



French Nuclear Deterrence Policy, Forces, And Future: A Handbook

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Key numbers and figures (2020)

Nuclear weapons	less than 300
Nuclear forces	3 (air, sea, aircraft carrier)
SSBN bases	1 (Ile longue)
SSBNs	4 (of which 3 in the operational cycle)
M51 SLBMs	48 (3 batches of 16)
Warheads per SLBM	variable
Nuclear air bases	3 (Saint-Dizier, Avord, Istres)
Nuclear-capable aircraft	2 squadrons of Rafale, 1 flottila of Rafale-M
ASMPA cruise missiles	classified [total of 54 launchers in 2015]
Warheads per ASMPA	1
Budget	5 billion euros / year (2019-2023)
Share of defense budget	12.5% / year (2019-2025)

CHAPTER I: HISTORICAL OVERVIEW

The origins of the programme

For France, the choice of the nuclear path, envisaged in 1945 and confirmed in the 1950s, resulted from a triple awareness.¹

- Firstly, the limits of its influence as a non-nuclear nation within the international community, notably within the Atlantic Alliance and the UN Security Council.² This prompted, very early in the 1950s, the governments of the Fourth Republic to take the necessary steps so that France could procure nuclear weapons. At the time, an independent deterrent force was not in the cards: the idea was that the possession of nuclear weapons would have restored political and military equality between Paris, London and Washington. No one in Paris had forgotten France's exclusion from the Quebec Agreements (1943), which had laid the foundations for American-British nuclear cooperation, even though French scientists had been at the origin of the first works on the military applications of the atom (the work of Frédéric Joliot in the 1930s); or its absence from the conferences of Yalta and Potsdam, which had seen the fate of the continent decided in the absence of Paris.³ Moreover, some political leaders wanted France to have a military capability that clearly differentiated it from Germany.⁴
- Secondly, the limits of the commitment of the United States towards its allies, which Paris noted on the occasion of the crisis of Diên Biên Phu (March-May 1954). Then came the first questions about the vulnerability of American territory with the first Soviet intercontinental missile test in July 1957, and the launch of the Sputnik I satellite in October 1957. At the end of the 1950s, NATO began to revise its nuclear military doctrine in a way that France did not like: responding to an aggression in an appropriate and flexible manner and no longer in a massive and immediate manner (cf. the first studies on a strategy of graduated response). This, for Paris, suggested a reduction in American protection.
- Thirdly, the limits of national autonomy vis-à-vis the American protector: the transatlantic crisis during the Suez intervention (October-November 1956) reinforced

¹ See Bruno Tertrais, "Destruction assurée" : The Origins and Development of French Nuclear Strategy, 1945-1981", in Henry D. Sokolski (ed.), *Getting MAD: Nuclear Mutual Assured Destruction, Its Origins and Practice* (Carlisle, PA: Strategic Studies Institute, 2004), pp. 41-123 ; Dominique Mongin, *La Bombe atomique française 1945-1958* (Bruxelles : Bruylant, 1997) ; Maurice Vaisse, "Le choix atomique de la France (1945-1958)", in *ibid.*, *Études d'histoire nucléaire* (Bruxelles : Bruylant, 1994), pp. 41-57.

² According to Francis Perrin, entering the Security Council room without nuclear weapons was like arriving at a "meeting of gangsters without having a knife to put on the table". Quoted in Herbert Krosney & Steve Weissman, *The Islamic Bomb* (New York: Times Books, 1981), p. 70.

³ A note from the Quai d'Orsay dated August 1954 summed up the argument in force at the time: "The direction of strategy will now increasingly belong to the powers possessing the atomic weapon. Moreover, a military without atomic means will no longer be a military. (...) It is therefore essential that France undertakes a military atomic programme. Otherwise, its safety will be fully assured by the Anglo-Saxons". (Jean-Marc Boegner, Ministry of Foreign Affairs, Service des pactes, 25 August 1954).

⁴ According to Bertrand Goldschmidt, Pierre Mendès-France estimated in December 1954 that "only the bomb can differentiate us from the Germans" (interview with Dominique Mongin reported in Mongin, *op. cit.*, p. 333).

France's determination to acquire the means of strategic autonomy within the Atlantic Alliance.

Thus, as one historian suggests, barely exaggerating, “it was more a question of protecting oneself from one's allies than of arming oneself against one's enemies”.⁵ But the background was also, of course, the traumatic defeat of 1940 and the occupation that followed. For the French leaders of the post-war years, all political camps combined (with the exception of the Communists, who militated against the nuclear programme until the 1970s), the French military nuclear option also meant “never again 1940”.⁶

It was also a strategy determined by the means available: as soon as France wished to have its own tools to guarantee its security against the Soviet Union, only the nuclear choice made sense. France would not have had the means to conduct a conventional arms race (the refusal of conventional deterrence as a possible substitute for nuclear deterrence would later reflect the permanence of this logic⁷). But this choice was fairly easy: at the time, nuclear power, both military and civilian, was considered a powerful symbol of modernity in the Western world.

The Fourth Republic: launching the nuclear effort⁸

The creation of the Atomic Energy Commission (CEA) on 18 October 1945 was already, for the Provisional Government of the French Republic, a means of creating a military nuclear option. The idea had apparently been suggested to General de Gaulle by Raoul Dautry, Minister for Reconstruction, who had been aware, since 1939, as Minister for Armament, of Frédéric Joliot's work.⁹ He will be its first general administrator.

The Gaullists were campaigning for the Bomb, but they were not alone. Radicals and Socialists were not insensitive to the idea of a national nuclear programme, as the orientations given by Pierre Mendès-France in 1954, Guy Mollet in 1956 and Félix Gaillard in 1958 showed. In addition, some key figures, such as Colonels Charles Ailleret and Pierre-Marie Gallois, both of whom were then stationed at NATO, made persuasive efforts.

Around the end of 1951, the idea of a French nuclear armament began to take shape, supported in particular by the Secretary of State for Atomic Affairs, Félix Gaillard, who held this post under four governments from August 1951 to June 1953. He appointed Pierre

⁵ Vaïsse, *op. cit.*, p. 41.

⁶ See Céline Jurgensen & Dominique Mongin (ed.), “France and nuclear deterrence – A Spirit of Resistance”, *Recherche&Documents* n°01/2020, Fondation pour la recherche stratégique, 2020.

⁷ “These concepts emphasise conventional power relations, which are by nature unstable and based on strategies for employment, preparation and warfare. They suggest the possibility of solving international problems through the use of force and lead to an arms race. They are not compatible with our strategy. Far from replacing nuclear deterrence, a so-called ‘conventional’ deterrence would only add to it.” *White Paper on Defence, 1994* (Paris: Editions 10/18, 1994), p. 99.

⁸ On the history of the French programme see André Bendjebbar, *Histoire secrète de la bombe atomique française* (Paris: Le Cherche-Midi éditeur, 2000); Marcel Duval & Yves Le Baut, *L'Arme nucléaire française: pourquoi et comment?* (Paris: Kronos, 1992) ; Dominique Mongin, *La Bombe atomique française 1945-1958* (Brussels: Bruylant, 1997) ; Robert S. Norris, Andrew Burrows & Richard Fieldhouse, *Nuclear Weapons Databook Series Volume V: British, French and Chinese Nuclear Weapons* (Washington, DC: National Resources Defense Council, 1994); Jean-Damien Pô, *Les Moyens de la puissance. Les activités militaires du CEA (1945-2000)* (Paris: Ellipses, 2001); and Bruno Tertrais, “Destruction assurée”, *op. cit.*

⁹ The first French research reactor, the ZOE pile, was built in 1946 and diverged in 1948.

Guillaumat, a Gaullist, to head the CEA. According to the latter, “the process begun at the end of 1951 was fatal”.¹⁰ In January 1952, the army created a Special Weapons Command entrusted to Colonel Charles Ailleret, who himself took the initiative of creating a Special Weapons Training Centre to familiarise the French military with nuclear weapons. At the same time, a joint organization, the Powders Directorate, was engaged in studies relating to the functioning of atomic weapons.

The CEA set up its study centre in Saclay in 1952. Under Félix Gaillard’s impetus, the first Five-Year Atomic Energy Plan passed by Parliament (Act of 24 July 1952) aimed at moving the French programme from the research to the industrial stage. Plutonium production was planned for late 1957. During the debate, a Communist amendment proposing France’s renunciation to nuclear weapons was rejected. The first British test (3 October) led to an acceleration of French efforts.

In 1953, Guillaumat approached Ailleret and proposed that he set up a formal partnership between the CEA and the armed forces. This cooperation was established in October 1954 (by secret decree of the Nuclear Explosives Committee, chaired by the Secretary General of National Defence). One month later, the decision was formally taken to build two reactors using natural uranium as fuel (Marcoule’s G1 and G2 piles), and capable of producing weapons-grade plutonium.¹¹ It is therefore clear that France was considering the use of a plutonium weapon (Alamogordo, Nagasaki) rather than an enriched uranium weapon (Hiroshima). Nevertheless, it maintained the ambivalence of its programme: the G1 and G2 piles would produce electricity and be connected to the national grid.

At the end of December 1954, Pierre Mendès-France’s government authorized the creation of a military applications division at the CEA (the *Bureau des études générales*) financed by the defence budget.¹² Mendès-France was ready to give the order to manufacture a bomb - but the fall of his government a few weeks later will prevent him from formalizing this decision.

Cooperation between the CEA and the armed forces took a qualitative leap with the secret protocol of 20 May 1955 (Koenig-Palewski agreement), which provided for a massive transfer of defence appropriations to the CEA over three years. The protocol provided for the construction in 1959 of a reprocessing plant at Marcoule allowing the separation of plutonium (UP1 plant), as well as a third plutonium-producing reactor (the G3 pile).¹³ In June, the CEA set up a study centre in Vaujours (Seine-Saint-Denis), notably for the manufacture of implosion plants. In July, Professor Yves Rocard, at the time the main scientific manager of the French programme, secretly acquired (from the funds of the intelligence services) a site in Bruyères-le-Châtel (Essonne), where the design teams would be located.

One can say that in the summer of 1955 France was truly engaged in the manufacturing of the Bomb, even if no political decision had been formally taken in this regard. The determination

¹⁰ Jacques Chevallier, “Histoire de la Direction des applications militaires du CEA”, in CEA, Quarantième Anniversaire de la Direction des applications militaires, 1998, p. 14.

¹¹ The G1 pile (Graphite-1, cooled with pressurized air) diverged on 7 January 1956, the G2 pile (cooled with carbon dioxide) on 21 July 1958.

¹² The role of General Albert Buchalet, who led the Bureau des études générales, was similar to that of General Leslie Groves who, in the United States, was responsible for the Manhattan Project (Po, op. cit., p. 59).

¹³ The G3 pile, similar to G2, diverged on 8 June 1959.

of the key actors of the nuclear programme, both at the CEA and within the armed forces, was matched only by the endemic governmental instability under the Fourth Republic.

In February 1956, a Nuclear Experiments Study Group was created – a joint body entrusted to Colonel Ailleret. For various reasons (pressure from the Gaullists, Colonel Gallois' persuasiveness, outcome of the Suez crisis), Guy Mollet became favourable to the manufacture of nuclear weapons. On 30 November, the Council Presidency and the Ministry of Defence signed a second protocol concerning the military applications of atomic energy (supplemented by a third one on 18 December), which provides in particular for studies for the production of a prototype weapon. In early December, it was decided to replace the intergovernmental Nuclear Explosives Committee with an Atomic Energy Military Applications Committee (CAMEA) chaired by the Chief of the Defence Staff.

In March 1957, the roles were divided between the CEA and the armed forces: to the former, the design and manufacture of the devices; to the latter, the preparation of nuclear experiments. The CEA undertook to deliver a device before the end of the first quarter of 1960. A test site in Algeria (Reggane) was chosen by Ailleret in July 1957. The second Five-Year Atomic Energy Plan was presented to Parliament at the same time. It confirmed the construction of the G3 pile and plans the construction of an isotope separation plant at Pierrelatte.¹⁴ At the same time, the Special Weapons Command became a joint agency, and the 1957 defence budget funded studies for nuclear weapon delivery systems.

In March 1955, the CEA's Bureau d'études générales consisted of five persons; at the end of 1957, it became the Department of New Technologies (DTN), with a staff of 600 people.

At the beginning of 1958, when the days of the Fourth Republic seemed numbered, all the tools were in place to build a nuclear force.¹⁵ The main fissile material production facilities are ready (the UP1 plant, which was central because it would produce plutonium for weapons, has been operational since 1 January). On 11 April, Félix Gaillard, who became President of the Council, gave the order to prepare a first nuclear test for 1960. The DTN now included 1,800 people. At the end of spring 1958, the CEA's engineers had a first formula of weapon. However, without General de Gaulle, France could have remained a virtual nuclear power, much like India after its 1974 nuclear test.

De Gaulle and nuclear weapons

De Gaulle was first and foremost concerned with the country's security in the face of the Soviet threat, and the conditions under which France's defence would be assured in the event of Soviet aggression. The Second World War had made the General distrustful of the United States. For him, the idea of American protecting Europe made no sense.¹⁶ A country could only

¹⁴ The Pierrelatte complex, which included four plants, began producing enriched uranium in April 1967.

¹⁵ The expression "*force de frappe*" (strike force) was proposed by the general staff in a note dated 13 February 1958. COMAERO, *Un demi-siècle d'aéronautique en France: les missiles balistiques*, Délégation générale pour l'armement, ministère de la Défense, 2004, p. 64.

¹⁶ De Gaulle pointed out that the United States had only committed itself to defending Israel from the moment it was armed with nuclear weapons. Alain Peyrefitte, *C'était de Gaulle* (Paris: Gallimard, 2002, p. 707).

defend its national interests.¹⁷ Furthermore, nuclear weapons changed the nature of alliances, especially since American territory was now vulnerable¹⁸: “No one in the world, especially no one in America, can say if, where, when, how, to what extent nuclear weapons would be used to defend Europe”.¹⁹

It was also a question of ensuring France's full sovereignty. For de Gaulle, the Bomb was an instrument of self-determination, a means “to exist by ourselves and, in case of a drama, to choose our own direction”.²⁰ If it ultimately remained dependent on the United States for its security, France would not develop an autonomous foreign policy. The reasoning was the same as for military integration: for de Gaulle, the French withdrawal from NATO's integrated military structure would be the logical corollary of building an autonomous nuclear force. Thus it would not possibly “find herself drawn into any quarrel which would not be her own and into any warlike action which she herself would not have wanted”.²¹ De Gaulle considered, moreover, that the credibility of the nuclear force required that the French military policy be fully independent, and perceived as such by the adversary.²²

Like the leaders of the Fourth Republic, de Gaulle also saw nuclear weapons as a means of restoring France's legitimate status as a great power. He considered it abnormal that the country was excluded from the Yalta and Potsdam conferences.²³ As a WW2 winner and member of the UN Security Council, France had to have nuclear weapons.²⁴ Thus the bomb was for de Gaulle, as General Albert Buchalet, one of the prime movers of the French programme, reminds us, “a political means enabling him to sit at the table of the Great Ones”.²⁵ General de Gaulle attached particular importance to the need to place France on an equal footing with the United Kingdom and the United States within NATO. The Anglo-American nuclear duopoly, which was all the more unacceptable as France held a geographically central place in the Western defence system, had to be brought to an end.

For de Gaulle, it was also unacceptable that France did not possess the “most powerful weapons of the time” and did not participate in a major scientific and industrial development.²⁶ He was aware of the scientific and economic benefits of the nuclear program. Finally, General de Gaulle was probably aware that the Bomb would also help him to consolidate his power in France. Being entirely in the hands of political authority, nuclear weapons would mechanically reduce the relative weight of the armed forces in the state

¹⁷ Press conference at the Elysée Palace, 29 July 1963, in Charles de Gaulle, *Discours et Messages*, vol. IV (Paris: Plon, 1970), p. 124.

¹⁸ “You see, for a long time we could count on the automatic play of alliances, because they did not totally commit the existence of a nation. Today, the atomic war calls into question all commitments. Can you imagine a President of the United States taking the risk of condemning tens of millions of Americans to death under an alliance treaty?” (reported by Peyrefitte, *op. cit.*, pp. 706-707).

¹⁹ ²Press conference at the Elysée Palace, 14 January 1963, in Charles de Gaulle, *Discours et Messages* (IV), *op. cit.*, p. 73.

²⁰ Peyrefitte, *op. cit.*, p. 1408.

²¹ Radio and television address by General de Gaulle, 10 August 1967.

²² See Peyrefitte, *op. cit.*, p. 1067.

²³ *Ibid.* p. 1408.

²⁴ *Ibid.* p. 708.

²⁵ General Alfred Buchalet, “Les premières étapes (1955-1960)”, in Université de Franche-Comté - Institut Charles-de-Gaulle, *L'Aventure de la bombe: de Gaulle et la dissuasion nucléaire, 1958-1969* (Paris: Plon, 1985), p. 52.

²⁶ See “Allocution prononcée au palais de l'Élysée, 19 avril 1963”, in de Gaulle, *Discours et Messages* (IV), *op. cit.*, p. 96.

apparatus. The 1962 constitutional reform was in part brought into being by the Bomb.²⁷ The election of the President of the Republic by universal suffrage was in fact a logical consequence of the control by the Head of State of the power to use nuclear weapons: de Gaulle considered that only a President elected in this way would have the legitimacy and credibility needed to decide on the possible use of nuclear fire.²⁸ It is therefore fair to say that “nuclear fire is consubstantial with state Gaullism”.²⁹

The Fifth Republic: an independent deterrent force

Under the Fifth Republic, France makes the considerable financial and technological effort necessary to build up a credible operational nuclear force. General de Gaulle's other essential contribution would be to place the French nuclear programme within the framework of a policy of national independence; the withdrawal from NATO's integrated military organisation and the implementation of the deterrent force are thus inseparable.

By the summer of 1958, the French programme accelerated. CEA's administrator, Pierre Guillaumat, becomes Minister of Defence. In July, the CEA acquired land in Valduc (Côte-d'Or), a site intended for the manufacture of these weapons from 1961 on. In September, the New Technologies Department became a Military Applications Division (DAM). Its workforce grew rapidly, reaching 8,200 in 1967.

The plutonium purification workshop was completed in January 1959. The DAM received the first serial delivery of plutonium on 21 November. The first experimental casting exceeding the kilogram mark was carried out on 15 June 1959 in the Baobab furnace in the centre of Bruyères-le Châtel.

The first nuclear test (*Gerboise bleue*) took place in Reggane on 13 February 1960. With a release of 70 kilotons and a fission rate above 50 percent (compared with about 20 percent for the first American test), it was considered a great success.

The first two Acts on Military Programming laws - a Fifth Republic's innovation aimed at ensuring continuity in the financing of the nuclear effort - focused the bulk of the defence effort on nuclear power. It was largely to federate these efforts that the Ministerial Delegation for Armaments (DMA) was created in 1961, which became the General Directorate for Armament (DGA) in 1977, and, within it, the Atom Mission, which became the CEA's main interlocutor, as well as the Research and Test Means Directorate (DRME).

The Acts on Military Programming for the years 1960-1964 (8 December 1960) provided for the rapid development of the deterrent force. The financial envelope voted for new programmes was 11.8 billion francs in programme authorisations, more than half of which (6 billion) was devoted to nuclear (including 3.9 billion for weapons themselves). The first

²⁷ France is probably the only country where the possession of nuclear weapons has influenced the nature of the regime to such an extent. Pakistan can perhaps be added, insofar as the control of nuclear means by the military in this country has played a role, since the 1980s, on the difficulty for the civilian elites to impose themselves at the top of the State.

²⁸ See Peyrefitte, op. cit., p. 1359; Bernard Chantebout, “La dissuasion nucléaire et le pouvoir présidentiel”, *Pouvoirs*, no 38, 1986, p. 22; Pierre Messmer, “Notre politique militaire”, *Revue de défense nationale*, May 1963, pp. 755-765.

²⁹ Jean Lacouture, *De Gaulle (III): le souverain, 1959-1970* (Paris: Seuil, 1986), p. 452.

weapon was delivered on 1 July 1963. The first Mirage IVA bomber went on alert in September 1964.

The Acts on Military Programming for the years 1965-1970 (23 December 1964) was a continuation of the previous one. It further consolidated the budgetary effort by programming a much larger share of planned expenditure (55 billion). The law provided for the realization of the French strategic triad with the installation of ground-launched missiles (which at the time were only to be a transitional system pending the entry into service of SSBNs) and the start of construction of two SSBNs. In 1967, nuclear weapons and systems accounted for 51.4% of the armed forces' equipment budget. The strategic air forces completed their ramp-up in 1968, with 62 aircraft delivered. The same year, the first test of a thermonuclear weapon (Canopus test, 2.6 megatons) was carried out, after years of difficulties.

The planned budgets will be largely exceeded, as some programmes (Pierrelatte plant, ballistic missiles for the Albion plateau, etc.) proved much more expensive than expected. But the reduction in operating appropriations following Algeria's withdrawal enabled the nuclear effort to remain bearable. When General de Gaulle left power in 1969, the construction of the strategic deterrent force with its three components was almost complete, since the strategic missiles and SSBNs would enter service at the beginning of the following decade. In a little over ten years, France has thus gone from being a virtual nuclear power to an operational nuclear power, with weapons systems of the same type as those of the two great powers.

In 1970, the Strategic Air Forces were able to inflict losses on the Soviet Union in the order of 15 to 20 million deaths.³⁰

The admission to active service of the second and third SSBN (1973 and 1974) gave France a permanent second-strike capability, and the entry into service in the mid-1970s of thermonuclear warheads enabled it to make a quantitative leap in terms of destruction capability. But it was also the time when Georges Pompidou gave up, for lack of financial means, the "all-azimuts" deterrence dreamt of by de Gaulle.

In 1980, the entry into service of the fifth SSBN enabled the French authorities to have up to four vessels at sea, including at least two permanently.³¹ The FOST had 64 one-megaton nuclear warheads, in addition to MRBM missiles on the Albion plateau and Mirage IV bombers. France had then the theoretical capacity – provided for all weapons reached their targets – to threaten about fifty opposing cities, that is to say about 20 % of the population of the USSR (33 % of the urban population), and between 40 and 50 % of its industry.³² It had reached for the first time a certain level of sufficiency: it was capable of destroying the equivalent of the "stake-France", and even approached, on paper, the threshold of

³⁰ Depending on the reliability of systems and warheads, etc. General Poirier mentions 14 to 18 million deaths with 50% weapons on target. Lucien Poirier, *Des stratégies nucléaires* (Paris: Hachette, 1977), p. 297.

³¹ At the time, patrols lasted 60 days and were followed by 30 days of maintenance. From 1982 on, the pace was more intense (70 patrol days followed by 20 maintenance days); Duval and Le Baut, *op. cit.*, pp. 193-194.

³² Tertrais, "Destruction assurée", *op. cit.*

unacceptable damage for the USSR that had been estimated by the Pentagon at the end of the 1960s.³³ The explosive power of its arsenal then ceased to grow.

But the number of its weapons would then increase dramatically, due to the shift to multiple warheads for SLBMs, justified by the construction of a perimeter of missile defences around the city of Moscow - which was then called the "Main Target". It was necessary, roughly speaking, to reserve the entire endowment of an SSBN for the saturation of Soviet defences.³⁴ The number of weapons doubled between 1984 and 1991: France then held some 550 nuclear weapons, a figure that rapidly decreased thereafter.

Paradoxically, it was at the end of the Cold War (around 1990-1991) that France reached a level of credibility and assured damage capacity it had never reached before, with the entry into service of a third batch of multiple warheads missiles.

Timeline of weapons produced by the CEA³⁵

First generation : fission weapons

AN 11	40 kt	1964-1966	Mirage IV	Pure fission ; very rudimentary
AN 21	55 kt	1965-1967	Mirage IV	Pure fission ; improved version of AN11
AN 22	55 kt	1967-1987	Mirage IV	Pure fission ; AN21 for low-altitude bombing
MR 31	115 kt	1971-1980	SSBS S2	Pure fission
MR 41.1	500 kt	1971-1973	MSBS M1 et M2	Boosted fission
MR 41.2	500 kt	1973-1979	MSBS M1 et M2	Boosted fission; improved version of MR41.1
AN 52	25 kt	1972-1991	Mirage IIIE, Jaguar, SEM	Pure fission
AN 51.1	10 kt	1974-1993	Pluton	Pure fission
AN 51.2	25 kt	1974-1993	Pluton	Pure fission
TN 83	Low	1992-1996	ASMP	Pure fission

Second generation : thermonuclear weapons

TN 60	1 Mt	1976-1980	MSBS M20	First hardened warhead
TN 61	1 Mt	1980-1996	MSBS M20/SSBS S3	Safer and lighter version of TN60
TN 70	150 kt	1985-1996	MSBS M4	
TN 71	150 kt	1988-2004	MSBS M4	Lighter and stealthier version of TN70
TN 75	100 kt	1997-2016	MSBS M45	Lighter and stealthier version of TN71
TN 80	300 kt	1986-1988	ASMP	
TN 81	300 kt	1988-2014	ASMP	Safer and lighter version of TN80
TN 92	< 1kt	Not weaponized	Hadès	Enhanced radiation warhead
TN 93	Low	Not deployed	Hadès	

³³ The final estimates by US Secretary of Defense Robert McNamara and his team (1968) were that the destruction of 20 to 25% of the Soviet population and 50% of the country's industry would constitute unacceptable damage to the Soviet Union.

