VI. Indian nuclear forces

HANS M. KRISTENSEN AND MATT KORDA*

As of January 2023 India was estimated to have a growing stockpile of about 164 nuclear weapons—a small increase from the previous year (see table 7.7). These weapons were assigned to a maturing nuclear triad of aircraft, land-based missiles and nuclear-powered ballistic missile submarines (SSBNs).

The warhead estimate is based on calculations of India's inventory of weapon-grade plutonium (see section X), the estimated number of operational nuclear-capable delivery systems, India's nuclear doctrine, publicly available information on the Indian nuclear arsenal, and private conversations with defence officials.[1] The Indian government has provided little public information about the size of its nuclear forces, other than conducting occasional parade displays and announcing missile flight tests.

This section starts by outlining the role played by nuclear weapons in Indian military doctrine. It then enumerates India's holdings of nuclear weapons—its aircraft and air-delivered weapons and its land- and sea-based missiles—and assesses the nuclear capability of its cruise missiles.

The role of nuclear weapons in Indian military doctrine

The limited ranges of India's initial nuclear systems meant that, until the early 2010s, their only credible role was to deter Pakistan. However, with the development over the subsequent decade of longer-range missiles capable of targeting all of China, in recent years it appears that India has placed increased emphasis on deterring China.

While India has adhered to a nuclear no-first-use (NFU) policy since 1999, this pledge was qualified by a 2003 caveat (reaffirmed in 2018) that India could also use nuclear forces to retaliate against attacks by non-nuclear weapons of mass destruction (WMD).[2] Doubts about India's commitment to the NFU policy have increased with evidence that some parts of India's nuclear arsenal are being kept at a much higher state of readiness.[3] This has prompted a debate about whether India could be transitioning towards

[1] Kristensen, H. M. and Korda, M., 'Estimating world nuclear forces: An overview and assessment of sources', SIPRI Commentary, 14 June 2021.

[2] Indian Ministry of External Affairs, 'The Cabinet Committee on Security reviews [o]perationalization of India's nuclear doctrine', Press release, 4 Jan. 2003; Indian Ministry of External Affairs, 'Draft report of National Security Advisory Board on Indian nuclear doctrine', 17 Aug. 1999; and Indian Prime Minister's Office, 'Prime Minister felicitates crew of INS Arihant on completion of nuclear triad', Press release, 5 Nov. 2018.

[3] For further detail see Kristensen, H. M. and Korda, M., 'Indian nuclear forces', *SIPRI Yearbook 2021*.

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a counterforce nuclear posture to target an adversary's nuclear weapons earlier in a crisis, even before they could be used.[4]

Aircraft and air-delivered weapons

India has several types of combat aircraft with performance characteristics that potentially make them suitable as nuclear-delivery platforms, including the Mirage 2000H, Jaguar IS and Rafale. However, there is no official source that confirms the nuclear-capable role of these aircraft, with one exception: a detailed source describes how the Mirage 2000H was converted for a nuclear strike role in the 1990s.[5] SIPRI estimates that approximately 48 nuclear gravity bombs were assigned to Indian aircraft as of January 2023.

Land-based missiles

The Indian Army's Strategic Forces Command operates five types of mobile nuclear-capable ballistic missile: the short-range Prithvi-II and Agni-I; the medium-range Agni-II; and the intermediate-range Agni-III and Agni-IV. SIPRI estimates that India had around 80 operational missiles as of January 2023. At least two new land-based ballistic missiles were in development: the medium-range Agni-P and the intermediate-range Agni-V; a variant with an intercontinental range, the Agni-VI, was in the design stage of development.[6]

Several of India's land-based ballistic missiles achieved significant milestones in 2022. The Agni-P completed its third test launch in October 2022, following two (one failed and one successful) in 2021. The Indian Army typically requires at least three consecutive successful tests before a missile can be inducted into military service.[7] The Agni-P is described by the Indian Ministry of Defence as a next-generation nuclear-capable ballistic missile. It reportedly incorporates technology developed specifically for the Agni-V programme, including an advanced navigation system and a new mobile canisterized launch system, which will reduce the time required to place the

[4] Clary, C. and Narang, V., 'India's counterforce temptations: Strategic dilemmas, doctrine, and capabilities', *International Security*, vol. 43, no. 3 (winter 2018/19); Kaushal, S. et al., 'India's nuclear doctrine: The Agni-P and the stability–instability paradox', Royal United Services Institute (RUSI), 8 July 2021; and Rajagopalan, R., *India and Counterforce: A Question of Evidence*, ORF Occasional Paper no. 247 (Observer Research Foundation: New Delhi, May 2020).

