

Missile power

The success of the canister-launched flight trial of Agni-V reaffirms India's status as a world-class missile power. BY T.S. SUBRAMANIAN

"A game changer" and "a giant leap in the country's deterrence capability" was how Avinash Chander, Scientific Adviser to the Defence Minister, characterised the success of canister-launched flight trial of **Agni-V** on January 31, also the day he laid down office. The strategic missile has a range of more than 5,000 kilometres and confirms India's status as a global missile power.

India now ranks fifth or sixth in the world, behind the United States, Russia, France, China/Israel, and has missiles that can carry nuclear warheads which can be launched from land, sea and air.

The Defence Research and Development Organisation (DRDO), of which Avinash Chander was also Director-General, is behind the development of India's portfolio of missiles. The strategic missiles, capable of carrying nuclear warheads, are a varied lot: Prithvi-II, Dhanush, Agni-I, II, III, IV and V, all surface-to-surface missiles.

The single-stage, liquid propelled **Prithvi-II** (10 metres long, six tonnes and 1 m in diameter), the earliest to be developed under the Integrated Guided Missile Development Programme, can strike at targets more than 350 km away. **Dhanush** is the ship-based variant of Prithvi-II.

The five **Agni variants**, all ballistic missiles, form the bulwark of India's nuclear deterrence. The single-stage, 15-metre-long, 12-tonne Agni-I, with a range of 750 km, is Pakistan-specific and was developed in 15 months after the Kargil war ended in June 1999. The two-stage Agni-II (20 m, 17 tonnes) followed. Agni-III's weight of 50 tonnes was a quantum jump. Agni-IV used several new technologies, including rocket motors made of composites, to weigh just 17 tonnes and has modern avionics, with redundancies in navigation and guidance systems.

With the addition of an extra (third) stage, Agni-III/IV metamorphosed into the redoubtable Agni-V. The January 31 launch was significant for one other reason than the long range: it was the first canisterised launch, from a truck, of an Indian-made intercontinental ballistic missile (ICBM).

According to informed sources, a missile that can carry a conventional warhead of 500 kg or more is also capable of carrying a nuclear warhead.

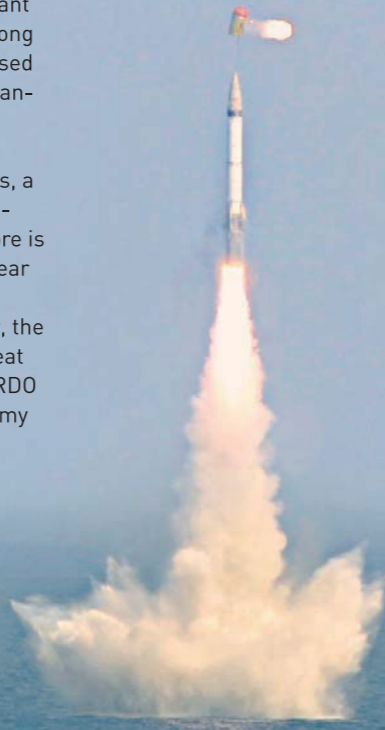
In the surface-to-air category, the **Akash** weapon system is "a great success story", according to DRDO spokesman Ravi Gupta. The Army and the Air Force have already

placed production orders worth Rs.23,000 crore. The 710-kg Akash, carrying a 55-kg payload, is the equivalent of the U.S.' "Patriot" missile and can destroy fighter aircraft, cruise missiles, helicopters and manoeuvring targets such as unmanned aerial vehicles flying 25 km away.

INTERCEPTORS

India ranks after the U.S., Russia, China and Israel in interceptor missile capability, providing the country with a ballistic missile defence (BMD) system. The BMD system detects, identifies and tracks the flight path of incoming ballistic missiles. Two interceptors, called Advanced Air Defence (AAD) and Prithvi Air Defence (PAD), with seekers can intercept ballistic missiles coming from adversarial locations 2,000 km to 5,000 km away.

K-15, also called B05: submarine-launched missile; range: 300 km; weight: 6.3 tonnes; length: 10.4 metres. It is to be integrated with India's nuclear-powered submarine, Arihant, in about six months after the boat completes its sea trials. Here, as the missile emerges from a pontoon at a depth of 50 metres, it sheds its cap that shields the warhead.



