

IV. French nuclear forces

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France's nuclear arsenal contains approximately 300 warheads, a number that has remained stable in recent years. The warheads are earmarked for delivery by 48 submarine-launched ballistic missiles (SLBMs) and 54 air-launched cruise missiles (ALCMs) produced for land- and sea-based combat aircraft (see table 6.5). These provide France with both strategic and tactical nuclear capabilities.¹

The main component of France's nuclear deterrence force is the Strategic Oceanic Force (Force Océanique Stratégique, FOST). It consists of four Triomphant class nuclear-powered ballistic missile submarines (SSBNs), each of which carries 16 SLBMs. The submarines began to enter operational service in 1997, replacing six older Redoubtable class SSBNs. The French Navy maintains a continuous at-sea deterrent posture, whereby one SSBN is on patrol at all times. In July 2018 it conducted the 500th submarine deterrence patrol since the FOST was established in 1972.²

France continues to modernize its SLBMs and associated warheads. In July 2018 the French Navy completed work to modify the Triomphant class submarines to carry the M51 SLBM, which has replaced the M45 missile.³ The M51 is currently deployed in two versions. The M51.1 is capable of carrying up to six multiple independently targetable re-entry vehicle (MIRV) TN-75 warheads, each with a yield of 100 kilotons. An upgraded version, known as M51.2, which has greater range and improved accuracy, was certified for service in 2016 and declared to be operational in 2017.⁴ The M51.2 is designed to carry the new, stealthier tête nucléaire océanique (TNO, oceanic nuclear warhead) with a reported yield of up to 150 kt.⁵ The number of warheads on some of the missiles is believed to have been reduced in order to improve targeting flexibility. France has commenced design work on a new

¹ Hollande, F., French President, 'Discours sur la dissuasion nucléaire: Déplacement auprès des forces aériennes stratégiques' [Speech on nuclear deterrence: Visit to the strategic air forces], Istres, 25 Feb. 2015. France considers all its nuclear weapons to be strategic, regardless of their range.

² French Ministry of the Armed Forces, '500e patrouille d'un sous-marin nucléaire lanceur d'engins' [500th patrol of a nuclear-powered ballistic missile submarine], 12 Oct. 2018.

³ Navy Recognition, 'Final French Navy SSBN "Le Téméraire" upgraded for M51 SLBM', 18 Aug. 2018; and Groizeleau, V., 'Brest: Le SNLE Le Téméraire remis à l'eau' [Brest: The SNLE Le Téméraire returned to the water], Mer et Marine, 19 July 2018. The fourth submarine in the class, *Le Terrible*, was equipped with launch tubes for the M51 missile during its construction.

⁴ French Ministry of the Armed Forces, 'Discours de Florence Parly, ministre des Armées prononcé à l'usine des Mureaux, ArianeGroup, le 14 décembre 2017' [Speech by Florence Parly, Minister of the Armed Forces, presented at the Mureaux factory, ArianeGroup], 14 Dec. 2017, p. 6; and French Ministry of the Armed Forces, 'Le système d'armes SNLE Le Triomphant/M51 validé en conditions opérationnelles' [Le Triomphant/M51 SSBN weapon system validated under operational conditions], Press release, updated 20 Sep. 2016.

⁵ Navy Recognition (note 3).

M51.3 SLBM with improved accuracy. It is scheduled to become operational in 2025.⁶

France is also beginning preliminary design work on a third-generation SSBN, designated the SNLE 3G, which will be equipped with the M51.3 SLBM. The construction of the first of four submarines in the class is scheduled to begin in 2023.⁷ The goal is to have an operational successor to the Triomphant class submarine in service by 2035.⁸

The airborne component of the French nuclear forces is made up of land- and sea-based combat aircraft. The land-based squadrons currently consist solely of Rafale BF3 aircraft, after the remaining nuclear-capable Mirage 2000N aircraft were retired from service in August 2018.⁹ All Rafale BF3 aircraft are normally based at Saint-Dizier Airbase. The French Navy also deploys a squadron of Rafale MF3 aircraft aboard its aircraft carrier the *Charles de Gaulle*.

The Rafale aircraft are equipped with the extended-range air-sol moyenne portée-améliorée (ASMP-A, improved medium-range air-to-surface) cruise missile, which entered service in 2009. France produced 54 ASMP-As, including test missiles.¹⁰ A midlife refurbishment programme for the ASMP-A is scheduled to begin in 2020.¹¹ The missiles are armed with the tête nucléaire aéroportée (TNA, airborne nuclear warhead), which has a reported yield of up to 300 kt. The French Ministry of the Armed Forces has initiated research on a successor missile, designated air-sol nucléaire (air-to-surface nuclear) fourth-generation (ASN-4G), with enhanced stealth and manoeuvrability to counter potential technological improvements in air defences.¹²

In 2018 the French President, Emmanuel Macron, reaffirmed the government's commitment to the long-term modernization of France's air- and sea-based nuclear deterrent forces.¹³ In July Macron signed the law on military planning for 2019–25 following its approval by the French parliament.¹⁴

⁶ French Ministry of the Armed Forces, Speech by Florence Parly (note 4).

⁷ Groizeleau, V., 'La construction du prochain SNLE français débutera en 2023' [The construction of the next French SNLE will begin in 2023], *Mer et Marine*, 22 Oct. 2018.

⁸ Hollande (note 1); and Le Drian, J. Y., French Minister of Defence, 'Discours de clôture du colloque pour les 50 ans de la dissuasion' [Conference closing speech on the 50th anniversary of deterrence], French Ministry of Defence, Paris, 20 Nov. 2014.

