

## VI. Indian nuclear forces

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As of January 2021, India was estimated to have a growing inventory of about 156 nuclear weapons, an increase of roughly 6 from the previous year (see table 10.7). These weapons are assigned to a maturing nuclear triad of aircraft, land-based missiles and ballistic missile submarines. The warhead estimate is based on calculations of India's inventory of weapon-grade plutonium, the 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. The Indian Government itself does not provide much public information about the status of its nuclear forces, other than occasional parade displays and announcements about missile flight tests. India is expanding the size of its nuclear weapon inventory as well as its infrastructure for producing nuclear warheads.

### **The role of nuclear weapons in Indian military doctrine**

In the past, the limited ranges of many of India's initial nuclear systems meant that their only role was to deter Pakistan. India now appears to place increased emphasis on China, with the development of longer-range missiles capable of targeting all of China. It remains to be seen how this development will affect India's nuclear arsenal and strategy. It also remains to be seen if recent border clashes with China and Pakistan will affect India's nuclear posture.<sup>1</sup>

India has long adhered to a nuclear no-first-use policy; however, this pledge is qualified by a caveat that India could use nuclear forces to retaliate against attacks by non-nuclear weapons of mass destruction (WMD).<sup>2</sup> Remarks in recent years by Indian defence ministers have also created doubts about India's commitment to the no-first-use policy.<sup>3</sup> Recent scholarship and government statements have called that policy into further question, with some analysts suggesting that 'India's NFU [no-first-use]

<sup>1</sup> On the border tensions in 2020 between China and India, and between India and Pakistan see chapter 4, section II, in this volume. On the escalation on the India–Pakistan border in 2019 see Smith, D., 'Introduction: International stability and human security in 2019', *SIPRI Yearbook 2020*, pp. 8–12.

<sup>2</sup> Indian Ministry of External Affairs, 'The Cabinet Committee on Security reviews [o]perationalization of India's nuclear doctrine', Press release, 4 Jan. 2003.

<sup>3</sup> E.g. Singh, R., Indian Minister of Defence (@rajnathsingh), 'Pokhran is the area which witnessed Atal Ji's firm resolve to make India a nuclear power and yet remain firmly committed to the doctrine of "No First Use". India has strictly adhered to this doctrine. What happens in future depends on the circumstances.', Twitter, 16 Aug. 2019; and Som, V., 'Defence Minister Manohar Parrikar's nuclear remark stressed as "personal opinion"', NDTV, 10 Nov. 2016.

policy is neither a stable nor a reliable predictor of how the Indian military and political leadership might actually use nuclear weapons'.<sup>4</sup>

In addition, India appears to be taking steps to increase the responsiveness of its arsenal by 'canisterizing' some of its ballistic missiles, initially the Agni-V (see below). This refers to keeping missiles inside a tube to protect them from the elements while being transported. Missiles can also be launched directly from canisters, usually using a 'cold-launch' process that involves using a gas generator to eject the missile from the canister before ignition. Missiles launched from canisters are pre-mated with their warheads to ensure rapid launch. Submarines on deterrence patrol will also have pre-mated warheads; however, it is currently unclear whether India has conducted a true deterrence patrol.

Former senior civilian security officials and former officers of India's Strategic Forces Command (SFC) have reportedly suggested that some portion of India's arsenal, particularly those weapons and capabilities designed for retaliation against Pakistan, 'are now kept at a much higher state of readiness, capable of being operationalized and released within seconds or minutes—not hours, as has been previously assumed'.<sup>5</sup> Whether that means that warheads are mated all the time is unclear; the first canisterized missile (the Agni-V) is not yet deployed. But pre-mating could form the basis of a higher alert posture in the future. Indeed, to provide a credible secure second-strike capability, warheads would have to be mated with missiles on India's nascent fleet of nuclear-powered ballistic missile submarines (SSBNs).