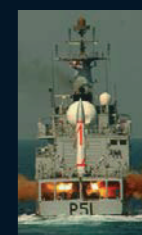
INDIA'S MISSILES

Missile	Range (km)	Operational status	Type of warhead	Weight of warhead (kg)
Prahaar	150	Not operational	Conventional	500
Prithvi-II	350	Operational	Nuclear	500
Dhanush	350	Operational	Nuclear/conventional	500
Agni-I	750	Operational	Nuclear	500
Agni-II	2,000	Operational	Nuclear	1,000
Agni-III	3,000	Deployed	Nuclear	1,000
Agni-IV	3,500	Operational	Nuclear	1,000
Agni-V	5,000	To be made operational before 2015-end after one more flight from a canister	Nuclear	1,100
Akash	25	Operational (Army and IAF)	Conventional	55
Astra	65	Not operational	Conventional	15
BrahMos	290	Operational (Army and Navy)	Conventional	300
Nirbhay	1,000	Not operational	Nuclear/conventional	--
K-15	700	Not operational	Nuclear	500
K-4	3,000	A couple of successful trials done from a submerged pontoon	Nuclear	>500
Shourya	700	Not operational	Nuclear	>500
Nag (anti-tank missile)	500 m to 4 km	Not operational	Conventional	--

Interceptors: Phase 1 of the deployment in advanced stage in New Delhi and Mumbai to intercept missiles up to 2,000 km away ; **LR-SAM** (long-range, surface-to-air missile, jointly developed by India and Israel) Not operational



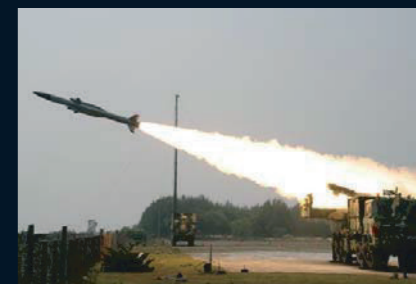
▲ **Astra:** Air-to-air missile; weight: 154 kg; length: 3.57 metres; launch speed: 0.4 Mach to 2 Mach; 21 flight trials done in ground-to-air mode; three air-to-air flight trials conducted from Sukhoi-30 MKI aircraft in 2014 and the range was 65 km. The target was Lakshya, a pilotless target aircraft, in these trials. Six more flight trials from Sukhoi-30 Mkl scheduled in March / April 2015, with a range of about 130 km. The DRDO will also fire Astra from the Light Combat Aircraft, Tejas, in 2015.



▲ **Dhanush:** Ship-launched missile; a variant of Prithvi-II; range: 350 km.



▲ **Agni-V:** Weight: 50 tonnes; length: 17 metres; nuclear payload weight: 1.1 tonnes; three solid fuel stages; three successful flights in a row on April 19, 2012, September 15, 2013, and January 31, 2015.



▲ **Akash:** A 710-kg surface-to-air missile carrying a 55-kg payload. It is the equivalent of the U.S.' "Patriot" missile and can destroy fighter aircraft, cruise missiles, helicopters and manoeuvring targets such as unmanned aerial vehicles flying 25 km away. The DRDO says the Akash weapons system is "a great success story". The Army and the Air Force have already placed production orders worth Rs.23,000 crore. Akash can fly at 2.5 Mach and climb to an altitude of 18 km.

India's hidden asset, the submarine-launched **K-15**, which carries a nuclear warhead, is under production, while **K-4**, another submarine-launched missile, with a range of 3,000 km, is under development. **Shourya** is the land-version of the

K-15 and is launched from a canister. **BrahMos**, developed by Russia and India, is a supersonic cruise missile and can fly at Mach 3. Cruise missiles are called so because they cruise at a constant altitude. BrahMos carries conventional warheads.

Nirbhay is a long-range subsonic cruise missile, flying at 0.7 Mach. Its

second flight on October 17, 2014, was a big success. Nirbhay is an innovative amalgam of missile and aeronautical technologies—it lifts off like a missile, but once it jettisons its booster engine, its wings spread out and its turbo-jet engine in the second stage kicks in to enable the contraption to fly like an aircraft.