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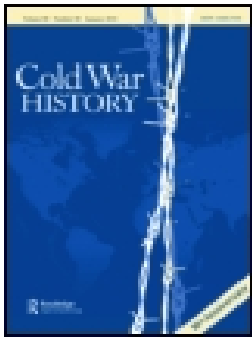
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Unfit for purpose: reassessing the development and deployment of French nuclear weapons (1956–1974)

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ABSTRACT

This article presents the first reassessment of the strategic rationality and credibility of French nuclear weapons policy before 1974. Building on untapped primary material from across the world as well as technical analysis, it shows that early Cold War French nuclear weapon procurement and deployment are incompatible with a precise grand design and the requirements of strategic rationality. The first generation of French nuclear forces also lacked technical credibility, despite reliance on outside help. Several French officials knew about it, as did their allies and adversaries. These findings de-exceptionalise French nuclear history and challenge conventional wisdom about Cold War nuclear history.

KEYWORDS

France; nuclear weapons; strategy; credibility; nuclear deterrence

Nuclear weapons programmes were a major factor in Cold War rivalries and alliances.¹ Understanding these programmes, their drivers, capabilities, effects, and how they were perceived is therefore an absolutely crucial part of the history of the Cold War. The French nuclear weapons programme is no exception; it was an element in the East-West military rivalry and a major issue in the politics of the Western Alliance.

This article revisits strategic, political, and technical aspects of the French nuclear weapons programme in light of new primary material declassified worldwide and new technical analysis. In particular, it provides a reassessment of the development and deployment of the first generation of French nuclear weapons from 1956 to 1974. Through this reassessment, it makes two arguments that have important implications for the scholarly understanding of the French nuclear weapons programme and beyond. First, the programme development did not follow any articulated strategic rationale, nor was it consistent with a Gaullist ‘grand strategy’. Second, contrary to what was claimed at the time, and continues to be claimed to this day, the French *force de frappe* was neither independent nor a credible deterrent force until 1974 at the earliest. By then, France’s third strategic ballistic missile submarine had entered service, providing the possibility of a continued presence at sea and a survivable retaliatory capability, French Pluton tactical nuclear missiles were replacing US *Honest John* rockets, and the North

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¹Odd Arne Westad, “The Cold War and the International History of the Twentieth Century”, 3 and David Holloway, “Nuclear Weapons and the Escalation of the Cold War,” 376 in *Cambridge History of the Cold War*, ed. Melvyn Leffler and Odd Arne Westad, vol. 1 (Cambridge: Cambridge University Press, 2010) and Westad, *The Cold War: A World History* (New York: Basic Books, 2017), 1, 3.

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Atlantic Treaty Organization (NATO) had acknowledged the contribution of French nuclear forces to the deterrent effort of the alliance.² The implications of this established, yet understudied, fact are addressed in this article.

As we engage with these arguments, we provide evidence that also challenges other established claims in French nuclear history, Cold War history, and security studies. First, evidence challenges the common periodisation which defines France as a 'nuclear weapon state' from 1960 (the year of the first nuclear test) or 1964 (the year of the first nuclear weapon deployment) through most of the Cold War.³ Instead, we argue that the lack of technical credibility of deployed nuclear weapon systems for most of the 1956–74 period challenges the very notion of what makes a state a nuclear weapon state, and what can be leveraged from this status. We support this argument through a technical analysis of the systems in question, in particular the Mirage IV nuclear bomber, and by showing that no relevant ally or adversary believed French nuclear threats were credible. Together, these findings make the claim that France's ability to challenge the Cold War order was grounded on its independent *force de frappe* hardly sustainable.⁴ Finally, regarding French nuclear history in particular, we find that both the programme's drivers and the nuclear posture France adopted have so far been mischaracterised. Claims that the search for security drove the procurement of French nuclear weapons appear to be at best incomplete or incapable of explaining the actual choices that were made.⁵ If one had to infer a French force posture and a doctrine from the analysis we present, it would not be an asymmetric escalation posture, as often claimed in the existing literature, but a catalytic posture.⁶ These findings add France to the long list of countries (the United States, the Soviet Union/Russia, the United Kingdom, India, and Pakistan) for which strategic rationality does not account for nuclear weapons procurement and deployment dynamics.⁷

²Marc Theleri, *Introduction à la force de frappe française* (Paris: Stock, 1997), 328; the authors of "Histoire de l'artillerie nucléaire de terre française 1959–1996," *Cahiers d'études et de recherches du musée de l'armée*, hors série n°7 (2013) claim 1 May, 250 and Marcel Duval and Yves Le Baut write about August 1974, *L'arme nucléaire française pourquoi et comment?* (Paris: SPM, 1992), 72. Mid-1974 is an important date too, from the perspective of this article, because it is the only time that a *Chef d'Etat Major*, General Maurin, used the notion of 'target' in a press conference and briefly moved beyond lyrical nuclear discourse. Theleri, *Introduction à la force de frappe française*, 10.

³John Lewis Gaddis, *The Cold War* (London: Allen Lane), 139–40; Gino Raymond, *Historical Dictionary of France*, 2nd ed. (Plymouth: Scarecrow Press, 2008), 97. Some historians have classified France as a 'nuclear' power from 1964: Frédéric Bozo, "France, 'Gaullism', and the Cold War," 158–78 and Francis J. Gavin, "Nuclear Proliferation and Non-Proliferation during the Cold War," 395–416 in Melvyn Leffler and Odd Arne Westad, eds., *The Cambridge History of the Cold War: Volume II, Crises and Détente* (Cambridge: Cambridge University Press, 2010).

⁴Bozo, "France, 'Gaullism', and the Cold War," 165; Westad, *The Cold War*, 277; Timothy Sayles, *Enduring Alliance: A History of NATO and the Post-War Global Order* (Ithaca: Cornell University Press, 2019), 184.

⁵Alexander Debs and Nuno Monteiro, *Nuclear Politics: The Strategic Causes of Proliferation* (Cambridge: Cambridge University Press, 2017), 431, 436; Vipin Narang, *Nuclear Strategy in the Modern Era* (Princeton: Princeton University Press, 2014), chap. 2.

⁶For claims of an asymmetric escalation posture, see Narang, *Nuclear Strategy in the Modern Era*, 163–9 and Avery Goldstein, *Deterrence and Security in the 21st Century: China, Britain and France and the Enduring Legacy of the Nuclear Revolution* (Stanford: Stanford University Press, 2000), 200.

⁷For instance, during the Cold War, US presidential discourse about nuclear weapons, the associated nuclear doctrines, and the targeting policies never coincided except at the time of the Schlesinger doctrine in 1974: Georges Le Guelte, *Les armes nucléaires: Mythes et réalités* (Arles: Actes Sud, 2009), 164, 79; Francis Gavin, "The Myth of Flexible Response: Unites States Strategy in Europe in the 1960s," *International History Review* 23 no. 4: (2001), 847–75; David Allan Rosenberg, "The Origins of Overkill: Nuclear Weapons and American Strategy 1945–1960," *International Security* 7, no. 4 (1983), 3–71; Lynn Eden, "The U.S. Nuclear Arsenal and Zero: Sizing and Planning for Use – Past, Present, and Future," in Catherine Kelleher and Judith Reppy, eds., *Getting to Zero: The Path to Nuclear Disarmament* (Stanford: Stanford University Press, 2011). In the case of the United Kingdom, Matthew Jones and Richard Moore have established similar inconsistencies. See Jones' *The Official History of the UK Strategic Nuclear Deterrent* (London: Routledge, 2018) and Moore's *Nuclear Illusion, Nuclear Reality: Britain, the United States and Nuclear Weapons 1958–1964* (Basingstoke: Palgrave, 2010). India and Pakistan also started to think about operational planning only after the 1998 tests. Lawrence Freedman and Jeffrey Michaels, *The Evolution of Nuclear Strategy* (Basingstoke: Palgrave, 2019), 591–6.

Methodologically, this revision of French nuclear history confirms that the so-called ‘existential deterrence bias’ of nuclear scholarship, which assumes that nuclear weapons do deter without assessing relevant evidence, exists beyond security studies.⁸ The article concludes by inviting further investigation into the domestic effects of nuclear weapons programmes and the production and perpetuation of a triumphalist narrative.⁹

This article addresses these interpretive challenges based on untapped primary sources from France, the United Kingdom, the Soviet Union, and the United States, international coverage of *the force de frappe*, interviews with former French nuclear weapons officials, and the latest scholarship and memoirs published in French.

