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Indian nuclear forces, 2012

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Abstract

In April 2012, India successfully test-launched the Agni V ballistic missile—and though the missile needs more testing and is still several years away from operational deployment, the Agni V introduces a new dynamic to the already complex triangular security relationship among India, Pakistan, and China. India is estimated to have produced approximately 520 kilograms of weapons-grade plutonium, sufficient for 100–130 nuclear warheads; however, not all of the material has been converted into warheads. Based on available information about its nuclear-capable delivery vehicles, the authors estimate that India has produced 80–100 nuclear warheads. In this article, the authors explore how the country will need even more warheads to arm the new missiles it is currently developing.

Keywords

Agni V, fighter bomber, intercontinental ballistic missile, land based missiles, multiple independently targeted reentry vehicles, nuclear triad, submarine launched ballistic missile

India's drive to develop a nuclear triad proceeds apace, with New Delhi developing or deploying several weapon systems to realize its goal of achieving offensive nuclear forces on land, at sea, and in the air. India took a significant step forward with the successful test-launch of the Agni V ballistic missile on April 19, 2012. With a range reportedly greater than 5,000 kilometers (3,107 miles), the Agni V can reach any target in China; however, the missile needs more testing and is still several years away from operational deployment. Nevertheless, the Agni V introduces a new dynamic to the already complex triangular security relationship among India, Pakistan, and China; a week after India's April test-launch, Pakistan (somewhat predictably) responded by test-firing its nuclear-capable Shaheen-1A medium-range ballistic missile.

India is estimated to have produced approximately 520 kilograms of weapons-grade plutonium (IPFM, 2011), sufficient for 100–130 nuclear warheads; however, not all of the material has been converted into warheads. Based on available information about its nuclear-capable delivery vehicles, we estimate that India has produced 80–100 nuclear warheads. It will need more warheads to arm the new missiles

it is currently developing. In addition to the Dhruva plutonium production reactor near Mumbai, India plans to construct a second reactor near Visakhapatnam, on the east coast. India is building an unsafeguarded prototype fast-breeder reactor at the Indira Gandhi Centre for Atomic Research near Kalpakkam (about 1,000 kilometers or 620 miles south of Visakhapatnam), which will significantly increase India's plutonium production capacity once it becomes operational.

Aircraft

India has the fourth-largest air force in the world. Its fighter-bombers constitute the backbone of India's operational nuclear strike force, and it likely assigns nuclear missions to Mirage 2000H, Jaguar IS/IB, and possibly MiG-27 aircraft.

Last year, New Delhi approved an upgrade for the Indian Air Force's 51 Mirage 2000H aircraft—an update for which the single-seat, multi-role fighter-bomber is long overdue—which is scheduled for completion by mid-2021 (Government of India, 2012c; Waldron, 2012). The aircraft are deployed at Maharajpur (Gwalior) Air Force Station with Squadrons 1 and 7 of the 40th Wing; we estimate that one of the squadrons has a secondary nuclear mission. In early 2012, two of the fighters crashed in separate incidents, reducing the Mirage 2000H force to 49. One of the aircraft crashed during a February 24 training flight near Bhind, approximately 60 kilometers (37 miles) northeast of Gwalior; the other crashed on March 5 (Government of India, 2012a). Neither accident was fatal. The cost of the Mirage upgrade has been reported as $43 million per aircraft (Waldron, 2011).

India has four operational squadrons of Jaguar IS/IB aircraft with approximately 76 aircraft; two of the squadrons may be assigned a secondary nuclear strike mission. The Jaguar, designed jointly by France and Britain, was nuclear-capable when deployed by those countries. An upgrade of India's Jaguar fleet is scheduled for completion in December 2017 (Government of India, 2012c); it has been reported that, in addition to new engines, the upgrade will also include modernized avionics, nighttime sensors, and integrated helmet sights (*Defence Now*, 2011).

The domestically manufactured, Soviet-origin MiG-27 Flogger fleet, sometimes suspected of having a nuclear-strike mission, is also undergoing an upgrade (Government of India, 2012c).

