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AGNI - V: INDIA'S FIERY SPEAR OF STRATEGIC SUPREMACY

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SUPREMACY**



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Introduction

In ancient Indian legends, *Agni*, the god of fire, represents power of transformation, destruction, and purification. Vedic texts depict *Agni* as a divine messenger between humans and the gods. India's Integrated Guided Missile Development Program (IGMDP) in 1983, named its long-range surface to surface missile series "*Agni*" to signify unyielding strength and precision. One missile in this series, the Agni - V, is an Intermediate Range Ballistic Missile (IRBM) with an impressive 5,000-5,500 km reach, (8000 according to some sources) nuclear capable, and is integrated with Multiple Independently targeted Re - entry Vehicle (MIRV) technology. It represents the pinnacle of the IGMDP evolution over the years. Developed by DRDO, it extends deterrence to northern China and parts of Europe. It is incorporated with advanced solid propulsion and cold launch mechanisms for rapid deployment and accuracy.

The Integrated Guided Missile Development Program

The missiles incorporated with energy source in it to provide the required force for its movement (propulsion), intelligence to go in the required direction (guidance) and effective manoeuvring (control) is known as a *Guided Missile*.¹

India started *Integrated Guided Missile Development Program* (IGMDP) in 1983 with objectives to develop:²

- Short Range Surface to Surface Missile (SSM) “*Prithvi*”³
- Long Range Surface to Surface Missile (SSM) “*Agni*”⁴
- Short Range Surface to Air Missile (SAM) “*Trishul*”⁵
- Anti-tank Guided Missile (ATGM) “*Nag*”⁶
- Medium Range Surface to Air Missile (SAM) “*Akash*”⁷

The Agni missile series, a cornerstone of India's IGMDP launched in 1983, includes short to intermediate range ballistic missiles for strategic deterrence. Developed by Defence Research Development Organisation (DRDO), the missile series includes *Agni-I, II, III, IV, V and Prime* along with ongoing researches and developments in *Agni - VI*, all featuring solid propulsion and nuclear capability. These missiles are integrated with advanced guidance systems for high precision and flexibility. Agni - V's Multiple Independently targeted Re - entry Vehicle (MIRV) technology enables multiple warhead delivery, enhancing strike capabilities. Canister-based launchesⁱ ensure mobility and rapid deployment. The series strengthens India's defense self-reliance under the *Atmanirbhar Bharat* initiative. It positions India as a global nuclear power, countering regional threats effectively.

ⁱ A system for storing and launching missiles from a sealed, transportable container called a canister.

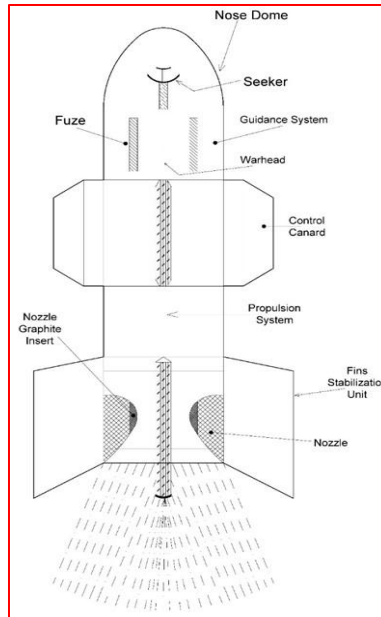


(Image source: DRDO)

This article focuses on the, Agni-5 Intermediate Range Ballistic, Surface to Surface Missile (SSM).

What is in a Missile⁸

A missile can be defined as an unmanned flying vehicle weapon system carrying a warhead to destroy the target with intelligence and guidance systems inbuilt.



(Fig. A General Construction of a Missile)
(Source: finsIndia.org)

1. Air Frame with Stabilization Unit

It is a main part which provides a strong support to all components from initiation point to target interception point during flight. It provides stiffness to withstand all aerodynamic forces exerted on it.