### **Aircraft and air-delivered weapons**

Aircraft are the most mature component of India's nuclear strike capabilities. It is estimated here that approximately 48 nuclear bombs are assigned to aircraft. The Indian Air Force (IAF) has reportedly certified its Mirage 2000H fighter-bombers for delivery of nuclear gravity bombs.<sup>6</sup> It is widely speculated that the IAF's Jaguar IS fighter-bombers may also have a nuclear delivery role.<sup>7</sup>

<sup>4</sup> Sundaram, K. and Ramana, M. V., 'India and the policy of no first use of nuclear weapons', *Journal for Peace and Nuclear Disarmament*, vol. 1, no. 1 (2018), p. 153. See also Clary, C. and Narang, V., 'India's counterforce temptations: Strategic dilemmas, doctrine, and capabilities', *International Security*, vol. 43, no. 3 (winter 2018).

<sup>5</sup> Narang, V., 'Five myths about India's nuclear posture', *Washington Quarterly*, vol. 36, no. 3 (summer 2013), p. 149.

<sup>6</sup> 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.

<sup>7</sup> Cohen, S. and Dasgupta, S., *Arming Without Aiming: India's Military Modernization* (Brookings Institution Press: Washington, DC, 2010), pp. 77–78; and Shukla, A., 'Jaguar fighter gets 20-year lease of life with DARIN-III avionics', *Business Standard*, 24 Nov. 2016.

**Table 10.7.** Indian nuclear forces, January 2021

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

Type/designation	No. of launchers	Year first deployed	Range (km) <sup>a</sup>	Warheads x yield <sup>b</sup>	No. of warheads <sup>c</sup>
<i>Aircraft<sup>d</sup></i>	48				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
<i>Land-based missiles<sup>e</sup></i>	64				64
Prithvi-II	24	2003	250 <sup>f</sup>	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	8	2018	>3 200	1 x 10–40 kt	8
Agni-IV	–	[2021]	>3 500	1 x 10–40 kt	–
Agni-V	–	[2025]	>5 000	1 x 10–40 kt	–
<i>Sea-based missiles</i>	3/14 <sup>g</sup>				16
Dhanush	2	2013	400	1 x 12 kt	4 <sup>h</sup>
K-15 (B-05) <sup>i</sup>	12 <sup>j</sup>	2018	700	1 x 12 kt	12
K-4	– <sup>k</sup>	[2025]	3 500	1 x 10–40 kt	–
<b>Total stockpile</b>	<b>126</b>				<b>128</b>
Other stored warheads <sup>l</sup>					28
<b>Total inventory</b>	<b>126</b>				<b>156<sup>l</sup></b>

– = nil or a negligible value; [ ] = uncertain figure; kt = kiloton.

<sup>a</sup> For aircraft, the listed range is for illustrative purposes only; actual mission range will vary according to flight profile, weapon loading and in-flight refuelling.

<sup>b</sup> 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 two-stage thermonuclear warheads.

<sup>c</sup> 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.

<sup>d</sup> Other aircraft that could potentially have a secondary nuclear role include the Su-30MKI. India is also in the process of acquiring Rafale aircraft from France, which could potentially be assigned a nuclear role in the future.

<sup>e</sup> In addition to the land-based missiles listed here, an Agni-VI is thought to be in the design phase. With a range of approximately 6000 km, it would be India's first intercontinental ballistic missile.

<sup>f</sup> The Prithvi-II's range is often reported as 350 km. However, the US Air Force's National Air and Space Intelligence Center (NASIC) sets the range at 250 km.

<sup>g</sup> 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 2 SSBNs, but only 1—INS *Arihant*—is believed to be operational and probably has only a limited operational capability. The other SSBN—INS *Arighat*—is being fitted out and might become operational during or after 2021.

<sup>h</sup> Each Sukanya-class patrol ship equipped with Dhanush missiles is thought to have possibly 1 reload.