In January 2012, the Indian government announced that it planned to buy 126 Rafale fighter-bombers from France, which uses its Rafale jets in a nuclear strike role (George, 2012). India intends to take delivery of 18 of the jets in ready-to-fly condition and to build the rest through Hindustan Aeronautics Ltd., a state-owned company (George, 2012). The contract has not yet been finalized, but the cost is estimated at between $10 billion and $15 billion.

Land-based missiles

India has three types of land-based missiles that may be operational: the short-range Prithvi I, the short-range Agni I, and the medium-range Agni II. The Prithvi I has been deployed for almost 15 years, but the Agni I and II, despite being declared operational, both have

reliability issues that have delayed their full operational service.

India has been busy growing its missile program, with four more Agni versions in progress: an Agni II+ was test-launched in 2010 but failed; the longer-range Agni III, after at least four flight-tests, remains under development; and the Agni IV may be a technology bridge to the newest type, the long-range Agni V, which had its first test-launch in April. Some of these Agni programs may serve as technology-development platforms for longer-range versions.

The bulk of the Indian ballistic missile force is comprised of three versions of Prithvi missiles, but only one of these versions, the army's Prithvi I, has a nuclear role. Given its small size (9 meters long and 1 meter in diameter), the Prithvi I is difficult to spot on satellite images, and therefore little is known about its deployment locations. The Prithvi I is a short-range missile (up to 150 kilometers or 93 miles) and is the mainstay of the Strategic Forces Command, India's designated nuclear weapons service.

In December 2011, India successfully test-launched its two-stage Agni I missile, which has a range of 700 kilometers (435 miles), for the eighth time—suggesting that the missile might finally have become fully operational. But a ninth test-launch scheduled for early May 2012 was postponed due to a technical glitch.

The road- or rail-launched Agni II, an improvement on the Agni I, can fly up to 2,000 kilometers (1,243 miles) and can carry a 1,000-kilogram payload, and it takes just 15 minutes for the missile to be readied for firing. The missile has been test-fired eight times with several failures, but more recent test-flights, on May 19, 2010 and September 30, 2011, were successful, demonstrating some progress toward making the Agni II fully operational. A 2010 test-launch of an extended-range Agni II, known as the Agni II+, failed.

Still under development is India's rail-mobile Agni III, a two-stage, solid-fuel missile with a range of more than 3,000 kilometers (1,864 miles). Several years ago, an army spokesperson remarked, "With this missile, India can even strike Shanghai" (*India Today*, 2008). To do so, however, would require the missile to be launched from the very northeastern corner of India. After the fourth Agni III test-launch in February 2010, defense officials said that the missile was "declared operational" (Chakravarty, 2010), but before the missile can become operational with the army, it will need additional flight-testing.

The Agni IV's first flight-test, on November 15, 2011, was a success. According to scientists at the Defense Research and Development Organization, the missile, designed to fly up to 3,500 kilometers (2,175 miles) and carry up to 1,000 kilograms, "has opened a new era" for Indian missiles (Subramanian, 2011). The Agni IV might be a "technology demonstrator" between the Agni III and V missiles, meaning that India is using it as a step toward creating the Agni V and that it will never be deployed.

India test-launched the Agni V for the first time on April 19, 2012 at a range of approximately 5,000 kilometers (3,107 miles). Although widely referred to as an intercontinental ballistic missile (ICBM), a range of 5,000 kilometers does not quite meet the internationally accepted definition of an ICBM as

having a range of at least 5,500 kilometers (3,418 miles). Still, the Indian government stated that the missile had a range of "more than 5,000 kilometers" (Government of India, 2012b). The Agni V needs several additional test-flights, but once it is deployed it will enable the Indian military to hold Beijing at risk for the first time. Unsurprisingly, rumors and speculation abound regarding the capability and role of the Agni V, including reports that the missile could be used to launch India satellites—or be used as an antisatellite weapon (Sharma, 2012).