2. Propulsion Technology

The energy for forward movement is provided by propulsion technology. The fuels when reacted with the oxidizing agent, produce enormous energy that will get released in the form of heat acting on high pressure and high temperature gases generated. These gases will escape from the rear nozzle with supersonic speed and in turn push the missile upward in opposite direction of the plume as per Newton's third law "every action has equal and opposite reaction".

3. Guidance Technology

Considered as a brain of the missile, this system provides steering commands to fly to a successful interception of the target.

4. Flight Control Technology

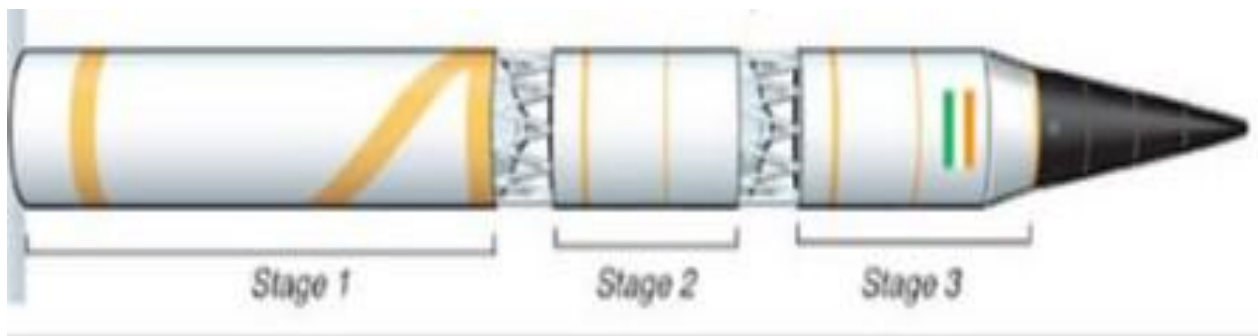
Function of flight control system is to provide stable, controlled and responsive flight of missile, which is achieved by controlling air frame motions using roll, pitch and yaw autopilots.

5. Warhead technology

Warhead is the bomb connected to a guided rocket to destroy enemy targets. It is a payload of missile and consists of various kinds of explosives.

Agni – V Intermediate Range Ballistic Missile

Agni 5 is a *three-stage solid propellant run, surface to surface, nuclear capable ballisticⁱⁱ missile*.



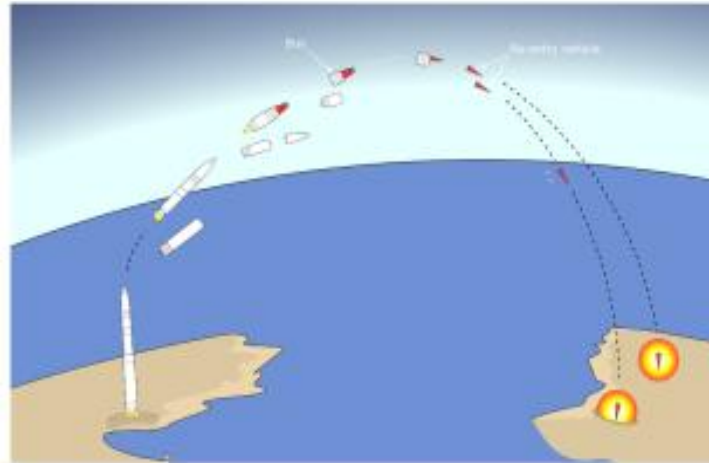
(Fig. Three Stages of Agni 5)

(Source: The Indian Express)

It is *incorporated with MIRVⁱⁱⁱ technology* i.e., capable of delivering multiple warheads through single missile.⁹

ⁱⁱ Weapons that follow a predetermined arched trajectory.

