

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, which provides France with both strategic and tactical nuclear capabilities.¹

The main component of France's strategic nuclear deterrence force consists of four Triomphant class nuclear-powered ballistic missile submarines (SSBNs), each of which carries 16 submarine-launched ballistic missiles (SLBMs). The submarines began to enter operational service in 1997. The French Navy maintains a continuous at-sea deterrent posture, whereby one SSBN is on patrol at all times. The SSBN force is complemented by nuclear-capable land- and sea-based combat aircraft (see table 6.5).

France continues to modernize its Strategic Oceanic Force (Force Océanique Stratégique, FOST). The French Navy is modifying the Triomphant class submarines to carry the M51 SLBM, which has replaced the M45 missile.² As of December 2017, all four submarines had been upgraded to the M51.1 SLBM.³ Each of the M51 missiles is capable of carrying up to six multiple independently targetable re-entry vehicle (MIRV) TN-75 warheads. The number of warheads on some of the missiles is believed to have been reduced in order to improve targeting flexibility.

The French SSBN fleet will be equipped with a longer-range version of the missile, the M51.2, by 2020. An M51.2 missile was successfully test launched under operational conditions from *Le Triomphant* in July 2016, after which the missile was certified and commissioned for service.⁴ The French Minister of the Armed Forces, Florence Parly, confirmed in December 2017 that the M51.2 was operational.⁵ The M51.2 is designed to carry the new, stealthier tête nucléaire océanique (TNO, oceanic nuclear warhead) with a

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, 19 Feb. 2015.

² French Navy, 'Modernisation de la force océanique stratégique: le SNLE Le Triomphant adapté au M51' [Modernization of the strategic naval force: the SSBN Le Triomphant adapted for M51], 13 Aug. 2015.

³ French Ministry of the Armed Forces, 'Madame Florence Parly, Ministre des armées Visite de l'usine des Mureaux: Ariane Group' [Florence Parly, Minister of the Armed Forces, Visit to the Mureaux factory: Ariane Group], Mureaux, 14 Dec. 2017, p. 6.

⁴ Groizeleau, V., 'DCNS débute la refonte du Téméraire' [DCNS begins the recasting of Le Téméraire], *Mer et Marine*, 8 Dec. 2016; and French Ministry of Defence, '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 French Ministry of the Armed Forces (note 3).

Table 6.5. French nuclear forces, January 2018

Type	No. deployed	Year first deployed	Range (km) ^a	Warheads x yield	No. of warheads
<i>Land-based aircraft</i>					
Mirage 2000N	20	1988	2 750	1 x up to 300 kt TNA	20
Rafale F3 ^b	20	2010–11	2 000	1 x up to 300 kt TNA	20
<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	2016	>6 000 ^e	4–6 x 150 kt TNO	80
M51.3 ^f	0	(2025)	>(6 000)	(up to 6 x 150 kt) TNO	0
<i>Reserves</i>					10 ^g
Total					300^h

.. = not available or not applicable; () = 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 Mirage 2000N and Rafale carry the air-sol moyenne portée-améliorée (ASMP-A, improved medium-range air-to-surface) air-launched cruise missile. A mid-life upgrade of the ASMP-A is scheduled to begin in 2022.

^c France has only produced enough submarine-launched ballistic missiles (SLBMs) to equip 3 operational nuclear-powered ballistic missile submarines (SSBNs); the 4th SSBN is out of service for overhaul and maintenance work at any given time.

^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 M51.2 has a ‘much greater range’ than the M51.1, according to the French Ministry of Defence.

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

^g The reserve includes 4 ASMP-A missiles.

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

Sources: French Ministry of the Armed Forces, ‘Madame Florence Parly, Ministre des armées Visite de l’usine des Mureaux: Ariane Group’ [Florence Parly, Minister of the Armed Forces, Visit to the Mureaux factory: Ariane Group], Mureaux, 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, 19 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’Île Longue, Brest, 19 Jan. 2006; French Ministry of Defence, various publications; French National Assembly, various defence bills; International Institute for Strategic Studies, *The Military Balance 2018* (Routledge: London, 2018); *Air Actualités*, various issues; *Aviation Week & Space Technology*, various issues; ‘Nuclear notebook’, *Bulletin of the Atomic Scientists*, various issues; and authors’ estimates.

reported yield of up to 150 kilotons.⁶ France has commenced design work on a new M51.3 SLBM with improved accuracy.⁷ It is scheduled to become operational in 2025.⁸ 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 goal is to have an operational successor to the Triomphant class submarine by 2035.⁹

The airborne component of the French nuclear forces consists of two squadrons of the land-based Mirage 2000N and Rafale F3 combat aircraft. The remaining Mirage 2000Ns will be replaced by Rafale B aircraft by 2018.¹⁰ The French Navy also operates a single squadron of Rafale MF3 aircraft deployed 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. There are 54 ASMP-As in France's nuclear arsenal.¹¹ A mid-life refurbishment programme for the ASMP-A is scheduled to begin in 2022.¹² 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 Defence 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.¹³

The French Government's commitment to the long-term modernization of the country's air- and sea-based nuclear deterrent forces will require a substantial increase in military nuclear expenditure.¹⁴ The draft law on military

⁶ French Senate, 'Avis présenté au nom de la Commission des Affaires Étrangères, de la Défense et des Forces Armées (I) sur le Projet de Loi de Finances pour 2014, adopté par L'Assemblée Nationale: Défense: équipement des forces et excellence technologique des industries de défense' [Opinions submitted on behalf of the committee on foreign affairs, defence and the armed forces (I) on the draft finance law for 2014, adopted by the National Assembly: defence: equipment of the forces and technological excellence of the defence industries], no. 158, 21 Nov. 2013, pp. 51–52.

⁷ 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.

⁸ French Ministry of the Armed Forces (note 3).

⁹ 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.

¹⁰ Hollande (note 1).

¹¹ Hollande (note 1).

¹² French Senate (note 6), p. 52.

¹³ Le Drian (note 9); and Tran, P., 'France studies nuclear missile replacement', *Defense News*, 29 Nov. 2014.

¹⁴ Guisnel, J., 'Le casse-tête financier de la modernisation de la dissuasion nucléaire' [The financial puzzle of modernization of nuclear deterrence], *Le Point*, 12 May 2016.

planning for 2019–25 has allocated €37 billion to maintain and modernize France's nuclear forces and infrastructure.¹⁵ This is a significant increase on the €23 billion allocated to nuclear forces and infrastructure in the military planning law for 2014–19.¹⁶

¹⁵ Agence France-Presse, 'La France va consacrer 295 milliards d'euros à sa défense entre 2019 et 2025' [France will spend €295 billion on defence between 2019 and 2025], *Le Figaro*, 7 Feb. 2018.

¹⁶ Collin, J. M., 'Dissuasion nucléaire: l'obstination française' [Nuclear deterrence: French obstinance], Group for Research and Information on Peace and Security (GRIP), Report, 19 Feb. 2015.