From France, it relies on primary sources about what de Gaulle said or thought about nuclear weapons, on diplomatic documents published by historian Maurice Vaisse in recent years, on 1300 pages of oral history interviews conducted with key participants in the French nuclear weapons programme by Admiral Marcel Duval, with the help of Dominique Mongin between 1988 and 1991, on documents available under derogation at the French National Archives (the Raymond Aron, Maurice Couve de Murville, Gaston Palewski, and Joël Le Theule papers), at the Service Historique de la Défense in Vincennes, and on documents about French nuclear testing obtained by the press or civil society in the past 12 years. From the United Kingdom, it relies on untapped 1969 and 1972 reports from the Joint Intelligence Council and a telegram from the Foreign Office, as well as on the assessments of French nuclear forces in the Chatham House publication *The World Today*. From the United States, it relies on Central Intelligence Agency (CIA) and RAND Corporation reports and State Department archives, as well as the personal papers of Albert Wohlstetter.

I. ‘A program without a strategy’

In the few recent works on French nuclear weapon history and policy, one reads an assumption of strategic rationality as the driver for French nuclear weapons policy.¹⁰ Similarly, recent scholarship claims that de Gaulle had a ‘grand strategy’ which, presumably, should include nuclear weapons.¹¹ In this section, we argue that strategic rationality does not account for French nuclear decision-making and military practices.

We understand strategic rationality as composed of three features: the definition of strategic goals *preceding* and *driving* the choice of military means to serve them; the belief that the chosen means/weapons systems can adequately serve the previously defined strategic goals; and the

⁸This diagnostic was first made by Vipin Narang, *Nuclear Strategy in the Modern Era*, 2. Benoît Pelopidas has shown that this assumption of existential deterrence cannot account for French behaviour during the Cuban Missile Crisis. See “The Unbearable Lightness of Luck,” *European Journal of International Security* 2, no. 2 (2017): 253–60.

⁹This triumphalist narrative is produced and perpetuated by three sources: (1) policy and expert triumphalist discourse; (2) scholarship that does not assess the performance of the weapons system and focuses on policy intentions only – for a typical example, see Céline Jurgensen and Dominique Mongin, eds., *Résistance et Dissuasion: Des origines du programme nucléaire français à nos jours* (Paris: Odile Jacob, 2018) – (3) scholarship that is derivative of the previous scholarship (2) and does not engage with French primary sources. We will specify this scholarship in each following section of the paper.

¹⁰Goldstein, *Deterrence and Security in the 21st Century*, 184; Narang, *Nuclear Strategy in the Modern Era*, 2; Debs and Monteiro, *Nuclear Politics*, 418–36.

¹¹Garret Martin, “A Gaullist Grand Strategy?” in Christian Nuenlist, Anna Locher, and Garret Martin, eds., *Globalising de Gaulle: International Perspectives on French Foreign Policy, 1958–1969* (Lanham, MD: Rowman & Littlefield, 2010) and *General de Gaulle’s Cold War. Challenging American Hegemony 1963–68* (New York: Berghahn, 2013), 5, 12; Thierry Balzacq, ‘France’ in Thierry Balzacq, Simon Reich and Peter Dombrowski, eds., *Comparative Grand Strategy: Framework and Cases* (Oxford: Oxford University Press, 2019).

meaningful articulation of these two relationships through strategic discourse and doctrine.¹² In the following paragraphs, we show that each feature is absent in the French case.

First, contrary to what we would expect if the procurement process were driven by strategic rationality, a close look at primary sources shows that the components of the force were selected and budgeted *before* the strategy was defined. Untapped archival documents, recent publications, and interviews with current French nuclear officials show that the technological means were driving the strategic ends in the early years of French nuclear weapons policy and procurement.¹³ One of them even calls it ‘a program without a strategy’.¹⁴

Technology repeatedly determined French nuclear choices negatively. For example, the decision to build the air component of the nuclear arsenal first was due to the inability to build long-range ballistic missiles.¹⁵ French historian Claude Carlier specifically states that France’s lack of experience with such technology led to a choice in favour of aircraft-delivered bombs as early as 1956.¹⁶ The contract to build the first Mirage IV prototype (Mirage IV-01) was signed with Dassault in April 1957, one year before the official decision to test a nuclear weapon was taken by Prime Minister Félix Gaillard.¹⁷ All of this happened before the articulation of a coherent strategy, let alone the outline of operational plans. Similarly, as late as November 1961, after contracts had been signed for 50 Mirage IVAs, Chairman of the Joint Chiefs of Staff General André Pujet wrote to Prime Minister Michel Debré to let him know that so far none of the chiefs of staff had conducted ‘operational studies of any value about which weapon systems should give France its *force de frappe*’.¹⁸

Second, the nuclear arsenal that was built was fundamentally not suited to the publicly stated strategy of deterrence as a source of security and independence.¹⁹ Prominent officials did not believe the nuclear force was able to serve such a strategy well.

Six months before the first French nuclear test, High Commissioner Francis Perrin, one of the two heads of the Atomic Energy Commission, directly wrote to President de Gaulle on 27 July 1959 that the possession of nuclear weapons would not provide much benefit beyond diplomatic prestige, and would make the country vulnerable.²⁰ In his top-secret note, he warned the President:

¹²Freedman and Michaels, *The Evolution of Nuclear Strategy*, xii–iii.

¹³Thierry d’Arbonneau, speech at the 9 December 2013 conference on the future of French nuclear weapons, Paris; Interview with General Vincent Desportes, Paris, 15 January 2014.

¹⁴Bruno Tertrais, “Destruction Assurée: The Origins and Development of French Nuclear Strategy 1945–1981,” in Henry Sokolski, ed., *Getting MAD: Nuclear Mutual Assured Destruction, Its Origins and Practice* (Carlisle, PA: US Army War College, 2004), 52.

¹⁵Jean-Damien Pô, *Les moyens de la puissance: Les activités militaires du CEA (1945–2000)*, (Paris: Ellipses, 2001), 104; Claude Carlier, “La genèse du système d’arme stratégique piloté Mirage IV,” in Maurice Vaïsse, ed., *Armement et Vème République* (Paris: CNRS éditions, 2002), 208.

¹⁶Marcel Duval Private papers, 551AP/13, vol. IV, interview XXI, 10 October 1988, 10, French National Archives, Pierrefitte sur Seine. The dates of 1956–57 for the Mirage IV bomber with a nuclear mission are also confirmed in Duval Private papers, 551AP/13, vol. III, interview XIII, 12 February 1988, 4, French National Archives.

¹⁷The technical clauses of the contract were agreed upon in March 1957 and the order for the Mirage IV-01 was placed on 29 April 1957. See Hervé Beaumont, *Mirage IV Le bombardier stratégique*, Docavia N° 47 (Clichy: Éditions Larivière, 2003), 35. Marcel Duval, “L’arme atomique et ses vecteurs. Pourquoi, comment, quand l’arsenal nucléaire?” in Vaïsse, ed., *Armement et Vème République*, 294.

¹⁸Cited in Sylvain Champonnois, “L’armée de l’air et l’innovation technologique (1945–1966),” PhD dissertation in history, Paris Sorbonne, 2012, 554–5.

¹⁹Alain Peyrefitte, *C’était de Gaulle*, vol. I (Paris: Fayard/de Fallois, 1994), 290; vol. II (Paris: Fayard/de Fallois, 1997), 112–15; Jean Lacouture, *De Gaulle*, vol. 3 (Paris: Seuil, 1986), 478–82; Georges-Henri Soutou, “La menace stratégique sur la France à l’ère nucléaire: les instructions personnelles et secrètes de 1967 et 1974,” *Revue historique des armées*, no. 236 (2004).

²⁰At the same time, as early as 26 November 1959, strategist Raymond Aron wrote publicly that the *force de frappe* as it was proposed could only be an element of prestige that serves in diplomacy. Raymond Aron, *L’armement atomique français et l’alliance atlantique*, part I and II, *Le Figaro*, 26 and 27 November 1959 and *Mémoires* (Paris: Robert Laffont, 2010 [1983]), 556.

