

## **China's Anti-Ship Missiles: The Growing Asian Missile Gap**

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Strategic Balance of Power is rapidly changing in Asia - often faster than most realise. The increasing defence budget of the Peoples' Liberation Army (PLA) in keeping with the rapid growth of the Chinese economy and the country's technical and industrial base has enabled China to rapidly introduce incremental qualitative improvements to its force structure. The developments since 1990 in fact have been so far reaching that today the PLA is well placed to have power projection capabilities equivalent to the United States in the Asia Pacific region in the next 20-25 years.

The term 'missile gap' was used for the first time in the mid 1950s to denote a supposed Soviet qualitative and quantitative superiority in Inter Continental Ballistic Missiles (ICBMs).<sup>1</sup> It is today known that the inflated figures<sup>2</sup> used by the US intelligence community then were mostly fictitious and the claimed Soviet threat did not exist at the time. However, the current situation in the Asia-Pacific region is an example of a real gap in anti-ship missile capabilities.

While advancements in Chinese power projection capabilities are numerous, the developments in their Anti-Ship Cruise Missile (ASCM) capabilities are important as they provide sea-denial; when coupled with modern air and sea platforms, they enable sea-control and naval supremacy on the high seas. Sea-control is the lynchpin for the Chinese policy of exerting influence up to and beyond the 'First Island Chain'.

While much has been made of the Chinese attempts to develop the Dong Feng DF-21D anti-ship ballistic missile, the extremely long kill chain involved from target acquisition to launching the missile and guiding the ballistic weapon in its terminal phase against a fast moving target is a technically challenging task. While, it has its

advantages of being able to launch an attack from missiles based on the Chinese mainland at a Carrier Battle Group (CBG) and not sending any ships or aircraft into harm's way, the disadvantages are far too many for it to be a reliable means of attack.<sup>3</sup>

This is more so because US Navy ships are increasingly being armed with RIM-161 Standard Missile 3 which has the ability to shoot down ballistic missiles in their boost and re-entry phase. Ballistic missiles are easy to detect and do not have the advantage of protection from radar by terrain masking and curvature of the earth. Therefore, a prohibitive number of weapons may be required to be effective. Lastly, it is relatively easy to disrupt the long kill chain involved in affecting an Anti-Ship Ballistic Missile (ASBM) attack.

Modern ASCMs, are available in large numbers with the People's Liberation Army Navy (PLAN) and outstrip the capabilities of their possible regional adversaries. More importantly, the difference in capabilities of PLAN ASCMs and its adversaries is rapidly widening.

### **Early PLAN ASCMs**

The first Chinese ASCM was the ubiquitous HY-1/CSS-1 Silkworm<sup>4</sup> - essentially a reverse engineered SS-N-2 Styx; the missile subsequently underwent evolution in the form of the HY-2/CSS-2 Seersucker. The Styx is considered obsolete because of its large size and vulnerable flight profile.<sup>5</sup> Modern Chinese ASCMs comprise a large family of subsonic and supersonic weapons of different designs and capabilities.

### **Subsonic**

The first modern design the YJ-8 or Yingji-8/C-801/CSS-N-4 Sardine introduced in the early 1980s, was the Chinese equivalent of western designs such as AGM-84 Harpoon and MM-38 Exocet. The Western designs were, however, superior in performance parameters such as speed with both the Harpoon and the Exocet maintaining a 'high-subsonic' speed near that of sound. The relatively slower and shorter ranged but compact C-801, speed Mach 0.75, range 40 km against 120 km for Harpoon and 70 km for Exocet is more versatile allowing its launch from helicopters, surface ships, submarines and aircraft. A follow-up design, the YJ-82/C-802 is a direct analogue to the Harpoon Block I and KH-35 Uran in performance. The C-802 is,

however, different from the KH-35 in that the latter uses a turbofan engine while the former uses a turbojet like the BGM-84 Harpoon arrange of 120 km and entered service in 1989.<sup>6</sup>

Improved air launched variants the YJ-83/C-802A with a greater range of 180-250 km are in service. Variants with radar, infrared, laser, optical and satellite guidance are available. The submarine launched variant was designated as the YJ-1 and the Air launched variant the YJ-81.<sup>7</sup>