³⁴ See Po, op. cit., p. 20.

³⁵ Sources: Po, op. cit.; Norris et al., op. cit., pp. 184-194; reports of the National Assembly and Senate; brochure published by the CEA on the occasion of the 40th anniversary of the DAM.

France as a nuclear power

For France, historically speaking, nuclear power has been a symbol of modernity, an instrument of independence and a tool of influence. France does not have the same nuclear policy as the UK: the two countries have neither the same conception of independence nor of influence, their choices having radically diverged after the Suez crisis (1956).

There is a real French nuclear exception.³⁶ No other country has associated military nuclear capability and national independence to that point. Few have such a conservative view of what deterrence is, and such mistrust of conventional deterrence. Finally, France is the only country in the world whose political regime has been partly determined by nuclear capacity (the 1962 reform). At the same time, no other country has gone this far in nuclear disarmament since the end of the Cold War. Of course, the reductions made by France since the end of the Cold War (almost half of its weapons, more than two thirds of its delivery systems) are no greater than those granted by the United States and Russia. However, in qualitative terms, it is the only one to have gone this far with the elimination of its ground-to-ground systems and, above all, the dismantling of its test centre and its fissile material production facilities.

There is a kind of paradox in France's nuclear policy today. It developed the Bomb in the face of a major threat, but at least as much for political reasons - to gain strategic autonomy from the United States - as for security reasons. However, in the post-Cold War context, where threats are less immediate and more diffuse, security motivations seem most important than political ones to justify the permanence of deterrence.

In 2001, the then President of the Republic, in a speech at the Institute of Higher National Defence Studies (IHEDN), assigned three functions to the deterrent force: ensuring that France's survival could not be called into question by a major power; preserving the country's freedom of action in the face of regional actors seeking to blackmail it; contributing to the security of Europe and the Atlantic Alliance.³⁷ These principles remain largely valid today.

If one were to summarise France's stated rationales to continue to have a deterrent force, one could say that it is an indispensable tool for its freedom of action and its strategic autonomy.³⁸ For Paris, this freedom must exist in relation to a potential adversary: nuclear weapons make it possible to ensure that it will not be subjected to blackmail intended to prevent it from acting militarily or politically. Deterrence makes it possible to guarantee that France would preserve its freedom of manoeuvre in the face of a country which would seek, for example, to exercise serious blackmail aimed at preventing it from fulfilling its international commitments (international mandate, Article 5 of the Washington treaty, defence agreement, etc.), or to ensure the protection of its strategic interests (protection of territory, security of supplies, freedom of navigation, etc.). One could say that in such a scenario, its nuclear arsenal would have a sort of "counter-deterrence" function: it would

³⁶ Except perhaps Israel, whose nuclear capability is, nonetheless, not visible.

³⁷ Speech by Jacques Chirac, President of the French Republic, to the Institut des hautes études de défense nationale, Paris, 8 June 2001.

³⁸ "It also gives us, wherever the pressure may come from, the power to be master of our actions, our politics, the permanence of our democratic values", speech by Jacques Chirac, President of the French Republic, during his visit to the strategic air and ocean-based forces, Landivisiau – L'Île Longue (Brest), 19 January 2006.

neutralize the deterrent power of the adversary in order to maintain the country's freedom of action.

But this freedom must also exist in relation to alliances, particularly in the United States. Through the possession of a deterrent force, France asserts that it does not depend on others for the defence of its essential interests and its survival. This results not only in independence of decision, planning and action in the exercise of deterrence, but also in independence in the mastery of the main technological tools of deterrence.

Could France, for example, have actively opposed the war in Iraq to the point of leading the anti-war protest in the Western camp, if it had been reliant on Washington for its ultimate security?³⁹ Some French politicians thus consider that the existence of an independent deterrent capacity “prevents us from being drawn into a war that is not our own”, thus echoing the argument developed by General de Gaulle in the 1960s (cf. supra).⁴⁰

According to the 2013 White Paper, nuclear deterrence thus constitutes the ultimate guarantee of France’s “sovereignty”, as well as “the security, protection and independence of the nation”.⁴¹ It “permanently guarantees our autonomy of decision and our freedom of action within the framework of our international responsibilities, including against attempts of blackmail which could be exercised against us in the event of a crisis”.⁴²

A similar language was used by President Hollande in 2015: “Deterrence allows us to preserve our freedom of action and decision in all circumstances, because it is it that allows me to avoid any threat of blackmail of state origin that would aim to paralyse us”. But, in a more innovative way, it also justified the maintenance of deterrence by the scale of French commitments in the service of its allies and the international community (unlike countries as diverse as, for example, Germany or Russia): “France is one of the few countries in the world whose influence and responsibility are precisely on a global scale (..) the deterrent force enable us to ensure that France's international commitments will always be honoured”.⁴³ This logic responds to the criticism that valuing deterrence as an instrument of freedom of action can encourage proliferation.

Nuclear weapons are sometimes still associated with prestige, but it is no longer the case in France. The then President of the Republic said it in 2008: “It is neither a matter of prestige nor a matter of rank”.⁴⁴ The French discourse no longer highlights the diplomatic advantages that could be conferred by the possession of nuclear weapons. France establishes all the less of a link between its nuclear status and its status as a permanent member of the United

³⁹ Germany had also opposed the war in Iraq, and in the summer of 2002 had refused any idea of participating in such an undertaking. But France actively opposed the war, going so far as to militate with the other members of the Security Council in this direction - something its neighbour could probably not have done, except to take the risk of a serious break with Washington.

⁴⁰ Jean-Pierre Chevènement, Speech at the conference “L'avenir de la dissuasion française”, Res Publica Foundation, 10 July 2006.

⁴¹ White Paper on Defence and National Security, 2013, p. 20.

⁴² White Paper on Defence and National Security, 2013, p. 69.

⁴³ François Hollande, Discours sur la dissuasion nucléaire, déplacement auprès des Forces aériennes stratégiques, Istres, 19 February 2015.

⁴⁴ Speech by Nicolas Sarkozy, President of the French Republic, at the presentation of SNLE Le Terrible, Cherbourg, 21 March 2008.

Nations Security Council as it already had this status in 1945.⁴⁵ It supports Security Council reform, which could include the permanent membership of non-nuclear weapon States. Above all, however, France cannot share the view that the creation of a nuclear arsenal could be an entry ticket to the Security Council, for this would be a tremendous encouragement to proliferation. On the contrary, the French discourse now emphasises the responsibilities linked to the status of nuclear power under the NPT, in the fields of disarmament, non-proliferation and stability.

The possession of an independent deterrent force also gives the country valuable expertise for its non-proliferation policy (i.e. the monitoring and analysis of programs, etc.). Finally, as will be seen below, it has a positive impact on French defence capabilities, as well as significant scientific, technological and industrial spin-offs, including in the civilian field.

The French deterrence concept

The origins of French nuclear strategy

French nuclear strategy developed in parallel with the building of the deterrent force.

It was initially organized around the notions of deterrence “from the weak to the strong” and the “equalizing power of the atom”. These formulations described concepts gradually developed in transatlantic circles, particularly in the United Kingdom, from 1945 onwards.

The foundations of French strategy owe much to the intellectual efforts of a few military personalities: colonels Pierre-Marie Gallois and André Beaufre (whose role has often been understated), posted to NATO in the first half of the 1950s, who were largely inspired by American, British and allied work; colonel Charles Ailleret, whose role was central to the implementation of the national programme and who would later attach his name to “all-azimuts” deterrence; and later on, colonel Lucien Poirier, who would attempt to formalize the French strategy in the Ministry of Defence in the years 1966-1968.

But the French concept of deterrence cannot be linked to either of these personalities in particular. If one had to attribute its paternity to one single person, it would probably have to be General de Gaulle himself. It is he who, while distrustful of the theoretical constructions of experts, in this field as in others, would make the synthesis between what could be called a school of “pure” and strictly national deterrence, associated with Gallois and Poirier, and another one of “flexible” deterrence, inscribed in a transatlantic framework, associated with Beaufre and political analyst Raymond Aron.⁴⁶

The idea that nuclear weapons were changing the equation of power came to the fore very early in French strategic thinking. A small country could perfectly well deter a large country from attacking it as long as it had the means to inflict damage at least equivalent to what was at stake in the conflict. Deterrence could thus be proportionate to the stake. This idea had

⁴⁵ Those who fear that a nuclear-free France would lose its permanent membership in the Council also forget that any reform of the Council would need a two-thirds majority in the General Assembly. It is hard to believe that this scenario, in which some 130 States, a majority of them in favour of nuclear disarmament, would see fit to punish France for abandoning nuclear weapons in this way, has any credibility.

⁴⁶ On this point see Tertrais, “Destruction assurée”, op. cit.

been assimilated very early by General de Gaulle: “I see, it is enough to tear an arm off the aggressor”, he said in April 1956, after a long conversation with colonel Gallois who had come to present NATO's nuclear strategy.⁴⁷ In 1962, he said, “It's not a question of getting to the same level as the other side. The idea is to represent a sufficient retaliation capacity to make him give up the aggression. Deterrence begins as soon as you have the opportunity to kill enough people (..) to convince the aggressor that it is not worth the risk”.⁴⁸

It was in his press conference of 23 July 1964 that he summed up his thinking best: “The career of deterrence is therefore now open to us. For attacking France would be tantamount, for anyone, to suffering horrendous destruction himself. No doubt the megatons that we could launch would not equal in number those that Americans and Russians are able to unleash. But, from a certain nuclear capacity and as far as the direct defence of each one is concerned, the proportion of the respective means no longer has absolute value. Indeed, since a man and a country can only die once, deterrence exists when one has enough to injure to death one's possible aggressor, when one is very determined to do so and when he himself is well convinced of it”.⁴⁹

Originally, the French strategy seemed to be modelled on that of massive retaliation, which the United States and NATO were about to replace by flexible response because of the vulnerability of American territory. This was a central point of disagreement between France and its allies, and it was only in 1967, after the French withdrawal, that they adopted the new strategy. However, the General hesitated to speak of a massive response in the event of a conventional aggression against France.⁵⁰ This is one of the reasons why he will agree to the development of tactical nuclear weapons, allowing to escape the dilemma of all or nothing in case of an attack.⁵¹ Moreover, he did not totally reject the selective or graduated use of strategic forces.⁵²

The French strategy at the time of General de Gaulle also included some original characteristics. One is the “all-azimuts” concept. The General considered that it was impossible to predict who France's adversaries would be in the future, and that nuclear proliferation was inevitable.⁵³ As early as 1959, he said that “since we can destroy France, potentially from anywhere in the world, our force must be made to act anywhere on earth”.⁵⁴ In 1967, he planned to provide France by 1980 with a triad of strategic means capable of striking any major power.⁵⁵

Does that mean that the United States was one of those potential adversaries, as was sometimes suggested? Things are more complex than that. De Gaulle considered that no one could predict the evolution of great powers, and that all scenarios for the future should therefore be taken into account. And he suggested that “deterrence is not just about deterring

⁴⁷ See Pierre-Marie Gallois, *Le Sablier du siècle. Mémoires* (Lausanne: L'Âge d'homme, 1999), pp. 370-373.

⁴⁸ Reported by Peyrefitte, *op. cit.* p. 350.

⁴⁹ Press conference at the Elysée Palace, 23 July 1964, in Charles de Gaulle, *Discours et Messages* (IV), *op. cit.* p. 233.

⁵⁰ See Peyrefitte, *op. cit.*, p. 710-711.

⁵¹ On this point see Tertrais, “Destruction assurée”, *op. cit.*

⁵² See Lacouture, *op. cit.*, p. 473; and Peyrefitte, *op. cit.*, p. 354, where De Gaulle imagines a scenario in which the Soviet Union threatens to bomb Marseille and France threatens to bomb Odessa in retaliation.

⁵³ See Peyrefitte, *op. cit.*, p. 708.

⁵⁴ Press conference of 3 November 1959, untitled document, Charles-de-Gaulle Foundation.

⁵⁵ See Lacouture, *op. cit.*, pp. 477-478.

an aggressor. It is also designed to deter an abusive protector. That's why it has to be 'all-azimuts'".⁵⁶ But it would be wrong to conclude that the United States was put on a par with the Soviet Union.

The French vision of deterrence

From the outset, France stated it maintained a comprehensive approach to deterrence, in which conventional forces and territorial defence participate. It never conceived deterrence as exclusively nuclear. The 1972 White Paper already recognised the deterrent virtues of conventional means and referred more broadly to "the overall deterrent effect of our military policy".⁵⁷ NATO's Strategic Concept (2010) states that "deterrence, built around an appropriate mix of nuclear and conventional capabilities, remains a central element of our overall strategy".⁵⁸

But the almost systematic association between the terms "deterrence" and "nuclear" remains a fixture of French strategic culture. In the United States, this association has always been less strong. The notion of "conventional deterrence" is an integral to American strategic culture; the notion of deterrence is now applied to the role of missile defense, or the idea of discouraging (dissuasion) a potential adversary from competing against the United States in a military competition. Conversely, the temptation to view nuclear weapons as "usable" in the same way as conventional weapons, although often exaggerated, has long remained strong in the American strategic community.

Also, nuclear deterrence has traditionally been associated in France with deterrence "by punishment", even though there is another deterrent mode, generally called deterrence "by denial".

Nuclear weapons have an exclusively political role for France: it is about preventing a major state aggression. This weapon cannot constitute a means of coercion or a warfighting tool that might be used the same way as conventional weapons. France claims that it "will never engage into a nuclear battle or any forms of graduated response".⁵⁹ Nuclear weapons are considered by France – as by most if not all the other nuclear-armed states – to be singular, different from conventional weapons in two ways: first, because of their destructive power, secondly for the terror they inspire. But the adversary must know that France does have the will and the capacity to use these weapons, if necessary. The paradox is well known: deterrence (non-employment) is credible only when use (employment) is possible and perceived as such by the potential adversary.

⁵⁶ Reported by Peyrefitte, op. cit.; p. 299.

⁵⁷ The 1972 White Paper also referred to the "spirit of popular deterrence" which resides in the desire for independence and is expressed through the defence of territory, the credibility of nuclear weapons and the will to resist an invader. At the same time, General Poirier defined an absolute deterrence concept consisting of radical deterrence (nuclear, applying to the "sanctuary") and limited deterrence (non-nuclear, applying to the "glacis").

⁵⁸ Strategic Concept for the Defence and Security of the Members of the North Atlantic Treaty Organisation, adopted by Heads of State and Government at the NATO Summit in Lisbon on 19-20 November 2010.

⁵⁹ Speech of the President of the Republic on the Defense and Deterrence Strategy, Paris, War College, 7 February 2020.

The place of nuclear weapons in defence policy

The place of deterrence in French strategy has evolved. For the French armed forces, during the Cold War, large-scale conventional action was reserved for the defence of the territory. It was, therefore, intimately linked to nuclear deterrence: the First Army's manoeuvre would have been aimed at testing the adversary's intentions and forcing him to raise the threshold of his aggression.

After the Cold war, the coupling between conventional and nuclear forces was loosened. The 1994 White Paper announced a kind of “Copernican revolution” in this area. Noting France's interest in being able to deploy major conventional forces without its vital interests being at stake, it announced that “the link between nuclear and conventional means is bound to evolve”. The priorities in defining the role of conventional weapons were reversed from the definition in the 1972 White Paper; conventional means are called upon in some cases to play their own strategic role. The affirmation of this new priority was one of the factors leading to the complete professionalization of the armed forces.

Similarly, the use of nuclear deterrence would not necessarily follow prior major action by conventional forces. Even more: whereas these forces previously helped to prevent deterrence from being circumvented, now the reverse may be true: in overseas operations, nuclear deterrence guarantees the freedom of action of political authorities, by preventing France from being subjected to blackmail involving its vital interests, for example by means of weapons of mass destruction. It also helps to maintain uncertainty in the mind of an aggressor as to his response to the use of such weapons.

In 2020, President Macron reaffirmed and insisted on the linkage between the two by stating:

Our defence strategy is a coherent whole: conventional and nuclear forces constantly support each other there. Once our vital interests could be under threat, the conventional military manoeuvre can be part of exercising deterrence. The presence of strong conventional forces thus helps to prevent a strategic surprise, the quick creation of a *fait accompli* or to test the adversary's determination as soon as possible by forcing it to reveal *de facto* its true intentions. With this strategy, our nuclear deterrence force remains, as a last resort, the key to our security and the guardian of our vital interests. Now, like in the past, it ensures our independence, our freedom to assess, make decisions and take action. It prevents adversaries from betting on escalation, intimidation and blackmailing to achieve their ends.⁶⁰

Deterrence was one of the five main “strategic functions” identified since the 2008 White Papers, but its role was upgraded over time: ranked third in 2008, it was second in the new 2013 White Paper and became first in the 2017 Defense and National Security Strategic Review. It appears linked to projection, of which it is a support: “Such a defence policy is based on the certainty that, whatever happens, our vital interests will be guaranteed”.⁶¹ But it is also

⁶⁰ Speech of the President of the Republic on the Defense and Deterrence Strategy, Paris, War College, 7 February 2020.

⁶¹ Address by Jacques Chirac, President of the French Republic, during his visit to the strategic air and ocean-based forces, Landivisiau – L'île Longue (Brest), 19 January 2006.

linked to prevention: Jacques Chirac declared in 2006 that deterrence was “in direct continuity with our prevention strategy. It is the ultimate expression of it”.⁶²

A permanent deterrence is an evidence for France. It is first and foremost a matter of principle. As President Hollande said in 2015: “What would be an intermittent deterrent?”⁶³ One of his predecessors stated: “The credible threat of their use constantly hangs over leaders with hostile intentions towards us. It is essential to bring them back to reason, to make them aware of the disproportionate cost their actions would have for themselves and for their States”.⁶⁴ But it is also a recognition that interrupting patrols, crew training, etc., would have damaging effects on staff training and motivation. Moreover, as the example of Russian navy has shown, the recovery (going back to continuous at-sea deterrence) could be long and difficult.

Nuclear policymaking

French nuclear policy is generally made in a very restricted circle. In addition to the President, the Prime Minister and the Minister of Defence (currently “Minister for the Armed Forces”), the main decisionmakers in this field are the Chief of Defence Staff (CEMA) and the Chief of the Presidential Military Staff (CEMP), assisted by the Nuclear Forces Division of the Defence Staff (EMA/FN), created in 1991.⁶⁵ The Nuclear Weapons Council, formally created in 2009, brings together these five authorities as well as the General Delegate for Armaments and the Director of Military Applications of the CEA.

Intergovernmental work on nuclear policy is generally prepared under the auspices of the General Secretariat for Defence and National Security (SGDSN, which reports to both the President and the Prime Minister), but ad hoc formats have also been used since the end of the Cold War. Since its creation in 1992, the Delegation for Strategic Affairs (DAS) of the Ministry of Defence (now the Directorate General for International Relations and Strategy [DGRIS]) has often played an important role in work related to nuclear doctrine and posture. A 1996 decree reformed the legal framework for nuclear policy for the first time since 1964. It had formalized the control of the President of the Republic over nuclear forces, which until then had only been justified by the presidential status of head of the armed forces and chairman of the Defence Council (the 1964 decree concerned only the FAS). The 1996 decree placed the CEMA at the centre of deterrence operations, as the operational commander of the nuclear forces and privileged interlocutor of the President of the Republic.

A new decree passed in 2009 clarifies the responsibilities of the various officials and institutions:

- The Prime Minister takes measures to implement the decisions taken in the Nuclear Weapons Council. He is also responsible for the “government control” (controlling the

⁶² Ibid.

⁶³ François Hollande, Discours sur la dissuasion nucléaire, déplacement auprès des Forces aériennes stratégiques, Istres, 19 February 2015.

⁶⁴ Address by Jacques Chirac, President of the French Republic, during his visit to the strategic air and ocean-based forces, Landivisiau – L’Île Longue (Brest), 19 January 2006.

⁶⁵ Between 1968 and 1991 there was a Strategic Nuclear Forces Division which, as its name suggests, managed only the then so-called “strategic” forces.

“engagement of forces”, the “integrity of means”, and the “compliance of employment”).

- The Minister of Defence is responsible for the organization, management and conditioning of the use of nuclear forces and the necessary infrastructure. He determines the composition, organisation and operation of these resources. He determines the operational responsibilities of force commanders. He is responsible for government control over the engagement of forces and the integrity of means.
- The Chief of the Defence Staff is responsible for preparing employment plans and operational directives, ensuring the operational capability of nuclear forces and associated communications, ensuring the execution of operations necessary for the implementation of nuclear forces, ensuring the execution of the order of commitment given by the President of the Republic. He is responsible for government control over employment compliance. As for force commanders, they are in charge of the operational readiness, training of assets and monitoring the implementation of missions.

The main characteristics of the deterrent force (number of weapons, range and accuracy of systems, date of entry into service, etc.) are a presidential decision, as are, of course, the employment plans.

Weapons are designed and developed in cooperation between the Ministry of Defence and the Atomic Energy Commission. This cooperation between equals, formalized in 1961 and called “Joint Work” (*Oeuvre Commune*), is governed by a classified decision of the Prime Minister renewed every five years.⁶⁶ The implementation of CEA’s programmes is monitored by the Joint Committee Armed forces-CEA.

The work of the Ministry of Defence on means of deterrence is led by the Military Nuclear Committee (CNM), chaired by the Minister, and supported by the Military Nuclear Group (GNM), chaired by a General Officer representing the CEMA. The overall coherence of the deterrence force system is ensured by the College of Force System Architects and Operational Coherence Officers (ASF/OCO), which, as for other force systems, brings together DGA) and the EMA. Nuclear weapons systems programmes are conducted jointly by the EMA/FN Division, as far as operational requirements are concerned, and the Cœlacanthe, Horus, Hermes and NBC units of the DGA, as far as choices and technical characteristics are concerned.

The development and production of these systems are entrusted to major companies: DCNS (submarines), TechnicAtome (nuclear boilers), Arianespace (ballistic missiles), MBDA (air-breathing missiles), Herakles (missile propulsion), Dassault Aviation (fighter-bombers), not forgetting companies specialised in defence electronics, guidance systems, etc. (Sagem Défense et Sécurité, Thalès, Électronique Serge Dassault, etc.).⁶⁷

⁶⁶ The Joint Work also concerns nuclear materials and propulsion reactors.

⁶⁷ Other French companies are indirectly involved in the nuclear programme, such as Bull, which supplies the CEA with supercomputers.

The Fifth Republic system considerably limited the Parliament's decisionmaking power in defence policy, and the nuclear field is no exception to this rule; ensuring the financing of the deterrence effort by Parliament was in fact the reason that prompted General de Gaulle to create the mechanism of military programming laws, which set the level of this financing for five years. But he also ensured the primacy of civil power over what is sometimes called the military-industrial complex, which had a fairly large autonomy of action under the Fourth Republic. The evolution of decisionmaking mechanisms in the field since 1958 has reinforced this trend. The force commanders and the chiefs of the three armed forces no longer have a major role in the nuclear policymaking.⁶⁸ Since the end of the 1980s, the SGDSN has been directed by a civil authority, as has the DAS, and then the DGRIS.

The budgetary effort

While deterrence remains a political priority, it is by no means exempt from budget trimming efforts. Since 1990, there have been a number of schedule shifts, optimization measures, and, in some cases, programme cancellations that have affected deterrence. This “protected” expense is not a “preserved” one. The best proof of it is that its share has remains more or less constant in a diminishing budget.

French nuclear deterrent cost was, on average, €3.88 billion euros per year in the Military Planning Act for 2014-2019 or about 12 % of the defence budget (23.3 billion over the entire duration of the Act). The budget for equipment provided for by the MPA was therefore 22 % devoted to nuclear forces, compared with more than 50 % at the end of the 1960s, and still more than 30 % in 1990. It is consistent with the conceptual importance of deterrence, which is, as has been said, one of the five major strategic functions identified in the 2013 White Paper. The financial effort made for deterrence represented about 0.17 % of France's GDP (against 0.45 % on average over the period 1960-2000, with a peak at 1 % in 1967).⁶⁹ This expense represented about €5 per month and per Frenchman, and less than €200 per year and per tax household. In the 2019-2025 Act, €37 billion were devoted to nuclear deterrence (of which €25 billion for the years 2019-2023), thus an average annual cost of €5.28 billion.