The possession by France of a small number of atomic weapons, even of great yield, risks producing a dangerous illusion of force and independence. Atomic weapons cannot be used in secondary wars, even to resist external pressure (risks of generalisation of conflict, example of Great Britain during the Suez expedition). In case of major war, France, even if threatened of invasion, could not take the initiative to use atomic weapons – neither tactical ones, facing a potential adversary possessing for a long time at least ten times as many – nor strategic ones because of its much greater vulnerability (this would be tantamount to national suicide, with France potentially wiped out as a nation by a few tens of H-bombs.) [...] The existence of such a strike force risks exposing France to an extreme danger in case of conflict, because of the temptation to use it without adequately weighing the immediate consequences of such use.²¹

Multiple claims by military officials, diplomats, and even de Gaulle himself suggest that there was a shared awareness of the weak deterrent effect of the French nuclear force, and that little could be expected of it – except perhaps to force or trigger the United States to use nuclear weapons to defend Europe against the Soviet Union.

On 27 November 1961, General Pujet, commenting on the Mirage IV force for Michel Debré, said it had no ‘deterrence value’ at the national level, but remained for the French government a trump card that could be played as early as 1963 with its allies.²² The French ambassador to the United States, Hervé Alphand, conveyed an even more direct message to Foreign Minister Maurice Couve de Murville in a confidential letter from 16 May 1962: ‘When it comes to our nuclear force, we believe that it is mostly destined to trigger, without the Americans being consulted, the use of the American force’.²³ On 3 May 1963, even de Gaulle wrote in a note to his chief military adviser that:

Of course, and in any case, we will have to use our own strategic force with Russia as a target, as soon as France is attacked. The deterrent effect resulting from our displayed resolve *may have some effect*. [...] Furthermore, this action may, eventually, trigger that of the United States from continent to continent and bring them, as a consequence, to use the only really effective means of defense of continental Europe before it is too late for us.²⁴

This catalytic posture linked to scepticism about the deterrent effect of French forces also appeared in de Gaulle’s conversations with his minister, Alain Peyrefitte, throughout 1963. In January, he told him: ‘We have become as formidable as a man with a lighter walking through a gunpowder magazine’.²⁵ Later that year he added: ‘The alliance does not force them [the United States] to be by our side right away. [...] That is why our atomic force is necessary. It is a triggering and pulling-in force. It is the starter’.²⁶

The disconnect between the public posturing and private statements of the highest French nuclear civil servants on the deterrence value of the Mirage IV (1964–72) is only one reason to doubt the consistency between means and ends in the French nuclear posture.

²¹Note du haut commissaire à l’énergie atomique sur la politique française d’armement atomique, 27 July 1959 to President Charles de Gaulle, ‘très secret’, annexe to letter from General Administrator Couture to Minister of Foreign Affairs Maurice Couve de Murville, 14 August 1959, in Maurice Vaïsse, ed., *Documents diplomatiques français* (Berlin: Peter Lang, 2003), 175–6.

²²Champonnois, *L’armée de l’air et l’innovation technologique (1945–1966)*, 554–5.

²³Confidential letter from Hervé Alphand to Maurice Couve de Murville, 18 May 1962, Maurice Couve de Murville papers, Correspondance CM7 (1958–62), file CM7.1962, Centre d’Histoire de Sciences Po, Paris.

²⁴Note from the Presidency of the Republic to the Chef de l’Etat-major particulier, 3 May 1963 about ‘la défense atomique de l’Europe’ Maurice Couve de Murville papers, Correspondance CM8 (1963–69), Centre d’Histoire de Sciences Po.

²⁵Peyrefitte, *C’était de Gaulle* vol. I, 344–5.

²⁶*Ibid.*, 49.

The specifications of the Mirage IV bombers as well as the SSBS S2 missiles, which composed the bulk of the French nuclear force before the deployment of SSBNs, manifest a similar mismatch between means and ends. The SSBS S2 missiles that would be placed on the *Plateau d'Albion* could only be launched towards the Soviet Union, despite de Gaulle's repeated claims that French weapons should be able to defend the country from attacks in any direction.²⁷ Because of technical difficulties in aligning the inertial guidance unit towards any given azimuth at the time of launch, the missile was restricted to targets in a ± 60 degrees range from a fixed direction.²⁸ This is ironically logical, given that the inertial guidance unit of the S2 manufactured by the French Companies SAGEM (*Société d'Applications Générales de l'Électricité et de la Mécanique*) and SFENA (*Société française d'équipements pour la navigation aérienne*) relied on US patents and tacit knowledge transfers.²⁹

When it comes to the Mirage IV, any claim that it was the basis for an independent French strategic deterrent would have to both neglect the original mission for which the plane was envisioned and overlook the technical choices that ended up being made.³⁰ The rationale for the Mirage IV procurement was a coordinated attack with the United States and the United Kingdom to destroy 20 Soviet cities 2500 km away.³¹ A classified note by the Air Force chief of staff from 21 April 1959 assumed that if France had the responsibility to destroy two objectives out of 20, a force of about 40 strategic bombers would be sufficient.³² Attacking alone would require at least 316 bombers to overcome the Soviet air defences – a scenario the note deemed not credible. The number 40 was later reiterated in a November 1959 law outlining a multi-year military programme, saying: "The first generation of the *force de frappe* will be constituted of 40 [atomic] bombs to be realised jointly with their delivery aircraft and commissioned until 1968".³³ Forty bombs were eventually built, which would be delivered by nine front line squadrons made up of 36 aircraft.³⁴ While these numbers are in clear agreement with the 1959 scenario, the aircraft delivered in the 1964–68 period were not the strategic bombers the Air Force chief of staff had envisioned at the time.

²⁷A November 1959 speech before the French military academy is often perceived as the early formulation of de Gaulle's view of deterrence *tous azimuts*. Champonnois, *L'armée de l'air et l'innovation technologique*, 552.

²⁸Theleri, *Introduction à la force de frappe française*, 57, 77; Hervé Beaumont, *Les Forces Aériennes Stratégiques, 50 ans de dissuasion nucléaire au service de la paix* (Paris: Histoire & Collection, 2014), 128.

²⁹Bill Gunston, *Les fusées et missiles d'aujourd'hui* (Paris: Elsevier Séquoia, 1979), 45; Jean Carpentier, *Un Demi-Siècle d'Aéronautique en France*, Les Equipements, vol. 1 (Paris: Comité pour l'Histoire de l'Aéronautique, 2004), 143.

³⁰See footnotes 58 to 62 for examples of such claims.

³¹The 20 cities were Moscow, Leningrad, Kharkov, Kiev, Dnepropetrovsk, Odessa, Riga, Kalinin, Tallin, Sebastopol, Tula, Gomel, Minsk, Nikolaiev, Baranovichi, Kaluga, Bobruisk, Kaliningrad, Smolensk, and Valdai (Sylvain Champonnois, "L'armée de l'air française et le nucléaire. L'adaptation au système d'arme stratégique piloté Mirage IV (1956–1966)," *Stratégie 1* (2013): 177–80 and Champonnois, *L'armée de l'air et l'innovation technologique (1945–1966)*, 523 adds the 2500 km criterion.

³²Champonnois, "L'armée de l'air française et le nucléaire," 180.

³³François Maurin, "La mise en place opérationnelle de la triade stratégique (Mirage IV, SSBS Albion, SNLE) et des chaînes de contrôle," in Institut Charles de Gaulle, ed., *L'Aventure de la Bombe: de Gaulle et la dissuasion nucléaire 1958–1969* (Plon: Paris, 1985), 224.

³⁴In practice, only nine aircraft (one per airfield) were ready to take off at any time. After an alert was given, nine more aircraft could be in the air in the next two hours, another nine after eight more hours, and the final nine after another eight hours. Beaumont, *Les Forces Aériennes Stratégiques*, 75. The other planes were usually undergoing maintenance or being used for training missions. See UK Joint Intelligence Committee (A), "France as a Military Nuclear Power," Top Secret, 22 May 1969, UK-CAB 186–2. Point 6.

In the spring of 1959, the Mirage IV being developed by Dassault was a long-range strategic bomber, the Mirage IVB.³⁵ The decision to pursue the IVB had been made on 31 March 1959 and an order for three pre-series aircraft was placed on 5 May 1959. While similar in shape, it was two times bigger than the Mirage IV-01 prototype and required either two additional engines (for a total of four) or two larger engines to be procured from the United States. The engineering risks and costs involved in supersizing the Mirage IV-01, and the issue of procuring engines from the United States, led Pierre Guillaumat, then minister of the armies, to kill the project in August 1959, and ask Dassault to pursue a compromise solution, the Mirage IVA.³⁶

The Mirage IVA was only a modest improvement of the Mirage IV-01 prototype developed as a light fighter and bomber aircraft, which had a much shorter range than the IVB. Military planners quickly realised that the plane would require in-flight refuelling to reach its Soviet targets and, even then, would not be able to come back after delivering its bomb. After Guillaumat's decision was announced, military officials and engineers scrambled to find the refuelling aircraft that would help increase the range of the Mirage IVA. In January 1961, after the idea of having Mirages refuelling one another was abandoned, General Grimal, number two in the Air Force, ordered French military attachés in London and Washington to find suitable 'second choice' planes.³⁷ He justified his demand by arguing that:

The in-flight refuelling operation of the Mirage IV will only happen in extraordinary circumstances – those where we will have no choice but to use the weapon of despair to strike Soviet cities – and this means that we can accept in such a case, risks that we would normally not accept for an ordinary combat aircraft [...] and use refuelling planes having serious shortcomings.