An associated development is the YJ-62 subsonic ASCM that has been in service since 2005. An improved variant the YJ-62A has a range of over 400 km. The export variant is designated the C-602, and has a reduced range of 280 km, but a larger warhead of 300 kg.<sup>8</sup> The missile can be employed from a wide variety of platforms including shore-based missile batteries and various modern PLAN warships and submarines such as Type 051B Luhai Class Guided Missile Destroyer (DDG), Type 053 Jiangwei-II Class Guided Missile Frigate (FFG), Type 039 Song Class Diesel-Electric Attack Submarine (SSK), Type 039A Yuan Class SSK, Type 093 Shang Class Nuclear Powered Attack Submarine (SSN). Chinese aircraft like the JH-7 and the H-6 are also capable of employing the C-802.

## **Supersonic**

The real revolution is happening not in the development of subsonic ASCM, but rather in the imminent large scale deployment of supersonic ASCMs. The first claimed Chinese supersonic ASCM was the 'C-803', a derivative of the YJ-83. A terminal speed of Mach 1.5 and has a range of 180 km to 250 km (air launched)<sup>9</sup> was claimed by many western sources, however, no source confirms the existence of such a weapon.

The first operational PLAN ASCM was the erstwhile Soviet/ Russian Raduga P-270/3M-80E Moskit/SS-N-22 Sunburn on two Sovremenny Class DDGs. The Chinese variant, 3M-80MBE differs from the original 3M-80E with a range of 240 km over 220 km respectively.<sup>10</sup> The Chinese financed the development of the Moskit for the PLAN which boasts a speed of Mach 3 and a 320 kg warhead.<sup>11</sup> It is certain that the Chinese employed the technology for their subsequent missile development programs.<sup>12</sup>

The first indigenous Chinese ASCM which maintains a supersonic flight throughout its flight envelope is the YJ-12. The missile is based on the Russian Kh-31 which the Chinese bought and reverse engineered as the YJ-91. The YJ-12 has an estimated range of 300 km at Mach 3 by following a Hi-Lo flight profile to the target. An alternate flight profile may help increase the range to 400 km at Mach 4 by using a high altitude cruise followed by a sharp dive onto the target.<sup>13</sup> The YJ-100, a subsonic turbofan variant of the YJ-12 is capable of achieving ranges of over 600-800 km as authenticated by various sources.<sup>14</sup>



Fig.1 - YJ-12



Fig.2 - YJ-100

ASCMs arming Xian H-6G Bombers<sup>15</sup>

The YJ-100 is the longest ranged anti-ship missile similar in concept to the now defunct BGM/RGM-109B Tomahawk ASM but with longer range. It also out ranges the monstrous Soviet/Russian P-700 Granit/SS-N-19 Shipwreck range 625 km and the P-1000 which is a P-500 Bazalt/SS-N-12 Sandbox derivative, range 680 km.<sup>16</sup>



Fig.3 - P-700 Granit with inlet cover installed, but wings and control surfaces deployed.<sup>17</sup>

While the Granit maintains a supersonic sea skimming flight profile, it is vulnerable to modern SAMs like the SM-6 employing cooperative engagement

capability. Moreover, its very large size,<sup>18</sup> comparable to a MiG-17<sup>19</sup> restricts deployment only by Kirov Class Nuclear Powered Guided Missile Battle Cruiser and Oscar Class Nuclear Powered Cruise Missile Submarine. The P-1000 attained its maximum range only in Hi-Lo profile while in sea skimming mode, its range is less than 500 km.

The closest equivalent of the YJ-100 in currently deployed weapons is the Russian 3M-54 Klub which arguably is the most lethal anti-ship missile ever designed. The basic variant of the Klub is a submarine launched anti-ship weapon and has a range of 440-660 km with the missile flying at subsonic speeds for most of the distance and engaging a ramjet engine at the terminal stage as it enters in range of the target's missile defence systems. The missile then flies at a speed of Mach 2.9 at a height of just 15 feet above sea level. It is also capable of performing evasive maneuvers to defeat point defence systems.<sup>20</sup> The combination of the missile's flight profile, range, speed and ability to perform evasive maneuvers make it a lethal ship-killer. The 3M-54T is the vertically launched ship based variant. An air launched version is also being developed designated the 3M-54AE Klub-A with a 300 km range and a 200 kg warhead and a supersonic terminal stage. A subsonic air-launched variant called the 3M-54AE1 also exists and probably uses the SU-34 Fullback and Su-35 Flanker E aircraft as launch platforms.<sup>21</sup>

