



EVOLUTION OF MISSILES IN INDIA

Sunit Kumar Sharma, Research Scholar,
Department of Defence and Strategic Studies,
Govt. SMS Model Science College, Gwalior, Madhya Pradesh, India

ORIGINAL ARTICLE



Corresponding Author :

Sunit Kumar Sharma,

Research Scholar,

Department of Defence and Strategic Studies,

Govt. SMS Model Science College,

Gwalior, Madhya Pradesh, India

shodhsamagam1@gmail.com

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Abstract :-

India's rivalry with China and Pakistan has resulted in the race for acquisition of superior missiles in the continent. A credible ballistic missile defence for India is, therefore, required as a 'Deterrent'. India launched its Integrated Guided Missile Development Programme in 1983. Development of Ballistic Missiles. Prithvi is a family of short-range ballistic missiles. Prithvi-I with a range of 150 km, Prithvi-II, with a range of 250-350 Km and Prithvi-III with a range of 350+ km have been successfully tested to carry the designated payload. Agni I (1500 km) and Agni II (2500 km) are medium range missiles. Agni III and IV are the intermediate range missiles. Agni III incorporating PSLV technology was test-fired in 2015. The Agni IV (4000 km) incorporating GSLV technology was tested in 2017. Agni-V (6000 km), an intercontinental missile, has been successfully tested. Agni-VI (10000 km), capable of being launched from submarines, is under development. Submarine-Launched Ballistic Missiles. K-15 (700 km) will be India's first nuclear-capable SLBM. K-4 (3,500 km) has been successfully tested. K-5 (6,000 km) missile is under development. Cruise Missiles. BrahMos is nuclear-capable cruise missile jointly developed by Russia and India. The original range of the BrahMos was 290 km. After India's induction into MTCR in June 2016, the range of BrahMos will be 600 km. Beyond Visual Range Air To Air Missile. Astra, a Beyond Visual Range Air to Air Missile is under production. The induction is expected in 2019.

Key Word :-

Missiles, Navigation, Defence, Nuclear, Satellite

Introduction :-

India's security environment is dominated by its mistrust of Pakistan, and its competition for regional influence with China. India's future security will be determined by the way it manages the threat posed by these two closely-aligned regional adversaries. India's rivalry with China and Pakistan has also precipitated an accelerating regional arms race in which ballistic missiles programmes of China and Pakistan continue to feature prominently. A credible ballistic missile defence regime for India is, thus, imperative for creating the much required 'Deterrent Defence'. Accordingly Indian scientists have been working along with Indian Space Research Organisation (ISRO), Bhabha Atomic Research Centre (BARC) and Defence Research and Development Organisation (DRDO) to develop a variety of conventional and nuclear warheads and the matching delivery systems like missiles.

India launched its Integrated Guided Missile Development Programme (IGMDP) in 1983 to achieve self-sufficiency in missile production / development. The mandate of IGMDP included development of a 2500 kms Agni (Fire) Intermediate Range Ballistic Missile (IRBM), a 150 kms Prithvi (Earth) battlefield support missile, two quick reaction surface-to-air Akash (Sky) and Trishul (Trident) missiles and an anti-tank Nag (Cobra) missile. India's missile development has come a long way since then.

Short Range ballistic missiles (SRBM) < 1000 KM Prithvi :-

Prithvi is a family of tactical surface-to-surface short-range ballistic missiles (SRBM) and is India's first indigenously developed ballistic missile. The liquid-fuelled, road-mobile SRBM was first tested in Feb 1988. Later, both 150 kms (SS-150) and 250 kms (SS-250) versions reached production by mid-1994. Prithvi's inertial guidance system gives a Circular Error of Probability (CEP) of 125 m at 125 km engagement. Integration of US Global Positioning System (GPS) into the guidance package has now provided enhanced accuracy.

Prithvi-I has an estimated range of 150 km. This may be replaced with the Prahaar missile system which was successfully tested in July 2011 with a range of 150 km.

Prithvi-II is estimated to have a range of 250-350 km. It can carry a single nuclear or conventional warhead. It is unclear if the Prithvi-II is still deployed as a nuclear-capable missile, given the development of the Agni series. The Prithvi-II has been successfully tested in 2012, 2013, 2014, and 2016.

Prithvi-III began development in 2000. It has an estimated range of 350+ km. When development is complete, it will be able to carry a single nuclear or conventional warhead.

Shaurya, A hypersonic land-based variant of the nuclear-capable K-15 submarine-launched ballistic missile; can carry a single conventional or nuclear warhead. A September 2011 test revealed a flight speed of 7.5 Mach and a range of 700 km. The Shaurya has been listed as a hybrid missile.

