How can Europe's Nuclear Trilemma be resolved?

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HOW CAN EUROPE'S NUCLEAR DETERRENCE TRILEMMA BE RESOLVED?

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The United States under President Donald Trump has adopted an ambiguous position on European security. Although no immediate risk of abandonment is apparent, European countries are rethinking their defence strategies in case the US declines to support them, or provides only partial support, in a crisis. This discussion is particularly sensitive in relation to nuclear weapons, the ultimate deterrent, for which European countries depend extensively on the United States.

We argue that a possible future US withdrawal from European nuclear security will force European countries to face a policy trilemma. If they stick to the existing policy framework of no proliferation and no joint deterrence, they expose themselves to nuclear blackmail, should the US withdraw its external guarantee. If they want to protect themselves from nuclear blackmail, they must choose how to provide nuclear security: either collective nuclear security, which would compromise some national sovereignty, or independent provision by individual countries, leading to nuclear proliferation in Europe.

Having established that uncontrolled proliferation is an inferior outcome to some form of joint deterrence, we identify four main alternatives: an extension of the Franco-British nuclear deterrent; an extension complemented by a jointly financed expansion of existing deterrence; the absorption of the French (and perhaps British) nuclear arsenals into a European arsenal; and the construction of a separate European submarine deterrent (with Europe using French or British technology or developing new technology). We also discuss briefly forms of non-nuclear deterrence, which however would likely be a complementary rather than a substitute for a nuclear deterrent. We compare these options using a set of parameters: strategic autonomy and credibility, changes to treaties (including non-proliferation), costs, capabilities and readiness. Our analysis shows that all options have advantages and disadvantages, but some are politically, financially and militarily more feasible.

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1 Introduction

For decades, the United States has provided the lion's share of nuclear and conventional capabilities to defend Europe. These capabilities consist of strategic nuclear weapons for deterrence by punishment, tactical nuclear weapons for deterrence by denial and signalling, and conventional capabilities for deterrence by denial and reinforcement[1], as well as for defence (Monaghan, 2022). However, apparent US reluctance under President Donald Trump to uphold this commitment has forced European nations to reconsider their strategic positioning (Fayet *et al*, 2024), creating a deterrence trilemma for Europe: without US backing, if European countries stick to the existing policy framework of non-proliferation and no joint deterrence, then they expose themselves to nuclear blackmail[2].

This raises a set of pressing policy questions about how European countries can respond. If a collective and coherent solution is not achieved, increasing Russian aggression could exploit Europe's nuclear weakness. However, some countries, such as Poland and Ukraine, could pursue nuclear weapons to deter Moscow – with the risk of fuelling an arms race[3]. Beyond these strategic risks, Europe faces practical hurdles: the financial and temporal costs of building new capabilities are significant, the challenge of unified decision-making in a fragmented continent is massive and European public opinion is wary of militarisation.

The paper is organised as follows. In section 2, we provide a contextual discussion of the European nuclear security architecture. In section 3, we discuss the nuclear trilemma. Then, having established that uncontrolled proliferation is an inferior outcome to some form of joint deterrence, in section 4 we identify several alternatives: the extension of the Franco-British nuclear deterrent; the development of a European submarine fleet, assembled by taking over Franco-British nuclear assets, using their technologies or developing a European submarine-based nuclear deterrent; and forms of non-nuclear deterrence. We measure these options against a set of parameters: strategic autonomy and credibility, changes to treaties (including non-proliferation), costs, capabilities and readiness. Notably, we do not argue that Europe should pursue nuclear independence from the US as an objective. Our analysis shows that all options have advantages and disadvantages, but some are politically, financially and militarily more feasible.

[1] For definitions of types of deterrence, see Mazarr (2018).
[2] Note that our trilemma is different to that of Bell and Hoffmann (2025).
[3] John J. Mearsheimer, 'Why We Will Soon Miss the Cold War', *The Atlantic*, August 1990, https://www.theatlantic.com/past/politics/foreign/mearsh.htm.