⁹ French Ministry of the Armed Forces, 'La dissuasion aéroportée passe au tout Rafale' [Airborne deterrence goes to the Rafale], 5 Sep. 2018; and Huberdeau, E., 'L'Adieu au Mirage 2000N' [Farewell to the Mirage 2000N], *Air & Cosmos*, 22 June 2018.

¹⁰ Hollande (note 1).

¹¹ French Ministry of the Armed Forces, 'Projet de loi de programmation militaire, 2019–2025, Dossier de presse' [Law on military planning, 2019–2025, Press kit], Feb. 2018, p. 41.

¹² French Ministry of the Armed Forces, 'La dissuasion nucléaire' [Nuclear deterrence], *Actu Défense*, 14 June 2018, p. 1; and Tran, P., 'France studies nuclear missile replacement', *Defense News*, 29 Nov. 2014.

¹³ Macron, E., French President, 'Déclaration sur les défis et priorités de la politique de défense' [Speech on the challenges and priorities of defence policy], Toulon, 19 Jan. 2018.

¹⁴ Agence France-Presse, 'Macron promulgue la loi de programmation militaire 2019–2025' [Macron signs the law on military programming 2019–2025], *Le Figaro*, 13 July 2018.

Table 6.5. French nuclear forces, January 2019

Type	No. deployed	Year first deployed	Range (km) ^a	Warheads x yield	No. of warheads
<i>Land-based aircraft</i>					
Rafale BF3 ^b	20	2010–11	2 000	1 x up to 300 kt TNA	40
<i>Carrier-based aircraft</i>					
Rafale MF3	10	2010–11	2 000	1 x up to 300 kt TNA	10
<i>Submarine-launched ballistic missiles^c</i>					
M51.1	32	2010	>6 000	4–6 x 100 kt TN-75	160 ^d
M51.2	16 ^e	2016	>6 000 ^f	4–6 x 150 kt TNO	80
M51.3 ^g	0	(2025)	>(6 000)	(up to 6 x 150 kt) TNO	0
<i>Reserves</i>					10
Total					300^h

() = uncertain figure; kt = kiloton; TNA = tête nucléaire aéroportée (airborne nuclear warhead); TNO = tête nucléaire océanique (oceanic nuclear warhead).

^a Aircraft range is for illustrative purposes only; actual mission range will vary according to flight profile and weapon loading.

^b The Rafale BF3 carries the ASMP-A air-launched cruise missile. The Mirage 2000N was officially retired in Aug. 2018. An ASMP-A midlife upgrade is scheduled for 2020.

^c France has only produced enough submarine-launched ballistic missiles (SLBMs) to equip three operational nuclear-powered ballistic missile submarines (SSBNs); the fourth SSBN is out of service for overhaul and maintenance work at any given time. The M45 SLBM was retired in 2016.

^d Although the M51 SLBM can carry up to 6 warheads, the number of warheads is believed to have been reduced on some of the missiles in order to improve targeting flexibility.

^e The French Navy is transitioning from the M51.1 to the M51.2. The Minister of the Armed Forces, Florence Parly, stated in Dec. 2017 that the M51.2 was operational.

^f The M51.2 has a 'much greater range' than the M51.1, according to the French Ministry of the Armed Forces.

^g The M51.3 is under development and has not yet been deployed.

^h President François Hollande confirmed a cap of 300 warheads in a speech in Feb. 2015.

Sources: French Ministry of the Armed Forces, 'Discours de Florence Parly, ministre des Armées prononcé à l'usine des Mureaux, ArianeGroup, le 14 décembre 2017' [Speech by Florence Parly, Minister of the Armed Forces, presented at the Mureaux factory, ArianeGroup], 14 Dec. 2017; Hollande, F., French President, 'Discours sur la dissuasion nucléaire: Déplacement auprès des forces aériennes stratégiques' [Speech on nuclear deterrence: visit to the strategic air forces], Istres, 25 Feb. 2015; Sarkozy, N., French President, Speech on defence and national security, Porte de Versailles, 17 June 2008; Sarkozy, N., French President, 'Presentation of SSBM "Le Terrible"', Speech, Cherbourg, 21 Mar. 2008; Chirac, J., French President, Speech during visit to the Strategic Forces, Landivisiau, L'Ile Longue, Brest, 19 Jan. 2006; French Ministry of Defence/Ministry of the Armed Forces, various publications; French National Assembly, various defence bills; Air Actualités, various issues; Aviation Week & Space Technology, various issues; 'Nuclear notebook', *Bulletin of the Atomic Scientists*, various issues; and authors' estimates.

Among other provisions, the law allocated €37 billion (\$43.7 billion) to maintain and modernize France's nuclear forces and infrastructure.¹⁵ This marked a significant increase on the €23 billion (\$27.1 billion) allocated to nuclear forces and associated infrastructure in the military programme law for 2014–19.¹⁶ Of the total amount allocated to nuclear forces in the new military planning law, approximately €23 billion (\$27.1 billion) will be spent during 2019–23.¹⁷

¹⁵ Agence France-Press, 'France to spend 37 bn euros on upgrading nuclear arsenal', France24, 9 Feb. 2018. The total defence budget approved for the 7-year period was €295 billion (\$348 billion).

¹⁶ Loi relative à la programmation militaire pour les années 2014 à 2019 [Law on military planning for the years 2014 to 2019], French Law no. 2013-1168 of 18 Dec. 2013.

¹⁷ Ministry of the Armed Forces (note 11).