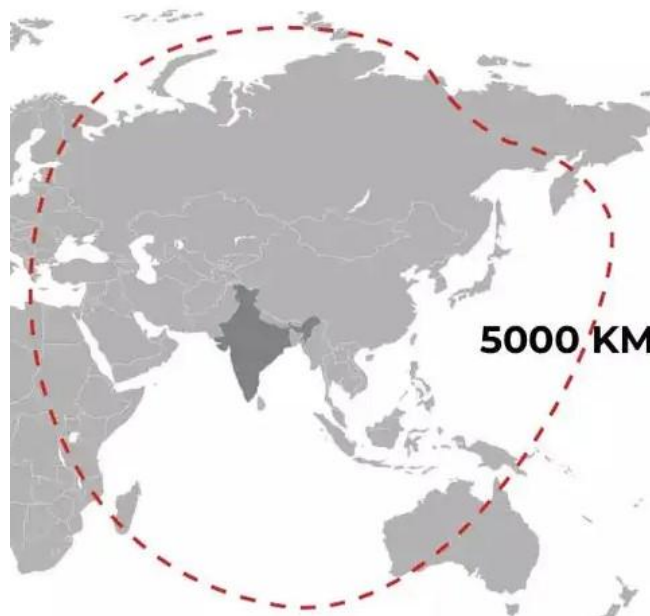
ⁱⁱⁱ Multiple Independently - targeted Re - entry Vehicle



(Fig. Schematic of the operation of an MIRV)

(Source: ResearchGate)

Being an IRBM with range of 5000 to 5500km, its deterrence extends as far as northern part of China and covers parts of Europe and it can carry 1500kg payload.



(Fig. Range of Agni 5)

(Source: THE TIMES OF INDIA)

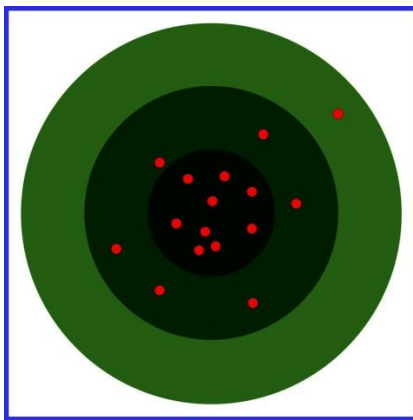
- **First Stage:** Uses solid propellant with *flex nozzle thrust vectoring*.¹⁰
- **Second Stage:** Composite cased solid rocket motor with *flex nozzle controls* for mid-flight adjustments.¹¹

- **Third Stage:** 1 meter long, weighing about 3.3 tonnes, it is a miniaturized, conical composite cased motor, enabling the extended range also featuring flex nozzles for trajectory control.¹²

Propulsion relies entirely on solid fuel across all stages, providing reliability and quick readiness.

The "*cold launch*" mechanism ejects the missile from its canister using pressurized gas before ignition, minimizing heat damage to the launcher and allowing launches from confined spaces.¹³

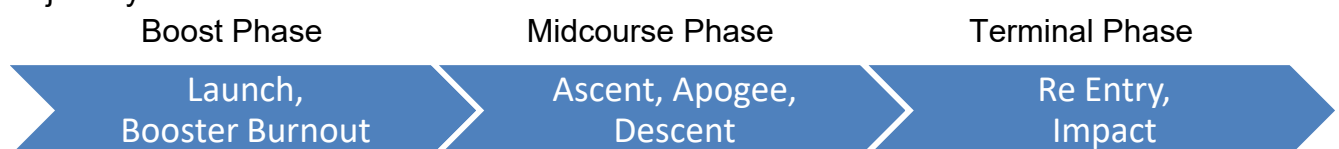
The *Circular Error Probable (CEP)*¹⁴ which is the radius of a circle, centered on the aim point, which is expected to encompass the landing points of 50% of fired rounds on board¹⁵, makes it one of the most accurate strategic ballistic missiles of its range class in the world