2 Europe's security architecture: past, present and future

Europe's security architecture, a complex blend of nuclear and conventional capabilities, has evolved over decades to deter threats and maintain stability, primarily under the stewardship of the United States. Since the Second World War, this transatlantic framework – centred on NATO – has provided Europe with a robust defence against external aggression, most notably from the Soviet Union and now Russia. Understanding how this system functions, who sustains it and why Europe remains dependent on external support is essential to grapple with the deterrence dilemmas posed by US ambiguity in 2025.

2.1 The origins

The foundations of Europe's security were laid in the aftermath of 1945, when the United States emerged as the continent's guarantor against a resurgent Soviet threat. Initially, the US maintained large conventional forces in Western Europe, with over 300,000 troops stationed by the early 1950s. However, the economic burden of sustaining such a presence prompted a strategic pivot. Under President Eisenhower's 'New Look' policy, the US shifted toward nuclear deterrence, deploying atomic weapons to offset Soviet numerical superiority. This deterrence-by-punishment approach – threatening massive retaliation against Soviet cities – aimed to impose catastrophic costs on any aggressor (Rosenberg, 1983).

By the 1960s, as Soviet nuclear capabilities grew, US strategy evolved into 'flexible response', a deterrence-by-denial model targeting enemy military forces (counter-force) rather than civilian populations (counter-value) (Gavin, 2014). NATO formalised this arrangement, integrating US strategic nuclear forces – intercontinental ballistic missiles (ICBMs), submarine-launched ballistic missiles (SLBMs) and strategic bombers – with tactical nuclear weapons hosted in five European countries (Belgium, Germany, Italy, the Netherlands and Turkey) (Stromseth, 1988). The United Kingdom and France, meanwhile, developed independent but smaller nuclear arsenals – the former integrated within NATO while autonomous (Daalder, 1991).

The Cold War's last decades saw further refinement. As Soviet nuclear modernisation accelerated in the 1970s, the US pursued arms control (eg SALT treaties) and technological superiority in conventional forces (Petrelli and Pulcini, 2018). Precision-guided munitions, real-time communications and electronic warfare tilted the military balance progressively in NATO's favour. The Soviet Union dedicated an increasing share of its limited resources to keeping up with NATO in terms of conventional, nuclear and space-related capabilities, exacerbating existing tensions, which eventually became unmanageable and resulted in the Soviet Union's collapse in 1991 (Epstein, 1984; Brooks and Wohlforth, 2000). This US-led system not only deterred aggression but also spared European nations the cost of matching Soviet power independently, cementing a transatlantic bargain: America provided security, while Europe contributed with bases, troops and political alignment (Sayle, 2019).

2.2 The current framework

Europe's defence remains based on a hybrid of US and European capabilities, though heavily reliant on American leadership. The US maintains its nuclear triad of delivery vehicles – ICBMs, SLBMs and bombers – while approximately 100 B61 tactical nuclear bombs are stationed in Europe under NATO's nuclear-sharing agreement. While these bombs are hosted by NATO allies, the US has primary authority over their use. Specifically, US personnel are responsible for the maintenance and security of the weapons. Use of the bombs would require both a decision of the US president and the host nation's political authorisation. Finally, to prevent unauthorised arming or detonation, Permissive Action Links (PALs) must be unlocked: only authorised personnel with the correct code can activate the weapon.

Dual-capability aircraft, some US-made (such as the F-16 and the F-35) and some European-made (the Eurofighter), carry these bombs. These aircraft, operated by host nations, ensure a visible deterrent against Russia, which fields an estimated 5,800 tactical and strategic warheads (Kristensen and Korda, 2019). France and the UK complement the US capability with their own forces: France's nuclear deterrent includes submarine-launched missiles and air-delivered weapons, tied to its 'vital interests' doctrine, and fully independent of US platforms, while the UK's nuclear submarines align with NATO's mission (Narang, 2014; Tertrais, 2014) and are dependent on the US for Trident missiles, their maintenance and, likely, for targeting (Messmer and O'Sullivan, 2025).