<sup>i</sup> Some sources have referred to the K-15 missile as Sagarika, which was the name of the missile development project.

<sup>j</sup> Each SSBN 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. SIPRI estimates that an additional

c. 12 K-15 missiles and warheads have been produced and might become operational during or after 2021 (see notes g and l).

<sup>k</sup> Each missile tube will be able to carry 1 K-4 SLBM once it becomes operational.

<sup>l</sup> In addition to the c. 128 warheads estimated to be assigned to operational forces, SIPRI estimates that an additional c. 28 warheads might have been produced to arm Agni-IV and Agni-V missiles (c. 16 warheads) and K-15 missiles (c. 12 warheads for INS *Arighat*), for a total estimated inventory of c. 156 warheads. India's inventory 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, National Air and Space Intelligence Center (NASIC), *Ballistic and Cruise Missile Threat*, various years; Indian news media reports; *Bulletin of the Atomic Scientists*, 'Nuclear notebook', various issues; and authors' estimates.

In addition, India has bought 36 Rafale combat aircraft from France, with delivery starting in July 2020.<sup>8</sup> According to the Indian Ministry of Defence, the 'Rafale will provide IAF the strategic deterrence and requisite capability cum technological edge'.<sup>9</sup> It is unclear whether this language indicates a future nuclear role for the Rafales.

### Land-based missiles

The Indian Army's Strategic Forces Command operates four types of mobile nuclear-capable ballistic missile: the short-range Prithvi-II (250 kilometres) and Agni-I (700 km); the medium-range Agni-II (>2000 km); and the intermediate-range Agni-III (>3200 km).<sup>10</sup>

Two new and longer-range land-based ballistic missiles are in development: the Agni-IV (>3500 km) and the Agni-V (>5000 km). A variant with an even longer range, the Agni-VI (6000 km), is in the design stage of development.<sup>11</sup> Unlike the other Agni missiles, the Agni-V is designed to be stored in and launched from a new mobile canister system, which will reduce the time required to place the missiles on alert in a crisis.<sup>12</sup> The Agni-V is currently undergoing final development trials. According to one report, the missile might be handed over to the military (inducted) sometime in the first half of 2021.<sup>13</sup>

India is also developing a land-based, short-range version (750 km) of the K-15 submarine-launched ballistic missile (SLBM)—known as the Shaurya.

<sup>8</sup> 'India: French Rafale jets land amid tensions with China', Deutsche Welle, 29 July 2020.

<sup>9</sup> Indian Ministry of Defence (MOD), *Annual Report 2018–19* (MOD: New Delhi, 2019), p. 43.

<sup>10</sup> The Prithvi-II's range is often reported as 350 km. However, the range is set at 250 km in US Air Force, National Air and Space Intelligence Center (NASIC), *Ballistic and Cruise Missile Threat 2020* (NASIC: Wright-Patterson Air Force Base, OH, July 2020), p. 17.

<sup>11</sup> Vikas, S. V., 'Why India may not test Agni 6 even if DRDO is ready with technology', OneIndia, 10 July 2019.

<sup>12</sup> Aroor, S., 'New chief of India's military research complex reveals brave new mandate', *India Today*, 13 July 2013.

<sup>13</sup> Rout, H. K., 'India plans deployment of nuclear-capable Agni-V this year', *New Indian Express*, 4 Jan. 2021.

Because the K-15 is nuclear-capable, media reports also widely attribute nuclear capability to the Shaurya.<sup>14</sup> No official government statement has confirmed this, however, and with only three or four flight tests, reports about imminent deployment seem premature.<sup>15</sup> The US Air Force's National Air and Space Intelligence Center (NASIC) does not mention the Shaurya in its ballistic and cruise missile reports of 2020 and 2017.<sup>16</sup> Because of the high level of uncertainty about the status of the Shaurya, it is not included in SIPRI's estimate for January 2021.