Rumors are also widespread that the missile might be equipped with multiple independently-targeted re-entry vehicles (MIRVs). The government did not mention a multiple-warhead capability in its announcement of the test, but when asked if India was developing a capability for an Agni V variant to hit multiple targets, Defense Research and Development Organization chief V. K. Saraswat said: "We are working in this area. It will take time for us to develop, but our work is on" (*Economic Times*, 2012). Some have even suggested that the Agni V would be capable of carrying up to 10 MIRVs (*Deccan Herald*, 2012a; IBN Live, 2012). However, there is good reason to doubt that India can or will add MIRVs to its missiles in the near future. The Agni V is estimated to be capable of delivering a payload of 1.5 tons (the same as the Agni III and IV), but India's first- and second-generation warheads, even modified versions, are relatively heavy compared with warheads developed by other nuclear weapon states that deploy MIRVs. It took the Soviet Union and the United States hundreds of nuclear tests and 25 years of effort to develop re-entry vehicles small enough to equip a ballistic missile with MIRVs. These were expensive programs fueled by the Cold War, a security environment very different from the one that faces India. Moreover, deploying missiles with multiple warheads would invite serious questions about the credibility of India's minimum-deterrent doctrine; using MIRVs would reflect a strategy to quickly strike many targets and would also run the risk of triggering a warhead race with India's adversaries.

Naval nuclear weapons

India is developing two naval nuclear weapon systems: a nuclear-powered ballistic missile submarine and a ship-launched ballistic missile.

India's ballistic missile submarine, the *Arihant*, has been under development since 1984.[1] Defense Minister A. K. Antony stated in May 2012 that the *Arihant* would be "inducted by the middle of next year" (*Deccan Herald*, 2012b); Pakistan has warned previously that it views an operational Indian nuclear submarine as "destabilizing" (*Times of India*, 2009). The *Arihant* is believed to have 12 tubes designed to launch the Sagarika submarine-launched ballistic missile. US intelligence has reported the range of the Sagarika at more than 290 kilometers or 180 miles (US Air Force, National Air and Space Intelligence Center, 2009), but media reports widely set the range around 700 kilometers (435 miles). It is also rumored that India is developing a longer-range submarine-launched ballistic missile called the K-4 that is based on the Agni III design and supposedly has a range of more than 3,000 kilometers (1,864 miles); however, such a missile would probably be too big for the *Arihant* to launch.

Table 1. Indian nuclear forces, 2012.

Type/Designation	Range (kilometers)	Payload (kilograms)	Comment
Aircraft			
Mirage 2000H/Vajra	1,800	6,300	Squadron 1 or 7 at Gwalior Air Force Station.
Jaguar IS/IB/Shamsher	1,600	4,775	At Ambala Air Force Station.
Land-based missiles			
Prithvi I	150	1,000	Nuclear version entered service after 1998 with the 333rd and 355th Missile Groups—will be converted from liquid to solid fuel.
Agni I	700+	1,000	Deployed with the 334th Missile Group in 2004.
Agni II	2,000	1,000	Under development: Successful test-launch on September 30, 2011; deployed with the 335th Missile Group in 2004.
Agni II+	2,000+	1,000	Under development: Failed test-launch on December 10, 2010.
Agni III	3,000+	1,500	Under development: Fourth test-launch on February 7, 2010.
Agni IV	3,500	1,500	Under development: First test-launch November 15, 2011.
Agni V	5,000+	1,500	Under development: First test-launch April 19, 2012.
Sea-based missiles			
Dhanush	350	500	Under development: Extended-range naval version of Prithvi II, seventh test-launch on March 11, 2011.
Sagarika/K-15	300–700	300–700	Under development: Test-launch on February 26, 2008, from a submerged platform; possible future deployment on the *Arihant*.

India's Dhanush, a ship-launched ballistic missile rumored to have nuclear capability, was successfully test-launched from the *Survana* patrol vessel on March 11, 2011—the seventh test-launch of the missile. The utility of the Dhanush, however, is severely limited by its short range (just 350 kilometers or 217 miles) and its payload capability (500 kilograms, just half that of the Prithvi I). These restrictions raise doubts about the Dhanush's nuclear capability; however, there is also the possibility that India has developed a smaller warhead to work within the Dhanush's limitations.[2]

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Notes

1. For more on India's *Arihant*, see Norris and Kristensen (2010).
2. India would also need a smaller, lighter warhead if it were to develop a nuclear-capable cruise missile. For more on this, see Norris and Kristensen (2010).

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