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High-Speed Cruise Missiles in Asia: Evolution or Revolution in Fire Power?

By Kalyan M Kemburi

Synopsis

Recent reports indicated that China has successfully tested a hypersonic system - a potential precursor for a high-speed cruise missile. What is the role of high-speed cruise missiles in providing firepower for land-attack missions?

Commentary

IN THE last two decades, cruise missiles were predominantly deployed by a select group of advanced industrial countries, in particular the United States. Subsequently, there had been a wider use of this weapon system by militaries, partly due to globalisation which accelerated technology diffusion, but also because of affordability and operational requirements (in particular the search for asymmetric capabilities).

Asian militaries top this list. The main advantage of cruise missiles involves the ability to strike targets accurately almost under any weather condition from a long range by evading most air defences, and with minimal risk to friendly forces.

Asian militaries and cruise missiles

Although most countries in Asia have acquired anti-ship cruise missiles (ASCM), China, India, Pakistan, South Korea, and Taiwan are developing or have deployed land-attack cruise missiles (LACM). Some Southeast Asian countries such as Indonesia, Malaysia, and Vietnam have also expressed interest. Japan has indicated interest in a system that could endow it with preemptive strike capabilities - for which cruise missiles could fit the bill.

For countries such as Japan, South Korea and Taiwan, the high-cost of deploying missile defences and the treaty restrictions in developing ballistic missiles, have made cruise missiles an attractive system to strike against potential adversaries' ballistic missiles and artillery systems.

As with any military technology, there is always a dynamic between defence and offence. Deployment of cruise missiles also have resulted in consequent developments in defence: active-counter measures include advances in early warning systems and the deployment of AWACS (Airborne Warning and Control System) aircraft as well as the strengthening of passive defences such as installations holding critical assets like aircraft or command and control equipment. Moreover, new operational requirements have intensified efforts to acquire

high-speed cruise missiles.

R&D in Supersonic and Hypersonic Systems

Five countries in Asia - China, Japan, India, South Korea, and Taiwan - have either civilian and/ or military programmes aimed at developing supersonic and hypersonic systems. It is generally agreed that supersonic systems (powered by ramjet engine) operate in the range of Mach 2-4 and hypersonic (scramjet engine) over Mach 5; most of the deployed LACMs fly at subsonic speeds of around 800km/hr.

China Aerodynamics R&D Centre and the National University of Defence Technology are currently working towards scramjet propulsion, pulse-detonation engines, and turbine-based combined cycle (TBCC) engines with an aim to eventually develop hypersonic missiles and aircraft. Further, the China Academy of Aerospace Aerodynamics has reportedly developed an experimental scramjet.

The Japanese Aerospace Exploration Agency (JAXA) is involved in developing high-speed air-breathing propulsion for a hypersonic aircraft. JAXA is also collaborating with institutions based in Australia, Germany, Italy, and the United States in developing scramjet-based systems for space access. In 2012, Japan reportedly tested a rocket-based combined-cycle engine model under Mach 8.

India currently deploys the ramjet-powered supersonic LACM Brahmos flying at 2.5-2.8 Mach, and has plans to collaborate with Russia to develop a kerosene-based hypersonic Brahmos 2. Concurrently, the Defence Research and Development Organisation is working on a hypersonic system that could fly at Mach 6-7 speed propelled by scramjet. Similarly, for space access, India's civilian space agency has been working on a hydrogen-fueled scramjet engine.

Taiwan's Hsiung Feng III (HF-3) LACM is propelled by a ramjet engine flying at a maximum speed of Mach 2 with an estimated range of 150-200 km. Initially developed as an ASCM by Chung Shan International Institute of Science and Technology, it was later reported that the missile also has land attack capabilities and entered into service in 2008.

A new entrant of the cruise missile club, South Korea, has also been developing a supersonic Haeseong-2 LACM from the existing ASCM Haeseong-1 (Sea Star, or SSM-700K). In September 2011, *Korea Times* reported that the missile was slated for deployment by the end of 2013 and has a range in excess of 500 kms. Additionally, the Korea Aerospace Research Institute (KARI) has on the drawing board a two-stage Mach 4 scramjet propelled surface to air interceptor. Reportedly KARI has ground-tested various scramjet components required for this concept.

Evolution or Revolution in Fire Power

Supersonic cruise missiles would increasingly become an attractive option due to the following factors: Firstly, they reduce sensor-to-shooter to-target times. A supersonic LACM flying towards a target at a distance of 1000 kms has clear time advantage of over sixty minutes over its subsonic counterpart. Secondly, the kinetic energy of a supersonic missile not only increases the explosive power of a warhead but also facilitates reduction of the warhead payload, which helps in expanding the range of the missile. Moreover, they are also very useful for targeting hardened targets; this is important given the hardening of installations as part of key passive defensive measures undertaken by many countries. Thirdly, supersonic LACM used in conjunction with subsonic and theatre ballistic missiles create processing difficulties for any advanced early warning and air defence system.

On the other hand, hypersonic air-breathing missile is a key emerging technology. For an effective and efficient use of this technology, changes are necessary in organisational structures, decision-making processes, operational concepts, and C4ISR systems. For most Asian militaries, accustomed to organisational and procedural inertia, bringing these changes in itself is revolutionary. Moreover, enormous technical and financial resources are necessary to deploy a hypersonic cruise missile; therefore, over the next 10-15 years supersonic cruise missiles offer a more viable complement to the existing cruise and ballistic missiles.

Asian militaries are still in the process of inducting subsonic LACMs - supersonics in some cases - in significant numbers, and currently are working on innovative concepts and organisational changes that aim to take advantage of these systems in affecting the outcomes on the battlefield. Therefore, induction of high-speed missiles is evolutionary.

Nevertheless, in a decade, military commanders in Asia would be able to have a cruise missile delivered to their target 1500 kms away in less than 30 minutes!

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