://www.arl.nus.edu.sg/web/pub/1999-NPTS-1>

14. Chih-Chung Kao, Ming-Che Huang., "Research on Non Acoustic Anti-Submarine Detection Via SAR Image to Detect Underwater Targets.", *2008 National Defense Technology Academic Cooperation Result Reports in Collection - Second Volume* December, 2008, p825-830.

15. For example, after IDF, Hsiung Feng missiles finished developing, U.S. Government then sold us F-16 and Harpoon missiles.

16. Chih-Peng Wong., "Do Bravely rather than Waiting in Vain.", *Asia-Pacific Defense Magazine*, February Issue, February, 2010, p33.