An official demand for the purchase of refuelling tankers was made by Pierre Mesmer to Robert McNamara in July 1962.³⁸ This demand, approved by Pierre Guillaumat, was met favorably by the United States, which agreed to sell France 12 Boeing KC-135 tankers.³⁹ While the KC-135 increased the Mirage IV range of action on paper, it was not operationally equivalent to deploying a long-range strategic bomber.

³⁵Beaumont, *Le Mirage IV*, 57–69.

³⁶According to General Gallois, the fact that US technology was needed for the motors of the Mirage IVB was unacceptable for de Gaulle; see Carlier, "La genèse du système d'arme stratégique Mirage IV (1956–1964)," 212. This is surprising since other key pieces of equipment of the Mirage IV were acquired from or even financed by the United States and the United Kingdom. They included the on-board Doppler radar and calculator to measure the aircraft ground speed and drift (Marconi Company, UK), the aircraft HF transmission systems (Collins Radio, US), the aircraft anti-radar chaffs (Chemring, UK), and the aircraft air-to-air Agacette electronic countermeasure system built by Electronique Marcel Dassault under a grant from the United States' Mutual Weapon Development Program. See Michel Bergounioux, *Un demi-siècle d'aéronautique en France, Electronique* (Paris: Comité pour l'histoire de l'aéronautique, 2003), 89, 95, and 103, available at https://www.3af.fr/sites/default/files/comaero_01.blanc_introductif_un_demi_sieccle_aeronautique.pdf (accessed October 13, 2020). Even more striking, the aircraft pre-series specifications of 1961 required the capability to deliver the NATO Mark 7 nuclear bomb, which happened to have the exact same diameter as the AN11 nuclear bomb that would eventually equip the Mirage IV in 1964. See Beaumont, *Les Forces Aériennes Stratégiques*, 20.

³⁷*Le Mirage IV*, 109.

³⁸UK Defence Intelligence Staff, French Defence Policy: Brief to the Secretary of State's meeting with Mr Messmer, D/DISSEC/20/2/1. Top Secret, 28 March 1968, TNA; Carlier, "La genèse du système d'arme stratégique Mirage IV (1956–1964)," 213.

³⁹Jean Forestier, "Le Mirage IV raconté par son ingénieur de marque," in Jacques Bonnet, ed., *Un demi-siècle d'aéronautique en France: Les avions militaires*, vol. I (Paris: Comité pour l'histoire de l'aéronautique, Centre des hautes études de l'armement, Division Histoire de l'armement, 2007), 145. At the time, Guillaumat was well aware of the development and testing timetable of the first French nuclear device. Relying on the United States was not a problem for him, however, as he continuously sought US help for the development of a missile based on the solid-fuelled Polaris at least until January 1960, when he declared: 'It is time we become conscious that there will be no American help.' See Emile Arnaud, *Un demi-siècle d'aéronautique en France, Les Missiles Balistiques de 1955 à 1995* (Paris: Comité pour l'histoire de l'aéronautique, 2004), 74.

The effective gain from in-flight refuelling was only marginal. The maximum range of the Mirage IV was increased by about 300 miles.⁴⁰ The distance from the Cambrai airbase to Moscow using a northern route passing through the northern tip of Denmark and then Finland before entering Russian airspace, as described in a May 1961 Air Force chief of staff map, is about 1650 miles.⁴¹ This means that the aircraft would still need to travel the remaining 1350 miles from its refuelling point to reach its most important target. The aircraft maximum fuel loading was about 15,000 litres of kerosene, which would burn at an approximate rate of 17.5 litres per mile (assuming a 50% supersonic flight), enough to travel 860 miles at most.⁴² This assessment is consistent with other available data points.⁴³ Even supported by the KC-135, the Mirage IV could not reach Moscow. This assessment will be reinforced in the next section, when we show that the Mirage IV mission quickly shifted from high altitude to low altitude bombing, with its maximum range reduced by half.

Because in-flight refuelling was a moment of great vulnerability for both the tanker and the four Mirage IV it was tasked to support, it needed to happen at specific places and times, thus greatly limiting the number of possible routes to reach Soviet cities. Despite these shortcomings, the foreign KC-135 acquisition ended the Mirage IV procurement saga, producing a weapons system that could only be at odds with any deterrence strategy claiming credibility.

Finally, contrary to what we would expect if strategic rationality were driving the nuclear weapons decision-making process, the strategic concepts that made sense of the French nuclear forces were crafted *after* the force structure was built.⁴⁴ The key concepts of French nuclear strategy were not articulated before the 1960s, when the official decision to test a nuclear explosive device was made on 11 April 1958 and then turned into a priority by De Gaulle when he came back into power. General Philippe Maurin, former Armies chief of staff, has explicitly stated that in 1957, when the contract for the prototype of the Mirage IV was signed, there was not yet a concept of nuclear defence.⁴⁵ The same dynamic is clear for tactical nuclear forces (ANT), which were born in a 1963

⁴⁰The number appears in UK intelligence assessments, see: Joint Intelligence Council, "France as a Military Nuclear Power," 25 September 1972 (JIC(A) (72)31), 9, para. 6, CAB186/12, and UK JIC, CAB186/2, 9, para. 6, UK National Archives, Kew as well as in Dassault's Mirage IV mission planning diagrams, reproduced in Beaumont, *Le Mirage IV*, 65. See also n. 41.

⁴¹The map titled "Examples of the Mirage IV Operational Possibilities," shows multiple routes. Only the northern route is deemed capable of reaching Moscow: a one-way mission. A direct flightpath over Eastern Europe was never an option given the multiple layers of air defence in place. The map (carte SHD/DAA, 4E4153 EMAA, 4 May 1961, Bureau des Plans généraux, Service Historique de la Défense, Vincennes) is reproduced in Champonnois, *L'armée de l'air et l'innovation technologique*, 848. The map also confirms a ~ 300-mile range extension obtained with in-flight refuelling.

⁴²This was estimated from flight and aircraft parameters provided by Beaumont, *Le Mirage IV*, in particular, data from the world speed records of the Mirage IV-01. The difference in flight performance and maximum fuel loading between prototypes and series do not modify this assessment. Overall, we estimate the average fuel consumption to vary from 12 to 24 litres of fuel per travelled mile for high altitude subsonic and supersonic flight respectively.

⁴³Beaumont (*Le Mirage IV*, 135) provides a Dassault diagram giving a 1275-km (~800 mile) range for a 50% supersonic flight, and a 1445-km (~900 mile) range for a 25% supersonic flight. The UK intelligence assessment estimates a maximum range of 1200 miles at high altitude subsonic speed and 600 miles at low altitude subsonic speed. The dramatic reductions in range at either low altitude or supersonic speed are consistent with increased drag at higher air density or higher speed.

⁴⁴Tertrais, *Destruction assurée*, 51; Beatrice Heuser, NATO, *Britain, France and the FRG: Nuclear Strategies and Forces for Europe, 1949–2000* (London: Palgrave Macmillan, 1997), 100; Jean Doise and Maurice Vaïsse, *Diplomatie et outil militaire, La politique étrangère de la France 1871–2015* (Paris: Hachette, 2015), 612–13.