[5] Kampani, G., 'New Delhi's long nuclear journey: How secrecy and institutional roadblocks delayed India's weaponization', *International Security*, vol. 38, no. 4 (spring 2014), pp. 94, 97–98. For further detail see Kristensen, H. M. and Korda, M., 'Indian nuclear forces', *SIPRI Yearbook 2022*, pp. 393–94.

[6] Vikas, S. V., 'Why India may not test Agni 6 even if DRDO is ready with technology', OneIndia, 10 July 2019.

[7] Gupta, S., 'Agni-P missile moves towards induction after user trials', *Hindustan Times*, 23 Oct. 2022; and O'Donnell, F., 'Aim for higher testing standards', *The Pioneer* (Nioda), 27 July 2015.

Table 7.7. Indian nuclear forces, January 2023

All figures are approximate and some are based on assessments by the authors.

Type/designation	No. of launchers	Year first deployed	Range (km)[a]	Warheads x yield[b]	No. of warheads[c]
Aircraft[d]	*84*				*48*
Mirage 2000H	32	1985	1 850	1 x 12 kt bomb	32
Jaguar IS	16	1981	1 600	1 x 12 kt bomb	16
Rafale	36	2022	2 000	. .	–
Land-based missiles	*80*				*80*
Prithvi-II	24	2003	250[e]	1 x 12 kt	24
Agni-I	16	2007	>700	1 x 10–40 kt	16
Agni-II	16	2011	>2 000	1 x 10–40 kt	16
Agni-III	16	2018	>3 200	1 x 10–40 kt	16
Agni-IV	8	2022	>3 500	1 x 10–40 kt	8
Agni-V	. .	[2023]	>5 000	1 x 10–40 kt	. .
Agni-VI	–	[2027]	>6 000	1 x 10–40 kt [possible MIRV]	–
Agni-P	–	[2025]	1 000–2 000	[1 x 10–40 kt]	–
Sea-based missiles	*3/14*[f]				*16*
Dhanush	2	2013	400	1 x 12 kt	4[g]
K-15 (B-05)[h]	12[i]	2018	700	1 x 12 kt	12
K-4	–[j]	[2025]	3 500	1 x 10–40 kt	–
Other stored warheads[k]					[*20*]
Total stockpile	**178**				**164**[k]

. . = not available or not applicable; – = nil or a negligible value; [ ] = uncertain SIPRI estimate; kt = kiloton; MIRV = multiple independently targetable re-entry vehicle.

[a] For aircraft, the listed range is for illustrative purposes only; actual mission range will vary according to flight profile, weapon payload and in-flight refuelling.

[b] The yields of India's nuclear warheads are not known. The 1998 nuclear tests demonstrated yields of up to 12 kt. Since then, it is possible that boosted warheads have been introduced with a higher yield, perhaps up to 40 kt. There is no open-source evidence that India has developed 2-stage thermonuclear warheads.

[c] Aircraft and several missile types are dual-capable—that is, they can be armed with either conventional or nuclear warheads. This estimate counts an average of 1 nuclear warhead per launcher. All estimates are approximate.

[d] The Rafale is listed as a potential future nuclear delivery platform. It seems likely that it would probably initially replace the Jaguar in that role. However, in the absence of official or authoritative sources, SIPRI has not attributed nuclear weapons to Rafale aircraft in its estimate for Jan. 2023. Other aircraft that could potentially have a secondary nuclear role include the Su-30MKI.

[e] The Prithvi-II's range is often reported as 350 kilometres. However, the United States Air Force's National Air and Space Intelligence Center sets the range at 250 km.

[f] The first figure is the number of operational vessels—2 ships and 1 nuclear-powered ballistic missile submarine (SSBN); the second is the maximum number of missiles that they can carry. India has launched 3 SSBNs, but only 1—INS *Arihant*—was believed to be operational as of Jan. 2023, and it was believed to have only a limited operational capability. The second SSBN—INS *Arighat*—was conducting sea trials throughout 2022 and might become operational in 2023. The third, known as S4, was reportedly launched in Nov. 2021 but, as of Jan. 2023, its status remained unclear.

[g] Each Sukanya-class patrol ship equipped with Dhanush missiles was thought to have possibly 1 reload.

[h] The K-15 may have been renamed the B-05. Some sources have referred to the K-15 missile as 'Sagarika', which was the name of the missile-development project, rather than the missile itself.

[i] Each of India's first 2 SSBNs has 4 missile tubes, each of which can carry 3 K-15 submarine-launched ballistic missiles (SLBMs), for a total of 12 missiles per SSBN. Only 1 SSBN was believed to be operational as of Jan. 2023 (see note f).