Those who see in the nuclear deterrence budget a potential source of savings often do not factor in the cost of dismantlement – which would be extremely expensive for many years. The same is true for those who wish to allocate this budget to the development of conventional forces. Experience shows that the sums released by the cuts in military programmes rarely remain in the Ministry of Defence: it is far from certain that any savings made on nuclear power would necessarily result in an increase in other defence budget items, especially in a difficult national context. (In this respect, it should be recalled that the development of the deterrent force has been achieved more by increasing the defence budget than by reducing the sums allocated to existing posts.)

The reduction of some programmes remains, of course, an option for policymakers. But there are no significant savings to be expected from such a reduction - unless a component was

⁶⁸ On this theme see Samy Cohen, *La Défaite des généraux. Le pouvoir politique et l'armée sous la V^e République* (Paris: Fayard, 1994).

⁶⁹ 228.67 billion between 1945 and 2010 (which corresponds to a total of 3.5 billion per year on average). Bruno Barrillot, *Audit atomique* (Lyon: CDRPC, 2002).

dismantled or the simulation programme is terminated, with major negative consequences on the credibility of deterrence.

Quite the contrary: the sustainability of deterrence benefits the armed forces as a whole and the defence industry. Setting up the deterrent has created a real “demand for excellence” for industry and the armed forces. Because of its sensitivity, its technicality and its high political value, the nuclear field has given the whole defence apparatus a know-how that it would probably not have been possible to obtain otherwise. It has been said above that the possession of a nuclear force promotes the projection of armed forces into high-intensity crises. But this strategic reasoning can be combined with technical reasoning: it is also because France maintains a nuclear programme that its conventional forces and equipment are of high standard. This can be seen at industrial level: French companies working for deterrence have an unrivalled quality label because of the very particular requirements of this field.

The French authorities thus has reasons to affirm that “there is a virtuous circle at the industrial level between deterrence and conventional forces, which also corresponds to a cross credibility at the operational level”.⁷⁰

It will also be recalled that many nuclear deterrent capabilities are dual, and that the format of some of them has only been preserved during the programmatic reviews of the last twenty-five years because of their role in deterrence: nuclear attack submarines, mine action vessels, anti-submarine frigates, maritime patrol aircraft, tankers, etc.

Lastly, the deterrence budget provides civilian expertise in the fields of space launchers, computer calculation, precision optics, etc.⁷¹ It should be noted in particular that the CEA/DAM transfers, depending on the year, between 60 and 80 % of its appropriations to industry, and that it makes two of its three major simulation tools (computers and lasers) available to researchers.⁷²

The legitimacy of French deterrence

The international legal dimension

France's possession of nuclear weapons is recognised by the Nuclear Non-Proliferation Treaty. The same is true for the United States, Russia, China, and the United Kingdom.

In some cases, France accepts the idea of legal constraints on the exercise of deterrence in order to strengthen the fight against the proliferation of weapons of mass destruction. Thus, in 1994, it embraced the principle of a Comprehensive Test Ban Treaty. It is also in this capacity that, in 1995, it gave negative security assurance to non-nuclear States that are parties to the NPT.

⁷⁰ Jean-Yves Le Drian, Closing speech for the 50th anniversary of DAM, 20 November 2014.

⁷¹ There is thus a strong degree of community between the Ariane-4 launcher and the M4 missile, on the one hand, and between the Ariane-5 launcher and the M51 missile, on the other.

⁷² On these issues see Bruno Tertrais, Budget nucléaire et “retombées” de la dissuasion, FRS Notes, No. 13/2015, 1 June 2015.

France considers that nuclear weapons could only be used under extreme circumstances. The French concept is based on the principle of self-defence, recognised by Article 51 of the United Nations Charter. This theme had thus been taken up in the French argument before the International Court of Justice (ICJ) in 1995-1996, when the latter was asked by the United Nations General Assembly to rule on the lawfulness of the use or threat of use of nuclear weapons.⁷³ The Court, in its 1996 Opinion, was unable to “conclude definitively whether the threat or use of nuclear weapons would be lawful or unlawful in extreme circumstances of self-defence, in which the very survival of a State would be at stake”, and that it had refused to pronounce on “the practice known as ‘policy of deterrence’”.⁷⁴ This had enabled France to state that the Court's opinion was in no way incompatible with the founding texts of its nuclear doctrine (White Paper, programming laws, etc.).⁷⁵ Since 2008 (Sarkozy's Cherbourg speech), France has, in fact, largely taken up the language of the ICJ by stating that the use of nuclear weapons would only be possible under “extreme circumstances of self-defence”, a language reaffirmed in every presidential speech since then.

Protocol I of 1977 to the Geneva Conventions of 1949 prohibits deliberate attacks on civilian populations. Upon ratification of this Protocol, France expressed reservations.⁷⁶ But its deterrence is not (or rather is no longer) deliberately directed against civilian populations. This is what can be deduced from the presidential speech of February 2015 (see below), which makes the French doctrine consistent with its legal framework. There is also a political dimension to this debate: even if one thinks that this argument has little weight in political debates (France has not participated in the conferences on the “humanitarian dimension of disarmament”), such a development can contribute to strengthening the legitimacy of deterrence among the public.

Domestic legitimacy

The head of state, who approves the nuclear plans, decides on the use of forces and is the only one capable of transmitting the authorization code(s), would be the one capable of assessing if our vital interests are questioned. One remembers François Mitterrand's famous statement: “The cornerstone of France's deterrence strategy is the head of state, it is me”.⁷⁷ In legal terms, his responsibility in this area derives from his dual constitutional status as head of the armed forces and chairman of the Defence Council; it is specified in a 2009 decree (see below).

The fact that deterrence ultimately rests on a single man, elected by direct universal suffrage, is seen as part of the credibility of deterrence.⁷⁸ But it also contributes to its legitimacy vis-à-

⁷³ See Marc Perrin de Brichambaut, “Les avis consultatifs rendus par la Cour internationale de justice le 8 juillet 1996 sur la licéité de l'utilisation des armes nucléaires dans un conflit armé (OMS) et sur la licéité de la menace et de l'emploi d'armes nucléaires (AGNU)”, *Annuaire français de droit international*, vol. XLII (Paris: CNRS Éditions, 1996), pp. 315-336.

⁷⁴ International Court of Justice, *Legality of the Threat or Use of Nuclear Weapons*, Advisory Opinion, 8 July 1996, para. 105, para. 67.

⁷⁵ On the other hand, France had not recognized the jurisdiction of the ICJ when it was seized, in 1973, by Australia and New Zealand, of a procedure tending to ban French atmospheric tests.

⁷⁶ These reservations make it clear that France understands that the Protocol applies only to conventional armaments and that it does not impede the inherent right of self-defence.

⁷⁷ Interview with Antenne 2 national TV channel, 16 November 1983.

⁷⁸ This does not mean that the Head of State can use nuclear forces without the physical assistance of the men and women involved in the implementation of deterrence. The implementation of nuclear forces requires the participation

vis public opinion: the French directly elect the person who has the power of life or death over the country.

The nuclear posture review conducted in 1998-2001, in a context of “cohabitation”, had enabled a real rebuilding of the political consensus on nuclear deterrence between the two major government forces, based on four elements: a confirmation of the exclusively political (deterrence) nature of the doctrine, but adaptation of discourse, planning and means; a refusal of preventive nuclear strikes, but a retention of the first-use option; a refusal of a blurring of the threshold between nuclear and conventional weapons, but a diversification of deterrence tools as necessary, in order to ensure their credibility in all circumstances; the absence of an artificial list of potential adversaries, but the need to be able to deter any power likely to attack vital interests.

It is sometimes said that there has been no debate in France on nuclear issues, particularly since the end of the Cold War. This statement is exaggerated. For example, in the 1990s, France experienced several major public nuclear debates: in 1993-1995, a period of “cohabitation”, on the modernisation of weapons and the advisability of resuming nuclear tests or not; in 1995-1996, with an important international dimension, on the occasion of the final series of tests and a possible “concerted” deterrence; in early 1997, a brief but particularly lively debate in Parliament, when the Franco-German Strategic Concept was published, on its potential implications for nuclear deterrence and the France-NATO relationship. Presidential speeches often get some media coverage. In Paris, nuclear deterrence is the subject of at least one or two public colloquia a year. There are countless forums and interviews that question the relevance of nuclear deterrence, that believe that the time for disarmament has come, or that demand a reduction in the French military nuclear budget.

But it is true that these do not have a major echo in the opinions and the political world. This should be seen as a sign of the continuing importance of nuclear deterrence in French strategic culture and of the public's commitment to nuclear deterrence - the weakness of the role of non-governmental organizations in these debates distinguishes us from our major partners and allies.

No major government party questions the choice of nuclear deterrence. Only the Greens propose concrete measures to limit the French programme. The Communist Party wants initiatives to eliminate all weapons of mass destruction, but it does not want deterrence to be abandoned. In 2006-2007 2011-2012 and 2016-2017, the vast majority of official presidential candidates supported continued nuclear deterrence.

The French political consensus on deterrence has a long history, dating back to the gradual rallying of the French Communist Party (Kanapa Report, 2 May 1977) and the Socialist Party (National Defence Convention, 7 January 1978).⁷⁹ It differentiates the French from most of their European neighbours, where some government parties still recently had, and sometimes continue to have, heated debates within their parties on the very relevance of nuclear

of a range of systems and personnel, in staffs, operations and communications centres, and on board aircraft and naval vessels, which contribute to deterrence.

⁷⁹ During the 1977 party convention, a consensus was reached on the formula “maintenance of nuclear force”.

deterrence. (This is particularly the case for the British Labour Party and the German Social Democratic Party.) It has its roots in the combination of deterrence and an independent foreign policy, particularly vis-à-vis the United States.

The French public opinion participates in this adhesion. Open protest action (demonstrations, Internet campaigns, etc.) against nuclear deterrence today mobilizes only a tiny segment of the population. Surveys confirm this attachment of the French population to deterrence, with systematic majority support not only for the maintenance of the nuclear arsenal but also for its sustainability. Large - and sometimes very large - majorities have existed since 1990 to approve the existence of the French deterrent; the value of its “modernisation” or “maintenance”; the idea that it is a “strong point of our armies”; the “credibility of French nuclear weapons to deter”; or the idea that “France could not ensure its defence without deterrence”. Conversely, the abandonment of nuclear weapons has never received more than 25 % approval, and the reduction of the nuclear arsenal has always received less than 20 % support.⁸⁰

France's commitment to nuclear deterrence has therefore not wavered since the end of the Cold War.

⁸⁰ Annual surveys commissioned by the Armed Forces Information and Public Relations Service (SIRPA), then the Defence Information and Communication Directorate (DICOD).

CHAPTER II: THE FRENCH DETERRENCE DOCTRINE

The French concept remains exclusively intended to deter any form of aggression against vital interests, the definition of which would be appreciated by the President of the Republic. This deterrence is primarily exercised by the threat of unacceptable damage.

The notion of vital interests

Nuclear weapons are therefore reserved for the defence of the country's vital interests, a notion that first appeared in the 1972 White Paper in French discourse. The head of state, who decides on the use of nuclear forces and is the only one capable of transmitting the authorization code(s), would be the sole judge of whether these interests are called into question.

It is not so much the nature of the objectives targeted by the adversary or the means used that would determine whether or not the interests in question are vital, but rather the scale and potential consequences of the aggression as assessed by the President of the Republic. The definition of vital interests, and therefore of the nuclear threshold, as given by official texts, is necessarily vague. First, because it should prevent an adversary from being able to calculate the risk inherent in his aggression. Then, because the nature of vital interests can evolve in time and space, depending on the circumstances of the moment. Last but not least, because the definition of vital interests is ultimately a matter for the head of state: if it were announced in advance when France would engage its nuclear forces, it would lose its freedom of action.

However, the definition of core vital interests is part of the concept of deterrence in its public expression. These are the constituent elements of the State: territory, population, sovereignty. The 1994 White Paper specified: “The integrity of the national territory, including the metropolitan part and the overseas departments and territories, its air and sea approaches, the free exercise of our sovereignty and the protection of the population, constitute its core today”.⁸¹ The explicit integration of the “free exercise of our sovereignty” in 1994 in the field of vital interests made it possible to preserve the possibility of diffuse hypotheses, corresponding to serious threats, military or not, on the full exercise of public power on national territory, on respect for the country's international commitments, and on the exercise of its responsibilities as a permanent member of the United Nations Security Council. The 2008 White Paper, for its part, referred in general terms to “the constituent elements of our existence as a nation-state” and, more specifically, in addition to the French territory and population, the “republican institutions of the country”.⁸²

In his February 2015 speech, President Hollande seemed to give a rather restrictive definition of the heart of French vital interests (“the integrity of our territory, the safeguarding of our

⁸¹ The explicit mention of the overseas departments and territories was relatively new. In 1977, the then Prime Minister, in his speech at the Mailly camp, implicitly excluded them. There are few credible assumptions in which these territories could be directly threatened. But in a Falklands-type scenario, an opponent could bet, wrongly, that they are not covered by deterrence. One can also imagine that if North Korea wanted to threaten Europe, New Caledonia would be more easily accessible to it than the territory of the European Union.

⁸² White Paper on Defence and National Security, 2008, p. 69.

population”). But it was to add at once: “We must preserve the capacity of our nation to live” and, throughout the speech, insist on the imperatives of freedom of action. It is therefore legitimate to conclude that his conception of vital interests is not at odds with that of his predecessors. In a February 2020 speech, President Macron remained equally vague by referring to the nuclear force as playing its role if an adversary “underestimate[d] France’s deep-rooted attachment to its freedom and consider[ed] threatening our vital interests, whatever they may be”.⁸³

France has always considered that the security of its allies could be in its vital interests. But it should be stressed that France today has a greater number of alliances, in the broadest sense of the term, than in the past: NATO has enlarged, the European Union has developed a common security policy and adopted a common defence clause, defence commitments have been made in the Gulf (Kuwait, Qatar, United Arab Emirates).⁸⁴ There is no reason to say that these alliances enter by their mere existence in the scope of our vital interests. Could a French president consider the territory of a Gulf monarchy to be of truly “vital” interest? The question remains, by nature, open. Nevertheless, the French nuclear status can contribute to complicate the calculation of an adversary who would consider attacking it.

Aggression against vital interests would be met by a nuclear response under any circumstance. It would be practiced first regardless of the identity of the adversary. French deterrence is theoretically “all-azimuths”, even though this term has hardly appeared in French official discourse.⁸⁵ It is true that the limited range of Cold War systems made it clear what the identity of the main adversary would be. But things changed after the Cold War. The 1994 White Paper stated from the outset that, in the new context, France did not identify any “designated adversary”.⁸⁶ France was therefore able to affirm in Moscow on 26 September 1997 that, with the dismantling of the missiles at plateau d’Albion, no French nuclear means were now permanently targeted. Since forces are now de-targeted, deterrence is less “all-azimuth” than “without any azimuth”. It concerns any State with the capacity and the will to attack vital interests. In the words of the late Sir Michael Quinlan, one of the leading British experts in the military nuclear field, deterrence is addressed “to whom it may concern”.⁸⁷ However, French nuclear deterrence is only addressed to States.⁸⁸

Aggression against vital interests would be met with a nuclear response regardless of the nature of the threat and the means employed. As early as the 1980s, the political authorities had already considered the possibility that a massive use of chemical weapons would be an

⁸³ Speech of the President of the Republic on the Defense and Deterrence Strategy, Paris, War College, 7 February 2020.

⁸⁴ In his 2006 speech, Jacques Chirac had seemed to place our “strategic supplies” within the scope of French vital interests, but this resulted from clumsy drafting, the intention having been to point out that a threat to these supplies could degenerate into a military crisis ultimately jeopardizing our vital interests.

⁸⁵ “By definition, our atomic armament must be an all-azimuth in one (...);” speech delivered by General de Gaulle on 27 January 1968 at the Centre des hautes études militaires (CHEM), quoted in Université de Franche-Comté - Institut Charles de Gaulle, op. cit., p. 211.

⁸⁶ Defence White Paper 1994, op. cit., p. 89.

⁸⁷ Michael Quinlan, *Thinking About Nuclear Weapons*, Whitehall Papers, No. 41 (London: RUSI, 1997), p. 28.

⁸⁸ “Nuclear deterrence, I had underlined it the day after the attacks of September 11, is not intended to dissuade fanatical terrorists”, speech of Jacques Chirac, president of the French Republic, during his visit to the strategic air and ocean-based forces, Landivisiau – L’Île Longue (Brest), 19 January 2006. However, Jacques Chirac also suggested that a state attack carried out by terrorist means could fall within the scope of deterrence if our vital interests were called into question. This concept was shared by London and Washington.

attack against vital interests.⁸⁹ In 1994, it was confirmed that chemical or biological weapons could threaten such interests.⁹⁰ According to the White Paper published that year, France should “take into account the risks that the proliferation of weapons of mass destruction, whether chemical or biological, could represent for our vital interests”.⁹¹ Jacques Chirac stated more clearly, in 1995, the relevance of nuclear deterrence in the face of such threats since they would affect our vital interests: “As the guarantor, before the nation, for the future and security of our country, it is my duty to remind the French that only deterrence guarantees France against the possible use of weapons of mass destruction, whatever their nature”.⁹² Until then, French political leaders had been rather discreet on this issue.

Of course, this does not mean that *any* threat of aggression by ballistic, nuclear, biological or chemical means would *necessarily* be covered by nuclear deterrence. Indeed, some small threats (e.g. a very limited use of chemical weapons against a unit deployed in a theatre, or a conventional ballistic missile falling on an uninhabited area of the territory) would not perhaps be considered by the political authorities as an attack on vital interests. Above all, it would probably not be credible, in any event, to threaten an adversary with a nuclear response to any ballistic or NBC aggression against French interests. But in any regional scenario involving an actor with such means, nuclear deterrence introduces a fundamental element of uncertainty into an adversary's mind as to the nature of French response to ballistic or NBC aggression.

Other means of calling vital interests into question are conceivable: while the probability of an air-land invasion of the country is extremely low in the foreseeable future, other forms of aggression are conceivable, such as the use of conventional ballistic missiles targeting inhabited or industrial areas.⁹³ But one can also imagine a campaign of acts of terrorism sponsored by a foreign government; this is the scenario mentioned by the President of the Republic in January 2006: “State leaders who would use terrorist means against us (..) must understand that they expose themselves to a firm and adapted response on our part. And that answer can be conventional. It can also be of a different nature”.⁹⁴ Provided, one might add, that the sponsoring country can be identified with certainty.

One can also imagine more original forms of calling vital interests into question, such as cyber attacks leading to a paralysis or the destruction of major infrastructures. The rapid progress of technologies and their increasing accessibility to a large number of actors suggest that this type of scenario should be taken into account. In such circumstances, if vital interests were

⁸⁹ See statements by Defence Minister Charles Hernu in 1985 and President Mitterrand's commentary during his visit to L'Île Longue (25 May 1985).

⁹⁰ France publicly excluded any use of nuclear, biological or chemical weapons during the Gulf War. By reassuring public opinion and the coalition's allies about French intentions, this declaration expressed the idea that, for the Head of State, France's vital interests were not likely to be called into question. It was also a question of stigmatizing chemical weapons, as France was preparing the drafting of a convention to ban these weapons. This does not mean that they could not be used in the future in a crisis of the same type; only the President of the Republic would be judge.

⁹¹ Defence White Paper 1994, op. cit. p. 97.

⁹² Speech by the President of the French Republic, Jacques Chirac, at the meeting of Ambassadors, Paris, 31 August 1995. The expression “alone” was somewhat clumsy, because one can imagine examples of using chemical or biological means that certainly do not jeopardize French vital interests.

⁹³ 22 V2 missiles had been fired on the Paris region in 1944.

⁹⁴ Address by Jacques Chirac, President of the French Republic, during his visit to the strategic air and ocean forces, Landivisiau – L'Île Longue (Brest), 19 January 2006.

deemed to be at stake, and provided for, of course, that the aggression was committed by an identified State, the exercise of nuclear deterrence would be relevant.

This is why President Hollande was able to recall in 2015 that “nuclear deterrence aims to protect our country from any State-led aggression against its vital interests, of whatever origin and in whatever form”.⁹⁵ President Macron used similar language in his 2020 speech.

To take into account these non-nuclear risks to our vital interests, the scope of the negative security guarantees given by France in 1982 and reiterated in 1995 was limited by reservations.⁹⁶ These assurances and reservations were reaffirmed for the first time by a President of the Republic in 2015. François Hollande stated: “France will not use nuclear weapons against non-nuclear weapon States that are parties to the NPT and that comply with their international obligations on the non-proliferation of weapons of mass destruction”.⁹⁷ A non-nuclear state which would consider using conventional, chemical or biological means contrary to its commitments, and on such a scale that French vital interests would be called into question, would thus risk nuclear retaliation. In 2010, Washington and London gave stronger guarantees: no exception but for, maybe, biological weapons; since then, the United States has restricted once again its guarantees.

From this conception stems the rejection of no-first-use (the idea that nuclear weapons can or must deter only nuclear weapons, notably put forward by some states or NGOs which seek to promote nuclear non-proliferation). It is true that there are numerous arguments against no-first use. The idea that nuclear weapons would only deter nuclear weapons is a value judgment, which is not demonstrated by facts. The proclamation of a no-first-use concept engages only its author, and is easily reversible, even if it is believed by the potential adversary. The contribution of such statements to non-proliferation has not been demonstrated. No-first use may in fact promote the use of chemical or biological weapons, since it is tantamount to announcing to the adversary that under no circumstances will it be the subject of a nuclear response if it uses such means. The possibility of putting nuclear deterrence into play in the event of a chemical or biological attack against vital interests is all the more necessary for Western countries, as they, as signatories to the conventions banning these weapons, would not be able to respond with identical means. Finally, no-first use would

⁹⁵ François Hollande, Discours sur la dissuasion nucléaire, déplacement auprès des Forces aériennes stratégiques, Istres, 19 February 2015.

⁹⁶ These were expressed by the then Minister of Foreign Affairs, Alain Juppé, in the Senate, in the following terms: “There is no doubt, in this context, that security assurances are compatible with our deterrence strategy, for three reasons. The first is that our deterrence strategy is strictly defensive: France refuses the threat of use and the use of nuclear weapons for aggressive purposes; our nuclear strategy is a strategy of non-war, based on nuclear capabilities limited to what is strictly necessary. This is called the principle of sufficiency. Secondly, our declarations on security assurances do not, of course, affect our inalienable right to self-defence, as recalled by Article 51 of the Charter of the United Nations, to which I have just referred. Finally, as you know, the purpose of French deterrence is to protect our vital interests, the assessment of which belongs to the President of the Republic. It goes without saying that our deterrence covers any questioning of our vital interests, whatever the means and origin of the threat, including of course that of weapons of mass destruction produced and used despite the international ban on them; no one can doubt, to use the words of the White Paper, our will and our ability to expose an adversary, in such circumstances, to unacceptable damage”. Communication from the Minister of Foreign Affairs, Alain Juppé, to the Senate, Paris, 6 April 1995. These reservations are in addition to the traditional ones expressed by the other nuclear powers (with the exception of China): security guarantees do not concern countries that are allied to a nuclear power.

⁹⁷ François Hollande, Discours sur la dissuasion nucléaire, déplacement auprès des Forces aériennes stratégiques, Istres, 19 February 2015.

prevent deterrence from being applied to new types of attacks on vital interests by means other than military.

While it does not exclude the first use of nuclear weapons, there is no evidence that France has ever considered “first strike” options, i.e. destroying opposing nuclear means by a massive nuclear strike meant to be preventive or pre-emptive in nature.

The notion of sufficiency

The sizing of French nuclear forces is based on the notion of sufficiency (sometimes described as “strict” sufficiency, even if this qualifier has no particular consequences). In fact, it is close to what the British call “minimum deterrence” and involves four elements.

It limits French needs to the minimum deemed necessary, i.e. to the sole capacity to exert unacceptable damage in all circumstances. France boasts, for example, of not having equipped itself with all the nuclear systems to which its technology gave it access (for example, the neutron bomb), and of “not having participated in the arms race”.⁹⁸ It involves scaling back the number of weapon systems if their quality increases (for example, the reduction in the number of nuclear squadrons in 2009, largely due to the improved performance of the new airborne missile that entered service at that time).

It expresses the refusal of a counterforce strategy, which would have the ambition to destroy the enemy nuclear means. A traditional French view is that such a strategy leads to the acceptance of the logic of nuclear war. It makes the sizing of a nuclear arsenal dependent on that of a potential adversary, and thus promotes arms race. Moreover, it is very expensive and technically demanding.