⁴⁵Interview by Admiral Marcel Duval, 2 November 1988, Marcel Duval Private papers 551AP/13, vol. IV, interview XXIII, 11, French National Archives.

defence council, while the doctrine to use them would only start to be elaborated a year later and finalised in the 1972 white paper.⁴⁶

Overall, the assumption of strategic rationality understood as the subordination of military means to pre-determined strategic goals, the belief in the consistency between those two, and the clear articulation between means and ends in the nuclear doctrine of the country does not account for French nuclear weapons choices until 1974. The illusion of strategic rationality is only made possible by the general, vague, and underspecified nature of de Gaulle's speeches about what is expected of the *force de frappe*, as well as, sometimes, his contradictions.⁴⁷ De Gaulle speaks about a small nuclear force that can deter any potential adversary from attacking France because of the threat of a retaliatory strike causing damage that would be disproportionate to the strategic value of France. As Raymond Aron wrote in 1963: 'General de Gaulle in his press conferences has never dealt with atomic strategy in any meaningful detail'.⁴⁸

Beyond being unclear and inconsistent about his preferences, de Gaulle was also lied to, uninformed, or misinformed about key elements of the French nuclear weapons programme, including the performances of the Mirage IV and the necessity to produce enriched uranium in addition to plutonium for weapons.⁴⁹ De Gaulle was also not informed about 'the episode he would have regarded as the most serious' by his chief of staff, Admiral Philippon: one in which a Mirage IV plane took off from the Orange base with a nuclear bomb under its wings.⁵⁰ When de Gaulle stated that he regarded two legs of

⁴⁶The date of the deployment of American *Honest John* rockets with French troops is still debated. Dates vary from 1957 to 1961, but all of them predate the moment when the concept was clarified. Louis-Marie Baille, "L'épisode nucléaire tactique français: 1957–1996," in Nicolas Haupais, ed., *La France et l'arme nucléaire* (Paris: éditions du CNRS, 2018, 68); Duval and Le Baut, *L'arme nucléaire française pourquoi et comment?*, 69; "Histoire de l'artillerie nucléaire de terre française 1959–1996," *Cahiers d'études et de recherches du musée de l'armée*, hors série n°7 (2013), 29, 249.

⁴⁷Martin, *General de Gaulle's Cold War*, 2; Lacouture, *De Gaulle* vol. 3, 470 and 472 on his absence of desire to articulate a proper doctrine.

⁴⁸Aron, *The Great Debate*, 120–1. See also Sten Rynning, *Changing Military Doctrine: Presidents and Military Power in Fifth Republic France 1958–2000* (London: Praeger, 2002), 26.

⁴⁹Over the years, Alain Peyrefitte repeatedly raised the criticisms identified in this paper before a de Gaulle extremely confident that some Mirage bombers would go through to Soviet targets and cause unacceptable damage. See Peyrefitte, *C'était de Gaulle*, vol. I, 340, 344–5, 359–60; vol. II, 116. Compare de Gaulle's defence of the Mirage IV as sufficient deterrent in Peyrefitte, *C'était de Gaulle* vol. I, 361 and his claims that the French force will only be credible in 1970: Peyrefitte, *C'était de Gaulle*, vol. III (Paris: Fayard/de Fallois, 2000, 149). Dassault also misinformed Prime Minister Michel Debré about the performance of the Mirage, claiming that it could indeed go to Moscow: Marcel Duval Private papers 551AP/13, vol. III, interview XVIII, 6, French National Archives. In April 1959, de Gaulle had requested documents on the Mirage IVB and its operational capabilities to keep in his office. It is not clear whether the general was aware of the shortcomings of the Mirage IVA before the plane and its capabilities were finally demonstrated to him in 1961. This presentation happened shortly before the order for the 12 U.S. KC 135 was placed. Champonnois, "L'armée de l'air française et le nucléaire," 182; Jean Forestier, *Le Mirage IV raconté par son ingénieur de marque*, 149–50; On the question of fissile materials procurement, De Gaulle was told that it was necessary to produce uranium for French weapons and discovered that it was not the case autumn of 1966. The first French experimentation towards the development of thermonuclear weapons (the TURQUOISE test on November 28, 1964) used only plutonium and lithium deuteride, and no highly enriched uranium, which would only be available three years later. *Rapport sur les essais nucléaires français 1960–1996, Vol. I: La genèse de l'organisation et les expérimentations au Sahara* (CSEM et CEMO), 192. On 6 July 1966, de Gaulle even told Peyrefitte he was lied to on this matter. *C'était de Gaulle*, vol. III, 125.

⁵⁰Amiral Philippon, *La Royale et le roi* (Paris: Éditions France Empire, 1982), 154. The incident apparently took place during a performance evaluation drill to assess the on-alert aircraft crew's level of readiness. After the crew was sent to their aircraft, and buckled up, an error in the mission display panel confirmed the mission and the crew took off, armed with their nuclear bomb. Following the procedure, the crew refused to come back, despite repeated attempts to cancel the mission. When the aircraft arrived at the refuelling *rendez-vous*, there was no tanker, and it eventually turned back. The Mirage IV landed with its bomb, something extremely risky that would later be forbidden. Robert Galan, *Forces Aériennes Stratégiques, Missions au Coeur du Secret défense* (Toulouse: Privat, 2014), 67–9.

the force as superfluous, his preferences were ignored, on top of massive budget overruns.⁵¹ Seven years after de Gaulle left office, Alain Peyrefitte concluded that the decision to build the bomb had been made ‘under administrative hypnosis’.⁵²

De Gaulle’s rough sense that all you need for deterrence is the ability to convince your potential adversary that attacking is not worth the damage that would follow is summarised in the literature as ‘tearing an arm off the aggressor’.⁵³ De Gaulle seems consistent in this belief that the deterrent effect is proportional to what is at stake, but his estimate of the required casualties that must follow in order to produce a deterrent effect, at least between May 1962 and January 1963, varies quite a lot.⁵⁴ After two meetings of his government, he stated that the certainty that Russia would not attack France required the ability to kill ‘one quarter or half the Russian population’ or ‘as many Russians as there are Frenchmen’.⁵⁵ Based on the demographic data of the time, that would mean being able to kill between 30 million (one quarter of the Russian population) and 60 million people (one half of the Russian population), with the French population in the middle (48 million people in 1963 according to the World Bank). Was the first generation of the *force de frappe* capable of doing that?

II. ‘A military lemon of the first order’

At first glance, the historiography of the French *force de frappe* shows a stark contrast between early sceptical assessments of its significance and a more recent triumphalist literature.⁵⁶ For example, when describing the strategic and military value of the emerging ‘independent’ French nuclear deterrent in the early 1960s, leading analysts, including Joseph Alsop and Raymond Aron, qualified it as ‘a military lemon of the first order’, leaving France unable ‘to deter attack against her until 1975 at the earliest’.⁵⁷

Fifty-five years after a nuclear armed Mirage IV aircraft was first placed on alert in 1964, the programme was now deemed ‘exemplary’: all ‘technical challenges were solved’⁵⁸; ‘the Mirage IV was [...] capable of reaching, back and forth, most of the targeted objectives and cross enemy territory at supersonic speed high altitude/high subsonic speed low altitude’⁵⁹; ‘the *force de dissuasion* is a reality in 1969 even if it has just become operational’.⁶⁰

Abroad, McGeorge Bundy, the former US national security advisor, shifted from claiming that ‘[m]easured in terms of defense against Soviet Russia, the French force in

⁵¹Pierrelatte’s overall cost was three times higher than the original budget and the building of the Albion IRBM site cost almost twice the original budget, see Doise and Vaïsse, *Diplomatie et outil militaire*, 621.

⁵²Alain Peyrefitte, *Le mal français* (Paris: Plon, 1976), 288–9.

⁵³Pierre Gallois, *Le sablier du siècle*, 372; Lacouture, *De Gaulle* vol. 3, 455.

⁵⁴Peyrefitte, *C’était de Gaulle*, vol. 1, 360, 415.

⁵⁵*Ibid.*, 289, 348; vol. II, 65.

⁵⁶See footnotes 58 to 62.

⁵⁷Joseph Alsop, “The French Mystery,” *New York Herald Tribune*, 18 January 1963; Raymond Aron, *The Great Debate: Theories of Nuclear Strategy* (New York: Doubleday, 1965), 136 (originally published in French in 1963). For an assessment of the debate making the points earlier, see also Raoul Girardet, “Autour du grand débat,” *Revue française de science politique* 14, no. 2 (1964): 343; *Esprit*, “La force de frappe, dossier technique et militaire,” December 1963 and Paul Stehlin, *La force d’illusion* (Paris: Robert Laffont), 1973.

⁵⁸Jean Cabrière, “Le Programme Mirage IV,” in *Colloque d’information sur l’arme nucléaire et ses vecteurs: stratégies, armes et parades*: Paris, 24 et 25 janvier 1989, *Grand amphithéâtre de la Sorbonne* (Paris: Atelier d’impression de l’armée de terre n°1, 1990), 135.

⁵⁹Christian Malis, *Pierre Marie Gallois. Géopolitique, histoire, stratégie* (Lausanne: L’âge d’homme, 2009), 411.