Conventional forces, meanwhile, are a collective effort, but the US still plays a dominant role due to the higher level of readiness and effectiveness of its forces, its unrivalled capabilities in critical enablers (including air-to-air refuel, intelligence surveillance and reconnaissance, theatre missile defence, suppression of enemy air defence, anti-submarine warfare and long-range artillery) and its leadership role in command and control, most notably with US officers historically serving as the Supreme Allied Commander Europe (SACEUR) or as Commandant of NATO Joint Force Command Naples (Giegerich *et al*, 2024; Gilli *et al*, 2025). Missile defence, a critical layer, remains patchy: systems such as the US-led Aegis Ashore in Romania and Poland, paired with NATO's Integrated Air and Missile Defence, offers partial protection against Russian ballistic threats, but key components depend on American hardware and expertise (Steinbach and Wolff, 2024).

In this context, it is worth mentioning briefly the growing role that non-nuclear capabilities play in deterrence. First, the growing precision, range and lethality of conventional weapons promise to open a new nuclear age in which conventional strikes can deliver effective counter-force capabilities (Lieber and Press, 2016; Futter and Zala, 2021). Second, and relatedly, cyber capabilities similarly play a growing role, both as deterrence by punishment, threatening to shut down critical infrastructures such as hospitals, logistical nodes, banks and other core services, and deterrence by denial (Lindsay, 2018; Cunningham, 2025). Finally, the growing contestation of the global commons (Posen, 2003; Gilli *et al*, 2022) and, in particular, space has some direct impact on nuclear deterrence given the role space communications play in nuclear command, control and communications (NC3) and in alert early warning (AEW) (Acton, 2021; Wirtz and Larsen, 2022).

Against this backdrop, the presence in the White House of Donald Trump and his administration's ambiguous stance on European security have brought about a period of unprecedented uncertainty. Trump's rhetoric and policy signals – questioning NATO's value, demanding greater European financial contributions and hinting at reduced US commitments – have eroded confidence in the stability of the transatlantic alliance. Although no formal US withdrawal has occurred, the mere prospect compels European leaders to confront the strategic and operational consequences of losing American support, especially in the nuclear realm, which is both the ultimate deterrent and the area for which Europe depends most overwhelmingly on the US. Importantly, the US administration's ambiguity erodes the credibility of deterrence without requiring a formal NATO exit, thus fundamentally weakening European security (Sartori, 2005; Press, 2006; Tomz, 2008).

3 Consequences of a US withdrawal and Europe's nuclear trilemma

The threat of a US withdrawal from Europe's security architecture, whether partial or total, would unleash a cascade of destabilising effects, amplifying existing threats and exposing structural weaknesses. Since European countries need a form of nuclear security to protect themselves from blackmail (from Russia as of now, but potentially from other rivals in the future), they must either provide such nuclear deterrence jointly, or provide it each separately, or rely on an external guarantor (the US). While not having to rely (and possibly, pay) the US for nuclear protection while avoiding both proliferation and sovereignty pooling might seem desirable, it would expose Europe to nuclear blackmail, creating a trilemma.

3.1 External guarantees and nuclear blackmail

The first part of the trilemma pertains to the presence or absence of nuclear guarantees provided by non-European powers, whose commitment to Europe's nuclear defence deters adversaries from exerting nuclear blackmail. In practice, the United States has played this role since 1945. The possible withdrawal of the US nuclear umbrella – or even hints that the US may not want to defend Europe – may encourage nuclear coercion from Russia. Nuclear weapons are associated with the concept of mutually assured destruction, or nuclear deterrence, but nuclear weapons can also be used for coercion. The most prominent example is their only actual use in history. With the attacks against Hiroshima and Nagasaki at the end of the Second World War, the United States tried to coerce Japan to surrender (Pape, 1996).

Countries, however, do not need to use nuclear weapons: they can just use the threat of use for coercive purposes or to impose a *fait accompli:* seizing territory and then threatening a nuclear response against any attempt to take it back (Zapfe, 2018). In such a case, Russia would enjoy a situation of escalation-dominance: France and the UK not only have significantly smaller nuclear arsenals than Russia, but those arsenals also contain very few tactical nuclear weapons, thus giving those countries, in a crisis, two unfavourable options: accepting enemy coercion or risking a nuclear war when the direct stakes, for them, are still limited (that is, it is not their national territory or their

sovereignty that is under threat). The lack of robust missile defence, the high population densities and the lack of strategic depth in both France and the UK weaken their bargaining positions further.

