

## IV. French nuclear forces

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France's nuclear arsenal consists of 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), which provides France with both strategic and tactical nuclear capabilities.<sup>1</sup> France has allocated 12 per cent (c. €22 billion) of its annual defence budgets for 2014–19 to maintaining and modernizing its nuclear forces and infrastructure at a level of 'strict sufficiency'.<sup>2</sup>

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 French Navy maintains that one SSBN is on operational patrol at all times. The SSBN force is complemented by nuclear-capable land- and sea-based combat aircraft (see table 11.5).

France continues to modernize its SSBN force. The French Navy is modifying the Triomphant class submarines to carry the M51 SLBM, which replaces the ageing M45 missile. Work is expected to be completed by 2019. As of December 2016 three submarines were carrying the initial version of the missile (the M51.1). Work on upgrading the fourth submarine has begun and is expected to be completed in 2018.<sup>3</sup> Each of the missiles is capable of carrying 4–6 multiple independently targetable (MIRV) warheads. An M51.1 missile was successfully test launched by *Le Triomphant* on 1 July 2016.<sup>4</sup>

The SSBN fleet will be equipped with an enhanced version of the missile (the M51.2), which has increased range and improved penetration aids.<sup>5</sup> The M51.2 is designed to carry the new, more robust Tête Nucléaire Océanique (TNO, Oceanic Nuclear Warhead), which has a reported yield of up to

<sup>1</sup> Hollande, F., '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.

<sup>2</sup> Guillemard, V., 'Dissuasion nucléaire: la France ne baisse pas la garde' [Nuclear deterrence: France will not lower its guard], *Le Figaro*, 19 Feb. 2015.

<sup>3</sup> Maass, R., 'DCNS begins final M51 missile adaptation for French submarines', United Press International, 13 Dec. 2016; and 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.

<sup>4</sup> French Ministry of Defence, 'Le système d'armes SNLE Le Triomphant / M51 validé en conditions opérationnelles' [Le Triomphant / M51 SNLE weapon system validated under operational conditions], Press release, updated 20 Sep. 2016.

<sup>5</sup> 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* [Opinions submitted on behalf of the Committee on Foreign Affairs], vol. 8, *Défense: Équipement des Forces* [Defence: equipping the forces], no. 158 (French Senate: Paris, 21 Nov. 2013), pp. 51–52; and 'Le SNLE Le Triomphant en refonte' [Le Triomphant SSBN being overhauled], *Mer et Marine*, 20 Sep. 2013.

**Table 11.5.** French nuclear forces, January 2017

Type	No. deployed	Year first deployed	Range (km) <sup>a</sup>	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 <sup>b</sup>	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<sup>c</sup></i>					
M51.1	48	2010	>6 000	4–6 x 100 kt TN-75	240 <sup>d</sup>
M51.2	.. <sup>e</sup>	(2017)	>6 000 <sup>f</sup>	4–6 x 150 kt TNO	..
M51.3 <sup>g</sup>	0	..	>(6 000)	(up to 6 x 150 kt) TNO	0
Reserves					10
<b>Total</b>					<b>300<sup>h</sup></b>

.. = not available or not applicable; ( ) = uncertain figure; kt = kiloton; TNA = Tête Nucléaire Aéroportée (Airborne Nuclear Warhead); TNO = Tête Nucléaire Océanique (Oceanic Nuclear Warhead).

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

<sup>b</sup> The Rafale carries the ASMP-A air-launched cruise missile.

<sup>c</sup> 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. The remaining M45 SLBMs were retired in Dec. 2016 at the start of the upgrade of *Le Téméraire* to carry the M51 SLBM.

<sup>d</sup> 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.

<sup>e</sup> The French Navy is transitioning from the M51.1 to the M51.2. The M51 SLBM test launched from *Le Triomphant* on 1 July 2016 may have been an M51.2.

<sup>f</sup> The M51.2 has a greater range than the M51.1, according to the French Ministry of Defence.

<sup>g</sup> The M51-3 is under development and has not yet been deployed.

<sup>h</sup> President François Hollande confirmed a cap of 300 warheads in a speech in Feb. 2015.

*Sources:* Hollande, F., ‘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., President of the Republic, Speech during visit to the Strategic Forces, Landivisiau–L’île Longue, Brest, 19 Jan. 2006; French Ministry of Defence, various publications, <<http://www.defense.gouv.fr/>>; 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.

150 kilotons.<sup>6</sup> France has commenced design work on an M51.3 SLBM, which will have a longer range and improved accuracy.<sup>7</sup> France is also beginning

<sup>6</sup> French Senate (note 5).

<sup>7</sup> Loi relative à la programmation militaire pour les années 2014 à 2019 [Law on military planning for 2014–2019], French Law no. 2013-1168 of 18 Dec. 2013.

preliminary design work on a next-generation SSBN with the goal of having a successor submarine to the Triomphant class in service by 2035.<sup>8</sup>

The airborne component of French nuclear forces consists of two squadrons of land-based Mirage 2000N and Rafale F3 combat aircraft. The remaining Mirage 2000Ns will be replaced by Rafale B aircraft by 2018.<sup>9</sup> The French Navy also operates a single squadron of Rafale MF3 aircraft deployed aboard its aircraft carrier *Charles de Gaulle*.

The Rafale aircraft are equipped with the extended-range Air-Sol Moyenne Portée-Améliorée (ASMP-A, Medium-Range Air-to-Surface-Improved) air-launched cruise missile, which entered service in 2009. A midlife refurbishment programme for the ASMP-A is scheduled to begin in 2022. This will allow the missile to continue in service until the mid-2030s.<sup>10</sup> 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 studies for a successor missile, designated air-sol nucléaire fourth-generation (ASN4G, air-to-surface nuclear fourth-generation), with enhanced stealth and manoeuvrability to counter potential technological improvements in air defences.<sup>11</sup>

<sup>8</sup> 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 for the 50th anniversary of deterrence], 21 Nov. 2014.

<sup>9</sup> Hollande (note 1).

<sup>10</sup> French Senate (note 5), p. 52; and Tran, P., 'France studies nuclear missile replacement', *Defense News*, 30 Nov. 2014.

<sup>11</sup> Le Drian (note 8); and Lagneau, L., 'Les défis technologiques posés par l'ASN4G, le futur missile des Forces aériennes stratégiques' [The technological challenges posed by ASN4G, the future missile of the Strategic Air Forces], *Zone Militaire*, Opex360.com, 18 Apr. 2016.