⁶⁰Doise and Vaïsse, *Diplomatie et outil militaire*, 620.

prospect could only be a danger to all – including the French themselves⁶¹ to observing in 1988 that ‘by 1969, when General de Gaulle finally withdrew from power, the French nuclear forces were comparable to those of the United Kingdom. The French achievement is remarkable’. Overall, from the mid-1960s to this day, assessments about the effectiveness of the first generation of the *force de frappe* range from technologically unfit and having no deterrent value, to a technological success and a source of credibility and effective deterrence.⁶² This section will adjudicate that issue.

Debates on the requirements of the credibility of a nuclear threat can be divided into two schools of thought: one considers credibility as composed of political/psychological and technical credibility; a second, epitomised by General Gallois, focuses on uncertainty. For the latter, which assumes away the adversary’s perception, credibility is much easier to achieve, because all you need to do is to prevent your potential adversary from being 100% sure that you cannot cause unacceptable damage; the smallest margin of doubt about the possibility of French nuclear strike, however unlikely, is deemed sufficient to produce the desired deterrent effect. Even for the latter school though, the survivability of the nuclear force to the possibility of a disarming first strike is a crucial requirement for credibility. As Gallois explains: ‘The survival of retaliatory forces needs to be assured’.⁶³ That in turn requires operational credibility.⁶⁴

In this section, we reassess the technological credibility of the Mirage IV and its perceived credibility abroad in the Soviet Union, the United States, and the United Kingdom, since, as de Gaulle explained on 9 May 1962, the *force de frappe* is not only aimed at adversaries but at ‘abusive protectors’ as well.⁶⁵ It therefore had to be directed *tous azimuts* (‘in all directions’). To assess technological credibility, we focus on the technological readiness of the deployed Mirage IV – AN11 weapon system, and its capability to strike key targets in the Soviet Union.

In terms of readiness, Jean Forestier, the lead military engineer for the Mirage IVA procurement programme, questioned whether the system was indeed operational when it went through its first alert status in 1964. He made two particular observations. First, with regard to the French procured ATAR 9 K engines of the Mirage IVA, he noted that the engines ‘had more flight hours on transport aircraft [due to maintenance requests] than on their actual platform’. Second, he mentioned that the first deployed atomic bomb, the AN11, was

⁶¹See McGeorge Bundy, ‘Action on Nuclear Assistance to France,’ 7 May 1962, cited in Matthew Jones, ‘Prelude to the Skybolt Crisis: The Kennedy Administration’s Approach to British and French Strategic Nuclear Policies in 1962,’ *Journal of Cold War Studies* 21, no. 2 (2019): 80 for the 1962 assessment; McGeorge Bundy, *Danger and Survival* (New York: Vintage Books, 1988), 472 for the 1988 observation.

⁶²See also Goldstein, *Deterrence and Security in the 21st Century*, 204, 210; Dominique Mongin, ‘L’arme nucléaire et la France, perspectives historiques,’ in Nicolas Haupais, ed., *La France et l’arme nucléaire* (Paris: CNRS éditions, 2018), 54.

⁶³Cited in Serge Gadal, *Forces aériennes stratégiques: histoire des deux premières composantes de la dissuasion nucléaire française* (Paris: Institut de stratégie comparée, 2009), 20.

⁶⁴We are leaving aside the issue of safety of the bases of the *Forces Aériennes Stratégiques*, which the president’s chief of staff regarded as unsatisfactory as late as 4 March 1967 in a note to de Gaulle. See point 5 in the note. GR1595, File 1, Service Historique de la Défense, Vincennes.

⁶⁵Peyrefitte, *C’était de Gaulle*, vol. 1, 290. On 26 May 1962, de Gaulle addressed Ambassador James Gavin’s offer of US protection by articulating that he was not only concerned about the limits of the US security guarantee, but also that the United States may well become a colonising presence in Europe. Archives de la Présidence de la République AG/5(1)/720, French National Archives. This is a change from de Gaulle’s attempt at getting US aid between 1958 and 1962. See Georges-Henri Soutou, *La guerre froide de la France, 1941–1990* (Paris: Tallandier, 2018), 354–7.

nicknamed the *bombe de précocité* (the ‘precocious bomb’), and may not have been fully operational either.⁶⁶

The AN11 was indeed problematic. It was based on the first rudimentary compact implosion design tested during the first three French nuclear experiments (*Gerboise Bleue*, *Blanche*, and *Rouge*), which took place in 1960. This design had significant safety problems. For example, its high explosives were very sensitive to the heat generated by the plutonium core, which would make them crack.⁶⁷ While the AN11 entered service in July 1964, safety tests and studies of the consequences of an accidental detonation of its high explosives provoking the dispersion of plutonium were not completed before November 1965.⁶⁸ Additionally, when such weapons were intentionally triggered, it was not uncommon for the devices to fizzle, i.e. to generate a much smaller explosion than intended. For some early weapon designs, such probability could be as high as 10% to 20%.⁶⁹ Finally, the yield of the AN11 and its successors, the AN21 and AN22 deployed through our period of interest (~50 kT on average, but ranging from 5kT to 70kT at most for a nominal detonation), was simply too low to cause the intended damage on Soviet cities.⁷⁰ Fatalities resulting from the bombing of cities such as Moscow, Kiev, Leningrad, or Sebastopol would range between 40,000 to 130,000 civilian deaths per city, far from the 30 to 60 million Soviets that the *force de frappe* intended to target.⁷¹

In terms of the abilities of the Mirage IV to strike key Soviet targets, it is now established that the aircraft could not reach Moscow.⁷² Strikingly, General Gallois, who was head of sales at Dassault and had worked with engineer Jean Cabrière on the specifications of the aircraft, mentioned privately to a US intelligence source in 1963 that the first-generation nuclear force based on the Mirage IV was already obsolete (before even being commissioned) but would have to be maintained until 1975, due to

⁶⁶The nuclear bomb was precocious because its nuclear explosive package was not the one originally intended. The intended concept was first tested during the Gerboise verte experiment (4/25/1961). The test was rushed; it took place during a tentative coup in Algiers, but failed for technical reasons. In this design, the plutonium core was not in direct contact with the tamper material. This allowed it to be kept outside of the high explosive ‘chamber’ until the bomb is armed a few minutes before being dropped, greatly minimising the risk of an accidental nuclear detonation. Once this concept was finally validated, it was used in the AN21, which replaced the ‘precocious’ AN11 in the 1965–67 period. Pierre Billaud, ed., *La grande aventure du nucléaire militaire français: des acteurs témoignent*. (Paris: L’Harmattan, 2017), 107–8; Beaumont, *Les Forces Aériennes Stratégiques*, 44; Rapport sur les essais nucléaires français 1960–1996, vol. I: *La genèse de l’organisation et les expérimentations au Sahara* (CSEM et CEMO), 107; On the fact that it may have not been fully operational, see Jacques Bonnet, ed., *Un demi-siècle d’aéronautique en France, Les avions militaires*, vol. I, 148.

⁶⁷Once assembled, the weapon had to continuously be cooled with liquid ammonia, to prevent the high explosives from cracking. Beaumont, *Les Forces Aériennes Stratégiques*, 42–4.

⁶⁸These tests were called ‘Essais POLLEN’ and ran from 1964 to 1966: *Rapport sur les essais nucléaires français 1960–1996*, vol. I, 198–204.

⁶⁹*Rapport sur les essais nucléaires français 1960–1996*, vol. I, 84.

⁷⁰These data are based on the full yield test of the AN11 conducted in Algeria (BERYL experiment, 1 May 1962, 30 kT yield), and the expected yield of the Tamoure nuclear test, which involved a live nuclear bomb test dropped from a Mirage IV on July 1966. See *Rapport sur les essais nucléaires français 1960–1996*, vol. I, 152–65; and Capitaine de Vaisseau Grenier, “Ministère des Armées, Décision des Centres d’Expérimentations Nucléaires, Groupement Opérationnel des Expérimentations Nucléaires,” *Compte-Rendu de la Première Demi-Campagne 19 August 1966*, 1966, 6. (<http://www.moruroa.org/medias/pdf/Compte-rendu%201%C3%A8re%20demi-campagne%201966.pdf>)

⁷¹These estimates were obtained from Alex Wellerstein’s Nukemap online platform (<https://nuclearsecrecy.com/nukemap/>), detonating a 50-kiloton weapon at 1000 metres (optimised for an 8 PSI air blast) above the city centre. The casualties obtained were corrected to account for the demographics of these cities in 1965. For Moscow see World Population Review <http://worldpopulationreview.com/world-cities/moscow-population/> accessed 20 September 2019. For Leningrad (St Petersburg), see Centre for Demography and Human Ecology, Institute of Economic Forecasting, Russian Academy of Sciences, “The Population of the Northern Capital,” *Population and Society*, nos 163–4 (1–15 August 2004): 1–3; For Ukrainian cities, see Anatole Romaniuk and Oleksandr Gladun, “Demographic Trends in Ukraine: Past, Present, and Future,” *Population and Development Review* 41, no. 2 (2015): 315–37.