It comprises the idea that damage must be exercisable in all circumstances, regardless of the adversary, and therefore as a second strike if necessary: France must be able to trigger nuclear retaliation after an attack by the adversary on its territory and assets. Its strategy is not based on the concept of launch-on-alert; it is not essential for it to have early warning means against a major and well identified adversary.⁹⁹ However, the ability of nuclear assets to survive is critical for a country like France, which must be able to inflict unacceptable damage even after an enemy strike by a major power. This need has had important consequences for French deterrence:

- A diversification of means: the missiles of the plateau d’Albion were put in place in 1971, in order to ensure this diversification on a temporary basis – that is what was planned at that time –, before the construction of a sea-based component, and entered service as from 1972¹⁰⁰ ;

⁹⁸ This is only true in a restrictive sense of the notion of arms race. In a broader sense, France was forced to participate, as were the other nuclear-weapon States: the deployment of a nuclear interceptor shield around Moscow had forced it to significantly increase the number of its weapons. Let us also recall the words used by the Prime Minister in 2014: “Throughout the Cold War, France made a considerable effort not to be left behind by the two great powers of the time. But now it is leading the race for deterrent technologies”, Speech by Manuel Valls, Prime Minister, CESTA visit, Le Barp, 23 October 2014.

⁹⁹ Such systems (satellites, radars) may, however, be useful in order not to depend on another State for the rapid identification of the origin of a missile departure in a complex crisis.

¹⁰⁰ According to the decisions taken in the Defence Council in 1963, the SSBs were only to “weld” (sic) the first and second generation of the strategic nuclear force between 1968 and 1972. See Maurin, *op. cit.*, p. 227. S3D missiles could be

- Continuous at-sea deterrence: since 1996, this has normally been ensured by at least one SSBN (two, if judged necessary, by presidential decision);
- The establishment of secure, protected and redundant transmissions: these are seen as an integral component of French deterrence.

Finally, it implies constant adaptation to the changing strategic context, in one way or another. Thus, the disappearance of the immediate major threat led to the removal of missiles from the plateau d'Albion in 1996.

Sufficiency is ultimately a matter of political judgment: it is up to the President of the Republic to decide what he considers necessary and sufficient to deter. It is translated in quantity and also in quality of means: it is not simply a question of a number of weapons. It takes into account variable elements, such as the penetration capacity of anti-missile and anti-aircraft defences, and the reliability of weapon systems, which may lead to a certain loss rate being taken into account. And it is, by nature, evolutionary. That is why the comparison of raw numbers (for example between France and the United Kingdom) makes little sense.

In 1980, with five SSBNs, four of which were equipped with thermonuclear weapons (allowing two and sometimes three ships to be always at sea), the French leaders were able to consider that France had reached a certain level of sufficiency, in line with the needs identified at the time. But it was only at the end of the 1980s that, with at least two SSBNs equipped with the M4 missile continuously at sea, the deterrent force's destructive capability was deemed sufficient.

Nuclear planning

Major powers and regional powers: a relevant distinction?

Since the end of the Cold War, two types of potential adversaries have often been identified. So-called "major" powers are countries that might have the will and capacity to threaten the vital interests of the country to the point of jeopardizing its very survival.

Among major non-allied countries, only Russia and China are technically in a position to threaten the survival of France as an organized entity. Of course, the Cold War scenario – the threat of a massive air-land aggression against Europe - is unlikely to recur. But the manifestation of a major threat, in one form or another, can hardly be excluded. Significant nuclear arsenals will remain in the world for a long time to come, and some are even on the rise. Great nations - Russia, China, India - are trying to find a place for themselves in a changing strategic context dominated by the US. Nationalism and energy needs contribute to the

deployed in minutes, so they could be fired as soon as an alert was issued. The plateau d'Albion demonstrated the sanctuarization of the metropolitan territory through what some called at the time the concept of the "picket goat": the means necessary for the destruction of the ground-to-ground component would have been such that the adversary trying to do so would inevitably expose himself to a nuclear response. See "an attack on Albion would mean that we would already be in war, nuclear war. Our strategic forces would immediately be launched", Speech by François Mitterrand, President of the French Republic, at IHEDN, Paris, 11 October 1988.

competition of powers. Nuclear and ballistic arsenals can be instruments in the service of these strategies. As early as 1999, the then Prime Minister stressed that French deterrence could equally well concern a “distant” threat – codeword for China.¹⁰¹

Nuclear deterrence thus constitutes what has sometimes been called a nation's long-term life insurance policy. It ensures that France's survival will never be called into question by a major power with hostile intentions and willing to use military means to achieve them.

The other category is the so-called “regional” powers. Since 1994, France has taken into account the possibility of non-major threats affecting its vital interests, without going so far as to question its very survival.¹⁰² These are mainly the so-called “proliferating” countries. One or the other could be tempted on the occasion of a crisis to exert an unbearable blackmail, to deter Paris from intervening in their neighbourhood for example (which could also be done by a major power). The proliferation dynamic remains significant: in the future, some French military interventions will happen under nuclear, biological, chemical and/or ballistic threat. French territory and that of its allies could be within range not only of Russian and Chinese missiles, but also of Syrian, Iranian, Pakistani and North Korean systems. This inclusion of regional powers in the doctrine of deterrence explains why, since 1994, French doctrine can no longer be described as “deterrence from the weak to the strong”.¹⁰³

The distinction between regional and major powers may have value in terms of capacity to inflict damage and military planning, but it remains somewhat artificial, as crisis scenarios could be similar. Moreover, some future crises could involve a regional power *and* a major power.

In concrete terms, the French nuclear arsenal may be called upon to play a role in deterring a State from attacking an ally whose security would be considered a vital issue (Europe); from using means of mass destruction against our forces and bases outside metropolitan territory (provided, of course, that the leaders concerned are convinced that such a threat can fall within the scope of our vital interests); from using these means against the French territory during a military intervention or a major political crisis, during which the adversary would utter serious threats against France.

In most cases, and contrary to the main Cold War scenario, this is what might be called a “counter-deterrence”: the objective would be to neutralize adverse deterrence, prevent it from using it as an instrument of coercion, and thus preserve the freedom of action of the political authorities.

Unacceptable damage

During the Cold War, French strategy focussed on counter-cities strikes targeting both the economy and the population.

¹⁰¹ Address by the Prime Minister, Lionel Jospin, to the IHEDN, Paris, 22 October 1999.

¹⁰² At the time of writing the 1994 White Paper (in 1993), the issue of Ukraine's possession of nuclear weapons inherited from the former Soviet Union was still unresolved.

¹⁰³ French deterrence cannot be qualified as “deterrence from the strong to the mad”: this clumsy expression suggests that the leaders of the regional powers are mentally unbalanced, which is rarely the case – and in any event, such leaders would not be receptive to the logic of deterrence.

The strategy of the time was linked to the idea of deterrence from the weak to the strong.¹⁰⁴ Faced with a country as large and powerful as the Soviet Union, it was supposed to be “the most effective and least costly strategy for a middle power like France”.¹⁰⁵ To use General de Gaulle's words, it was a matter of attacking the “living works” of the enemy country, or inflicting a “mortal wound” on it.¹⁰⁶ De Gaulle clearly wanted the Soviet economy to be threatened. The presidential directives demanded that the forces be capable of inflicting on the USSR a significant reduction (50 to 65% depending on the sources) in its economic potential.¹⁰⁷ He also referred privately to the destruction of “their combinats, dams, power plants”.¹⁰⁸ The target of 50% of the country's economy was still that of the FAS in 1971.¹⁰⁹ It was thus a question of addressing the “living works” or the “living forces” of the adversary.¹¹⁰ As a result, the French strategic forces, moreover, few in number and not very accurate (unless exceptionally skilful manoeuvres by bomber pilots), and lacking in intelligence, were essentially to be targeted at opposing cities, and the objectives set in terms of the number of deaths.¹¹¹ In fact, in 1961, de Gaulle mentioned privately the future capacity of French forces to “destroy 20 Russian cities”.¹¹² He will refer several times to some key objectives: Moscow, Leningrad, Odessa and Kiev.¹¹³

During the first major parliamentary debate over what was then called the “strike force” (force de frappe), Prime Minister Georges Pompidou summed up the French objective as follows: “France must therefore possess nuclear weapons of such a power that the aggressor knows with certainty that he cannot hope to attack and defeat without surely suffering destruction such as he could not bear it, or at least that it removes all attraction to the hypothesis of victory. Hence our programme that gives us sufficient destructive capacity because it is equivalent to what our country can represent as a stake.”¹¹⁴ In 1970, the Strategic Air Force was still far from fulfilling this contract: it was estimated that it could cause between 15 and 20 million deaths.

In the 1970s, the political authorities referred to “the large agglomerations of an adverse nation, where most of its demographic and economic power is concentrated”¹¹⁵, or “the

¹⁰⁴ Cf. “For our country, the problem of choosing between an anti-forces strategy and an anti-cities strategy does not arise”, Speech by the Prime Minister, Raymond Barre, at the IHEDN, Paris, 11 September 1980; “deterrence of the strong by the weak, that is, a strategy that has to target cities”, Speech by the Prime Minister, Pierre Mauroy, at IHEDN, Paris, September 1981; “an anti-cities strategy, a corollary to the weak-to-strong deterrence”, Speech by the Minister of Defence, Charles Hernu, at IHEDN, 14 September 1981.

¹⁰⁵ Presentation by General Jeannou Lacaze, Chief of the Defence Staff, at IHEDN, Paris, 10 May 1984.

¹⁰⁶ “Œuvres vives”: Allocution du 19 avril 1963, op. cit., p. 96; and Mémoires d'espoir: le renouveau, Paris, Gallimard, 2000, p. 1067; “blessure mortelle”: conférence de presse au palais de l'Élysée, 23 juillet 1964, in Charles de Gaulle, Discours et messages (IV), op. cit., p. 233.

¹⁰⁷ 50 %: General François Maurin, “La mise en place de la triade stratégique (Mirage IV, SSBS Albion, SNLE) et des chaînes de contrôle” in Université de Franche-Comté - Institut Charles-de-Gaulle, op. cit. p. 229. 65%: Hervé Alphand, L'Étonnement d'être. Journal, 1939-1973 (Paris: Fayard, 1977), p. 368.

¹⁰⁸ Reported by Peyrefitte, op. cit., p. 710.

¹⁰⁹ Forces Aériennes Stratégiques, Air and Cosmos, special issue, 2014.

¹¹⁰ The first term was regularly used in the 1970s. The second was employed by François Mitterrand in 1986.

¹¹¹ At the origin of the deterrent force, it was even possible to use postcards from the city concerned to identify more precisely the objectives of interest.

¹¹² Quoted in Alphand, op. cit.; p. 368.

¹¹³ See for example Peyrefitte, op. cit., p. 654.

¹¹⁴ Georges Pompidou, Address to the National Assembly, 2 December 1964.

¹¹⁵ Speech by the Prime Minister, Raymond Barre, at Mailly camp, 18 June 1977.

assured destruction of a significant part of its cities and its economy”.¹¹⁶ In his memoirs, Valéry Giscard d'Estaing stated that his objective for our strategic strike was “the destruction of 40% of the Soviet Union's economic capacities located below the Urals and the disorganisation of the country's management apparatus”.¹¹⁷

In 1980, France had, on paper, the capacity to threaten 50 opposing cities, or about 20% of the population of the USSR (thus about 50 million people at the time), and 40-50% of its industry.¹¹⁸ In practice, Soviet anti-aircraft and anti-ballistic defences would certainly not have enabled France to achieve this objective. In 1987, Jacques Chirac, then Prime Minister, still referred to the capacity that French forces would soon have to “destroy 50% of Soviet cities”.¹¹⁹ François Mitterrand referred to “40 cities”.¹²⁰

Insofar as, faced with the Soviet Union, the stakes of the conflict were nothing less than the survival of the country, one could consider that the nuclear forces had to be able, in order to exert damage out of proportion with the stakes of a conflict, to destroy in the USSR at least the demographic or economic equivalent of what France represented (at the time, 50 million people).¹²¹ Moscow was, of course, a key objective of the deterrent force, and its protection by nuclear missile defences had justified the move to multiple warheads in the 1980s.

The public discourse on targeting became more discreet at the end of the Cold War, crystallizing in the 1990s in the mere mention of “unacceptable damage”. This expression of American origin already appeared in the 1972 White Paper.¹²² It corresponded to an idea present since the origins of the deterrent force: General de Gaulle used to evoke, in his flowery language, the need to be able to inflict “appalling destruction” on the adversary.¹²³ But its use only became systematic from 1981.

The desired damage should then be “out of proportion with the stakes of a conflict” (1994 White Paper), or “out of proportion with the objective of an aggression” (2008 White Paper).¹²⁴ This notion of incommensurable damage, therefore not directly proportionate to the immediate aggression, is a classic element of the French vision of deterrence. It was mentioned in the 1972 White Paper. It does not, however, appear in the current discourse.

¹¹⁶ Speech by the Prime Minister, Raymond Barre, at the IHEDN, Paris, 11 September 1980.

¹¹⁷ Valéry Giscard d'Estaing, *Le Pouvoir et la Vie*, tome II (Paris: Compagnie 12, 1991), p. 180. It is interesting to compare these data with the American objectives in 1965: the destruction of 25 to 33% of the Soviet population and about 66% of its industrial capacity allegedly represented an “intolerable punishment” for Moscow (figures revised in 1968 to 20% to 25% of the population and 50% of industrial capacity).

¹¹⁸ Bruno Tertrais, “Destruction assurée...”, *op. cit.*

¹¹⁹ Interview with President Ronald Reagan, quoted in *Le Nouvel Observateur*, 19-25 August 2010, p. 41.

¹²⁰ Conference “What defence for France?”, 8 February 1986.

¹²¹ See Georges Pompidou's above-mentioned statement (1964). In 1986, President Mitterrand envisaged “destroying territories larger than the territory of France (...), the risk is more serious than the stakes (...) France can destroy a territory larger than ours, and a territory that would cover all the living forces of an enemy country”. Conference “What defence for France?”, 8 February 1986. In 1988, he spoke of “damage at least equivalent to what we represent (...)”. For him, it would have been a question of “destroying a territory within a range of 4,000 kilometres on an area at least equal to that of our own territory”, Speech by the President of the French Republic, François Mitterrand, at the IHEDN, 11 October 1988. In other words, to destroy Muscovia.

¹²² “An immediate risk out of proportion with the stakes of the conflict”. White Paper on National Defence, Volume I (Paris: Ministry of Defence, 1972).

¹²³ Conférences de presse du président de la République à l'Élysée, Paris, 14 January 1963 and 23 July 1964, in de Gaulle, *Discours et Messages* (IV), *op. cit.*, pp. 72, 233.

¹²⁴ Defence White Paper 1994, *op. cit.*, p. 100; Defence and National Security White Paper 2008, p. 69.

Since the end of the Cold War, planning itself - that is, the translation of these political objectives into military terms - has also evolved. The notion of equivalence in relation to what is at stake in France has been abandoned, because the deterrent threat must be adapted to both the stake and the adversary; the scenarios in which vital interests are at stake are now more diverse. The notion of counter-cities deterrence disappeared from public language in the mid-1990s.

In 2001, a distinction was made between major and regional powers. Faced with a major power, the French forces had to be able to inflict unacceptable damage “of any kind”.¹²⁵ Faced with a regional power, the stake of the conflict would not be the survival of the country, and the adversary would not necessarily be receptive to a threat to its population: that is why it was announced in 2001 that, in such a case, “the damage to which a possible aggressor would be exposed would be exerted primarily on its centres of political, economic and military power”.¹²⁶ This idea was clarified by the Chief of the Defence Staff in 2005: “What [political leaders] are always sensitive to is the pressure that can be exerted on what constitutes their power. So if the deterrent to their means of mass destruction is based on the possibility, in return, of destroying all their centres of power, they are indeed sensitive to this rationality.”¹²⁷ In 2008, the distinction between these two types of powers disappeared. It would then be “primarily the centres of political, economic and military power that would be targeted”, said Nicolas Sarkozy.¹²⁸ The notion of “unacceptable damage” was maintained, sometimes with a rhetorical qualification (“absolutely unacceptable”).

Finally, in 2015, the expression “primarily” no longer appeared: François Hollande stressed that planning would target “its centres of power, i.e. its political, economic and military nerve centres”.¹²⁹ French deterrence therefore no longer addresses other types of objectives. Emmanuel Macron used exactly the same expression in his 2020 speech.

Nuclear planning options have thus been diversified, in particular through the modulation of the number of warheads per ballistic missiles and the adaptation of the yield-accuracy equation. On the one hand, it is a question of guaranteeing the vulnerability of the threatened objectives, whatever their size and hardening, and, on the other, of being able, if requested by the political authorities, to reduce collateral damage that would result from a strike in order to give credibility to the deterrent threat. In 2006, the then Chief of Defence Staff announced that France could exercise “a precise threat of destruction of the main centres of government or the army, or even of the main economic capacities of a country, with a very strong limitation of collateral fallout for the populations” and that it had “very accurate weapons with a flexible yield to avoid collateral damage”.¹³⁰

¹²⁵ Address by Mr Jacques Chirac, President of the French Republic, during his visit to the strategic air and ocean forces, Landivisiau – L’Île Longue (Brest), 19 January 2006.

¹²⁶ Speech by Jacques Chirac, President of the French Republic, to the Institut des hautes études de défense nationale, Paris, 8 June 2001.

¹²⁷ “Interview with Henri Bentegeat, Chief of Defence Staff”, *Le Monde*, 12-13 March 2005.

¹²⁸ Speech by Nicolas Sarkozy, President of the French Republic, at the presentation of SNLE Le Terrible, Cherbourg, 21 March 2008.

¹²⁹ François Hollande, Discours sur la dissuasion nucléaire, déplacement auprès des Forces aériennes stratégiques, Istres, 19 February 2015.

¹³⁰ General Henri Bentegeat, in *Rapport d’information fait au nom de la Commission des affaires étrangères, de la défense et des forces armées sur le rôle de la dissuasion nucléaire française aujourd’hui*, by Serge Vinçon, Senator, Document no 36, 24 October 2006, p. 24.

In short, the key concepts of current planning are “unacceptable damage”, “centres of power”, as well as flexibility, adaptation and responsiveness.

The “nuclear warning”

Regardless of the adversary and the circumstances of the crisis, France maintains the capacity to mark when the time comes, if necessary, to a potential adversary, that its vital interests are at stake and that it is determined to safeguard them, in order to “restore deterrence”.¹³¹ This was traditionally called the final warning option. Adopted in the early 1970s, this expression may seem somewhat dated. But in more complex crises than in the past, including in the face of a regional adversary who might misunderstand France's determination, the concept it covers is still judged relevant – perhaps even more so than it was in the scenario of an aggression in Europe at the time of the Cold War: a regional or distant actor would undoubtedly know less well the French strategy and would apprehend less well the contours of its vital interests than, undoubtedly, the Soviet Union.¹³² It is also a question of predicting the scenario in which the adversary would test the determination of France to defend its vital interests.

What is now called the “nuclear warning” - which, to repeat the point, is only an option and not a necessary step before unacceptable damage is inflicted - thus remains a counterpart to the uncertainty that exists about the delimitation of our vital interests. The logic of the French concept leads one to consider that it could, if necessary, be delivered in a pre-emptive way. This final warning is, by definition, a nuclear one. There would be no sense in issuing a final “conventional” warning.¹³³ Such a concept would signify to a potential adversary that he could test France up to the limit of vital interests without fear of a nuclear response. The adversary having by definition proceeded, or being on the verge of proceeding, to call into question vital interests, this would mean that France accepts that these interests are at stake without resorting to nuclear weapons. A final conventional warning would not be more credible than if it were nuclear: on the contrary, necessarily less powerful, it could cast doubt on an adversary of French determination. Finally, it would correspond to a return to “all or nothing” in nuclear doctrine, a concept that no nuclear-weapon State seems to have adopted.

The nuclear warning warning would probably take the form of a limited strike, probably on military objectives: command centre(s), base(s) of operations, facilities for the production or storage of weapons of mass destruction. But the French authorities have indicated that it could also take the form of recourse to what is called the HA-EMP effect (high altitude electromagnetic pulse): the detonation of a nuclear weapon at high altitude to neutralise the adversary's electrical and electronic circuits, and thus paralyse its action.¹³⁴ The then President

¹³¹ This expression was publicly used for the first time by General Henri Bentegeat, in *Rapport d'information fait au nom de la Commission des affaires étrangères, de la défense et des forces armées sur le rôle de la dissuasion nucléaire française aujourd'hui*, by Serge Vinçon, Senator, Document no 36, 24 October 2006, p. 29.

¹³² At the time of the Cold War, the final warning would have been intended to disrupt the enemy's military apparatus threatening France, including, if necessary, by strikes on Soviet territory using missiles from the plateau d'Albion.

¹³³ Nothing in the French defence strategy, on the other hand, excludes the possibility that, during a conflict, it may be called upon to deliver a conventional massive strike intended to put an end to the aggression.

¹³⁴ General Henri Bentegeat in *Rapport d'information fait au nom de la Commission des affaires étrangères, de la défense et des forces armées sur le rôle de la dissuasion nucléaire française aujourd'hui*, par Serge Vinçon, sénateur, no 36, 24 October 2006, p. 29.

of the Republic referred to this in 2006 by referring to “his capacity to act” and the 2008 White Paper referred to the possibility of “paralysing [the] opponent's freedom of action”.¹³⁵

But in all scenarios, the purpose of such a strike would be political: it would be to express to an adversary France's determination to safeguard its vital interests, or to show it that it has crossed the red line, and thus to stop the aggression and restore deterrence.

Both components (sea and air) may participate in the potential exercise of the final warning. In his 2008 speech, the then President of the Republic failed to mention the “final” nature of the warning. It was therefore not illegitimate to wonder about a possible evolution of French doctrine, in a sense which brought it closer to that of our allies (the hypothetical possibility of repeating a limited strike if necessary). In 2015, President Hollande did the same, but the speech delivered by Defence Minister Jean-Yves Le Drian in 2014 did mention this qualifier (“a final warning strike”).¹³⁶ The ambiguity was dispelled by President Macron's speech, which included the following reaffirmation: “Should there be any misunderstanding about France's determination to protect its vital interests, a unique and one-time-only nuclear warning could be issued to the aggressor State to clearly demonstrate that the nature of the conflict has changed and to re-establish deterrence”.¹³⁷

Other doctrinal developments

The uniqueness of the French concept

Since the end of the Cold War, one of the features of the French conception of deterrence has been the “uniqueness” of the concept and the forces.

With regard to the concept, France considers that deterrence applies to any threat to its vital interests, regardless of the adversary and the means employed. Any use of nuclear weapons would be of a strategic nature; it would indicate a change in the nature of the conflict, a radical break. All French nuclear weapons have been considered “strategic” since 1996. Thus, no weapon system is assigned exclusively to one type of planning or another.

The evolution of the organization of nuclear forces reflects this conception. In September 1991, nuclear air assets were grouped under the same command, that of the Strategic Air Forces (FAS). This unification of forces then called “prestrategic” with strategic forces had the symbolic consequence of breaking the link between conventional and nuclear means, thus eliminating any tactical dimension in the use of nuclear weapons.

This process of reorganization continued in 1996, with the publication of a text repealing and replacing the old 1964 decree on which the presidential authority for the use of nuclear forces was based. The new text made the Chief of Defence Staff solely responsible for the execution of nuclear operations. At the same time (1992) the Nuclear Forces Operations Centre (COFN)

¹³⁵ Address by Jacques Chirac, President of the French Republic, during his visit to the strategic air and ocean forces, Landivisiau – L'île Longue (Brest), 19 January 2006; White Paper on Defence and National Security, 2008, p. 170.

¹³⁶ Jean-Yves Le Drian, Closing speech for the 50th anniversary of DAM, 20 November 2014.

¹³⁷ Speech of the President of the Republic on the Defense and Deterrence Strategy, Paris, War College, 7 February 2020.

was established. A 2009 decree clarified government responsibilities in the various areas relating to deterrence.

The issue of missile defence

One consequence of the French doctrine is to refuse the principle of the protection of the territory against a massive nuclear attack, which could be interpreted as an admission of weakness, a sign of a lack of confidence in nuclear deterrence (or, worse, an acceptance of the idea of conducting a nuclear war). Hence the absence of a massive anti-nuclear shelter programme and, above all, of any ambition for a strategic ballistic missile shield.¹³⁸ Since 1995 (the US project known at the time as NMD, National Missile Defense), France has been led to question the possible impact of the potential deployment by the United States of a strategic missile defence system, in line with its opposition, twenty years earlier, to the Reagan Strategic Defence Initiative.