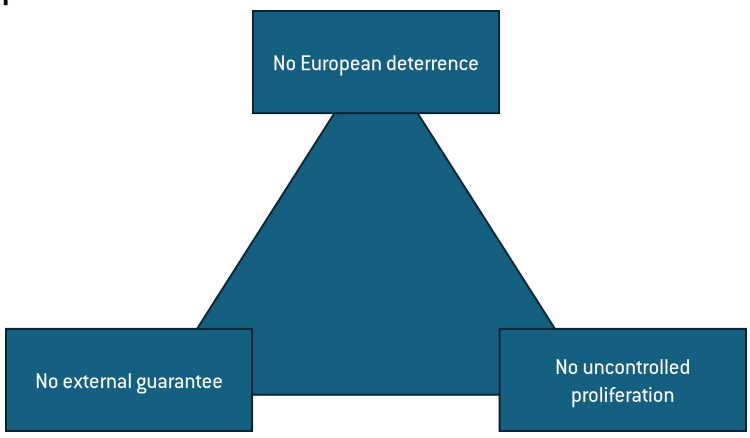
3.2 Nuclear proliferation, crisis instability and arms races

The second, evident implication of the withdrawal of US nuclear deterrence from Europe would be the risk of nuclear proliferation. The US's extended nuclear deterrence has, over the years, explicitly aimed to counter proliferation. Meanwhile, US allies have used the 'threat' of proliferation to bargain for more extensive nuclear guarantees (Volpe, 2017; Lutsch, 2022; Jang, 2016; Bowers and Hiim, 2021). However, if we accept that nuclear weapons represent an effective deterrence, the abrupt disappearance of the US nuclear deterrent from Europe may push countries to pursue their own nuclear weapons. Poland, for instance, has been hinting at nuclear ambitions since 2022 to counter Russia if NATO falters and, more recently, has reiterated these plans[4]. Ukraine, stripped of its Soviet-era nuclear weapons in 1994 under the Budapest Memorandum, has similarly voiced regret and interest in rearmament, citing Russia's violation of security guarantees[5].

Proliferation, however, can promote crisis instability and arms races. From a rational perspective, countries have, in fact, an incentive to neutralise threats before they grow more acute, and thus proliferation may invite enemy attacks (Fearon, 1995). For instance, if Russia were faced with diffused nuclear rearmament across Eastern Europe, it might decide to intervene militarily by striking the development sites, similarly to what has happened against Iraq and Syria, and to what the US and Israel have considered in relation to Iran (Raas and Long, 2007). This, in turn, can invite other destabilising actions, ultimately fuelling greater crisis instability (Bas and Coe, 2018).

3.3 Europe's nuclear trilemma

Figure 1: The European nuclear deterrence trilemma



Source: Bruegel.

[4] Jan Cienski and Wojciech Kość, 'Poland seeks access to nuclear arms and looks to build half-million-man army', *Politico Europe*, 7 March 2025, https://www.politico.eu/article/donald-tusk-plan-train-poland-men-military-service-russia/.
[5] Joe Stanley-Smith, 'Give Ukraine Nuclear Weapons, Says Zelenskyy', *Politico Europe*, 4 February 2025, Available at https://www.politico.eu/article/give-ukraine-nuclear-weapons-says-volodymyr-zelenskyy/.

The possible withdrawal of the US nuclear guarantee leaves Europe facing choices: European countries cannot simultaneously have non-proliferation, no external guarantees from the US and no joint deterrence capabilities without exposing themselves to nuclear blackmail. Currently, US extended nuclear deterrence protects against (Russian) blackmail and prevents proliferation – but European countries have only marginal influence on US policy through the NATO Nuclear Planning Group (Sayle, 2020). If the US deterrent is withdrawn, European countries will have sovereignty but will either face a lack of deterrence or nuclear proliferation and its possibly destabilising effects. Specifically, nuclear proliferation would enhance deterrence against Russia and would somewhat boost strategic autonomy. However, a growing number of aspiring nuclear powers in Europe may not organise their arsenals coherently, ultimately undermining stability or deterrence, or both. In particular, collective-action problems related to the costs, risks and time required for developing nuclear weapons (Hymans, 2013) and the high costs of such weapons (Vaez and Sadjadpour, 2013) may favour choices that do not strengthen Europe. Meanwhile, enhancing deterrence could undermine non-proliferation rules and norms – to which European countries subscribe.