The Klub has been exported to China where it has been reverse-engineered as YJ-18,<sup>22</sup> to arm PLAN warships and submarines.<sup>23</sup> The missile has a range of 540 km and is armed with a 140-300 kg warhead<sup>24</sup> which coupled with its high supersonic speed delivers tremendous kinetic energy onto the target; a single hit being sufficient to sink or cripple an 8,000 to 10,000 ton warship like a Ticonderoga Class CG. It is appreciated that technology gleaned from the Klub would have been integrated into upcoming air-launched Chinese ASCMs like the YJ-100.



Fig.4 - 3M-84 Sub-launched Variant<sup>25</sup>

The versatile YJ-100 is capable of launch from aircraft in addition to being launched from surface ships and submarines. The new PLAN Type 055 DDG expected to be deployed by 2019 will be armed with the YJ-100 as its primary ASCM.<sup>26</sup> The Type 055 is expected to be armed with 128 VLS cells<sup>27</sup> and equipped with an advanced variant of Type 346/348 series AESA radar.

In November 2014, the Chinese unveiled a new supersonic ASCM designated the Chaoxun CX-1 bearing an uncanny resemblance to the Indo-Russian PJ-10 BrahMos. Indian scientists associated with the BrahMos program have denied any correlation between the two weapons,<sup>28</sup> and even Russian military experts point out that although the design may superficially resemble the BrahMos, several finer aerodynamic and engine differences set it apart as an unrelated development.

