

## IV. French nuclear forces

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France's nuclear arsenal contains approximately 300 warheads earmarked for delivery by submarine-launched ballistic missiles (SLBMs) and aircraft-launched cruise missiles (see table 16.5). In a speech in February 2015 President François Hollande reaffirmed France's commitment to maintaining an up-to-date nuclear deterrence strike force (*force de frappe*), consisting of sea- and air-launched components, at a level of 'strict sufficiency'.<sup>1</sup> France has allocated 12 per cent (€22 billion) of its annual defence budgets for 2014–19 to maintaining and modernizing its nuclear forces and infrastructure.<sup>2</sup>

The main component of France's nuclear arsenal consists of four Triomphant class nuclear-powered ballistic missile submarines (SSBNs) based at Île Longue in western Brittany. Each submarine is armed with 16 M45 or M51.1 SLBMs carrying up to 6 warheads per missile. The French Navy deploys one SSBN on patrol at all times, while the other submarines are in various stages of refit and overhaul work.<sup>3</sup>

France continues to modernize its SSBN force. The French Navy is modifying the Triomphant class submarines to carry the M51 SLBM, a three-stage solid-propellant missile, which replaces the ageing M45 missile.<sup>4</sup> The work is expected to be completed by 2019. As of August 2015, two submarines had been retrofitted to carry an initial version of the missile, the M51.1. A third Triomphant-class vessel, commissioned in 2010, was upgraded to carry the M51.1 missile while under construction.<sup>5</sup> On 30 September 2015 an M51.1 missile was successfully launched from a land-based platform at the missile testing centre at Biscarrosse to an impact zone in the North Atlantic.<sup>6</sup> This was the first test-launch of an M51.1 since an unsuccessful test of the missile from a submerged SSBN in 2013.

<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 guard], *Le Figaro*, 19 Feb. 2015.

<sup>3</sup> For an overview of French nuclear forces see Patton, T., Podvig, P. and Schell P., *A New START Model for Transparency in Nuclear Disarmament: Individual Country Reports* (United Nations Institute for Disarmament Research: Geneva, 2013), pp. 17–23.

<sup>4</sup> 'Le SNLE Le Triomphant en refonte' [The SSBN Le Triomphant being overhauled], *Mer et Marine*, 20 Sep. 2013.

<sup>5</sup> 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 suitable for M51], Press Release, 13 Aug. 2015.

<sup>6</sup> French Ministry of Defence, 'Tir dessai réussi pour le missile M51' [Successful test firing for M51], Press Release, 30 Sep. 2015.

**Table 16.5.** French nuclear forces, January 2016

Type	No. deployed	Year first deployed	Range (km) <sup>a</sup>	Warheads x yield	No. of warheads
<i>Land-based aircraft</i>					
Mirage 2000N <sup>b</sup>	~20	1988	2 750	1 x up to 300 kt TNA	~20
Rafale F3	~20	2010–11	2 000	1 x up to 300 kt TNA	~20
<i>Carrier-based aircraft</i>					
Rafale MK3	~10	2010–11	2 000	1 x up to 300 kt TNA	~10
<i>Submarine-launched ballistic missiles<sup>c</sup></i>					
M45	16	1996	>5 000 <sup>d</sup>	4–6 x 100 kt TN-75	80 <sup>e</sup>
M51.1	32	2010–11	>6 000	4–6 x 100 kt TN-75	160 <sup>e</sup>
M51.2	0	(2016)	>6 000	4–6 x TNO	0
M51.3	–	–	>(6 000)	(up to 6 x 150 kt) TNO	–
Spares					~10
<b>Total</b>					<b>~300</b>

( ) = 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 Mirage 2000N will be replaced by the Rafale F3 in the nuclear mission in 2018.

<sup>c</sup> France has only produced enough SLBMs to equip 3 operational SSBNs; the 4th SSBN is out of service for overhaul and maintenance work at any given time.

<sup>d</sup> Although often reported to have a range of 6000 km, the range of the M45 is listed as only 4000 km in a 2001 report from the French National Assembly's National Defence Commission. The French Navy lists the range as >5000 km.

<sup>e</sup> Although the M45 and M51 SLBMs 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.

*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.

The SSBN fleet will be equipped with an enhanced version of the missile, the M51.2, beginning in 2016.<sup>7</sup> The M51.2 will carry the TNO warhead (tête nucléaire océanique, oceanic nuclear warhead). The new warhead has a

<sup>7</sup> French Senate, *Projet de loi de finances pour 2016: Défense: équipement des forces* [Finance Bill 2016: Defence: equipping the forces], no. 166 (French Senate: Paris, 19 Nov. 2015); and Hollande (note 1).

variable explosive yield similar to that of the current TN-75 warhead, but it features a more robust design for improved reliability and a longer life-span.<sup>8</sup>

France is beginning preliminary design work on a next-generation SSBN. The goal is to have a successor submarine to the Triomphant class in service by 2035.<sup>9</sup> The new submarine will carry the M51.3 SLBM, which will have greater range and accuracy than earlier versions. Design work will begin in 2016, and the missile is expected to enter service in the mid-2020s.<sup>10</sup>

The airborne component of the French nuclear forces consists of the land-based Mirage 2000N and Rafale F3 combat aircraft; and the Rafale MK3 deployed on the aircraft carrier *Charles de Gaulle*. The Mirage 2000Ns will be replaced by Rafale F3 aircraft by 2018.<sup>11</sup> The aircraft are equipped with the ASMPA (air-sol moyenne portée amélioré, medium-range air-to-surface-improved) cruise missile, which entered service in 2009. A mid-life refurbishment programme for the ASMPA is scheduled to begin in 2022.<sup>12</sup> The missiles are armed with the TNA (tête nucléaire aéroportée, airborne nuclear warhead), which has a reported yield of up to 300 kilotons. The French MOD has initiated studies for a successor missile, designated air-sol nucléaire fourth-generation, ASN4G (air-to-surface nuclear fourth-generation), with a focus on enhanced stealth and hypersonic technologies.<sup>13</sup>

<sup>8</sup> 'La France prépare la mise en service d'une nouvelle version du M51' [France prepares for the commissioning of a new version of the M51], *Mer et Marine*, 6 Oct. 2015; and Tertrais, B., *Entente Nucléaire: Options for UK-French Nuclear Cooperation*, BASIC Trident Commission Discussion Paper 3 (British-American Security Information Council: London, June 2012), p. 12.

<sup>9</sup> Le Drian, J. Y., French Minister of Defence, 'Discours de clôture du colloque pour les 50 ans de la dissuasion' [Speech closing the Conference to mark the 50th anniversary of deterrence], French Ministry of Defence, 21 Nov. 2014.

<sup>10</sup> Hollande annonce des études pour préparer le SNLE de troisième génération' [Holland announces study to prepare the third generation SSBNs], *Le Marin*, 19 Feb. 2015.

<sup>11</sup> Hollande (note 1).

<sup>12</sup> French Senate (note 7), p. 52.

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