India reportedly carried out at least five test launches of land-based ballistic missiles in 2020. The known launches included night-time flight tests of four Prithvi-II missiles and one Shaurya missile.<sup>17</sup> An Agni-IV test may have been scheduled for late December; however, it is unclear whether that test took place.

India is reportedly pursuing a technology development programme for multiple independently targetable re-entry vehicles (MIRVs). However, there have been conflicting views among defence planners and officials about how to proceed with the programme, in particular about whether MIRVs should be initially deployed on the intermediate-range Agni-V or on the intercontinental Agni-VI, which will have a heavier payload capacity.<sup>18</sup>

### Sea-based missiles

With the aim of creating an assured second-strike capability, India continues to develop the naval component of its nascent nuclear triad and is building a fleet of four to six SSBNs.<sup>19</sup> The first SSBN, the *INS Arihant*, was launched in 2009 and formally commissioned in 2016.<sup>20</sup> It is estimated here

<sup>14</sup> Press Trust of India (PTI), '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.

<sup>15</sup> Subramanian, T. S. and Mallikarjun, Y., 'India successfully test-fires Shourya missile', *The Hindu*, 24 Sep. 2011; and Press Trust of India (PTI), "'Shaurya" successfully test fired', *The Hindu*, 3 Oct. 2020.

<sup>16</sup> US Air Force (note 10); and 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).

<sup>17</sup> Express News Service, 'Nuke capable Prithvi-II night trial successful', *New Indian Express*, 24 Sep. 2020; Press Trust of India (PTI), 'Successful night trial of nuclear-capable Prithvi-2 missile', *Times of India*, 16 Oct. 2020; Rout, H. J. (@TheHemantRout), '#FirstVisual of Prithvi #missile night trial from ITR off #Odisha coast. #India test fires 2 variants of #Prithvi in quick succession to reconfirm operational readiness. Developed by @DRDO\_India, the tactical #nuclear capable weapons can strike targets at a range up to 350 km.', Twitter, 17 Dec. 2020; and Mohanty, D. and Singh, R., 'India successfully tests nuclear-capable Shaurya missile', *Hindustan Times*, 3 Oct. 2020.

<sup>18</sup> Basrur, R. and Sankaran, J., 'India's slow and unstoppable move to MIRV', eds M. Krepon, T. Wheeler and S. Mason, *The Lure and Pitfalls of MIRVs: From the First to the Second Nuclear Age* (Stimson Center: Washington, DC, May 2016).

<sup>19</sup> Davenport, K., 'Indian submarine completes first patrol', *Arms Control Today*, vol. 48, no. 10 (Dec. 2018).

<sup>20</sup> Dinakar, P., 'Now, India has a nuclear triad', *The Hindu*, 18 Oct. 2016.

that 12 nuclear warheads have been delivered for potential deployment by the *Arihant* and another 12 produced for a second SSBN, the *INS Arighat*, which is being fitted out.

In November 2018 the Indian Government announced that the *Arihant* had completed its first ‘deterrence patrol’.<sup>21</sup> However, it is doubtful that the submarine’s missiles carried nuclear warheads during the patrol.<sup>22</sup> The *Arihant* is assessed here to have only a limited operational capability.

The *INS Arighat* was launched in November 2017 and is expected to be commissioned into the Indian Navy in early 2021.<sup>23</sup> Construction work has reportedly begun on a third and fourth submarine, with expected launch dates in 2021 and 2023, respectively.<sup>24</sup>

Photographs indicate that the *Arihant* and *Arighat* are each equipped with a four-tube vertical-launch system and can carry up to 12 two-stage, 700-km range K-15 SLBMs (which the Indian Ministry of Defence calls the B-05).<sup>25</sup> India’s third and fourth submarines are expected to be larger than its first two. They will reportedly have 8 launch tubes to hold up to 24 K-15s or 8 K-4 missiles, which are in development.<sup>26</sup>