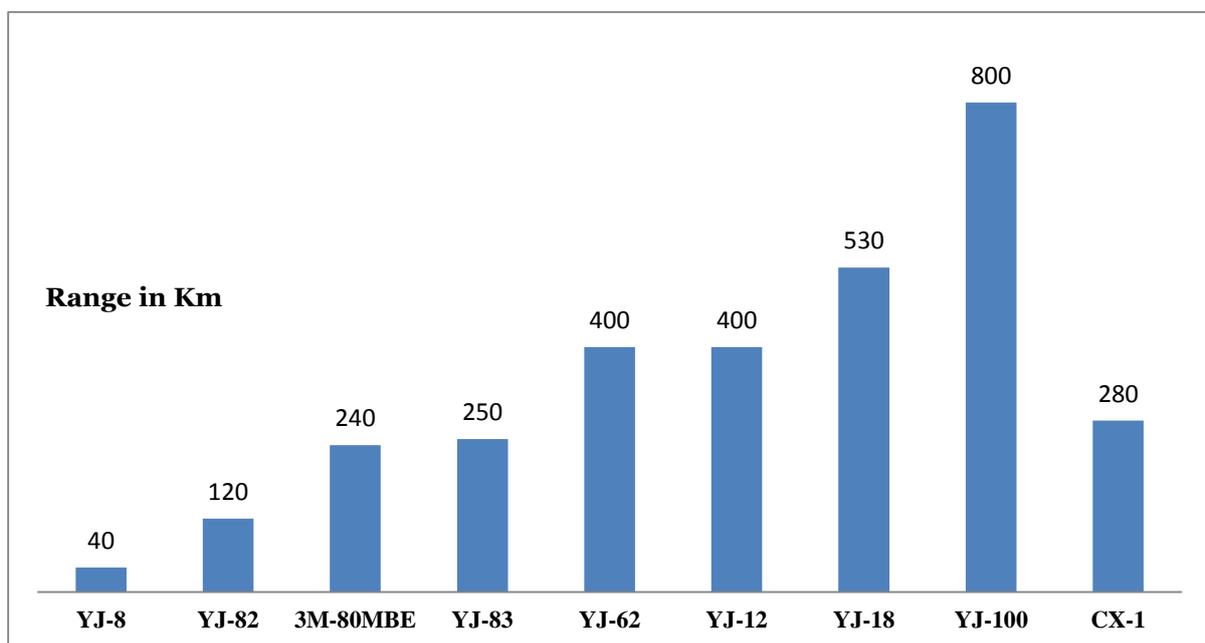


Fig.5 - Range Comparison of Modern PLAN ASCMs

The cited performance parameters for the Chinese missile are however, very similar to the BrahMos. The CX-1 has a speed of Mach 3 and a range of 280 km and drops to an altitude of 10 m at a range of 10 km from its target. As per Richard Fischer, the new missile looks very similar to the Brahmos ASCM; the two missiles "share the distinctive cone shaped air-inlet based on Russia's highly regarded P-800 Oniks supersonic ASCM."<sup>29</sup> Nevertheless, it only proves that the Chinese have a weapon system identical in performance and technology to the much vaunted BrahMos and if the Indian and Russian defence experts are right, the capability to develop it independent of foreign assistance.



Fig.6 - Chaoxun CX-1 Missile<sup>30</sup>



Fig.7 PJ-10 BrahMos Missile<sup>31</sup>

## Employment

The Chinese naval strategy draws heavily from the Soviet Cold War doctrine of asymmetrically countering NATO's conventional naval superiority. It does not intend to match the US ship for ship, but rather to have a local regional superiority and employ superior long range firepower from multiple directions against a US CBG attempting to intervene in a relatively confined area like the Taiwan Strait or the Senkaku/Diaoyu Islands. Specifically the entire 'First Island Chain' is suitable for such surprise attacks using asymmetrical means. A typical scenario includes the BeiDou Satellite Navigation System (BDS) providing targeting information to ships, submarines and aircraft carrying ASCMs making a coordinated missile attack from well beyond the task forces' own anti-ship weapons. Small vessels employing stealth features are especially suitable for such attacks as they remain undetected long enough to close in to missile firing

range of a CBG. Modern PLAN FFGs, DDGs and SSNs/SSKs combine together to form a large number of ASCM platforms.

In the next decade, it is certain that the remaining older warships of the PLAN would be replaced by state of the art warships like the DDGs Type 052D, Type 055 and FFGs Type 054A, Type 054B. Their advanced stealth features, AESA radars, long range HHQ-9 SAMs and long range ASCMs like the YJ-18 and YJ-100 would provide standoff superiority.

## **Conclusion**

The lack of an equivalent weapon which can engage powerful PLAN Surface Action Groups (SAGs) or possible CBGs at comparable ranges is a destabilizing factor in Asia. The BrahMos ASCM, has a maximum range of 290 km. The missile entered induction in 2007 and arms a few Indian Navy warships; it does not yet have an air launched variant although one has been under development for some time;<sup>32</sup> while the Chinese have already developed a direct equivalent of the BrahMos in the CX-1 ASCM. The Chinese presently deploy missiles capable of longer ranges and most of which have enjoyed longer serial production runs than weapons developed by their regional peers. Additionally, both the YJ-12 and YJ-100 have air launched variants which are already deployed on PLAN aircraft.<sup>33</sup> Chinese BeiDou global satellite navigation system is being increasingly used by them for missile guidance.

This emerging anti-ship cruise missile gap is recognized by the US Navy as an area of concern too as it finds its surface warships lacking the punch to perform Anti Surface Warfare missions because its primary weapon, the BGM-84 Harpoon is outclassed. US Navy began the Long Range Anti-Ship Missile (LRASM) program in 2009 to have a weapon capable of remedying it. The LRASM-A is a stealthy turbofan powered derivative of the AGM-158 Joint Air-to-Surface Standoff Missile – Extended Range (JASSM-ER) with an effective range of over 500 miles.<sup>34</sup> Work on the LRASM-B, a ramjet powered and more technically challenging derivative of the same weapon has currently been deferred.<sup>35</sup>

It is clear that there are hardly any Anti-Ship Cruise missiles to counter the Chinese threat at sea who are rapidly in the process of deploying superior weapons in superior numbers vis-à-vis their adversaries. Only the US Navy can today effectively challenge the PLAN at sea because of its naval air power, however if current trends continue, and

the development of effective anti-ship weapons is neglected, the US navy will lose its sharp edge in the Asia-Pacific. In the face of budget cuts and money spent on vessels like the Littoral Combat Ship which are barely armed to defend themselves and have absorbed tremendous resources, the LRASM project which is still under development runs the risk of being put on the back burner. It would do well to remember that a navy must first win the war at sea before turning to the littorals.

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