However, it is now showing a certain amount of pragmatism on the issue. It has provided its deployed forces a modicum of anti-missile protection: aggression against them would not necessarily be an attack on vital interests. It participates in the Atlantic Alliance's missile defence. Thus its position today is more nuanced than in the past. France still believes that missile defence cannot replace deterrence. As Jacques Chirac said in 2006: "No one can claim that missile defence is sufficient to counter the threat posed by ballistic missiles. No defensive system, however sophisticated, can be 100% effective. We will never be guaranteed that it cannot be circumvented. To base our entire defence on this one capability would, in fact, invite our adversaries to find other means to implement their nuclear, chemical or bacteriological weapons. Such a tool cannot therefore be considered a substitute for deterrence". But missile defence can usefully complement nuclear deterrence. This has been recognized since 2006: missile defence can "complement [deterrence] by reducing our vulnerabilities".¹³⁹ This logic of complementarity, which brings missile defence within the "Protection" function, was confirmed by Nicolas Sarkozy and François Hollande.

The public discourse on deterrence

Public discourse (texts and interventions), relayed by the media and administrations, is an essential element of the political credibility of deterrence. It aims to convey to adversaries and allies France's determination to safeguard its vital interests. It can be complemented, if necessary, for example during a crisis, by potentially discreet messages conveyed to a potential adversary. Besides, texts and public interventions on deterrence ensure that public opinion is aware of how their elected representatives commit themselves to protecting them against the most serious threats and their determination to ensure their security, which goes without saying in a democracy. Finally, the public discourse is also aimed at women and men who work for the deterrence (scientists, engineers, soldiers), as well as France's allies.

¹³⁸ In contrast, missile defence at sensitive points in the territory, against a limited attack, as an extension of air defence, has never been explicitly excluded.

¹³⁹ Address by Jacques Chirac, President of the French Republic, during his visit to the strategic air and ocean forces, Landivisiau – L'île Longue (Brest), 19 January 2006.

The basic elements can be found in the 1994, 2008 and 2013 Defence White Papers as well as in the 2017 Strategic Review, in the reports annexed to the military programming laws, and in the public interventions of successive presidents and prime ministers. The presidential speeches of 8 June 2001 (Chirac), 19 January 2006 (Chirac), 21 March 2008 (Sarkozy) and 19 February 2015 (Hollande) were motivated by the desire to reaffirm the importance of French deterrence in the country's defence strategy and by the need to make certain adjustments to the doctrine and deterrence posture publicly known.

Since the end of the Cold War, France has made an effort to be more transparent as to its nuclear means. This effort contributes both to the credibility and legitimacy of French nuclear deterrence.

In 1994, during an intervention at the Elysée, President Mitterrand gave detailed information on the French nuclear arsenal, which no nuclear power had done before: total number of weapons (about 500), number of S3D missiles (18), number of warheads (384) and missiles (64) carried by submarines, number of patrols carried out by SSBN (more than 300), number of Mirage-IV aircraft equipped with TN81 warhead (15), range of ASMP missile (300 kilometres) and number available (45), yield of main warheads (150 kilotons for the TN71, 300 kilotons for the TN81).¹⁴⁰

Transparency also applies to installations, and this is a characteristic feature of the French nuclear policy. In 1996, following the final nuclear test campaign, the French authorities decided to open the Pacific Testing Centre to an international expert mission to evaluate the effect of French tests on the environment. This was an unprecedented decision among the nuclear-armed powers. The aim was to show in concrete terms the scale of the disarmament measures taken by Paris and their irreversible nature.

This effort of transparency was pursued over the last years. In 2008, President Sarkozy revealed that France had, in total, “less than 300” nuclear weapons, and invited international observers to visit the facilities at Pierrelatte and Marcoule which were being dismantled.¹⁴¹ In 2015, President Hollande clarified somewhat the composition of the French arsenal (3 batches of ballistic missiles and 54 ASMPA launchers) and opened new dismantled facilities for international visits (plateau d’Albion, Luxeuil base). In 2020, Paris paid special attention to transparency over its nuclear policy by preparing a special dossier on this question in the run-up to the NPT Review Conference.

¹⁴⁰ Speech by François Mitterrand, President of the French Republic, on the French policy of deterrence, Paris, 5 May 1994.

¹⁴¹ At the time, France was the only country to publicly reveal the full extent of its nuclear arsenal.

CHAPTER III: THE INTERNATIONAL FRAMEWORK

French deterrence, NATO and Europe: historical developments

“The definition of our vital interests cannot be limited to the national scale alone, because France does not conceive its defence strategy in isolation, even in the nuclear field,” said François Hollande in 2015.¹⁴²

The French programme was never conceived as a strictly national one. At its origins, in the years 1952-1954, it was even resolutely inscribed in an Atlanticist perspective: it was a question of increasing France's status within NATO. As for the European dimension, it was considered from the outset, with the so-called FIG project (France, Italy, Germany) for the joint development of nuclear assets from 1957-1958.¹⁴³

Even under de Gaulle, France never reserved its deterrence for the defence of the French “sanctuary”. It has always been clear that the national territory is at the forefront of vital interests, but no less clear that they are not limited to it. The 1972 White Paper already said so: “France lives in a web of interests that transcends its borders. She's not isolated. Our vital interests lie in our territory and its approaches.” Nuclear deterrence, in its origins, applied “essentially to our national territory, the heart of our existence as a nation, but also to its approaches, that is, to neighbouring and allied territories”.¹⁴⁴ It is therefore wrong that French deterrence is reserved to the selfish defence of strictly hexagonal interests.

De Gaulle envisaged the coordination of the use of French nuclear forces with those of its allies. For him of course, nuclear deterrence was fundamentally a national matter. He wanted to be “unbearable on his own”.¹⁴⁵ But while the nuclear decision could not be shared, it could be coordinated. As early as 1954, de Gaulle had suggested that the use of nuclear forces should be “three-way” (London, Paris, Washington), in particular in cases of emergency making consultations involving all NATO members impossible. As is well-known, he wanted a tripartite Atlantic Alliance directorate, including for the use of nuclear forces.¹⁴⁶ He envisaged, obviously without much illusion, to combine the use of French and allied forces.¹⁴⁷ It was “possible to combine these forces in the service of common defence”.¹⁴⁸

This vision was consistent with his idea that nuclear force contributed to the security of Europe and that of the Alliance as a whole. French deterrence was to be reserved for the defence of France's vital interests, an expression sometimes used by the General.¹⁴⁹ But contrary to a

¹⁴² François Hollande, Discours sur la dissuasion nucléaire, déplacement auprès des Forces aériennes stratégiques, Istres, 19 February 2015.

¹⁴³ A November 1957 Protocol, signed by the French, German and Italian Defence Ministers, provided for close cooperation in the field of conventional weapons and in “military applications of atomic energy”, a formulation deliberately left ambiguous at Germany's request. Another agreement, concluded in April 1958, provided for the construction of a uranium enrichment plant financed 45% by Paris, 45% by Bonn and 10% by Rome. This cooperation was denounced by General de Gaulle.

¹⁴⁴ Speech by the Prime Minister, Raymond Barre, at Mailly camp, 18 June 1977.

¹⁴⁵ Quoted in Lacouture, *op. cit.*, p. 353.

¹⁴⁶ See his meeting with Eisenhower in de Gaulle, *Mémoires d'espoir*, *op. cit.*, p. 1068.

¹⁴⁷ See Peyrefitte, *op. cit.*, p. 360.

¹⁴⁸ Address to the École militaire, 15 February 1963, in de Gaulle, *Discours et Messages (IV)*, *op. cit.*, p. 83.

¹⁴⁹ See Peyrefitte, *op. cit.*, p. 618.

popular belief, these vital interests were not limited to national territory. For de Gaulle, the fate of France and that of Europe were closely linked. He privately indicated that the French nuclear force was protecting his immediate neighbours, notably Germany.¹⁵⁰ In secret instructions given to the armed forces in 1964, General de Gaulle reportedly specified that France should “feel threatened as soon as the territories of federal Germany and Benelux are violated”.¹⁵¹

Beyond that, de Gaulle believed that the French nuclear force contributed to the security of the West.¹⁵² He told Eisenhower that the presence of additional deterrence in Europe would certainly be a problem for Moscow: “The Soviets know me. They know that if I have the strike force to respond to an invasion of Western Europe, I will use it, and that will be an additional deterrent for them”.¹⁵³ Along with the United Kingdom, Paris was thus to be another center of nuclear decision in the Alliance.

At this point, one must mention another original feature of the French strategy, the concept of the “detonator” or “trigger”. The idea was that France had the capacity to force the United States to defend Europe in case of war. The mere existence of a French nuclear force was, according to this concept, likely to force the United States to intervene to avoid an uncontrolled nuclear escalation because of the opening of nuclear fire by France; Paris possessed the capacity to initiate a nuclear war that would necessarily engage the United States. We now know that De Gaulle fully subscribed to this concept¹⁵⁴: “The Alliance does not oblige them to be at our side immediately, with all their weight and with all their weapons. That's why our atomic force is needed. It is a triggering and driving force. It's the starter.”¹⁵⁵ The concept of the detonator did not survive the Gaullist era, especially since from 1969, under the presidency of Richard Nixon, the United States came to accept the existence of the French force.

The indirect contribution of French deterrence to the security of the Atlantic Alliance, which lies in particular in the fact that the existence of an autonomous deterrent complicates the calculation of a potential aggressor, earned France official recognition of the value of its deterrent force in the eyes of its allies, by the Ottawa Declaration (1974), the terms of which have since been taken up almost word for word in all the major NATO texts. This contribution had also been recognised by France's European partners in the Western European Union (WEU).¹⁵⁶

¹⁵⁰ In private, de Gaulle said: “But it will automatically protect them! Much better than the American force! For the simple reason that we are European, while the Americans are not. The interest of the Americans in not allowing Europe to be destroyed is tiny compared to ours. If Europe is invaded, we are toast”, reported by Peyrefitte, *op. cit.*, p. 653.

¹⁵¹ Quoted in Jacques Isnard, “Le grand déballage nucléaire”, *Le Monde*, 4 February 1997.

¹⁵² See Peyrefitte, *op. cit.*, p. 710.

¹⁵³ Citations in Lacouture, *op. cit.*, p. 353. See also Peyrefitte, *op. cit.*, p. 710.

¹⁵⁴ See Peyrefitte, *op. cit.*, p. 433.

¹⁵⁵ Reported by Peyrefitte, *op. cit.*, p. 638.

¹⁵⁶ Western European Union, Platform on European Security Interests, The Hague, 1987; Preliminary Conclusions on the Formulation of a Common European Defence Policy, Noordwijk, 1994; Common European Security Concept, Madrid, 1995.

In the 1970s and 1980s there were discussions at military level to coordinate, as necessary, the so-called “tactical” nuclear forces of France and NATO.¹⁵⁷

At that time, France seemed clearly more and more willing to insert its deterrent force into the transatlantic framework. In 1983, it explicitly supported the deployment of the Euromissiles. In February 1986, the President of the Republic affirmed his readiness to consult the German Chancellor in the event of the opening of a nuclear fire. Coordination of the possible use of French and allied forces, both at the strategic and pre-strategic level (a term that was established in 1984), was discussed at the Elysée during a Defence Council in April 1987.¹⁵⁸ The same year, a dialogue was initiated with Germany on the role of the Hades missile. Hubert Védrine, then Secretary General of the Elysée, revealed that he had suggested to François Mitterrand, around 1987-1988, to propose to London and Washington a concept of a “common ultimate warning”, in order to achieve a “synthesis from above of the Atlantic and French strategies”.¹⁵⁹

Later, in January 1996, France would say that it was ready for a dialogue on nuclear deterrence within the North Atlantic Council.¹⁶⁰ At the time, Paris was then seriously considering joining NATO's integrated military command.

The idea that French deterrence contributes to the overall deterrence of the Atlantic Alliance, including by complicating the calculation of a possible adversary, has been endorsed by all presidents since 1974. NATO's 2010 Strategic Concept used traditional language: “The supreme guarantee of Allied security is provided by the Alliance's strategic nuclear forces, in particular those of the United States; the independent strategic nuclear forces of the United Kingdom and France, which have their own deterrent role, contribute to the overall deterrence and security of the Allies.” France was thus able to agree with its partners on a common understanding of allied nuclear deterrence. This is briefly summarized in three points in the 2010 Concept: “The conditions under which the use of nuclear weapons could be envisaged are extremely improbable (...). As long as there are nuclear weapons, NATO will remain a nuclear alliance (...). Deterrence, articulated around an appropriate mix of nuclear and conventional capabilities, remains a central element of our overall strategy”.¹⁶¹

French policy on this issue is hardly the subject of national debates and is part of a certain continuity. Its elements can be summarised as follows: the wish that the Atlantic Alliance should remain a “nuclear alliance”, in which the major role of nuclear deterrence is highlighted; recognition of the importance of sharing risks and responsibilities in this field; contribution to the definition of the Alliance's common nuclear policy; fidelity to Article V of

¹⁵⁷ On this historical aspect see Jeffrey Lewis and Bruno Tertrais, “Deterrence at Three”, *Survival*, vol. 57, no 4, August-September 2015; and *ibid*, *US-French Nuclear Cooperation: Its Past, Present and Future*, *Fondation pour la recherche stratégique*, 4/2015, October 2015.

¹⁵⁸ Jacques Attali, *Verbatim II, 1986-1988* (Paris: Fayard, 1995), p. 300; and correspondence with the author, August 1995.

¹⁵⁹ Hubert Védrine, *Les Mondes* by François Mitterrand. À l'Élysée, 1981-1995 (Paris: Fayard, 1996), p. 727.

¹⁶⁰ Address by Gérard Errera, Permanent Representative of France to the Atlantic Council, Brussels, 17 January 1996.

¹⁶¹ Strategic Concept for the Defence and Security of the Members of the North Atlantic Treaty Organisation, adopted by Heads of State and Government at the NATO Summit in Lisbon on 19-20 November 2010.

the Washington Treaty, and thus possible engagement of French nuclear forces under this article; non-participation of France in the Nuclear Planning Group.¹⁶²

Which European dimension?

Since the end of the Cold War and the creation of the European Union, France has stressed more clearly than in the past the European dimension of deterrence.

In 1992, François Mitterrand spoke of the need for the Member States of the Union to tackle the nuclear issue together when the time came: “The debate on the defence of Europe raises unresolved problems that will have to be resolved. Only two Community countries possess nuclear weapons. Is it possible to devise a European doctrine? This question will very soon become one of the major questions in the construction of a common European defence”.¹⁶³ It was at this point that the expression “concerted deterrence” first appeared, a formula proposed at the time by Jacques Mellick, junior minister for Defence, among other possible options.¹⁶⁴

In 1994, the White Paper stated that there could be no European strategic autonomy without nuclear power. In 1995, the then Minister of Foreign Affairs, Alain Juppé, wondered in these terms: “Could the adoption of a single currency, a new Franco-German contract (...) have no effect on the perception of France by its vital interests? Should our generation be afraid to consider not shared deterrence but at least concerted deterrence with our major partners?”¹⁶⁵ It can hardly be denied that the progress of European integration has led almost inexorably to the emergence of common vital interests. And if the nuclear decision cannot be shared, the nuclear risk will be shared simply because of the considerable progress made in the construction of Europe over the last thirty years. France had thus declared itself ready from that moment to handle issues related to nuclear deterrence with its European partners, and “to introduce the collective dimension as a constituent factor of our doctrine”, including within the Atlantic Alliance.¹⁶⁶

These openings were conceived as the first step in a long-term process.¹⁶⁷ But progress in this area has remained very limited. The decision to dismantle the Hades system was taken after

¹⁶² The 2008 White Paper had opened a door by stating: “Participation in the Nuclear Planning Group poses a different problem [from that of participation in other integrated forums] given the complete independence of our nuclear capabilities. (...) France’s commitment to NATO has no a priori limits, as long as the independence of our nuclear forces, the freedom of appreciation of our authorities and the freedom to decide on the commitment of our forces are safeguarded” (White Paper on National Security and Defence, 2008, pp. 110-111). But Hollande was firmer in 2015 when he said: “France does not, and will not, participate in NATO’s nuclear planning mechanisms”. François Hollande, Discours sur la dissuasion nucléaire, déplacement auprès des Forces aériennes stratégiques, Istres, 19 February 2015. This may appear as a corollary to the French return to the military organisation: the maintenance of a strictly national deterrent makes it possible to create the image of a country which retains its full independence from the United States.

¹⁶³ Speech by François Mitterrand at the Rencontres nationales pour l’Europe, 10 January 1992.

¹⁶⁴ It defined it as follows: “it would consist for a nuclear power in maintaining its nuclear decision-making independence, while consulting its partners on the arrangements to be made for the application of nuclear fire”. Quoted in “M. Mellick énumère les différentes formules d’une doctrine nucléaire européenne”, *Le Monde*, 4 February 1992.

¹⁶⁵ Address by Alain Juppé, Minister of Foreign Affairs, on the occasion of the 20th anniversary of the CAP, Paris, 30 January 1995.

¹⁶⁶ Speech by Alain Juppé, Prime Minister, at the IHEDN, Paris, 7 September 1995.

¹⁶⁷ See Bruno Tertrais, *Nuclear Policies in Europe*, Adelphi Paper No. 327 (Oxford: Oxford University Press/IISS, 1999). The 1997-2002 Programming Act sets out the elements: “With our British partners, consultation and cooperation are underway. With Germany, an in-depth dialogue will be undertaken, respecting each other’s specificities. With the other

consultation with Germany.¹⁶⁸ French and British leaders recognised the existence of common vital interests and increased their cooperation (see below). The Franco-German Common Concept on Security and Defence adopted in December 1996 stated that “our countries are ready to engage in a dialogue on the function of nuclear deterrence in the context of European defence policy”.¹⁶⁹ But more than twenty-five years after François Mitterrand asked the question in 1992 (“How can we manage the difference in nuclear status within the European Union?”), and more than twenty years after the assertion of the 1994 White Paper (“No European autonomy without nuclear power”), this field remains largely fallow despite occasional French openings. France’s partners, with the notable exception of Poland, are hardly interested in the subject.

Nevertheless, France clearly considers that its deterrence plays a European role and protects the Union’s common interests, all the more so now that it is linked to its partners by a common defence clause (Lisbon Treaty).¹⁷⁰ Two main ideas appear. On the one hand, French deterrence, by its very existence, contributes to Europe’s security; in other words, a possible aggressor would do better to take this into account.¹⁷¹ On the other hand, an attack on a member country of the European Union could be considered by France as an attack on its own vital interests.¹⁷²

In 2020, President Macron affirmed more clearly than his predecessors the European dimension of French deterrence. He also invited again France’s partners – the EU was not mentioned – to a dialogue on nuclear deterrence, and even to participate in French nuclear exercises, with the goal of fostering the development of a common strategic culture:

Furthermore, our nuclear forces have a deterrent effect in themselves, particularly in Europe. They strengthen the security of Europe through their very existence and they have, in this sense, a truly European dimension. On that point, our independent decision-making is fully compatible with our unwavering solidarity with our European partners. Our commitment to their security and their defence is the natural expression of our ever-closer solidarity. Let’s be clear: France’s vital interests now have a European dimension. In this spirit, I would like strategic dialogue to develop with our

European countries, the potential implementation of a common defence as provided for by the Treaty on European Union calls for consultation”. Report attached to 1997-2002 Military Planning Law, 3 July 1996, *Journal officiel de la République française*, no 153, 3 July 1996, pp. 9985-10002.

¹⁶⁸ Speech by the President of the Republic, Jacques Chirac, at the *École militaire*, Paris, 2 February 1996.

¹⁶⁹ Common Franco-German concept on security and defence, adopted in Nuremberg on 9 December 1996.

¹⁷⁰ Theoretically, the new commitment of this clause concerns only non-NATO countries, since France is already engaged in the defence of its allies through Article V of the Washington Treaty. But this novelty is not insignificant, for example, in countries close (Sweden) or even close (Finland) to Russia.

¹⁷¹ “The development of the European Security and Defence Policy, the growing interweaving of the interests of the countries of the European Union and the solidarity that now exists between them make French nuclear deterrence, by its very existence, an essential element of the security of the European continent” (Jacques Chirac, 2006 speech); “As far as Europe is concerned, it is a fact that French nuclear forces, by their very existence, are a key element of its security. An aggressor who would consider calling Europe into question must be aware of this” (Nicolas Sarkozy, 2008 speech); “France’s deterrence capability contributes by its very existence to the security of the Atlantic Alliance and that of Europe” (2013 White Paper, p. 69).

¹⁷² “The President of the Republic has to assess, in a given situation, the damage that would be done to vital interests. This assessment would naturally take account of the growing solidarity of the countries of the European Union” (Jacques Chirac, 2001 speech); “France also has, with its European partners, a de facto and heartfelt solidarity. Who could believe that an aggression, which would jeopardize Europe’s survival, would have no consequences?” (François Hollande, 2015 speech).

European partners, which are ready for it, on the role played by France's nuclear deterrence in our collective security. European partners which are willing to walk that road can be associated with the exercises of French deterrence forces. This strategic dialogue and these exchanges will naturally contribute to developing a true strategic culture among Europeans.¹⁷³

Bilateral cooperation with allies

On the technical level, contrary to a popular belief, the French programme has never been a hundred % national one - indeed, this is the case for all the other States that have acquired nuclear weapons. Cooperation with our allies was envisaged from the outset: "Overall, we are sticking to the decision we have made: to build and, if necessary, to employ our own atomic force. This without, of course, refusing cooperation, whether technical or strategic, if it is desired by our allies on the other hand".¹⁷⁴

Bilateral cooperation enables the nuclear powers of the Alliance to mutually benefit from certain assets or know-how developed at the national level. For all that, the conception of the French weapons was always national. As one analyst pointed out about foreign inputs in the French deterrent programs: "although contributions from abroad are not inexistent, they are nevertheless too fragmentary, and therefore sibylline, to help the CEA in a very notable way in its research; from this constraint, French atomic research derives its essentially endogenous character".¹⁷⁵ Thus France has always maintained two skills that it considered necessary to the credibility of its deterrence, which distinguishes it from the United Kingdom, whose deterrence is partly integrated with that of the United States: national control of all the technologies and the related scientific and industrial tools essential to the constitution of forces (warheads, missiles, SSBNs, etc.¹⁷⁶); and total national independence with regard to the planning and decision on the use of its weapons.

*Franco-British cooperation*¹⁷⁷

London was, very early on, pragmatic about the possibilities for nuclear cooperation between the two countries. In 1963, the UK government officially proposed to France to share its nuclear know-how and went so far as to consider the establishment of a common plan of objectives; but, in exchange, London requested its admission to the European Community.

The history of nuclear cooperation between Paris and London goes back to the Second World War.¹⁷⁸ But it truly began with a curious episode: the contribution of an English researcher, Sir William Cook, to DAM's mastery of the thermonuclear formula in September 1967. While it would be wrong to say that the United Kingdom gave the H-bomb to France, the fact remains

¹⁷³ Speech of the President of the Republic on the Defense and Deterrence Strategy, Paris, War College, 7 February 2020

¹⁷⁴ Press Conference by General de Gaulle, Paris, 14 January 1963, in de Gaulle, *Discours et Messages* (IV), op. cit., p. 76.

¹⁷⁵ Po, op. cit., p. 99.

¹⁷⁶ When EADS was established in 1999, provisions were made to ensure that the design and manufacture of strategic missiles could continue to be subject to national control.

¹⁷⁷ See on this subject Bruno Tertrais, *Entente nucléaire. Options for UK-French Nuclear Cooperation*, Discussion Paper 3 of the BASIC Trident Commission, London, British-American Security Council, June 2012.

¹⁷⁸ See the contribution by John Baylis, in Jurgensen & Mongin (ed.), "France and Nuclear Deterrence – A Spirit of Resistance", *Recherches & Documents*, n°01/2020, Fondation pour la recherche stratégique, 2020.

that this contribution enabled the CEA to save time by moving towards one of the possible designs among others.¹⁷⁹

In the early 1970s, serious cooperation was envisaged by President Pompidou and the British Labour Government. But the latter stressed the need for France to participate in NATO's Nuclear Planning Group. There were then, during the decade, technical discussions between French and British soldiers on issues of mutual interest (exchange of experiences), but these never went very far.

From 1987 onwards, a joint airborne missile project, which would have been the successor to the French ASMP and the British WE-177 bomb (long-range air-to-ground project,), was seriously studied with the approval of the political authorities, especially as Margaret Thatcher was then questioning the sustainability of the American nuclear commitment in Europe; but the end of the Cold War quickly put an end to these discussions (the British decision not to renew the airborne component in 1993).

At the end of 1992, a Franco-British Joint Commission on Nuclear Policy and Doctrine was set up. It was made permanent in 1993. This commission was able to report on the convergences that existed between British doctrine and French doctrine, thus denying the idea of a specificity of French doctrine that would radically distinguish it from that of its US and UK partners.¹⁸⁰ It is designed as a forum for exchange, reflection and debate on nuclear issues of mutual interest to both sides, and a political framework for bilateral cooperation.