The K-4 is a two-stage, 3500-km range SLBM that is being developed by the Defence Research and Development Organisation (DRDO). It will eventually replace the K-15, although only with four or eight missiles per submarine, depending on the number of launch tubes.<sup>27</sup> The DRDO has also started to develop extended-range versions: the K-5 SLBM, which will reportedly have a range in excess of 5000 km, and the K-6, which will have an even longer range.<sup>28</sup> The K-4 was tested twice by the DRDO in January 2020 from a submerged pontoon.<sup>29</sup> With only two successful launches (two

<sup>21</sup> Indian Prime Minister’s Office, ‘Prime Minister felicitates crew of INS Arihant on completion of Nuclear Triad’, Press Information Bureau, 5 Nov. 2018; and Davenport (note 19).

<sup>22</sup> Joshi, Y., ‘Angels and dangles: Arihant and the dilemma of India’s undersea nuclear weapons’, *War on the Rocks*, 14 Jan. 2019.

<sup>23</sup> Bedi, R., ‘India to commission second Arihant-class submarine in 2021’, *Janes*, 22 Dec. 2020. Until its launch, the submarine was assumed to be named *INS Aridhaman*.

<sup>24</sup> Unnithan, S., ‘A peek into India’s top secret and costliest defence project, nuclear submarines’, *India Today*, 10 Dec. 2017.

<sup>25</sup> Indian Defence Research and Development Organisation (DRDO), ‘MSS—Achievements’, 6 Sep. 2019.

<sup>26</sup> Philip, S. A., ‘Ballistic missile submarine Arighat in final stages of trials, to be commissioned early 2021’, *ThePrint*, 16 Dec. 2020; and Kristensen, H. (@nukestrat), ‘New submarine cover (17°42’23”N, 83°16’23”E) constructed at Vizag is 40m longer than first one. India’s third SSBN will be longer with more missile tubes than the 4 on first two boats. Current missile compartment is -15m with tubes in row instead of pairs as other navies have.’, *Twitter*, 12 Mar. 2021.

<sup>27</sup> Jha, S., ‘India’s undersea deterrent’, *The Diplomat*, 30 Mar. 2016; and US Air Force (note 10), p. 30.

<sup>28</sup> Unnithan (note 24).

<sup>29</sup> Peri, D., ‘India successfully test-fires 3,500-km range submarine-launched ballistic missile K-4’, *The Hindu*, 19 Jan. 2020; and Pandit, R., ‘DRDO: Arihant’s N-capable missile “ready to roll”’, *Times of India*, 25 Jan. 2020.

previous attempts failed), and none from a submarine, the K-4 still seems to be several years from operational capability.

India's first naval nuclear weapon was the Dhanush missile, a version of the dual-capable Prithvi-II that can be launched from a surface ship. Two Sukanya-class offshore patrol vessels based at the Karwar Naval Base on India's west coast have been converted to launch the Dhanush. The missile can reportedly carry a 500-kg warhead to a maximum range of 400 km and is designed to be able to hit both sea- and shore-based targets. Its utility as a second-strike deterrence weapon is limited by its relatively short range, which would make its carrier vessels vulnerable to anti-ship missiles and rapid-response combat aircraft.<sup>30</sup> The Dhanush will probably be retired when the SSBN programme with longer-range missiles matures. The most recent known Dhanush test launch was in November 2018.<sup>31</sup>

### **Cruise missiles**

There are numerous claims in news articles and on private websites 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.<sup>32</sup> There is, however, no official or authoritative source that attributes nuclear capability to India's cruise missiles. Therefore, they are not included in SIPRI's estimate for January 2021.

<sup>30</sup> 'Nuke-capable Dhanush and Prithvi-II launched', *New Indian Express*, 12 Mar. 2011.

<sup>31</sup> Indian Ministry of Defence (note 9), p. 100.

<sup>32</sup> 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.