

IV. French nuclear forces

SHANNON N. KILE, PHILLIP SCHELL AND HANS M. KRISTENSEN

France's nuclear forces consist of aircraft and nuclear-powered ballistic missile submarines (SSBNs), carrying a total of about 300 warheads (see table 7.5). The backbone of the French nuclear deterrent consists of four Triomphant class SSBNs. The newest boat in the class, *Le Terrible*, is equipped with 16 M51.1 submarine-launched ballistic missiles (SLBMs).¹ The M51.1 is a three-stage, solid-fuelled missile that can carry up to six TN-75 warheads. The other three Triomphant class SSBNs will be rearmed with the M51.1 by 2017, replacing the M45 SLBM.² The upgrade of *Le Vigilant* was expected to be completed in 2011, and those of *Le Triomphant* and *Le Téméraire* in 2012 and 2017, respectively.³ An improved version of the M51.1, the M51.2, is designed to carry the new Tête Nucléaire Océanique (TNO, Oceanic Nuclear Warhead) with selectable yields of up to 150 kilotons, which is believed to be housed in a new re-entry vehicle and will replace the M51.1 after 2015.⁴

By the end of 2011 the aircraft component of the French nuclear forces consisted of two land- and one sea-based nuclear-capable aircraft squadrons, comprised of Mirage and Rafale combat aircraft.⁵ The Mirage 2000N aircraft of the 3/4 Limousin Fighter Squadron will be replaced by Rafales in 2018. The aircraft are equipped with the Air-Sol Moyenne Portée-Améliorée (ASMP-A, medium-range air-to-surface-improved) missile.⁶ The ASMP-A cruise missiles carry the Tête Nucléaire Aeroportée (TNA, Airborne Nuclear Warhead), which is a new thermonuclear warhead that is reported to have a selectable yield of 20 kt, 90 kt and 300 kt. A new TNO warhead with selectable yields up to 150 kt will become operational around 2015.⁷

¹ French Navy, 'Le Terrible livré à la marine' [*Le Terrible delivered to the navy*], Press release, 4 Oct. 2010, <<http://www.defense.gouv.fr/marine/actu-marine/le-terrible-livre-a-la-marine>>.

² Richardson, D., 'France tests M51 SLBM under operational conditions', *Jane's Missiles and Rockets*, vol. 14, no. 9 (Sep. 2010), p. 6; and Richardson, D., 'M51 SLBM performs fourth test-flight', *Jane's Missiles and Rockets*, vol. 14, no. 3 (Mar. 2010), p. 3.

³ Lennox, D. (ed.), *Jane's Strategic Weapon Systems*, no. 54 (IHS Global Limited: Coulsdon, 2011), p. 51.

⁴ Lennox, ed. (note 3), p. 50.

⁵ French Senate, *Avis présenté au nom de la commission des affaires étrangères, de la défense et des forces armées (1) sur le projet de loi de finances pour 2012*, vol. 6, *Défense: Equipement des forces* [Opinions submitted on behalf of the Committee on Foreign Affairs, Defence and Armed Forces (1) on the finance bill for 2012, vol. 6, Defence: Equipping the forces], no. 102 (French Senate: Paris, 17 Nov. 2011), chapter II, section I. B.

⁶ French Ministry of Defense, 'Le missile ASMPA' [The ASMPA missile], 16 June 2011, <<http://www.defense.gouv.fr/dga/equipement/dissuasion/le-missile-asmpa>>.

⁷ Lennox, ed. (note 3), p. 48.

Table 7.5. French nuclear forces, January 2012

Type	No. deployed	Year first deployed	Range (km) ^a	Warheads x yield	Warheads in stockpile
<i>Land-based aircraft</i>					
Mirage 2000N	-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^b</i>					
M45	32	1996	6 000 ^c	4–6 x 100 kt TN-75	160 ^d
M51.1	16	2010–11	6 000	4–6 x 100 kt TN-75	80
M51.2	0	(2015)	6 000	4–6 x TNO	0
Total					-300^e

() = 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 France transitioned to a posture of 4 SSBNs in the mid-1990s, which meant having enough SLBMs to equip 3 operational SSBNs, with the 4th being overhauled.

^c The range of the M45 is listed as only 4000 km in a 2001 report from the French National Assembly's National Defence Commission.

^d The missile upgrade that started with the *Le Vigilant* submarine does not affect its warheads, which will be fitted back to the new M51.1 missiles.

^e France does not have a reserve but may have a small inventory of spare warheads for a total stockpile of c. 300 warheads.

Sources: Sarkozy, N., French President, Speech on defence and national security, Porte de Versailles, 17 June 2008, <<http://www.elysee.fr/president/les-dossiers/defense/livre-blanc/paris-17-juin-2008/livre-blanc-sur-la-defense-et-la-securite.6651.html>>; Sarkozy, N., French President, 'Presentation of SSBM "Le Terrible"', Speech, Cherbourg, 21 Mar. 2008, <<https://pastel.diplomatie.gouv.fr/editorial/actual/ael2/bulletin.gb.asp?liste=20080331.gb.html>>; French Ministry of Defence, various publications, <<http://www.defense.gouv.fr/>>; French National Assembly, various defence bills; Norris, R. S. et al., *Nuclear Weapons Databook*, vol. 5, *British, French, and Chinese Nuclear Weapons* (Westview: Boulder, CO, 1994), p. 10; *Air Actualités*, various issues; *Aviation Week & Space Technology*, various issues; 'Nuclear notebook', *Bulletin of the Atomic Scientists*, various issues; and authors' estimates.