The Joint Commission was at the origin of the recognition in 1995, by the French and British leaders, of the existence of vital interests which are common to the two European nuclear powers. In a somewhat convoluted formulation, which preserves the freedom of action of the political authorities while showing strong mutual solidarity, Chirac and Major had indeed declared that they did not imagine “a situation in which the vital interests of one of our two countries, France and the United Kingdom, could be threatened without the vital interests of the other also being threatened” and decided to increase nuclear cooperation between the two countries.¹⁸¹ This statement – known as the “Chequers Formula” – has been confirmed and reiterated at other bilateral summits.

Since the end of the 1990s, there has also been a regular dialogue between the headquarters of the two countries on nuclear issues, and protected links have been established between Paris and London.

But cooperation between the two nuclear powers has made a real qualitative leap since 2010 and the signing of the Lancaster House treaties. These led, in particular, to the Teutates programme aimed at pooling, for financial reasons, the X-ray radiography programmes (intended for simulation) of the two countries. The Epure installation, located in Burgundy, has been operational since 2014. This is the first time that France has agreed to share an

¹⁷⁹ It was that of the engineer Bernard Carayol, which had been proposed in April 1967 but had received great scepticism. On this episode see Po, *op. cit.*, pp. 128-129; and Bendjebbar, *op. cit.*, pp. 376-378.

¹⁸⁰ See Malcolm Rifkind, Minister of Defence, speech at King's College, London, 16 November 1993.

¹⁸¹ Agence France-Presse, text of the joint Franco-British declaration on nuclear power, 30 October 1995.

essential instrument of its nuclear programme with another country - even if the experiments remain, of course, national and separate.

In his 2020 speech - the first French presidential speech since the Brexit referendum – President Macron reaffirmed the “Chequers” language and stated: “The high level of mutual trust, enshrined in the Lancaster House Treaties in 2010, the 10th anniversary of which we celebrate this year, is reflected in our daily and unprecedented cooperation on nuclear issues. We will steadfastly maintain this cooperation and Brexit will have no impact at all in this regard”.¹⁸²

*Franco-American cooperation*¹⁸³

The French nuclear programme had originally aroused the benevolence of the American administration. In 1954, then NATO Colonel Pierre-Marie Gallois was encouraged by the Commander-in-Chief of Allied Forces Europe, General Lauris Norstad, to brief General de Gaulle on the Alliance's nuclear strategy. The French military had been invited twice (1957 and 1959) to attend American test campaigns in Nevada. France had been able to acquire from the United States some sophisticated measuring instruments for its own tests (whose exports were not yet controlled), as well as a small stockpile of enriched uranium for research, until the Pierrelatte plant was operational. And French aeronautics manufacturers are asking their American colleagues about the most promising techniques for the production of ballistic missiles.¹⁸⁴

A more difficult period begins under Kennedy. An agreement in July 1961 enabled Paris, as a NATO ally likely to be equipped with American nuclear weapons, to benefit from certain knowledge enabling weapons to be used by French delivery systems.¹⁸⁵ It also provided that the use of American bases in France for nuclear strikes would be subject to the formal agreement of Paris.¹⁸⁶ A bilateral steering committee was set up in 1962.¹⁸⁷

But the US Administration was seeking to centralise nuclear decisionmaking mechanisms within the Alliance, and was concerned about proliferation. De Gaulle, for his part, wanted a totally independent deterrent force, and clearly expressed his intentions by withdrawing from NATO's integrated organisation in 1967. The 1961 agreement was suspended. The administration blocked the export to France of ballistic technology and inertial navigation systems. Kennedy would consent to the sale of Boeing KC-135 tankers, but only because American specialists believed that the Mirage-IV missions were doomed to failure.¹⁸⁸ As for

¹⁸² Speech of the President of the Republic on the Defense and Deterrence Strategy, Paris, War College, 7 February 2020.

¹⁸³ See on this topic Jeffrey Lewis and Bruno Tertrais, “Deterrence at Three”, *Survival*, vol. 57, no. 4, August-September 2015; and *ibid*, US-French Nuclear Cooperation: Its Past, Present and Future, *op. cit.*

¹⁸⁴ COMAERO, *op. cit.*, p. 77.

¹⁸⁵ Agreement Between the Government of the United States of America and the Government of the French Republic for Co-operation in the Operation of Atomic Weapons Systems for Mutual Defense Purposes, Paris, 27 July 1961. See Norris et al., *op. cit.*, p. 190.

¹⁸⁶ Memorandum for Mr McGeorge Bundy, White House, Subject: Check List of Presidential Actions, Top Secret, 28 July 1961.

¹⁸⁷ Éric Roussel, *Pompidou* (Paris: Jean-Claude Lattès, 1994), p. 352.

¹⁸⁸ Vincent Jauvert, *L'Amérique contre de Gaulle. Histoire secrète 1961-1969* (Paris: Éditions du Seuil, 2000), p. 54.

the sale of IBM and Control Data computers in 1964, it was authorized only because Washington feared reprisals against American companies in France in case of refusal.¹⁸⁹

The cooperation took off with the arrival of the Nixon-Kissinger team. The US leaders considered that, as the independent French force was a reality, it was in the United States' interest for it to be as effective and secure as possible, to the benefit of the Atlantic Alliance's overall deterrent posture. But Washington no doubt hoped in this way to learn more about the French practice of deterrence and make it dependent on the United States. As the French adage says: since these events are out of control, let's do as if we had been organizing them.

Nixon announced his intentions to de Gaulle at the beginning of 1969, and issued a directive authorising cooperation with France in May.¹⁹⁰ The subject was then discussed with Pompidou in February 1970.¹⁹¹ In 1971, White House guidelines authorized the sale of new IBM computers and the initiation of cooperation on surety.¹⁹² This cooperation, which was secret because it could contravene American law, was initiated in 1971. A first bilateral technical protocol for cooperation on missiles (Blancard-Foster agreements) is signed in July.¹⁹³ In parallel, a 1972 agreement initiated cooperation on nuclear safety and security. It will help France to achieve what is called "self-safety" the equivalent of "one-point safety") in 1976.¹⁹⁴

At the request of Paris, cooperation was broadened from 1975 onwards. The US President authorized assistance for underground testing.¹⁹⁵ French materials were tested in Nevada.¹⁹⁶ A 1978 agreement authorized the sale of new IBM Cray-1 supercomputers.¹⁹⁷ A cooperation on the benefits of lasers for the simulation of the operation of weapons was also initiated in 1978.

Cooperation in the field of ballistic missiles, including third stage technology, was then of particular interest to French engineers.¹⁹⁸ It would save Paris time in three areas, which are linked to each other: multiple warheads, miniaturization and hardening.¹⁹⁹ The United States also helped France to penetrate Soviet defences: it gave it information on these defences.²⁰⁰

¹⁸⁹ Ibid, p. 141.

¹⁹⁰ "Policy Towards Post-de Gaulle France", National Security Decision Memorandum (NSDM) 14, 29 May 1969; see also Jauvert, op. cit., pp. 180-181.

¹⁹¹ Pompidou suggested to Nixon that there was no need at this time to cooperate on targeting, because "our objectives correspond to objectives that you already cover", but that it could be possible as soon as France would have SSBNs and tactical nuclear weapons. Cité in Éric Roussel, Pompidou (Paris: Jean-Claude Lattès, 1994), p. 352.

¹⁹² "Military Cooperation With France", NSDM 103, 29 March 1971; "Cooperation with France on Nuclear Safety", NSDM 104, 29 March 1971.

¹⁹³ Norris et al., op. cit. p. 191; Pierre Mélandri, "Aux origines de la coopération nucléaire franco-américaine", in Vaïsse (ed.), La France et atome : études d'histoire nucléaire, op. cit. p. 243.

¹⁹⁴ Probability less than 10 to the power of 9, per weapon and per year, of releasing a nuclear energy greater than 1 kiloton in the event of an accident.

¹⁹⁵ "Cooperation With France", NSDM 299, 23 June 1975.

¹⁹⁶ National Security Council, "Memorandum for the Record: Meeting with Mr Conze of France", 25 November 1975.

¹⁹⁷ Norris et al, op. cit. at 192-193.

¹⁹⁸ Mélandri, op. cit., pp. 242-245.

¹⁹⁹ Norris et al, op. cit., p. 192; Valéry Giscard d'Estaing, Le Pouvoir et la Vie. Tome II : L'Affrontement (Paris : Hachette, 1992), p. 184.

²⁰⁰ Mélandri, op. cit., p. 245.

The cooperation generally took place in a particular way, initially suggested by Henry Kissinger, and which consisted, for Washington, not in giving technical formulas to Paris but in indicating, among the options envisaged by the French researchers, which ones would lead to nothing”.²⁰¹ Franco-American cooperation was formalised by a new global agreement in July 1985, which repeated certain terms of the agreement of 1961 and extended them.²⁰² It brought bilateral cooperation in line with US law. The separate agreement on lasers was renewed in 1988.

Cooperation between the two countries has never been one-way. For example, in the field of lasers, there have been technology transfers from France to the United States since the early 1970s. But from the 1980s onwards, in view of the progress made by France - whose technological choices were not always the same as those of the United States - cooperation really became mutual.²⁰³ A “two-way street”, according to the expression commonly used by the Americans.²⁰⁴ For example, during the Cold War, a French counter-expertise enabled the United States to correct a serious flaw in the design of one of its theatre weapons, which called its safety into question.

However, these very sensitive forms of cooperation have never included exchanges of warheads designs.

Bilateral agreements were updated again in 1994 and 1996 to take into account simulation programs.²⁰⁵ The Megajoule Laser facility (LMJ) and its American equivalent, the National Ignition Facility (NIF), were the subject of concerted studies and developments.²⁰⁶ The principles and achievements of supercomputers for simulation were also the subject of in-depth consultation.

There has also been, on several occasions, a very discreet cooperation between French and Americans (outside NATO) on issues relating to the targeting of nuclear forces and the possible coordination of their use if deterrence failed. The interest shown by both parties in such discussions in the 1970s is in any case historically attested. More precisely, according to some sources, France and the United States exchanged information about their target catalogues, but not about their detailed strike plans (priorities, firing sequences, etc.).²⁰⁷ One of François Mitterrand's advisers mentioned high-level discussions on these subjects.²⁰⁸

²⁰¹ Valéry Giscard d'Estaing, *Le Pouvoir et la vie*. Tome III: Choisir (Paris : Compagnie 12, 2006), p. 504. The former President of the Republic thus confirmed the revelations of the American academic Richard Ullman, who had referred to this method in a controversial article (“The Covert French Connection”, *Foreign Policy* No. 75, summer 1989).

²⁰² Amendment Modifying the Agreement Between the Government of the United States of America and the Government of the French Republic for Co-operation in the Operation of Atomic Weapons Systems to Provide for Co-operation on the Safety and Security of Nuclear Activities and Installations for Mutual Defense Purposes, Paris, 22 July 1985.

²⁰³ Norris et al., *op. cit.*, p. 193.

²⁰⁴ Following the publication of Richard Ullman’s article, the Ministry of Defense stated: “Technical information exchanges in the nuclear field are taking place, to the benefit of both parties, between France and the United States mainly in the fields of security and safety. Trade in these areas was the subject of an agreement between the two countries in 1961. This agreement was amended in 1985. The existence of these agreements is not secret. Although some of the work done within this framework is classified, it has not resulted in any transfer of concepts or designs”. (Ministry of Defence press release, 28 May 1989).

²⁰⁵ Memorandum of Agreement on Co-operation Concerning Nuclear Safety and Security, Washington, 4 June 1996.

²⁰⁶ The LMJ’s 4,000 glass amplifying plates were manufactured in a French-American facility built for the occasion.

²⁰⁷ See Ullman, *op. cit.*

²⁰⁸ Jacques Attali, *Verbatim II 1986-1988*, Paris, Fayard, 1995, p. 300; and written correspondence with the author, August 1995.

France has also maintained a regular and sustained strategic dialogue with the United States on nuclear policy issues since the early 1990s. The latter suffered somewhat for a time from the crisis in bilateral relations in 2002-2003, but then resumed under the Obama administration.

Paris, London, Washington: convergences and divergences of doctrine

Such bilateral cooperation is all the more legitimate because, contrary to a widespread idea, the French concept of nuclear deterrence is not so different from that of its allies.

It is little known that French doctrine, as developed in the 1960s, drew on British and American reflections and the experiences of some of the principal French strategists then stationed at NATO, the first of whom were colonels André Beaufre and Pierre-Marie Gallois. The latter were among the main architects of the strategy known as massive retaliation that was formalised in documents MC-48 (1954), MC-48/1 (1955), and MC-48/2 (1957). Gallois had also been particularly impressed by the British example, which had been the first posture from the weak to the strong fort. The expressions “unacceptable damage”, “sufficiency” and “non-employment”, traditionally associated with the French strategy, are in reality of American origin.²⁰⁹

The only real French conceptual innovations were the “detonator” theory (the idea that France was contributing to Allied deterrence by threatening to open nuclear fire first, cf. supra.), the Gaullist notion of all-azimut deterrence, and, most importantly, the idea of a single, non-renewable final warning. Emerging in the late 1970s, this concept was meant to be a compromise that avoided both the all-or-nothing impasse and the dilemmas of the flexible response.

The United States and the United Kingdom share with France the idea of a political conception of nuclear weapons, which should be a deterrent and not a weapon of battle. France has thus been able to agree on several occasions with its partners on a common understanding of nuclear deterrence, within the framework of the Alliance's Strategic Concepts.

Since the end of the Cold War, the three countries have reduced the role of nuclear weapons in their defence strategies. In 1995, they formally gave negative security assurances (commitments not to use nuclear weapons) to non-nuclear countries, but these remain conditional because of the risks of NBC proliferation. They therefore refuse to tie their hands in advance and do not want to adopt a non-employment posture first.²¹⁰ They consider that deterrence is not credible if one adheres to a doctrine of all-or-nothing use and have developed limited nuclear options (the “final warning” for France), which would aim to restore deterrence in the event of major aggression. The ultimate deterrent threat for them is based on the idea of unacceptable harm and must be aimed at the objectives to which the adversary attaches particular importance, without targeting civilian populations as such. Only the defence of vital interests is likely to be affected by deterrence.

²⁰⁹ See Tertrais, “Destruction assurée”, op. cit.

²¹⁰ In its public stance, however, the United Kingdom now emphasises the nuclear threat alone - considered sufficient to justify, in the eyes of the political world and public opinion, the modernisation of deterrence.

There are nevertheless some differences between the French conception of deterrence and that of its two allies:

- The United States and the United Kingdom have given an explicit nuclear guarantee (extended deterrence, or “nuclear umbrella”) to the member countries of the Atlantic Alliance; the use of their forces in this framework would be planned within NATO's integrated military structure. Basically, British deterrence is part of a collective system.
- The United States and the United Kingdom usually deter a limited NBC threat by the promise of a “devastating” or “proportionate” response, without specifying its nature; France, for its part, emphasizes that any such aggression would fall within the scope of nuclear deterrence, as long as it jeopardizes our vital interests.²¹¹
- The negative security assurances given by Washington and London were reinforced in 2010: both countries lifted some of their reservations and thus made a stronger commitment never to use nuclear weapons against a non-nuclear state that respects its non-proliferation obligations. The French language has always been less restrictive. (In 2018, the US Nuclear Posture Review brought US doctrine more or less back in line with the French one.)
- France explicitly places its deterrence within the framework of the natural right of self-defence, recognised by Article 51 of the United Nations Charter, something its allies do not: they prefer, vis-à-vis non-nuclear countries, to refer to the legal principle known as “belligerent reprisals”.
- The “nuclear warning” of French doctrine is by nature unique and non-renewable, whereas the Allies do not exclude, at least in theory, from carrying out other nuclear strikes to restore deterrence in the event of initial failure, before the exercise of unacceptable damage.²¹²

But both the British and French doctrines differ from the United States on a few points. For France and the United Kingdom, nuclear deterrence is the ultimate foundation of the country's security; in the United States, it is often conceived as part of a broader concept, which notably includes conventional deterrence and missile defences. The two European nuclear powers have adopted a logic of sufficiency (“minimum deterrence” for the United Kingdom) and do not see themselves in the logic of disarming or anti-force nuclear strikes. Moreover, the United States is still making, albeit less and less, a distinction between strategic and non-strategic forces; France and the United Kingdom, for their part, consider that all their nuclear forces are strategic, and that any use of nuclear weapons would be of a strategic

²¹¹ In 2006, France resorted to a similar rhetoric: “The leaders of States that would use terrorist means against us, just as those who would consider using, in one way or another, weapons of mass destruction, must understand that they are exposing themselves to a firm and adapted response on our part. And that answer can be conventional. It can also be of a different nature”, Address by Jacques Chirac, French President of the Republic, during his visit to the strategic air and ocean forces, Landivisiau – L’Île Longue (Brest), 19 January 2006.

²¹² A former Reagan administration official, Admiral Ron Lehman, called the final warning “the poor man’s graduated response” (personal source).

nature in that it would bring about a profound transformation in the nature of the conflict.²¹³

France and nuclear disarmament

France's nuclear disarmament policy is marked by a certain continuity. More than twenty years ago, Jacques Chirac stated that the problem of French participation in disarmament negotiations did not arise: "I do not think (...) that French participation in international negotiations on nuclear arms reduction is topical. Our deterrent capacity has been defined, in the new planning, at a strictly measured level to guarantee our security. The size of the strategic and tactical arsenals that remain for a long time in Russia and the United States remains disproportionate to that of French or British capabilities. There are also too many uncertainties about the future of parameters that are essential for our defence, such as the ABM Treaty, a guarantee of strategic stability, or respect for non-proliferation regimes".²¹⁴ He thus updated the "three conditions" set by President Mitterrand in 1983.²¹⁵

The uncertainties expressed by Chirac about the future of the Treaties seem to have been validated by the developments that have taken place since then. There is therefore little reason for France to participate in this process that, by the way, is lying dormant today.

The absence of French participation in these negotiations is also a corollary of the principle of sufficiency. The United States and the USSR have partly sized their arsenals in relation to each other, their nuclear forces targeting each other: the existence of a negotiated bilateral process is therefore deemed to have its own logic, to which the other nuclear powers are foreign. In terms of strategic analysis, the level of French nuclear forces is therefore not linked to that of the other nuclear powers.

One wonders, incidentally, what such future multilateral disarmament negotiations would be. Would they take into account the arsenals of nuclear powers not recognized by the NPT? And what would be the objective? Proportional reductions (in percentage) would be to the disadvantage of the smaller nuclear powers: in an unchanged context, they would bring them below the threshold of sufficiency or minimum deterrence (in addition to increasing, perhaps considerably, the unit cost of weapons). Conversely, reductions in the direction of equalization of arsenals would be unacceptable to the Great Powers, who would then see their nuclear status lowered to the same level as the others.

Admittedly, by ratifying the NPT, France has legally submitted itself to the nuclear disarmament obligation contained in article VI of the Treaty. But Paris likes to recall that Article VI is a whole, and connects nuclear disarmament to general and complete disarmament.²¹⁶ As a result, the then Prime Minister could state in 1998 that "until general

²¹³ For the British, this development was publicly announced in 2006: "Any possible use of nuclear weapons would necessarily be strategic" (Des Brown, Secretary of State for Defence, reference 108795, Hansard, 18 December 2006, column 1485W). See also: "Our nuclear weapons are also not designed or made for military use during conflict. In this regard, we have deliberately chosen to no longer use the term 'substrategic Trident', which we previously used to describe the possible limited use of our weapons". Des Brown, Speech at King's College, London, 25 January 2007.

²¹⁴ Speech by the President of the Republic, Jacques Chirac, at the IHEDN, Paris, 8 June 1996.

²¹⁵ They were: a considerable narrowing of the gap between the American and Soviet arsenals and the French arsenal; a correction of conventional imbalances in Europe and elimination of chemical weapons; the cessation of overbidding in the areas of anti-missile defences, anti-satellite weapons and anti-submarine warfare.

²¹⁶ "Each Party to the Treaty undertakes to pursue negotiations in good faith on measures relating to cessation of the

and complete disarmament is achieved, nuclear weapons will remain a necessity”.²¹⁷ For France to consider further significant reductions, at a minimum, the disproportion between its arsenal and that of the United States and Russia would have to change in nature. This caution was reiterated by the then President of the Republic in 2006: “We will only be able to make progress towards disarmament if the conditions of our global security are maintained and if the will to progress is unanimously shared”.²¹⁸ In 2015, François Hollande declared: “I therefore share the ultimate objective of the total elimination of nuclear weapons, but I add: when the strategic context permits it”.²¹⁹ In 2020, Emmanuel Macron reaffirmed France’s cautious approach and made it clear that the country vigorously opposed the Nuclear Ban Treaty, on strategic and ethical grounds:

Yet I do not believe that the choice is between a moral absolute with no link to strategic realities, and a cynical return to a lawless power struggle. I will not fall into the trap of this false choice, which destabilizes the international security architecture and does not live up to France’s ambitions for peace, multilateralism and law. We have no choice but to accept that we live in an imperfect world and to realistically and honestly face the problems which this brings. I cannot therefore set France the moral objective of disarming our democracies while other powers, or even dictatorships, would be maintaining or developing their nuclear weapons. For a nuclear-weapon State like France, unilateral nuclear disarmament would be akin to exposing ourselves as well as our partners to violence and blackmail, or depending on others to keep us safe. I refuse this prospect. And let us not be naïve: even if France, whose arsenal cannot be in any ways compared to that of the United States and Russia, were to give up its weapons, the other nuclear powers would not follow suit. Similarly, France will not sign any treaty on the prohibition of nuclear weapons. The Treaty will not create any new obligations for France, either for the State or for public or private actors on its territory.²²⁰

Moreover, France considers that it has made a major contribution to the implementation of article VI through the unilateral disarmament measures to which it has consented since 1989, by adjusting its level of sufficiency to changes in the strategic context. The S45 ground-to-ground missile project was abandoned in 1991, and the next-generation SSBN programme was reduced from six to four (1992). The Hades programme was capped at 30 missiles (compared with 120 initially planned), and the Hades Force was placed on technical operational watch (VTO) in 1991, before being dismantled in 1996. France also reduced its nuclear forces in service: reduction of the number of Mirage 2000N squadrons from five to

nuclear arms race at an early date and to general and complete disarmament under strict and effective international control”. (Treaty on the Non-Proliferation of Nuclear Weapons, Article VI).

²¹⁷ Speech by Prime Minister Lionel Jospin at IHEDN, Paris, 3 September 1998.

²¹⁸ Address by Jacques Chirac, President of the French Republic, during his visit to the strategic air and ocean forces, Landivisiau – L’Île Longue (Brest), 19 January 2006.

²¹⁹ François Hollande, Discours sur la dissuasion nucléaire, déplacement auprès des Forces aériennes stratégiques, Istres, 19 February 2015. He added: “If the levels of other arsenals, notably Russian and American, were one day to fall to a few hundred, France would draw consequences, as it has always done. But we are still far from that today.” This statement should not be read as an expression of a mechanical relationship between the level of the arsenals of the Great Ones and that of the French arsenal, but rather as suggesting that such a reduction by Russia and the United States could only occur following a positive transformation of the strategic context.

²²⁰ Speech of the President of the Republic on the Defense and Deterrence Strategy, Paris, War College, 7 February 2020

three (1989), early withdrawal of the AN52 bombs (1991), reduction from six to five SSBNs (1992), early withdrawal of the Pluton missiles (1993). Further reductions took place in 1996: reduction from five to four SSBNs, end of the the Mirage IVP's nuclear mission, and withdrawal of the S3D and Hades missiles, France becoming the first country to have developed ground-to-ground missiles to completely renounce them. Finally, in 2008, France announced a one-third reduction (one of three squadrons eliminated) in its strategic air forces. Its stockpile has been halved from the Cold War maximum. Alert levels were reduced twice (1992 and 1996), and nuclear forces de-targeted (1997). Finally, in 1996, it was decided to dismantle the Pacific Testing Centre and the fissile material for explosive purposes production facilities.²²¹ It should be noted that between 1990 and 2005, the nuclear budget was halved, and its share in the equipment budget had been reduced from over 30 % to about 20 %.

France also contributes to the “general and complete” disarmament envisaged by Article VI through its assistance to the countries of the former USSR and its action in favour of conventional disarmament (including anti-personnel mines or small arms).

Finally, because it has adopted a logic of sufficiency, constantly adjusting its arsenal to the lowest possible level compatible with the strategic context, it considers itself less concerned by disarmament requirements than the United States and Russia, whose arsenals are, in its view, “oversized”.

France and nuclear non-proliferation

France had kept itself out of the NPT when it came into force in 1970, believing at the time that it reflected the will of the Great powers to establish a condominium over world affairs, as well as that of the United States to control the European civilian nuclear industry. If it has not always been a model pupil in the field of nuclear non-proliferation, but it was also the case, after all, for many other Western countries, including the United States, France has, however, ensured since 1976 (creation of the Foreign Nuclear Policy Council, CPNE, renamed in 2008 the Nuclear Policy Council), that the risks associated with its nuclear technology exports were kept to a minimum.