⁷²Theleti, *Introduction à la force de frappe française*, 11.

delays in the missile and warhead programmes.⁷³ Even General Martin, who was in charge of the first generation of the nuclear force, explained in 1985 that his first order of concern was credibility. In line with High Commissioner Perrin's 1959 note as well as General Pujet's 1961 letter to Prime Minister Debré cited earlier, he observed that 'there was a clash between the long term vision – deterrence from the weak to the strong – and the short term role we had to continue to hold within the alliance.'⁷⁴ Regarding credibility, he observed more specifically that 'the tool had to be up to the goals of the strategy it was supposed to serve, which for the *Mirage IV* seemed tangential.'⁷⁵

Those concerns were widely shared. Prominent Air Force generals Jouhaud, Challe, and Stehlin (the first two were involved in the 1961 coup against de Gaulle; the latter was Air Force chief of staff), opposed the *Mirage IV* force as strategic bombers early on because its range was too short, and refuelling in conditions of war over enemy territory was not credible. Leading French nuclear weapons policy officials were fully aware of the criticisms of the capability of the *Mirage IV*, as we found the key articles of leading foreign critics in the papers of Gaston Palewski, who was then minister for scientific research, and atomic and space affairs.⁷⁶

The fact that only one year after entering service, the primary missions of the *Mirage IV* radically shifted from high altitude supersonic bombing to low altitude subsonic bombing to deal with the increasing effectiveness of Soviet anti-aircraft missiles,⁷⁷ at the cost of reducing its range by half,⁷⁸ reinforces our assessment. No terrain-following radar was ever installed on the aircraft, however, limiting safe flight altitudes (which differed during the day and the night) to minimise the risk of collisions. New dedicated electronic countermeasures were developed and tested by flying over British and US electronic warfare fields equipped with systems mimicking Soviet ground-to-air tracking and engagement systems.⁷⁹ In 1974, French military planners finally learned the precise location of all surface-to-air missile sites in the USSR, thanks to US intelligence sharing.⁸⁰

Overall, if one follows the first school of thought requiring both leadership and technical criteria for deterrence, the French *force de frappe* was not credible between 1960 and 1974, since it lost the political credibility attached to de Gaulle in 1969, and did not have full technical credibility at least before the submarines created a survivable force in the 1970s.⁸¹

⁷³On Gallois' involvement on the specifications of the *Mirage IV* plane, see Malis, *Pierre Marie Gallois*, 410; CIA, Current Intelligence Weekly Summary, "France May Reassess Nuclear Force," Secret, 12 April 1963. Available online at the George Washington University National Security Archive, <https://nsarchive2.gwu.edu/NSAEBB/NSAEBB184/index.htm> (accessed October 16, 20). Claude Carlier identifies Gallois as the CIA source, see Claude Carlier, "La surveillance par les États-Unis des programmes nucléaires français armes et vecteurs (1960–1966)," *Stratégique* 1 (2013): 162. De Gaulle believed Gallois formally denied such claims, however. Peyrefitte, *C'était de Gaulle* vol. 1, 422.

⁷⁴Général Martin in *L'aventure de la bombe*, 204.

⁷⁵*Ibid.*, 204. Italics in original.

⁷⁶Gaston Palewski's papers within Alain Peyrefitte's, where one finds Joseph Alsop's articles 20110333/13: file RECH 36 French National Archives, Pierrefitte-sur-Seine. Peyrefitte, *C'était de Gaulle* vol. I, 344–5, 359–60; vol. II, 123–4.

⁷⁷Beaumont, *Forces Aériennes Stratégiques*, 138–9.

⁷⁸Joint Intelligence Council, "France as a Military Nuclear Power," 25 September 1972 (JIC(A) (72)31), 9, para. 6, CAB186/12, UK National Archives, Kew; Beaumont, *Forces Aériennes Stratégiques*, 44 and 138.

⁷⁹Beaumont, *Forces Aériennes Stratégiques*, 145.

⁸⁰W.E. Colby, French Request for Data on the Locations of Soviet Missile Sites, Memorandum from the Director of the Central Intelligence Agency for the Secretary of State and the Secretary of Defence, 6 August 1974. This help does matter as the French had seriously underestimated Soviet capabilities. For example, Sebastopol was assumed not to be defended by surface to air missiles, while a 1964 CIA map of Soviet air defence assets shows clearly otherwise; see Office of Scientific Intelligence, *French Development of Nuclear Weapons Delivery Systems*, 14 July 1964, Figure 2, Central Intelligence Agency, Washington, DC.

⁸¹Général Gallois in *L'aventure de la bombe*, 205.

Even if one adopts an existential deterrence approach, the technology did not meet the requirements. And everyone – French officials, allies, and adversaries – knew it.

In the Soviet Union, there is little evidence that the French *force de frappe* was considered as having any credibility other than in a first strike, which is the opposite of the stated rationale for the force. Such an attack was considered suicidal since it would trigger a Soviet retaliation that would end France, and the French were not considered as willing to attack anyway.⁸² This was apparently made clear to President Pompidou during his October 1970 visit to the Soviet strategic nuclear forces command, when Premier Brezhnev invited Pompidou to turn a launch key, telling him: ‘You have just destroyed France.’⁸³

Interestingly, there is no evidence that the Mirage IV threat was a driver for Soviet strategic air defence interceptors. In a March 1964 report of the Embassy of the USSR in France, one reads:

It is pointed out in the US, and this point of view is supported by many politicians in France, that the nuclear ‘contribution’ of France in the already existing nuclear potential of the West, cannot play, in the following years at least, a significant role.⁸⁴

French nuclear weapons are mostly treated by the Soviets as having a role in NATO internal dynamics. And in 1965, it was asserted that France was trying to use its nuclear forces as a ‘trump card in the political card game’ against its ‘allies’.⁸⁵ Soviet analysts were likely also to benefit from the awareness of the weaknesses of the French force, which was published by its US and British counterparts, to which we now turn.

Across the divides about doctrines and nuclear strategy, most of the US strategic community doubted the credibility of French nuclear threats. Only proponents of existential deterrence did not question it.⁸⁶ But this was by far a minority view. The CIA, the State Department, National Security Advisor McGeorge Bundy, and strategist Albert Wohlstetter were highly sceptical of the credibility of the French force in the face of the Soviet threat. A 31 May 1963 CIA special report by the office of current intelligence on ‘the French nuclear strike program’ clearly states that, at best, ‘the Mirage IV weapons system falls short of French requirements.’⁸⁷ In a 7 May 1962 note to President Kennedy cited earlier, Bundy wrote: ‘Measured in terms of defense against Soviet Russia, the French force in prospect could only be a danger to all – including the French themselves.’⁸⁸

Many US commentators mocked the name of the plane as telling the truth about its illusory deterrent capability.⁸⁹ Alsop’s analysis summarises the criticisms: too short a range; vulnerability to Soviet air defences; in need of American radars for terrain

⁸²Thomas W. Wolfe, “Soviet Commentary on the French *force de frappe*” (Washington DC: RAND Corporation 1965), 7–10.

⁸³Galan, *Forces Aériennes Stratégiques*, 177.

⁸⁴USSR Embassy in France, *Report on Soviet-French Relations and the Position of France on Key International Issues* (March 1964), 187.

⁸⁵Robbin F. Laird, *France, the Soviet Union and the Nuclear Weapons Issue* (Boulder: Westview Press, 1985), 93, citing Col. A. Slobodenko, “Franko-amerikanskije spory o strategii,” *MZ*, 1965 n° 1: 72.

⁸⁶Hanson W. Baldwin, “Taking Stock of Europe’s Nuclear Defences,” *The Reporter* 25 (April 1963).

⁸⁷CIA Special report: “The French Nuclear Strike Program,” 31 May 1963, 3. https://www.cia.gov/library/readingroom/docs/DOC_0000572657.pdf

⁸⁸McGeorge Bundy, “Action on Nuclear Assistance to France,” 7 May 1962 cited in Jones, “Prelude to Skybolt,” 80.