Medium-Range Ballistic Missiles (1,000-3,000 km) Agni I & II :-

Agni, the medium range missile programme, envisages two variants with ranges of 1500 kms (Agni I) and 2500 kms (Agni II). The Agni I had its first successful launch in 1989. However 1998 nuclear tests changed the status of Agni from a 'technology demonstrator' to a

real IRBM for the delivery of nuclear weapons. Another successful launch of Agni I was carried out in Jan 2003.

The Agni II was successfully test fired on 11 Apr 1999 and again on 17 Jan 2001. The missile is a rail-mobile, two-stage solid propellant rocket motor with a Strap-down Inertial Navigation System and has achieved a range of 2000 km with a 1000 kg payload. Its designed range however is 2500 kms. Unlike Agni I, Agni II uses a mix of solid-liquid propellant.

Intermediate Range Ballistic Missiles (3,000-5,500 Km): Agni III & IV :-

The Polar Satellite Launch Vehicle (PSLV) forms the basis of the Agni III. The Agni III is a hybrid of Agni II and the PSLV-one stage liquid fuel and two stages solid fuel. In 2014, the Indian Ministry of Defense announced that the Agni-III was “in the arsenal of armed forces” and it was successfully test-fired in April 2015.

The Agni IV is incorporating the ISRO’s ambitious rocket technology from the Geostationary Satellite Launch Vehicle (GSLV) program. Agni IV has since been successfully tested, most recently in January 2017 with an estimated range of 4000 km and inducted in the armed forces.

Intercontinental Ballistic Missile (>5,500 km): Agni V & VI :-

Agni-V, with an estimated range of 5500–6000 km, can carry a single nuclear or conventional payload. It has been successfully tested 5 times till 2018. Agni-V will be a road mobile system.

Agni-VI is an Intercontinental ballistic missile with an envisioned range of 8000–12000 km, is under development by India. Reportedly, it will be capable of being launched from submarines or from land and strike a target of over 10,000 km with features such as Multiple independently targetable re-entry vehicles (MIRVs) or Maneuverable re-entry vehicles (MARVs).

Surya, the latest ICBM is likely to be developed for ranges in excess of 5000 kms and up to 20000 kms. It is likely to exploit the PSLV technology or the ISRO’s technology from the Geostationary Satellite Launch Vehicle (GSLV), program. The GSLV as ICBM could strike targets at 12000-14000 km.

Short Range Surface to Air Missile –Trishul :-

The Trishul, a 9 km range surface to air missile, was conceived with a quick reaction and all weather capability. The central government, in 2008 announced closure of work on the multi-mission Trishul missile claiming that development of Trishul missile system has been completed as technology demonstrator.

Medium-Range Surface-to-Air Missile : Akash :-

Akash has been designed as a radar- guided missile incorporating terminal homing by radar fitted in its nose cone, a slant range of 25 Kms and a height of engagement of 12 Kms. Akash is a BMP based medium-range surface-to-air missile with an intercept range of 30 km. It has a launch weight of 720 kg, a diameter of 35 cm and a length of 5.8 meter. Akash flies at supersonic speed, reaching around Mach 2.5. It is propelled by a solid fuelled booster stage. The missile has a terminal guidance system capable of working through electronic countermeasures. The entire AkashSAM system allows for attacking multiple targets (up to 4 per battery). The Akash missile’s use of ramjet propulsion system allows it to maintain its speed without deceleration, unlike the Patriot missiles. The missile is supported by a multi-

target and multi-function phased array fire control radar called the 'Rajendra' with a range of about 80 km in search, and 60 km in terms of engagement. The first test flight of Akash missile was conducted in 1990, with development flights up to March 1997. In 2007, Indian Air Force completed user trials for the Akash missile system and declared that it would initiate the induction of 2 squadron strength (each squadron with 2 batteries) of this missile system, to replace retiring SA-3 GOA (Pechora) SAM systems. In February 2010, the Indian Air Force ordered six more squadrons of the Akash system, taking orders to eight. Development of an advanced version, Akash MK-II, began in June 2010. Two versions of the missile are being built for the Indian Air Force (IAF) and the Indian Army (IA). The first Akash missile was delivered to the IAF in March 2012. The first Akash SAM production model for the Indian Army successfully destroyed a target in receding target mode during two flight trials in February 2014. The first batch of the Akash missiles was inducted by the Indian Army in May 2015. The missile was formally inducted into the IAF in July 2015. The MK-II version is expected to be ready for user trials by 2018.