Then, with the end of the Cold War and the manifestation of new proliferation risks, illustrated by the Gulf War (the discovery of the scale of the Iraqi nuclear programme, 1991), its position hardened.

It is now proactive, and marked, one would say, by a dual approach, both legal (importance of international law, and therefore of the distinction between States that are party to the NPT and those that are not) and pragmatic (case-by-case examination of export authorizations and requests for nuclear cooperation).

France successively ratified the NPT (1992), the protocols to the treaties of Tlatelolco (1992), Pelindaba (1996) and Rarotonga (1996) establishing nuclear-weapon-free zones, reaffirmed the negative security assurances it gave to non-nuclear States and gave positive security assurances for the first time (1995). It was the first nuclear power to propose, in August 1995, that the CTBT be based on the “zero option” (a total ban on low-energy tests), conducted its

²²¹ The production of weapons-grade plutonium ceased in late 1992 and that of highly enriched uranium in 1996.

last test on 27 January 1996, and was the first nuclear power, together with the United Kingdom, to ratify the CTBT (1998). It is the only nuclear power to have decided to dismantle its nuclear testing centre and fissile material production facilities.²²² Therefore, it considers that its stocks of fissile materials are “sufficient” and that it does not have any in excess. In order to promote the prompt negotiation on a treaty banning the production of fissile material for explosive purposes, it proposed a draft treaty in the spring of 2015.

Involved, since 2003, together with its European allies, in the discussions with Iran about its nuclear programme, it has made the settlement of this crisis a diplomatic priority because of its stakes: the security of France, its allies and many of its partners in the Middle East; the future of non-proliferation; and Europe's strategic credibility.

France considers that its contribution to the nuclear disarmament of the former USSR is also non-proliferation: it is about preventing materials, even weapons, from falling into the wrong hands. It actively participates in sensitive international export control bodies.

A global action plan proposed by France in 2008 included (1) ratification by all of the CTBT, (2) verifiable dismantling of testing sites, (3) launching negotiations on a FMCT, (4) a moratorium on the production of fissile material for weapons, (5) the adoption of transparency measures on arsenals, (6) the opening of negotiations on the prohibition of short-range missiles, (7) the universalization of the Hague Code of Conduct against Ballistic Missile Proliferation.

France considers that it is a model in terms of transparency. Having opened its testing site for an international visit in 1983, it has organised numerous visits to disused sites (Pierrelatte and Marcoule factories in 2008 and 2020, Luxeuil base, plateau d’Albion) for diplomats and NGOs, and visits its operational bases to allied delegations. It has repeatedly demonstrated transparency on its capabilities, without equivalent among the other nuclear powers (Mitterrand's speech in 1994), and by making public the total number of its nuclear weapons.²²³

²²² The dismantling of the Pacific Testing Centre was completed in 1998. Plutonium production was stopped in 1992, highly enriched uranium in 1996.

²²³ Only the United Kingdom, since 2010, has also communicated the exact size of its arsenal. Since 2010, the United States has declared the number of its weapons operational or in reserve, but not weapons awaiting dismantling.

CHAPTER IV: FRENCH NUCLEAR FORCES

The current format

The disappearance of the Soviet threat made it possible for France to eliminate, in 1996, the ground-launched component of deterrence (plateau d'Albion), whose mission was in particular to be able to respond without delay to a surprise nuclear attack. France now has only two complementary components, airborne and sea-based, each with its own characteristics. This is the translation of an old adage telling that you should not “put all your eggs in the same basket” and a guarantee against any operational or technological surprise. The existence of two components offers additional flexibility in planning and operations, and also opens the possibility of managing a limited crisis with one, while keeping the other in second line to ward off any surprise.

There is, strictly speaking, no “first” or “second” component. Both can participate in different types of employment plans, as part of the ultimate warning or the exercise of unacceptable damage.

Dual-capable forces (which can fulfil conventional or nuclear missions) assigned to nuclear deterrence may be used for out-of-area operations only with the agreement of the President of the Republic.²²⁴ Deterrent missions can mobilise up to two SSNs, four ASW frigates, mine warfare assets, maritime patrol aircraft, air refuelling aircraft.²²⁵

The sea-based component

Since the end of 1996, the Strategic Oceanic Force (FOST), based in L'Île Longue, with its operational centre in Brest and some 2,400 personnel, has had four ballistic missile submarines (SSBN), each with 16 launch tubes – four new generation SSBNs (S616 Le Triomphant, S617 Le Téméraire, S618 Le Vigilant, S619 Le Terrible). Le Triomphant and Le Téméraire carry the M51.2 missile, Le Terrible and Le Vigilant are equipped with the M51.1 missile.²²⁶

There are always three SSBNs in the operational cycle (which is the case when it holds a batch of missiles), and a fourth that is periodically unavailable for maintenance and repair (major overhaul every ten years). French SSBN patrols last approximately 70 days. Two crews (Red and Blue) take turns to ensure maximum availability. Their concept of use is based on the principle of dilution. The French SSBNs seek to be as discreet as possible, even if it means being isolated (whereas other nuclear powers have an employment concept based more on the bastion principle). Patrol departures and returns are protected by the surface fleet and

²²⁴ White Paper on Defence and National Security, 2013, p. 76.

²²⁵ White Paper on Defence and National Security, 2008, pp. 172-173.

²²⁶ The SSBNs currently in service were admitted to active service on 21 July 1997 (Le Triomphant), 23 December 1999 (Le Téméraire), 26 November 2004 (Le Vigilant) and 20 September 2010 (Le Terrible) respectively.

nuclear attack submarines, based in Toulon.²²⁷ The Admiral Commanding FOST (ALFOST) has authority over both SSBN and SSN squadrons.

Two operational SSBNs would probably be sufficient to give the capacity to exert unacceptable damage against a major power in all circumstances; but it would be impossible for France to be satisfied with a global format of three SSBNs. The fourth is indeed necessary to maintain a minimum second strike capability at sea (one or two SSBNs), which is deemed essential to the credibility of deterrence. With only three ships in the fleet, it would not be possible to guarantee FOST's invulnerability, since the permanence at sea of an SSBN under good conditions of dilution (guaranteeing its invulnerability) would no longer be possible.²²⁸ This would be, to use a French expression, a "dotted deterrent".²²⁹ The fourth ship also provides insurance against a possible "act of God" affecting a vessel on patrol (see the fortuitous incident of 2009, the collision between a British SSBN and a French SSBN).

The M51 ballistic missile has a much greater maximum range than its predecessor the M45. This range has not been made public, and, in any case, cannot be summarized by one single figure: it varies according to the payload (number of weapons, etc.), as for every missile.²³⁰ In addition, its M51.2 version has a longer range than the M51.1.²³¹ Indeed, the re-entry vehicles of the new TNO warheads are designed for a range greater than what was permitted by the previous TN75. Some sources mention "more than 9,000 kilometres".²³² The M51.2 is, in any case, intercontinental, a real instrument of "all-azimuths" deterrence. With a speed of up to Mach 20 (seven kilometres per second), it could reach the far reaches of Asia in about thirty minutes.

The M51 carries decoys and penetration aids that allow it to penetrate foreseeable defenses. It has an autonomous in-flight re-alignment capability (celestial navigation), giving it greater accuracy than the M45.²³³ It is optimized for the oceanic nuclear warhead (TNO), which is larger and heavier than the TN75.²³⁴

The French missiles are evolutionary: M45 took up part of the architecture of M4; M51 takes up part of the architecture of the M45. There will be no "M6" or "M52", but a M51.3, to be followed by a M51.4.

²²⁷ France currently has six Rubis-class SSNs, which are considered to be just sufficient to carry out all the missions entrusted to them, with an availability rate of 66%. The SSN/SSBN ratio is 3.7 in the United States, 2.7 in the United Kingdom and only 1.5 in France. TTU (Very Urgent), "How many nuclear submarines?", in Supplement to No. 607, 6 December 2006, p. 3.

²²⁸ In addition, the presidential guidelines require France to maintain, if necessary, two SSBNs at sea at all times, which would not be possible in a three SSBN format, since only two would be in the operational cycle.

²²⁹ Yves Boiffin in Pierre Pascallon and Henri Paris (eds.), *La Dissuasion nucléaire française en question(s)* (Paris: L'Harmattan, 2006), p. 196.

²³⁰ Boiffin in Pascallon and Paris, *op. cit.*, p. 296.

²³¹ Yves Boiffin, "La loi de programmation militaire 2003-2008: adapter les forces nucléaires", *Les Cahiers de Mars*, no 178, 3^e trimestre 2003, p. 122.

²³² Jean Dupont, "Dissuasion: le M51 commence ses essais", *Air et Cosmos*, 17 November 2006.

²³³ Boiffin, *op. cit.*, p. 123.

²³⁴ "Notification du M51-2", TTU (Très Très Très Urgent), no 611, 10 January 2007, p. 7. TNO would weigh 230 kilos, compared to 115 kilos for TN75 (Jane's Strategic Weapons Systems, "M-5/M-51", 23 June 2006).

Each M51.1 missile carry up to six TN75 weapons, each with a yield of 100 kilotons.²³⁵ The M51.2 carries an unspecified number of TNOs. The number of weapons has been reduced on some of the missiles to allow more flexibility in planning. For the same reason, at-sea targeting has been made possible.²³⁶

FOST's alert stage ranges from a few days to a few hours.²³⁷ The permanence at sea responds to many concerns. It is a question of principle and of guaranteeing the motivation, and therefore the performance, of the staff (cf. supra). In the particular case of FOST, it is also a question of avoiding, if the SSBN were to set sail only in times of crisis, that it would be vulnerable in the face of an adversary who would have mobilised means to neutralise it; that the departure of the ship would be perceived as an escalation signal; or that the personnel would be subjected to external influences.²³⁸ Moreover, Russia's experience shows that it is very difficult to "return to CASD" once it has been abandoned. These principles are particularly relevant for a medium power such as France, which has only one SSBN base and three operational SSBNs.

- The sea-based component has two major assets, which make it indispensable. The SSBN guarantees a massive strike capacity even in second, because of its very low vulnerability and the large number of weapons carried.
- The ballistic missile allows to reach very quickly and with a quasi-certainty any target on an enemy territory, even at very great distance.

This component is, in the final analysis, the one that ensures that France will be able to survive in all circumstances. But it is also suitable for more limited planning, for example on regional powers.²³⁹

The airborne component

The Strategic Air Forces (FAS), whose command is located in Villacoublay, and the operational centre in Taverny, comprise two Rafale squadrons, i.e. a total of about 40 aircraft. These aircraft can be deployed on three nuclear bases (Saint-Dizier, Istres, Avord). The FAS also have a fleet of 14 Boeing tankers (11 C-135FR with the French standard, and 3 KC-135 with the American standard of origin), now gradually replaced by new-generation tankers.²⁴⁰ KC-135s are also used for transmissions.

²³⁵ Hearing of Admiral Charles-Edouard de Coriolis, Committee on National Defence and Armed Forces, National Assembly, 16 April 2014, p. 8.

²³⁶ Hearing of General (2S) Henri Bentegeat, Committee on National Defence and Armed Forces, National Assembly, 9 April 2014, p. 4.

²³⁷ Hearing of Admiral Charles-Édouard de Coriolis, Committee on National Defence and Armed Forces, National Assembly, 16 April 2014, p. 8.

²³⁸ Hearing of Admiral Bernard Rogel, Committee on National Defence and Armed Forces, National Assembly, 16 April 2014, p. 7.

²³⁹ General Henri Bentegeat in Rapport d'information fait au nom de la Commission des affaires étrangères, de la défense et des forces armées sur le rôle de la dissuasion nucléaire française aujourd'hui, by Serge Vinçon, Senator, no 36, 24 October 2006, p. 29.

²⁴⁰ Three air bases have been adapted for ASMPA storage (K buildings): Saint-Dizier, Istres and Avord.

A flotilla embarked by the aircraft carrier Charles de Gaulle, i.e. about ten Rafale Marine, constitutes the Nuclear Naval Air Force (FANu), which would be generated by presidential decision. The value of this onboard component, which only France has, is not slight.²⁴¹ First, it has a natural capacity for demonstration: the deployment of the carrier group near a crisis zone materialises France's desire to defend its vital interests. Then, the FANu is free from certain constraints related to the flight profile (defended zones, etc.). Its contribution to planning can be surprise, saturation or diversification of penetration routes. In the absence of a second aircraft carrier, it is not permanently available and is generated only by presidential decision.

French nuclear air forces are versatile: they have participated in many conventional missions since the end of the Cold War. The Mirage 2000N contributed to NATO's first offensive mission in 1994 in Croatia (bombing of Ubdina). In Libya (2011) and Mali (2013), Rafale from FAS were solicited. The intensive FAS training, which includes full-scale "Poker" exercises four times a year, allows this component to be particularly effective for long distance raids, even at short notice.

The maximum range of the bombers depends on a large number of parameters: speed (fuel consumption), number of refuellings, trajectory (avoidance of certain territories), flight profile (high or low altitude), location of the base on return, etc. The upper limit (12-13 hours) depends on technical parameters (oil, oxygen, etc.). In April 2014, the FAS demonstrated their ability to conduct very long distance raids during an exercise leading two aircraft to La Reunion (8,800 kilometers, 10 h 35 flight, five refuellings).

These aircraft carry the improved medium-range air-to-ground missile (ASMPA), a highly supersonic ramjet missile equipped with a TNA (airborne nuclear warhead) weapon. The ASMPA is not a radically new system, but rather, as its name implies, an evolution of the previous one (the ASMP), which has been modified to adapt to the threat (ability to carry out manoeuvres allowing the missile to penetrate modern anti-aircraft defences) and to give a greater margin of safety to the pilot. Thus the propulsion and aerodynamic assembly has been redesigned. The ASMP had been designed at the end of the 1970s, for a flight profile in Eastern Europe and a penetration of the defences of the Warsaw Pact. The ASMPA has a "more than doubled" range in trajectory at high altitude (thus higher than 600 kilometres), and the same precision at maximum range as the ASMP at minimum range; hence a notable gain in terms of effectiveness against anti-aircraft defences and safety for the pilot.²⁴² It is equipped with a new generation inertial power unit and an autonomous in-flight re-alignment capability.

The number of ASMPAs does not necessarily equal the total number of aircraft that can carry the missile. And the "54 delivery systems" announced by François Hollande in 2015 naturally include assets intended for tests.²⁴³

Like the seaborne component, the airborne component has specific advantages.

²⁴¹ FANu would use FAS weapons, but it is part of the Naval Action Force, whose commander (ALFAN) is therefore, strictly speaking, a nuclear force commander.

²⁴² Strategic Air Force 40th Anniversary Review, 2004, p. 77.

²⁴³ Ibid; and Boiffin, "La loi de programmation militaire 2003-2008", op. cit., p. 123.

The first one is accuracy, which is much better today than that of the sea-based ballistic component. That is the reason why, if it can participate in the full-spectrum of nuclear missions, it is particularly valuable either for the exercise of the warning or for a limited and tailored planning.²⁴⁴ The Chief of the Defence Staff said in 2006 that the accuracy of the airborne component “is such that it can effectively destroy all the centres of power [of a regional power], with very limited collateral damage, unlike the sea-based ballistic weapon that does not have the same precision”.²⁴⁵ In 2014, the French authorities referred to “targeted strategic effects” or “adaptable effects”.²⁴⁶ The FAS commander added that this advantage also made it possible to threaten “highly hardened” objectives.²⁴⁷

Its other assets are its penetration mode (supersonic aerobic) which complicates the task of opposing defences; its visibility, permanently on the national territory and in particular in the event of an increase in the alert level (movements, manoeuvres, etc.); its flexibility of planning (number of strikes, yield/accuracy); its ability to conduct a limited fire without risk of misunderstanding by the adversary as to the nature of the nuclear strike, nor of compromising the second strike capability²⁴⁸; and the ultimate possibility of a recall of the aircraft if the deterrent threat has played its role.

These characteristics allow the airborne component to open, “in case of necessity, a space for a politico-military manoeuvre”.²⁴⁹

This contribution is obtained for a development cost essentially limited to the sole missile: the carriers are indeed dual-capable, and the TNA which entered service in 2009 is based on the design tested during the final campaign of 1995-1996, also used for the TNO.

It is sometimes argued that the United Kingdom has abandoned its air component and France could do the same. But the British example is not applicable. The UK has great flexibility with its sea-based component due to the high accuracy of the US Trident-2 missile. Moreover, British deterrence is, fundamentally, part of a multilateral arrangement. There is, within NATO's integrated posture, a complementary component (allied DCA) on which NATO's limited strike capability is essentially based. And if part of the British assets were unavailable for a nuclear strike within NATO, these could be compensated by other assets (US SLBMs, allied DCA).

FAS

Squadron 1/4 Gascogne

BA 113 Saint-Dizier ~20-25 Rafale B

Squadron 2/4 La Fayette

BA 113 Saint-Dizier ~20-25 Rafale B

²⁴⁴ A launcher becomes a missile when it is equipped with a warhead.

²⁴⁵ “It contributes strongly, by decision of the President of the Republic, to the exercise of targeted strategic effects, or to an ultimate warning strike”. Jean-Yves Le Drian, Closing speech for the 50th anniversary of DAM, 20 November 2014.

²⁴⁶ General Henri Bentegeat in Rapport d'information fait au nom de la Commission des affaires étrangères, de la défense et des forces armées sur le rôle de la dissuasion nucléaire française aujourd'hui, par Serge Vinçon, Senator, no 36, 24 October 2006, p. 29.

²⁴⁷ General Patrick Charaix, hearing before the Committee on National Defence and Armed Forces, National Assembly, 15 April 2014, p. 5.

²⁴⁸ In a crisis involving major power, a limited SLBM strike could potentially run the risk of the SSBN being spotted by opposing forces.

²⁴⁹ Jean-Yves Le Drian, Closing speech for the 50th anniversary of deterrence, 20 November 2014.

Squadron Sologne

BA 125 Istres 11 C-135FR, 3 KC-135

Units that may constitute the FANu

Flotilla La Furieuse 11F

BAN Landivisiau 8 Rafale F3 single-seater

Flotilla La Douzeff 12F

BAN Landivisiau 16 Rafale F3 single-seater

The future of French nuclear forces

The maximum life duration of a new-generation SSBN is about 35 years, so the first ship in the new series will need to be ready for use by the end of the *Triomphant's* life, around 2032. The 14 C- and KC-135 tankers are now being replaced by 15 modified Phenix Airbus A330 (Multi Role Transport Tanker, MRTT) with much higher refuelling capacities than the C135. This will allow the airborne component to fully exploit its potential in terms of geographical extension.

Timeline of French nuclear modernization

2020	Replacement of the last batch of M51.1 missiles by a batch of M51.2 missiles Third axis of Epure machine enters service Construction of first third-generation SSBN begins Completion of Transoum transmission programme
2021	Mid-life renovation of ASMPA launched Launch of ASN4G programme Exa-1.1 computer enters service
2022	First renovated ASMPA enters service Epure machine becomes fully operational Launch of M51.4 missile programme Design of future nuclear warheads launched
2023	Syderec-2 system enters service Third-generation SSBN begins construction Exa-1.2 computer enters service
2025	First M51.3 missile enters service First TNO-2 warhead enters service Completion of Transaero transmission programme
2026	Delivery of last Phenix MRTT refuelling aircraft Decommissioning last C135/delivery last Phenix MRTT
2027	Exa-10 computer enters service
2032?	Decommissioning <i>Le Triomphant</i> /commissioning first SN3G
2033	First third-generation SSBN enters service?
2035	First ASN4G missile enters service New generation warhead enters service?
2048?	<i>Fourth third generation SSBN enters service</i> Decommissioning <i>Le Terrible</i> /commissioning fourth SN3G

Warheads and the simulation program

Nuclear weapons are designed and manufactured by the CEA's Directorate of Military Applications (DAM) in its Bruyères-le-Châtel (basic physics), Le Barp (weapons design), Le Ripault (pyrotechnics, re-entry vehicles) and Valduc (weapons manufacturing) centres.

In the absence of “hot” nuclear tests and of production of fissile material for explosive purposes, the sustainability of French nuclear deterrent is now to a large extent carried out in a closed circuit.²⁵⁰ A simulation program, a major new technological challenge of deterrence and a key element of its sustainability, was launched in 1996. The bet launched at the time - it was a real leap into the unknown - by the CEA is now considered unanimously won. France is thus the first country, and, as it seems, the only one up to now, that is capable of guaranteeing the operation of a thermonuclear weapon by simulation alone. For example, the Barp facilities have been used for TNO validation as early as 2004.

Conceived to refine the design of “robust” warheads, guarantee the reliability and safety of weapons in the long run and maintain the expertise necessary for the sustainability of the arsenal, the program has three components: weapons physics, digital simulation and experimental validation. It relies in particular on:

- The use of supercomputers operating in so-called massively parallel architecture, in particular a 100 teraflops computer delivered by Bull, to model the weapons’ operating behaviour.
- Subcritical experiments (no release of nuclear energy) using the Laser Megajoule (LMJ), installed at Le Barp (Gironde). It is a facility for inertial confinement nuclear fusion experiments, under extreme temperature and pressure conditions, using 176 laser beams directed at balls a few millimetres in diameter, containing a cryogenic mixture of deuterium and tritium. The LMJ has been operational since 2014.
- Experiments conducted on the architecture of weapons and the behaviour of materials, photographed in three dimensions by the AIRIX machine (induction accelerator for X-ray imaging) installed in Moronvilliers, then now the British-French Epure machine, installed in Valduc (Burgundy), whose first photographs were delivered in 2014.

Without nuclear testing, it would not be possible to develop safe and reliable weapons based on entirely new designs. Thus, successive French officials were able to affirm that there was

²⁵⁰ Plutonium production was stopped in 1992, highly enriched uranium in 1996. Existing stocks are considered sufficient to ensure the sustainability of deterrence.

no question of developing “new families” (2008 White Paper) or “new types” of nuclear weapons (2015 presidential speech).

The TNA and TNO are weapons stemming from the concept of “robust” design, validated during several tests conducted during the final campaign of 1995-1996. These weapons are less sensitive, for their reliability and safety, to variations in parameters resulting, for example, from the ageing of certain materials or components. This robustness (the engineers also speak of “forgiving” weapons) implies a more important weight and size.

French nuclear forces, 1990-2020

1990	2005	2015	2020
18 SSBS S3D (TN61) Pluton (AN51)			
Mirage-IVP/ASMP (TN81) Mirage-III (AN52) Jaguar (AN52) Super-Étendard (AN52)	3 sq. Mirage 2000N/ASMP (TN81) 1 fl. Super- Étendard/ASMP (TN81)	1 sq. Rafale-Air/ASMPA (TNA) 1 sq. Mirage 2000N/ASMP (TN81) 1 fl. Rafale Marine/ASMPA (TNA)	2 sq. Rafale-Air/ASMPA (TNA) 1 fl. Rafale Marine/ASMPA (TNA)
2 SNLE/M20 (1 TN61) 4 SNLE/M4 (6 TN71)	1 SNLE/M4 (6 TN71) 3 SNG/M45 (TN75)	2 SNG/M45 (TN75) 2 SNG/M51.1 (TN75)	1 SNG/M51.1 (TN75) 3 SNG/M51.2 (TNO)

The total number of French nuclear weapons since 2008 is “less than 300”. This figure includes a small number of weapons for maintenance and ageing monitoring. As France has 54 ASMPA delivery systems (including for testing, which happens yearly) and 48 ballistic missiles, with a reduced number of weapons on some of them, one can deduce that about 80-90% of these weapons are intended for ballistic missiles and 10-20% for airborne missiles.

The adaptation of weapons systems has been the subject of political decisions at the highest level, but the details of these adaptations have not been made public. France has expanded the range of its nuclear planning options, both in terms of accuracy and yield of weapons.²⁵¹ However, it has “limited down” the energy of its weapons to make it clear that it does not intend to consider them as battle weapons, or “in such a way that no one ever forgets that nuclear weapons are, in essence, different”.²⁵² As one nuclear forces official pointed out, the French concept “is not to descend to the level of surgical strikes”, especially since “it would make no sense to imagine that there will be zero death from a nuclear strike, except in certain particular cases of ultimate warning where the number of victims could be kept to a

²⁵¹ The TN80 and TN81 warheads equipping the ASMP were designed to destroy Warsaw Pact air bases (Po, op, cit., p. 172). It is possible to modify the yield of existing weapons in several ways, by adjusting the quantity of materials in the primary or secondary stages, without changing the warhead design.