[j] Each of the 8 missile tubes on India's third and fourth SSBNs will be able to carry 3 K-15 SLBMs or 1 K-4 SLBM once the latter missile becomes operational.

[k] In addition to the *c.* 144 warheads estimated to be assigned to operational forces, SIPRI estimates that *c.* 20 warheads might have been produced for missiles nearing operational status, including the Agni-V (*c.* 8 warheads) and the K-15 (*c.* 12 warheads for INS *Arighat*), for a total estimated stockpile of *c.* 164 warheads. India's warhead stockpile is expected to continue to increase.

Sources: Indian Ministry of Defence, annual reports and press releases; International Institute for Strategic Studies, *The Military Balance*, various years; US Air Force (USAF), National Air and Space Intelligence Center, *Ballistic and Cruise Missile Threat*, various years; Indian news media reports; *Bulletin of the Atomic Scientists*, 'Nuclear notebook', various issues; and authors' estimates.

missiles on alert in a crisis.[8] The solid-fuelled Agni-P can reportedly manoeuvre during re-entry, which could allow the missile to evade future missile defences of states in the region (e.g. China and Pakistan). An unidentified government source denied that the Agni-P was intended to replace older Agni missiles.[9]

In 2022 India also conducted test launches of the Prithvi-II, the Agni-III, the Agni-IV and the Agni-V. Notably, the Indian government, for the first time, described the Agni-IV test as 'part of routine user training launches', which is the language typically used to describe tests of Indian missiles already in service.[10] Given the missile's apparent induction in 2014 and subsequent serial production, SIPRI assesses that the Agni-IV became operational in 2022.[11] The three-stage, solid-fuelled Agni-V was test launched for the ninth time in December 2022.[12] Reports on the test suggest that the Indian Defence Research and Development Organisation (DRDO) may have been testing a new solid rocket motor made from lighter composite materials to increase the missile's range.[13]

[8] Indian Ministry of Defence (MOD), 'DRDO successfully flight tests new generation Agni P ballistic missile', Press release, 28 June 2021; and Rout, H. K., 'India test fires new generation nuclear capable Agni-Prime missile off Odisha coast', *New Indian Express*, 28 June 2021.

[9] Philip, S. A., 'Agni Prime is the new missile in India's nuclear arsenal. This is why it's special', ThePrint, 30 June 2021; and Zhen, L., 'India's latest Agni-P missile no great threat to China: Experts', *South China Morning Post*, 1 July 2021.

[10] Indian Ministry of Defence, 'Intermediate range ballistic missile, Agni-4, successfully tested', Press release, 6 June 2022; Indian Ministry of Defence, 'Year end review 2022', 17 Dec. 2022; and Wright, T., 'India's test of the Agni-IV', International Institute for Strategic Studies, 27 June 2022.

[11] Subramanian, T. S., 'Agni-IV missile successfully test fired', *The Hindu*, 20 Jan. 2014.

[12] Sharma, A., 'India tests long-range missile for nuclear deterrence', AP News, 15 Dec. 2022; and Gupta, S., 'Has the range of Agni V missile been increased?', *Hindustan Times*, 16 Dec. 2022.

[13] Gupta (note 12).

India is developing a land-based version of the short-range K-15 submarine-launched ballistic missile (SLBM), known as the Shaurya.[14] However, because of the high level of uncertainty about the status of the Shaurya, it is not included in SIPRI's estimate for January 2023.[15]

India is believed to be developing multiple independently targetable re-entry vehicles (MIRVs), but as of January 2023 the status of the programme remained unclear. The technology has reportedly been tested on the Agni-P and could potentially be used on the intercontinental Agni-VI currently in development.[16] The Agni-VI is controversial because its expected range may extend well beyond India's possible regional targets in Pakistan and China.

Sea-based missiles

With the aim of creating an assured second-strike capability, India has continued to develop the naval component of its nascent nuclear triad and to build a fleet of four to six SSBNs.[17] The first of these SSBNs, INS *Arihant*, completed what the Indian government described as its first 'deterrence patrol' in 2018—although it seems unlikely that the missiles were armed with nuclear warheads at the time.[18] A second SSBN, INS *Arighat*, was launched in November 2017 and underwent advanced sea trials in 2021–22 ahead of its expected commissioning into the Indian Navy in 2023.[19] Satellite imagery indicates that each submarine has been equipped with a four-tube vertical-launch system and each could carry up to 12 two-stage, short-range K-15 SLBMs (which may have been renamed the B-05).[20] SIPRI estimates that 12 nuclear warheads have been delivered for potential deployment by INS *Arihant* and another 12 have been produced for INS *Arighat*.