Low-Level, Quick-Reaction Surface-to-Air Missile (LLQRM) : Maitri :-

The Maitri missile project is a next-generation Low-Level, Quick-Reaction Surface-to-Air Missile (LLQRM) being developed by DRDO in collaboration with the Britain-based MBDA. Defense Research and Development Laboratory (DRDL) of DRDO will act as the design center in India. DRDO is expected to design the missile, the radars and the C3I system along with the launchers. MBDA's principal contribution will be in co-developing the seekers for the missiles. The DRDO with MBDA is planning to develop 9 short-range surface-to-air missile system (SRSAM). Over a 1000 missiles are expected to be produced for the Indian Army, Air Force and Navy. In March 2015, the development of the missile commenced for a point air defence system for Indian Navy.

Submarine - Launched Ballistic Missile (SLBM) :-

India is currently developing its SLBM capabilities with its K-series missiles, a high-priority project of the DRDO.

K-15 (Sagarika), under development will be India's first nuclear-capable SLBM. The K-15 is believed to have a 700 km range and no MIRV capabilities. The K-15 was first tested in 2004 and again in 2007, 2008 (total 10 tests 2004-08), 2013 and most recently in November 2015. It is the first of India's K Series missiles.

K-4 missile under development, has been successfully flight tested at a range of 3,500 km in 2016. Some cite it can carry a conventional or nuclear payload. The first undersea launch of the K-4 was conducted in March 2014.

A K-5 missile is also under development. The K-5 missile would have a range of over 6,000 km (a high estimate of 10,000 km) with a capacity to carry 4 MIRVs. The K-5 would be the first MIRV equipped missile in India's nuclear arsenal.

Cruise Missiles :-

BrahMos is a nuclear-capable land-attack cruise missile jointly developed between Russia and India. It can carry a single nuclear or conventional payload. The original striking-range of the BrahMos was planned at 290 km. However, now that India was inducted into MTCR in June 2016, the range of the BrahMos missiles are anticipated to be extended to 600 km.

Induction of the first version of BrahMos in the Indian Navy commenced from 2005 with INS Rajput as the first ship. Army has also inducted three regiments of BrahMos missile. An enhanced version of the BrahMos missile with an Extended Range was successfully test-

-fired In March 2017. The technology upgrade comes after India's full membership to the Missile Technology Control Regime (MTCR), which removed caps on range of BrahMos cruise missile. The air launched version of missile was successfully flight-tested from Sukhoi-30MKI against in the Bay of Bengal on 22nd Nov 2017.

Beyond Visual Range Air To Air Missile : Astra :-

Astra is an active radar homing Beyond Visual Range Air to Air Missile (BVRAAM). This air-to-air missile enables fighter pilots to lock-on and shoot down enemy aircraft at varying range and altitudes allowing for engagement of both short-range targets at 20 km and long-range targets at 80 km. The missile is fitted with a proximity fuze, the DRDO is now working on a new laser fuze. The missile was successfully tested in May 2003, March 2007 and September 2008. Astra has been integrated with Sukhoi Su-30MKI and will be integrated with Mirage 2000 and MiG-29 in the future. Limited series production of Astra missiles began in 2017. A series of successful flight trials of Astra have been conducted by the Indian Air Force (IAF) in October 2018. The induction is expected in 2019.

S - 400 :-

The S-400 Triumph, is an anti-aircraft weapon system developed by Russia as an upgrade of the S-300 family. The S-400 system uses four types of missiles to fill its performance envelope: the very-long-range (400 km), the long-range (250 km), the medium-range (120 km) and the short-range (40 km). The S-400 is able to intercept cruise missiles up to a range of about 40 km. On 15 October 2016, India and Russia signed an Inter-governmental Agreement (IGA) for five S-400 anti-aircraft missile systems. The S-400 was described by The Economist in 2017 as "one of the best air-defence systems currently made". On 5 October 2018, India and Russia signed a US\$5.43 billion (₹ 40,000Cr) deal for five S-400 missile systems. The deliveries are expected to commence by the end of 2020.

References :-

1. Gupta R.K. *World Viewpoint on National Missile Defence*. New Delhi: Atlantic Publishers and Distributors.
2. Krepon, M. (2003). *Cooperative Threat Reduction, Missile Defence and the Nuclear Future*. New York: Plagrave Macmillan.
3. Robert L, Pfalzgraff Jr. (1997). *Special Report - Security Strategy and Missile Defence*. New Delhi: Ritana Books.
4. Levi, G. B. (1989). *The Future of Land Based Missiles*. New York: American Institute of Physics.
5. Mazzar, M. J. (1989). *Missile Defence and Asian - Pacific*. London: The Macmillan Press Ltd.
6. Srivastava, Dr MP, (2002). *US National Missile Defence Strategy*: New Delhi : Gyan Publishing House.
7. *Indian Defence Review - Quarterly, Jan 2018*
8. *Indian Military Review - Monthly, Jun 2018*.
9. *India Strategic Defence Magazine, Dec 2018*
10. *SP's Military Year Book, 2017*
11. *Force - National Security & Aerospace News Magazine, May 2018*