²⁵² General Henri Bentegeat in Rapport d’information fait au nom de la Commission des affaires étrangères, de la défense et des forces armées sur le rôle de la dissuasion nucléaire française aujourd’hui, par Serge Vinçon, Senator, no 36, 24 October 2006, p. 25. The then President of the Republic said in 1995 to justify his position on the zero option in the field of testing: “Small weapons are excessively dangerous because one can be tempted to use them more easily than large weapons. This is the reason why this new generation of weapons, small ones which require small tests that some want, in France or elsewhere, are very dangerous. The position I took in June was that France would not accept a new generation of weapons, all the more dangerous as they are small and it might be tempting to use them”. Interview with Jacques Chirac, President of the French Republic, on TF1 on 10 September 1995.

minimum”.²⁵³ The accuracy of French weapon systems is deemed to be consistent with the French concept of deterrence. It is generally considered to be inferior to that of its conventional weapons systems. Improving accuracy has a dual purpose: it allows, if necessary, to fire the missile from further away (range and precision being an inseparable couple); it allows a possible yield reduction (precision and yield also being inseparable), and thus a limitation of collateral damage.²⁵⁴

The aim of such adaptations is to ensure that the exercise of deterrence will be credible in the eyes of the adversary in all scenarios, whatever the objectives and political circumstances (cf. supra). For example, a foreign leader might bet that a president of the Republic would not dare to carry out mass destruction in response to an attack. If it was a smaller country, it would not fail to present itself as the “weaker party” and perhaps expect a reaction from the international community leading to inhibit the French decision-making process. Beyond that, it is the President of the Republic himself who must be convinced at all times to have the means to exercise a credible threat adapted to the stakes, in order to ensure his freedom of political and military action. All the testimonies agree that the preservation of this freedom of action is considered essential by the national authorities, whatever their political colour.

Nevertheless, the foundations of French deterrence remain unchanged.

Management and use of nuclear forces

All decisions relating to the deployment and use of nuclear forces are taken or must be explicitly approved by the political authorities, following very specific procedures subject to what is called “government control”. Under the responsibility of the Prime Minister, this covers three areas: the control of the integrity of the means (until 2009 it was the sole “control of the situation of the materials”); the control of the engagement (i.e. the correct routing of the firing order), which is the responsibility of the Minister of Defence; and the control of the conformity of the use (which consists in verifying that it is indeed the approved plans that are executed), which is the responsibility of the CEMA. A general officer, the Nuclear Weapons Inspector, under the authority of the President of the Republic, is responsible for ensuring the relevance and proper execution of these controls by the relevant authorities. The robustness of the control procedures is conferred by the existence of two independent chains: an implementation chain and a security chain, in which the Nuclear Weapons Security Gendarmerie (GSAN, a special unit under the direct orders of the Minister of Defence) plays a major role. There is also a nuclear safety control procedure under the responsibility of the Defence Nuclear Safety Delegate on behalf of the Minister of Defence.

The use of forces is the subject of plans submitted to the President of the Republic for approval. The tools available to Western nuclear powers today allow such planning to be carried out only in times of crisis, if necessary. The President of the Republic also decides on the alert stage of the nuclear forces. The 2008 White Paper specified that “the level of

²⁵³ Boiffin, in Pascallon and Paris, op. cit. pp. 195-198.

²⁵⁴ However, there are potential targets for which it is useful to have both significant yield and good precision (e.g. hard targets with a small footprint).

responsiveness of these capabilities adapts to the circumstances and commitment plans decided by the President of the Republic”.²⁵⁵

Since 1996, the CEMA has been the sole military planning and employment authority. Nuclear force commanders, for their part, are responsible for Operational Readiness Training of assets and monitoring of mission execution from the Brest (COFOST) and Taverny (COFAS) operational centres.²⁵⁶

The order of engagement would be routed directly and without human intervention from the President of the Republic to the nuclear forces. In concrete terms, the order could be given from the Jupiter PC located at the Elysée, retransmitted by the RAMSES (réseau amont maillé stratégique et de survie, or strategic and survival upstream meshed network) network supported by the RETIAIRE system. Transmission stations (La Régine, Sainte-Assise, Rosnay) acting in the very low frequency range would relay the order to the SSBNs. If the infrastructure networks were not available, it would be retransmitted by a backup system called SYDEREC (système de dernier reCours or Last Resort System), based on captive balloons.

All French nuclear weapons are equipped with a government control box (BCG) that prohibits their use without an order from the President of the Republic or his legitimate successor, the only authority issuing the government code that allows this prohibition to be lifted. This unlock code is both an employment authorization and a security mechanism. The execution of the firing order involves, at the end of the chain, at least two persons (on SSBNs, the commander and his second-in-command; on bombers, the pilot and the navigator).²⁵⁷ No military authority knows the whole chain of codes that assigns a code to a weapon and a target.

If the President of the Republic is unavailable, procedures for the devolution of the employment authority, which are kept secret, have been provided for. It is common knowledge that the Prime Minister is the first “devolutionary authority”.

²⁵⁵ White Paper on Defence and National Security, 2008, p. 169.

²⁵⁶ Alternate command posts exist at Mont-Verdun, near Lyon.

²⁵⁷ The FANu (single-seat bombers) is subject to special procedures.

CHAPTER V: CHALLENGES AND SCENARIOS FOR THE FUTURE

Domestic challenges

For the future, one can mention some challenges that the French deterrent will have to address in order to ensure its sustainability and adaptation to the new environment.

France will have to maintain a base of technical and human resources enabling deterrence to retain the flexibility and responsiveness necessary to deal with any changes in the strategic context.

This will require maintaining the long-term scientific, technical, industrial and operational skills needed to sustain deterrence, while budgets and orders are reduced, production cycles staggered and modernization programs limited. The example of the United Kingdom shows that the loss of skills in submarine design and manufacture, for example, can happen quickly. Nuclear deterrence involves systems of great complexity - that of an SSBN is equalled only by that of the space shuttle - produced in very small numbers and with a very long lifespan.

It will therefore be necessary to constantly ensure that the skills of the CEA and the main companies concerned (cf. supra), as well as their subcontractors (several hundred companies), are maintained. This is essential to ensuring that nuclear forces can evolve, notably if the strategic context changes. This is not about the sole sustainability of the deterrent. Some civilian activities will undoubtedly suffer from this loss of skills, as the techniques and know-how are common to both areas.

Future programs include:

- the construction, notably to ensure the penetration of future defence systems, of successors to the M51.2 (M51.3 and M51.4), notably to take into account the evolution of missile defenses, and to the ASMPA (ASN4G for fourth-generation nuclear air-to-ground missile, which will be both hypersonic and stealthy, in proportions to be determined by 2025);
- the design and construction of third-generation SSBNs, which will enter service in the late 2030s and whose tonnage will be - in a logic of sufficiency and lower cost - very close to that of current submarines, for they will carry a missile derived from the M51;
- the design of future nuclear warheads, at the end of the life of current weapons, i.e. during the 2030 decade.

Among the avenues that could be explored in the future, as appropriate, are improving the performance of current weapon systems: range, accuracy, stealth, agility, ability to penetrate resistant environments; the development of new types of carriers (e.g. mixed ballistic/aerobic propulsion systems; long-range armed drones, etc.); and modulating the effects of weapons, based on existing formulae.

Intelligence, analysis, warning and detection resources represent an area in which investment will be particularly important. Of course, one thinks of the ability to locate missile launches (Europe today relies heavily on NATO capabilities), but other fields are concerned: for example, technically, the ability to determine the precise origin of a fissile material (to deal with the extreme hypothesis of state nuclear terrorism), or, intellectually, the understanding of the political operating methods of powers endowed with weapons of mass destruction.

French political authorities will also have to ensure that the consensus on deterrence is maintained. As we have seen, this one is not immediately in danger. Despite the intentions of some politicians, this is an area that does not lend itself to U-turns. France has experienced a generational change since 2007: the men and women who now hold the highest positions of responsibility did not experience the Second World War, and sometimes even began their careers after the end of the Cold War. For them, the imperative of maintaining deterrence may not have been self-evident. Yet they have fully endorsed the Fifth Republic's nuclear legacy. However, the financial weight of deterrence in the defence budget, which will increase in the coming years, could affect the legitimacy of military nuclear spending among elites and public opinion.

Maintaining a nuclear deterrence culture in the defence community is another challenge. In a field already highly confidential in nature, whose work is often covered by classification levels to which only a tiny minority of civilian and military personnel have access, the dissemination of knowledge is now made problematic because of the considerable reduction in the number of people who need to know it. The army, for example, has been completely disengaged from nuclear affairs since 1996, although, naturally, a small number of its officers have to deal with these cases because of the joint nature of their functions. This does not facilitate the consideration, in crisis management, of a potential nuclear dimension: crisis management and nuclear deterrence are still two too often separate spheres.²⁵⁸

France may also need to adjust its approach to deterrence. As mentioned above, no other country has associated the terms “deterrence”, “retaliation” and “nuclear” to this point. Yet, as already suggested in the 1972 and 1994 White Papers, nuclear weapons do not have a monopoly on deterrence. The inclusion of the French concept in an overall concept of deterrence, which would also integrate conventional operations and means of interdiction (including anti-missile defences), remains to be achieved in the contemporary context.

Sharing deterrence?

Last but not least, France may need to prepare to place its nuclear deterrent more firmly in the European and allied context.

If the leaders of the two countries recognized the identity of French and British vital interests, the idea of a joint force based on a total of only six SSBNs (three per country) could then take shape, with patrol coordination and, perhaps, mutual protection of the national SSBNs by the other nation's SSNs. But it would be a real strategic break for both Paris and London – and an unlikely one after Brexit.

²⁵⁸ In a crisis where vital interests could be called into question, the junction between these two domains would only take place at the level of the Chief of Defence Staff.

If the US protection to Europe appeared less assured, France could consider moving closer to transatlantic nuclear bodies, even if only as an observer, without losing its independence in this field.²⁵⁹ And to participate more directly in joint deterrence by deploying, on an intermittent basis, FAS aircraft on allied bases, including on the territory of the most Eastern countries of the Alliance in order to demonstrate its solidarity, or even to assign part of the airborne component to the Atlantic Alliance (for example, one of the two FAS squadrons), with the aim of demonstrating France's solidarity towards its NATO partners.²⁶⁰ Of course, it will nevertheless give the priority to the national planning of the use of these assets.

In the event of withdrawal of US B61 from Europe, could France replace this capacity by proposing to the allies to carry French ASMPA? This appears unlikely.²⁶¹ The sustainability of the US nuclear presence in Europe seems assured; there is more uncertainty about the maintenance of the nuclear capacity of the Allies's aviation in the long run, both for financial and political reasons.

European political and monetary union is a reality, and a mutual defence clause has been inserted in the Lisbon Treaty. Has France really drawn all the conclusions for its nuclear deterrence? Would it be absurd for Paris to transpose the so-called Chequers logic (1995) to the European scale by affirming that we do not conceive of a situation in which the vital interests of another European country of the Union are called into question without our own being called into question, as Prime Minister Georges Pompidou already said in 1964?²⁶² Emmanuel Macron took a step in that direction in 2020, but only cautiously (see above).

It would in any case be fully unrealistic to imagine that a European federation of a few States, including France, with a unique political executive, might be created in a foreseeable future, In such a case (at least, France, Germany and the three Benelux countries would probably have been part of it), the issue of the pooling of the French deterrent might have been raised. On the contrary, the sharing of the decision to use it would not have been discussed, since one assumes in this scenario that there would be a unified executive.

Force reductions?

In the face of a structurally large budget deficit and public debt, and the existing needs in the field of conventional military forces, voices are often raised calling for a reduction in nuclear deterrence appropriations. It will be very difficult to cut this budget without severely undermining the credibility of this deterrent as it is designed today.

²⁵⁹ Contrary to its name, the Nuclear Planning Group does not do nuclear planning; it is more of a nuclear policy group (doctrine, principles of operation and consultation, security, etc.).

²⁶⁰ The hypothesis had been imagined in 1996, when France was planning to resume its place in military institutions. President Macron confirmed France's non-participation to the NPG in his 7 February speech.

²⁶¹ The European countries carrying US weapons are still pondering the durability of the nuclear role of their aviation when it comes to the modernization of their aircraft, which must take place in the years to come.

²⁶² "By taking this attitude, we are at the same time helping to guarantee Europe to a large extent. (...) By the mere fact that France is in Europe, its strength fully and automatically plays to Europe's advantage, whose defence is inseparable physically and geographically from its own". Speech to the National Assembly, 2 December 1964.

Let us assume, however, that Emmanuel Macron or one of his successors asked his advisers whether it is possible to reduce the current programmes in order to save money. What could they reply?

Perhaps the stockpile of nuclear weapons could be reduced if the President determined that the strategic context allowed for a reduction in the level of sufficiency (depending on the evolution of the threat, but also of missile defences), or simply if the President felt that one could “deter with less”, that is, if he made a very different judgment (something which would be his absolute right) from his predecessors on the notion of unacceptable damage. What do we know, for example, of what will be considered unacceptable by the future leaders of powers likely to threaten Europe's interests?

A reduction in the number of SSBNs, for the reasons explained above, is not possible if one wishes to maintain the permanence of at least one ship at sea - a principle which is considered in France to be consubstantial with the very notion of deterrence (cf. *supra*). The only realistic possibility of reducing the number of SSBNs without jeopardizing CASD would be to pool British and French sea-based forces. But, as said above, this would require the simultaneous recognition by London and Paris of an absolute coincidence of the vital interests of the two countries.

What about the airborne component? The financial arguments in favour of its dismantlement are not convincing. The ASMPA is derived from the ASMP, and the TNA warhead is based on the same design as the TNO. Because it was recently modernized, this component represents only 5% of the cost of deterrence between 2015 and 2025 and is fully dual-use.²⁶³

As for the strategic arguments, the logic according to which “Britain has done it, so we can do it” is hardly relevant. London has a more efficient sea-based component than France (accuracy of the US Trident-2 D5 missile).²⁶⁴ Furthermore, British deterrence is part of NATO arrangements, which include a “second component” (DCA equipped with US B-61 bombs), on which NATO's limited strike capability is essentially based. And if part of British assets were unavailable for a nuclear strike in the framework of NATO, these could be compensated by other assets (US SSBNs, DCA). It is for these reasons that the United Kingdom was able to choose to abandon the airborne component. These conditions are not applicable to France.

Also, even if this argument is secondary, the removal of the airborne component would close the door to some future options for operational nuclear cooperation in a European or transatlantic framework.

Finally, could the budget of the simulation program and the schedule of experiments be reduced? There would then be a price to pay, at least in terms of the degree of assurance given to the political authorities in terms of the reliability and safety of weapons.

²⁶³ Jean-Yves Le Drian, Closing speech for the 50th anniversary of DAM, 20 November 2014.

²⁶⁴ Trident missiles are “infinitely more accurate than our ballistic missiles”. General Henri Bentegeat in Rapport d'information fait au nom de la Commission des affaires étrangères, de la défense et des forces armées sur le rôle de la dissuasion nucléaire française aujourd'hui, par M. Serge Vinçon, Senator, no 36, 24 October 2006, p. 24.

APPENDIX I:

The Defense and National Security Review of 2017 (excerpts)²⁶⁵

Nuclear deterrence remains the cornerstone of our defence strategy. It protects us from any aggression against our vital interests emanating from a state, wherever it may come from and whatever form it may take. It rules out any threat of blackmail that might paralyze its freedom of decision and action. Our deterrent is strictly defensive. The use of nuclear weapons would be conceivable only in extreme circumstances of legitimate self-defence, a right enshrined in the UN Charter. In this respect, nuclear deterrence is the ultimate guarantee of the security, protection and independence of the Nation.

By its existence, it contributes to the security of the Atlantic Alliance and that of Europe.

Nuclear deterrence is embedded in the more global framework of the defence and national security strategy, which takes into account the entire spectrum of threats, including those considered to be under the threshold of our vital interests.

Nuclear deterrence will remain based on the permanent posture of its airborne and seaborne components, which are indivisible and complementary. Both contribute to all deterrence missions. Thanks to their performance, adaptability and characteristics, they will remain a credible instrument in the long term, while being structured in accordance with the principle of strict sufficiency. Upon discontinuing nuclear testing, France invested in simulation systems that ensure the safety and reliability of its nuclear weapons.

We must continue the necessary adaptation of our deterrence capabilities, in response to changes in the strategic environment, to shifting threats and changes in areas such as air defence, missile defence, and undersea detection. This implies renewing the two components and sustaining our nuclear warheads.

These two components, which boost our whole defence system and ensure the freedom of action of our forces, are supported by a range of conventional capabilities, thereby offering a broad range of strategic options. Several assets that contribute to deterrence may be deployed in conventional operations.

Furthermore, due to its requirements in terms of effectiveness, reliability, and safety, nuclear deterrence sustains our research and development efforts and contributes to the excellence and competitiveness of our defence industry. It is also a driving force for our technological skills.

Maintaining our deterrent over the long term is essential, as multiple powers are developing their nuclear forces, and as some of them use these for power demonstration, intimidation, or even blackmailing purposes.

²⁶⁵ Defence and National Security Strategic Review, 2017, pp. 69-70 (official translation).

APPENDIX 2:

Speech by Emmanuel Macron on defense and deterrence, 7 February 2020 (Excerpts)²⁶⁶

As I am responsible before the nation for the security of our country and its future, it is my responsibility to protect France and its people from a State threat against our vital interests, wherever it comes from and in whatever form.

Every day, I take on this ultimate responsibility, which is at the core of the duties of President, with the strongest determination. It is carried out through nuclear deterrence. Like the transparency and the trust we owe to the international community, which is part of our responsibilities as a “nuclear-weapon State” under the NPT, exercising deterrence requires a strictly defensive, clear and predictable doctrine, the main foundations of which I am recalling here today.

Should the leader of any State underestimate France’s deep-rooted attachment to its freedom and consider threatening our vital interests, whatever they may be, that leader must realize that our nuclear forces are capable of inflicting absolutely unacceptable damages upon that State’s centres of power: its political, economic and military nerve centres.

Our nuclear forces have been configured to that purpose with the required flexibility and responsiveness. Should there be any misunderstanding about France’s determination to protect its vital interests, a unique and one-time-only nuclear warning could be issued to the aggressor State to clearly demonstrate that the nature of the conflict has changed and to re-establish deterrence.

Within this framework, France draws on a daily basis on the two components of its nuclear forces, which are complementary. I have taken and will continue to take the decisions necessary to maintain their long-term operational credibility at the level of strict sufficiency required by the international environment.

(..)

In this regard, our defence strategy is a coherent whole: conventional and nuclear forces constantly support each other there. Once our vital interests could be under threat, the conventional military manoeuvre can be part of exercising deterrence. The presence of strong conventional forces thus helps to prevent a strategic surprise, the quick creation of a fait accompli or to test the adversary’s determination as soon as possible by forcing it to reveal de facto its true intentions. With this strategy, our nuclear deterrence force remains, as a last resort, the key to our security and the guardian of our vital interests. Now, like in the past, it ensures our independence, our freedom to assess, make decisions and take action. It prevents adversaries from betting on escalation, intimidation and blackmailing to achieve their ends.

Nuclear deterrence has played a fundamental role in maintaining peace and international security, particularly in Europe. I am firmly convinced that our deterrence strategy maintains

²⁶⁶ www.elysee.fr (official translation)

all of its stabilizing virtues, a particularly valuable asset in the world which we see before us, one of competition between powers, disinhibited behaviours and the erosion of norms. The fundamental purpose of France's nuclear strategy, the doctrinal bases of which I have just set out, is to prevent war.

Our nuclear forces are not directed towards any specific country and France has always refused that nuclear weapons be considered as battlefield weapons. I hereby reaffirm that France will never engage into a nuclear battle or any forms of graduated response.

Furthermore, our nuclear forces have a deterrent effect in themselves, particularly in Europe. They strengthen the security of Europe through their very existence and they have, in this sense, a truly European dimension.

On that point, our independent decision-making is fully compatible with our unwavering solidarity with our European partners. Our commitment to their security and their defence is the natural expression of our ever-closer solidarity. Let's be clear: France's vital interests now have a European dimension.

In this spirit, I would like strategic dialogue to develop with our European partners, which are ready for it, on the role played by France's nuclear deterrence in our collective security.

European partners which are willing to walk that road can be associated with the exercises of French deterrence forces. This strategic dialogue and these exchanges will naturally contribute to developing a true strategic culture among Europeans.

Our nuclear forces also significantly contribute to the overall strengthening of the Atlantic Alliance's overall deterrent, alongside the British and American forces. France does not take part in the Alliance's nuclear planning mechanisms and will not do so in the future. But it will continue to contribute to political-level discussions aiming to strengthen the Alliance's nuclear culture.

Since 1995, France and the United Kingdom, Europe's only nuclear powers, have clearly stated that they can imagine no circumstances under which a threat to the vital interests of one would not constitute a threat to the vital interests of the other.

I want today to formally reiterate that assessment. The high level of mutual trust, enshrined in the Lancaster House Treaties in 2010, the 10th anniversary of which we celebrate this year, is reflected in our daily and unprecedented cooperation on nuclear issues. We will steadfastly maintain this cooperation and Brexit will have no impact at all in this regard.

(..)

Before I finish, I would like to take a few more moments to discuss the meaning of deterrence strategy in today's world.

First of all, we must acknowledge that there is a long-standing ethical debate about nuclear weapons, which is not new, and to which Pope Francis very recently contributed during his visit to Hiroshima.

There is also a legal and strategic debate: in the face of a degraded international environment, some, including in Europe, have recently engaged in a prohibitionist approach, largely based on an absolute imperative and simple strategic reasoning: to eliminate fear, to eliminate war, we must simply eliminate nuclear weapons!

I profoundly respect the opinions which have been voiced. But France, a nuclear-weapon State, which is responsible for international peace and security, only partly shares this vision of the realities of our world. I would like to present my vision of the balances on which the Non-Proliferation Treaty is based and of the ethical reasoning which should be applied to maintain peace.

The ultimate goal of the complete elimination of nuclear weapons as part of general and complete disarmament is indeed enshrined in the preamble of the NPT. But given the realities of our world, progress towards this goal can only be gradual, and based on a realistic perception of the strategic context.

Since there is no means of quickly eliminating nuclear weapons from our world, the advocates of abolition have attacked the legitimacy of nuclear deterrence – and have especially done so, before anywhere else, where it is easiest, that is to say in our European democracies.

Yet I do not believe that the choice is between a moral absolute with no link to strategic realities, and a cynical return to a lawless power struggle.

I will not fall into the trap of this false choice, which destabilizes the international security architecture and does not live up to France's ambitions for peace, multilateralism and law.

My responsibility is to keep our country safe, in compliance with its international commitments, particularly those of the NPT.

This does not mean, however, that France is disregarding ethical issues relating to nuclear weapons. Democracies must examine the purposes of their nuclear deterrence policy, which raises moral dilemmas and paradoxes.

To do this, we must view deterrence in all its dimensions, which means placing it in a broader political framework in relation to our vision of the world order.

In 1945, nuclear weapons brought humanity into a new era, by providing it with the means to destroy itself and thus making it realize that we all share a single destiny. Their spread was limited in 1968 by the Treaty on the Non-Proliferation of Nuclear Weapons which was – so to say - a snapshot of the nuclear world of the time, noting that there were five nuclear-weapon States, and since then, with a small number of exceptions, it has been complied with. Possessing nuclear weapons places a historically unprecedented moral responsibility on the leaders of those countries. When it comes to France, I fully shoulder this responsibility.

We have no choice but to accept that we live in an imperfect world and to realistically and honestly face the problems which this brings.

I cannot therefore set France the moral objective of disarming our democracies while other powers, or even dictatorships, would be maintaining or developing their nuclear weapons.

For a nuclear-weapon State like France, unilateral nuclear disarmament would be akin to exposing ourselves as well as our partners to violence and blackmail, or depending on others to keep us safe.

I refuse this prospect. And let us not be naïve: even if France, whose arsenal cannot be in any ways compared to that of the United States and Russia, were to give up its weapons, the other nuclear powers would not follow suit.

Similarly, France will not sign any treaty on the prohibition of nuclear weapons. The Treaty will not create any new obligations for France, either for the State or for public or private actors on its territory.

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In fact, disarmament only has meaning if it is part of a historical process to limit violence.

The deterrence strategy is actually contributing to this, even paradoxically. In deterrence as practised by France, it is the very possibility of unacceptable harm to a potential adversary which, even with no threat issued, limits the effective violence. We must recognize, however, that this rationality of deterrence is not enough to ensure peace, in the fullest sense of the term, that is to say a situation in which violence is not simply inhibited but rather in which there is true cooperation and harmony between all parties.

Our goal must be to work to set up a different international order, with effective global governance which can set up and enforce law. This goal to transform the international order is not just an ideal – from now on, it sets out a political and strategic path which must enable us to make concrete progress. To do this, it is essential to limit the role of deterrence to extreme circumstances of self-defence. Nuclear weapons must not be designed as tools of intimidation, coercion or destabilization. They must remain instruments of deterrence, with the objective of preventing war. France's nuclear doctrine strictly adheres to this framework. I call on the leaders of the other nuclear powers to show the same transparency in their doctrine of deterrence and to stop any attempts to exploit this strategy for the purposes of coercion or intimidation.