A third submarine, known as S4, was reportedly launched in November 2021, and a fourth is under construction for possible launch in 2023.[21] These

[14] See e.g. Press Trust of India, 'India successfully test-fires nuclear capable hypersonic missile Shaurya', *Hindustan Times*, 3 Oct. 2020; and Gupta, S., 'Govt okays induction of nuke-capable Shaurya missile amid Ladakh standoff', *Hindustan Times*, 6 Oct. 2020.

[15] For further detail see Kristensen and Korda (note 5), p. 395.

[16] Rout, H. K., 'India to conduct first user trial of Agni-V missile', *New Indian Express*, 13 Sep. 2021.

[17] Davenport, K., 'Indian submarine completes first patrol', *Arms Control Today*, vol. 48, no. 10 (Dec. 2018).

[18] Peri, D., 'Now, India has a nuclear triad', *The Hindu*, 18 Oct. 2016; Indian Prime Minister's Office (note 2); Davenport (note 17); and Joshi, Y., 'Angels and dangles: Arihant and the dilemma of India's undersea nuclear weapons', War on the Rocks, 14 Jan. 2019.

[19] 'Indian submarine fleet to get fresh impetus by early 2023', *Economic Times* (Mumbai), 21 Oct. 2022.

[20] Indian Defence Research and Development Organisation (DRDO), 'MSS—Achievements', 6 Sep. 2019.

[21] Biggers, C. (@CSBiggers), Twitter, 28 Dec. 2021, <https://twitter.com/CSBiggers/status/1476048094580117509>; and Unnithan, S., 'A peek into India's top secret and costliest defence project, nuclear submarines', *India Today*, 10 Dec. 2017; and Bhattacharjee, S., 'Third Arihant class submarine quietly launched in November', *The Hindu*, 4 Jan. 2022.

submarines are believed to be significantly larger than the first two; satellite imagery indicates that they are approximately 20 metres longer.[22] They will reportedly have eight launch tubes able to hold up to 24 K-15 missiles or 8 K-4 missiles.[23] The K-4 is in development but probably remains several years away from operational capability. Two potential test launches of the K-4 in 2022 were apparently disrupted by the presence of Chinese spy ships.[24]

India's first naval nuclear weapon, the short-range Dhanush missile, is a version of the dual-capable Prithvi-II that can be launched from two Sukanya-class offshore patrol vessels.[25] Given the slow speed and high degree of vulnerability of the Sukanya-class vessels, the system will probably be retired when the SSBN programme with longer-range missiles matures.

Cruise missiles

There have been numerous media claims that some Indian cruise missiles are nuclear-capable. These claims concern the ground- and air-launched Nirbhay subsonic cruise missile and the supersonic air-, ground-, ship- and submarine-launched BrahMos cruise missile.[26] Notably, one of the latter was accidentally launched into Pakistani territory in March 2022 (see section VII).

Although a DRDO poster at an Indian defence exhibition in October 2022 listed the Nirbhay as capable of delivering 'conventional and strategic warheads', as of January 2023 no known official or authoritative source had explicitly attributed nuclear capability to India's cruise missiles.[27] In addition, United States sources list the BrahMos as 'conventional'.[28] The systems are therefore excluded from SIPRI's estimate for January 2023.

[22] Sutton, H. I., 'Indian Navy's third ballistic missile submarine doubles missile armament', Covert Shores, 29 Dec. 2021.

[23] Bhattacharjee (note 21). See also Kristensen and Korda (note 5), p. 397.

[24] 'Chinese spy ships may complicate India's missile test plans in Indian Ocean for the second month in a row', *Swarajya*, 7 Dec. 2022.

[25] 'Nuke-capable Dhanush and Prithvi-II launched', *New Indian Express*, 12 Mar. 2011; and Indian Ministry of Defence (MOD), *Annual Report 2018–19* (MOD: New Delhi, 2019), p. 100.

[26] See e.g. Pandit, R., 'India successfully tests its first nuclear-capable cruise missile', *Times of India*, 8 Nov. 2017; Gady, F.-S., 'India successfully test fires indigenous nuclear-capable cruise missile', The Diplomat, 8 Nov. 2017; and Mitra, J., 'Nuclear BrahMos: On the anvil?', South Asian Voices, 10 July 2018.

[27] A copy of the DRDO poster is available on Twitter. Alpha Defense (@alpha_defense), Twitter, 19 Oct. 2022, <https://twitter.com/alpha_defense/status/1582584800191590401>.

[28] US Air Force, National Air and Space Intelligence Center (NASIC), *Ballistic and Cruise Missile Threat 2017* (NASIC: Wright-Patterson Air Force Base, OH, June 2017), p. 37.