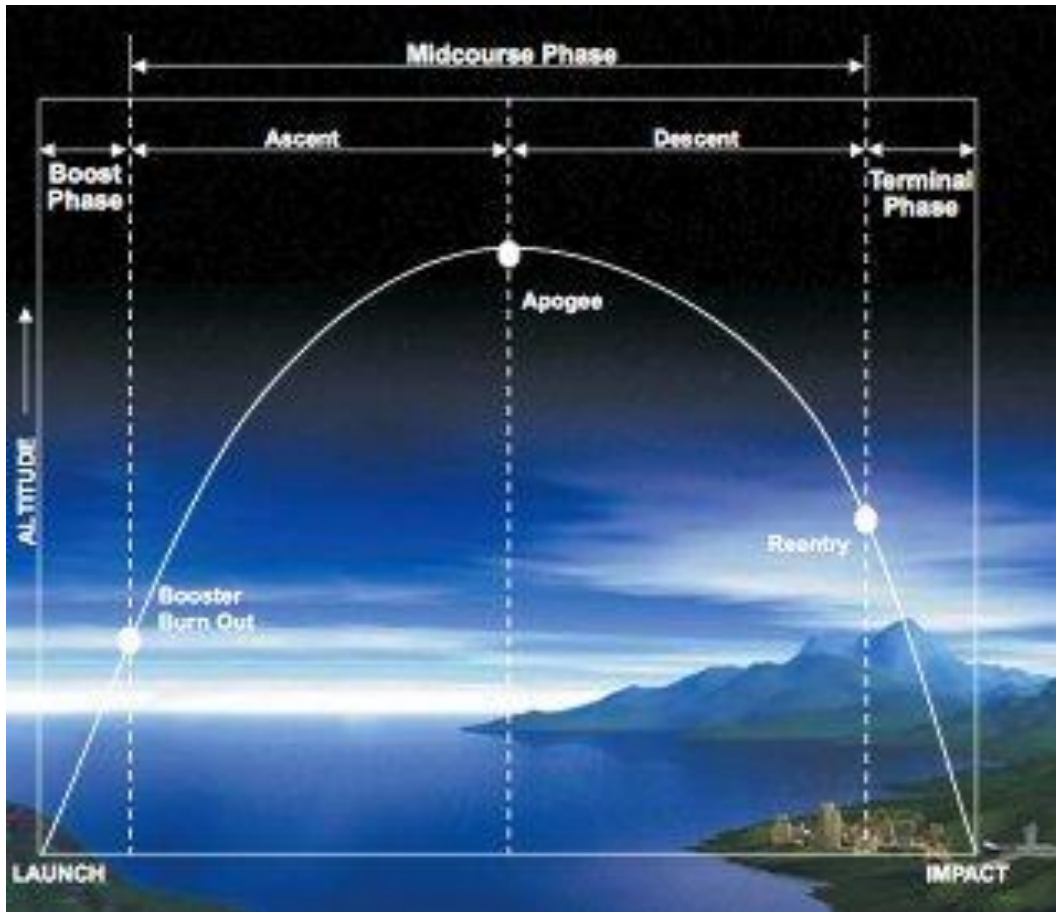


(Fig. Representation of CEP)
(Source: Medium)

How does a Ballistic Missile work?

1. Trajectory





(Fig. Trajectory of a Ballistic Missile)
(Source: Missile Defense Advocacy Alliance)

1.1. Boost Phase

The beginning of the launch during which the rocket generates thrust to launch the missile into flight.¹⁶ The booster and sustainer engines operate, and the warheads are not yet deployed.¹⁷ The missile uses all its propellant in this phase of short duration.¹⁸

1.2. Midcourse Phase

The missile coasts in an arc under the influence of gravity. It is the longest phase in the flight path of a ballistic missile.¹⁹ During this phase the missile is coasting, or freefalling towards its target.²⁰

1.3. Terminal Phase

The warhead is decoupled from the missile and re-enters into the earth's atmosphere and proceeds towards its target.²¹

Towards Success: One step at a time

Since its inception and initiation in 2008, the missile program has achieved many significant milestones achieving all crucial objectives the same were meant for. Given below is a comprehensive roadmap of all the test objectives achieved so far.