⁸⁹Joseph Alsop, “The French Mystery” and “The Mirage of the Mirage,” *New York Herald Tribune*, 18 January 1963 and 18 February 1963; Albert Wohlstetter, “Nuclear Sharing: NATO and the N + 1 Country,” *Foreign Affairs*, April 1961, 363. NB: Wohlstetter papers show that he followed closely the controversy over the Mirage IV and was very critical of inconsistencies in French pronouncements as well as the technical credibility of the plane. Albert Wohlstetter papers, box 165, folder 5, Hoover Institution, Stanford.

avoidance to carry out low altitude attacks (regarded as the only credible option); and vulnerability due to the refuelling needed over enemy territory.⁹⁰ By Alsop's estimate, only one plane would deliver its payload on target. Harvard University Professor Robert Lieber published a similar diagnostic of very limited military credibility in *International Affairs*. He added credibility problems between de Gaulle's departure and the moment when survivability is achieved:

Any test of will must be quite unequal as long as the French are only threatening the Soviets with damage whereas they themselves face total annihilation. The essence of credibility is psychological: after de Gaulle, no French leader is likely to be believable in standing firm for annihilation before surrender.⁹¹

In an 8 December 1967 note to the US secretary of state assessing Chief of Staff Ailleret's speech on '*tous azimuts*', Thomas Hughes interpreted it in a way which is consistent with a catalytic posture rather than the stated strategy of independent deterrence. Hughes reads Ailleret's claim that alliances are acceptable 'in the case where deterrence would not be acceptable to preserve us from war' as possibly meaning that the French *force de frappe* is credible only because the Soviet Union knows that the United States would have to engage in a conflict involving France.⁹²

In the United Kingdom, scepticism about the survivability and therefore the credibility of the French *force de frappe* can also be read as late as 1972, in a report of the Joint Intelligence Committee, which also assesses the credibility of the Intermediary Range Ballistic Missiles (IRBMs also referred as Sol-Sol Ballistique Stratégique or SSBS in French) deployed on the Plateau d'Albion. In particular, the report notes that 'a serious weakness in France's strategic position is her lack of a ballistic missile warning system'. Because of this,

if the Russians chose to launch a pre-emptive attack with missiles against the French strategic forces, there is a high probability that all 18 SSBS silos would be destroyed. Even if political warning had enabled the Mirage IVAs to be deployed to dispersal airfields, the prospects for their survival in a pre-emptive strike are very poor.

Adding that 'a strategic nuclear force which is vulnerable to pre-emptive attack is not a credible second-strike force', like their US counterparts, they regarded the French nuclear force as only being viable in the context of a first strike. However, the committee concluded it was 'virtually impossible to visualise circumstances in which the French would strike first'.⁹³

In sum, allies and potential enemies, in public and in the classified realm, did not regard the French nuclear arsenal as credible and producing a deterrent effect before the mid-1970s, contrary to the recent triumphalist narrative. Evidence of foreign assistance and cooperation in the Mirage IV programme, as well as the absence of early warning systems for Albion and the need to obtain such information from allies, invite further

⁹⁰Alsop, "The French Mystery" and "The Mirage of the Mirage."

⁹¹Robert Lieber, "The French Nuclear Force: A Strategic and Political Evaluation," *International Affairs* 42, no. 3 (July 1966): 426, but see also 424, 29.

⁹²Record Group 59, Records of the Department of State. Subject-Numeric Files, 1967-69, folder DEF 1 FR, 7, U.S. National Archives, Courtesy of William Burr.

⁹³Joint Intelligence Council, "France as a Military Nuclear Power," 25 September 1972 (JIC(A) (72)31), bullet points 7, 10 and 12a, 3-4, 6, CAB186/12. See also point 15, 14-15. Courtesy of Matthew Jones.

investigation in the frequent claim that French forces may not have been credible, nor had a deterrent effect, but were at least independent.⁹⁴

III. Conclusion

Based on available records, we have shown that the construction of the French nuclear arsenal between 1956 and 1974 was not driven by strategic rationality – the components of the arsenal had often been chosen before the strategy was set, means rarely matched ends, French leaders did not even believe they possibly could, and the doctrine did not match the equipment. The severe limits of the safety and credibility of the arsenal, pointed out by the early critics of the *force de frappe* and progressively ignored or overlooked by the scholarship that followed, were real. More importantly, they undermine claims that French nuclear weapons were a source of security and independence. This was well understood within French nuclear circles and among putative deterrees, allies, or adversaries alike. In this concluding section, we reflect on the implications of these findings. We call for further declassification of primary sources on the French nuclear weapons programme to confirm the diagnosis.⁹⁵

Until then, our first finding – that the development of the French nuclear force was chaotic and absent of any strategic rationality – de-exceptionalises the French case, bringing it closer to the other nuclear histories characterised by inconsistencies between public justifications and drivers of nuclear programmes, doctrines, and arsenals. It shows that the revived rationalism and exclusive focus on security drivers in nuclear and Cold War studies are fundamentally inadequate as modes of explanation for the composition of the French nuclear force posture.⁹⁶ In doing so, it confirms and expends Beatrice Heuser's diagnostic on the inconsistencies and irrationalities of the French nuclear debate.⁹⁷ It also confirms Itty Abraham's claim that no nuclear weapons programme was purely indigenous.⁹⁸ It finally disproves the recent claim that the French nuclear posture was one of 'asymmetric escalation' and instead shows that the deployed technology reflected a catalytic posture. By looking into the politics of technological design and procurement, we go beyond an interpretation in terms of 'nuclear mentalities' to a political interpretation of French nuclear dynamics and their effects. Claims of a Gaullist 'grand design' or 'grand strategy' across Cold War history have to take into account the nuclear weapons realm, given the centrality of the *force de frappe* in de Gaulle's publicly articulated political project. Our findings make any claim of a French nuclear weapons grand design, beyond the pursuit of total nuclearisation of France at any cost, unsustainable.

Our second finding – that French nuclear weapons lacked credibility until at least 1974 – confirms how problematic the assumption of a deterrent effect of any weapon is. Primary sources even suggest that in 1974, France had not yet acquired a survivable second-strike capability.⁹⁹ Thus, identifying when France possessed an independent and credible second-strike capability remains an open question. Consequently, the

⁹⁴Lieber, "The French Nuclear Force: A Strategic and Political Evaluation," 422, 429.

⁹⁵Terrence Peterson, "The French Archives and the Coming Fight for Declassification," *War on the Rocks*, 6 March 2020.

⁹⁶This confirms Aron's diagnostic in *Mémoires*, 557.

⁹⁷Beatrice Heuser, *Nuclear Mentalities* (London: Palgrave, 1997), 142.

⁹⁸Itty Abraham, "The Ambivalence of Nuclear Histories," *Osiris* 21, no. 1 (2006): 56.

periodisation accepted in most Cold War historiography about French nuclearisation, as well as the claim that France was able to challenge the Cold War order because of its *force de frappe*, seem misplaced. This invites further investigations into the domestic drivers of nuclearisation beyond the leader, as well as the production of a triumphalist narrative.¹⁰⁰

Contrary to an assumed strategic design emanating from de Gaulle himself, our findings suggest that the French nuclear programme was run by a group who needed a leader to act behind. De Gaulle's reluctance to engage with technical details and critics alike, his often enigmatic ways of expressing himself, his desire to believe in French technology, and his advisers' reluctance to disagree or argue with him, carved out a space in which key public servants and industrialists were free to engage in the systemic nuclearisation of France. While de Gaulle – the king – happily embraced his new clothes, his followers produced no credible national security, but very concrete and long-lasting domestic effects, entrenching new positions of power and privilege in the pursuit of what they would themselves name – a mirage.

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⁹⁹In an interview, Admiral Duval was told France only had 1.9 submarines available on average at all times during the July 1974 to August 1976 period. Only after would two submarines be available at all times – the necessary threshold to guarantee one of them is always on patrol during periods of transit. Marcel Duval Private papers, 551AP/13, vol. V, interview XXXV, 6 March 1990, 28.

¹⁰⁰See Pelopidas, Thibault Boncourt, Marielle Debos, Mathias Delori, Benoît Pelopidas and Christophe Wasinski, “The Unbearable Lightness of Luck,” 251–3 and Marielle Debos et al., “Que faire des interventions militaires dans le champ académique?” 20&21 (2020/1): 145–9.

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