Year	Milestone Achieved
2012	Agni 5 Missile deveopment began ²²
April 19, 2012	First successful test fire with the missile reaching 5000km reaching an altitude of 600km. ²³
September 15, 2013	Second successful test witnessing an <i>Auto Launch</i> as well. ²⁴
January 31, 2015	First successful canister based test firing. ²⁵
December 26, 2016	Fourth developmental, second canisterised and final experimental test conducted successfully. ²⁶
January 18, 2018	First user trial conducted. ²⁷
June 3, 2018	Second user trial conducted successfully. ²⁸
Inducted by Indian Armed forces in 2019	
March 27, 2024	First test of Agni-V with MIRV technology ²⁹ , (Mission Divyastra)
August 20, 2025	Successful test validating operational parameters. ³⁰

Significance of Agni - V

A cornerstone of India's strategic defense, the Agni-V missile is significantly enhancing its deterrence capabilities and global stand. Developed by the Defence Research and Development Organisation (DRDO), this IRBM boasts a range of over 5,000 km, and also having potential to be extended even beyond that, enables India to project power across the globe.

Its three staged, solid fueled design, along with a canister launch system, helps in ensuring mobility, fast paced deployment, and increases chances of survival against strikes. The multiple independently targetable reentry vehicles (MIRVs) capability demonstrated in the August 2025 test,³¹ allows Agni-V to deliver multiple warheads to distinct targets, effectively countering and overwhelming enemy missile defenses.

The *Ring Laser Gyroscope based Inertial Navigation System (RLG-INS)* and a *Micro Inertial Navigation System (MINGS)*, supported by satellite navigation systems like India's NavIC and the US GPS provides pinpoint precision.³² Replacing maraging steel (very high tensile steel) with lightweight composite materials made the Agni-V missile 20 per cent lighter than its previous variants.³³

Beyond deterrence, Agni-V promotes technological independence under the *Atmanirbhar Bharat* initiative that opts for indigenous advancements in propulsion, navigation, and composite materials. It boosts aerospace and electronics sectors by creating high skilled jobs and promotes innovations applicable to civilian industries like satellite launches.

Geopolitically, Agni-V elevates India's position as a global nuclear power. Integration of Agni-V with its Ballistic Missile Defence (BMD) system, enhances India's strategic posture, ensuring both offensive reach and defensive resilience in a volatile multipolar world.

Challenges

India faces multifaceted challenges in advancing its long range (i.e., IRBM, ICBM) missile programs, driven by technological, strategic, and geopolitical hurdles.

Technologically, to achieve reliable multiple independently targetable reentry vehicle (MIRV) systems and to extend missile ranges beyond 5000 km (ICBM thresholds), there is a need of advanced fuel propulsion and guidance systems. India lags behind global leaders in this area.

Strategically, escalating missile capabilities from adverse neighbours like that of China's hypersonic advancements and Pakistan's nukes add fuel to the arms race, raising India's defense budget and creating complexities in deterrence credibility in the region. An effective Indian credible nuclear deterrence against China still remains unfulfilled due to Agni-V's limited payload carrying capacity of 1.5 tonnes.³⁴

India is the only nuclear-armed state without a clear security rationale for ICBMs. Its pursuits are often criticized to be of prestige driven.³⁵ This creates risks of international isolation amid non - proliferation scrutiny and undermining frameworks like the Missile Technology Control Regime (MTCR).

What is India doing to address this?

India has intensified indigenous R&D, such as of conducting rigorous tests like the *August 2025, Agni-V MIRV trial* that validated the operational parameters and enhanced payload flexibility against regional threats. Reclassification of Agni-V from ICBM to IRBM status exploited classification ambiguities that allowed range extensions without causing any violations.³⁶ Concurrently, the Ballistic Missile Defence (BMD) program advances to Phase II, deploying AD-1 and AD-2 interceptors which are capable of neutralizing IRBMs and ICBMs, bolsters second strike assurance. International collaborations especially in the areas of space tech transfers aid propulsion innovations, while budget allocations prioritize self-reliance to reduce import dependencies.

India's trajectory points toward an enhanced ICBM arsenal in the upcoming years, with Agni-VI prototypes aiming for 9,000-12,000 km ranges with 3 tonne nuclear payload and

14,000 to 16,000 with 1.5 tons to project power beyond Asia.³⁷ This enables to have an assertive diplomacy and counter the adversarial global reach. BMD Phase II completion will shield key cities from hypersonic incursions, but this escalation could strain strategic ties over proliferation issues. Balancing ambition with stability remains pivotal to avert a destabilizing South Asian nuclear spiral.

Way Ahead

India needs to boost its indigenous research and development. This is the need of the hour in order to overcome technological gaps that exist in advanced propulsion and guidance for reliable MIRV systems. The aim should be for an extended range that goes beyond 5,000 km in order to obtain a true ICBM status. Priority should be to counter hypersonic threats from adversaries. This can be achieved through an enhanced BMD Phase II. Integration of advanced interceptors for an effective second-strike capability needs to be worked upon.

India needs to expand its international collaborations in space technology. This should be done while making sure that the import dependencies is accounted for. It has to be in compliance with Atmanirbhar Bharat Initiative. The budgetary allocations are to be enhanced enough to be balanced with missile advancements while taking economic growth into account. One way to ensure this is to create high skilled jobs in aerospace. The workforce can be trained in collaboration with academic institutions in the aerospace field. There should be continuance of multiple tests like that of MIRV trials. This is to ensure that the operational parameters are aptly validated. An assertive yet stable diplomatic policy could potentially prevent arms races. This can further promote regional dialogues. It would lead to mitigation of proliferation risks. Thus there is an assurance of deterrence without having to deal with problems associated with isolation. Overall, the integration of Agni-5 with comprehensive nuclear doctrines could strengthen India's global position in its pursuit of asserting power through peace.

Where does Agni 5 stand globally?

(Table: Comparison of parameters of various Missiles across the globe)

Parameter	Agni - V (India) ³⁸	DF - 41 (China) ³⁹	RS-24 Yars (Russia) ⁴⁰	Minuteman III (USA) ⁴¹	Jericho III (Israel) ⁴²	Shaheen III (Pakistan) ⁴³
Type	IRBM	ICBM	ICBM	ICBM	IRBM	MRBM
Range (km)	5,000 to 8,000 ⁴⁴	12,000 to 15,000	10500	9000 to 13000	4800 to 6500	2,750
Length (m)	17.5	22	22.5	18 ⁴⁵	15.5	19.3
Diameter (m)	2	2.25	2	1.67	1.56	1.4
Launch Mass (kg)	50,000	80,000	49,600	36,030	29,000	15,500
Speed (Mach)	24 ⁴⁶	25	>20 ⁴⁷	23	7	18 ⁴⁸
Payload	1,100 to 1,500 (nuclear) ⁴⁹ (est. for MIRV)	2,500 (est. for MIRV)	1,200 (est. for MIRV)	~1,150	750 (nuclear)	~1,000 (nuclear) ⁵⁰
MIRV Capability	Yes	Yes	Yes	No	Possible	No
Propulsion	3 stages, Solid fuel	3 stage, Solid fuel	3 stage, Solid fuel	3 stages, Solid fuel	3 stages, Solid fuel	2 stages, Solid fuel
Accuracy (CEP, m)	<10 ⁵¹	100	100	200	~100	~150 ⁵² (est.)

(Source: Compiled by Author)

Conclusion

The Agni-5 missile stands as a testament to India's technological advancement and strategic deterrence capabilities, evolving from the IGMDP's vision into a nuclear capable IRBM with MIRV technology, solid propulsion, and exceptional accuracy. Its >5000 km range, canister-based mobility, and cold launch system enhance deterrence against regional threats, covering Asia and beyond while fostering self-reliance in defence. Globally, it positions India alongside powers like China (DF-41) and Russia (RS-24 Yars), though challenges in hypersonic tech and geopolitical scrutiny remain. By addressing these through R&D, BMD integration, and balanced diplomacy, India

mitigates arms race risks and bolsters resilience. Agni-5 not only elevates national security but drives innovations in civilian sectors, symbolizing a commitment to sovereignty in an otherwise volatile world. As India advances toward extended capabilities, it must prioritize stability to ensure Agni V's legacy as a guardian of peace through strength.

DISCLAIMER

The paper is author's individual scholastic articulation and does not necessarily reflect the views of CENJOWS. The author certifies that the article is original in content, unpublished and it has not been submitted for publication/ web upload elsewhere and that the facts and figures quoted are duly referenced, as needed and are believed to be correct.

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