Alternatively, European countries can try to develop collaborative, common or integrated capabilities to re-establish deterrence. This would have the triple advantage of increasing coherence in the nuclear posture, reducing costs and averting proliferation. We discuss this option in the next section.

4 Organising European deterrence

In this section we discuss different options for European deterrence. Different proposals have been made on this already. Fayet *et al* (2024) suggested, for instance, that a Franco-British agreement to share development costs for a quantitative expansion of their capabilities would be *"preferable to horizontal nuclear proliferation in Europe"*. Fayet *et al* (2024) also suggested that such a *"collaborative effort"* should include the Nordics, Germany, Belgium, France, Italy and Turkey. In a separate paper, Fayet *et al* (2025) argued that if well-calibrated, such collaborative efforts, when combined with increased investment in conventional forces, might require only *"a minimal nuclear force"*. Building on this set of proposals, we assess four options:

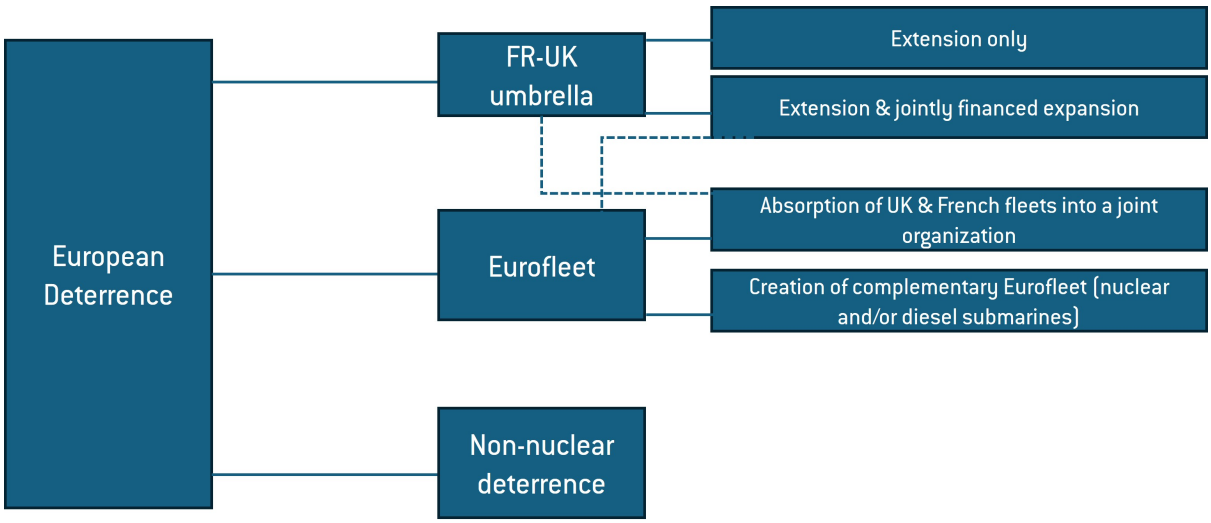
1. A Franco-British umbrella;
2. European countries funding an expansion of Franco-British nuclear forces;
3. European countries absorbing existing French and British nuclear forces in a novel organisation;
4. The development of a European submarine-based deterrent.

We also assess certain non-nuclear deterrence postures. Importantly, when discussing nuclear options, we focus primarily on a submarine-based deterrent. A land-based deterrent seems unlikely and impractical in the European theatre, for both political and strategic reasons, at least in the short-to-medium terms. First, some EU countries have promoted, signed and ratified the Treaty on the Prohibition of Nuclear Weapons (TPNW), and thus are highly unlikely to ever be part of the equation. Second, other countries have some of the highest population densities in the world and by deploying land-based nuclear weapons would expose a very high share of their populations to the risk of a

counter-strike – a politically unsustainable option. Meanwhile, many Nordic, central and eastern European countries border or are close to Russia, thus posing a set of political and military dilemmas concerning the effectiveness of detonating nuclear warheads. Finally, many EU countries regularly see major protests and opposition to even the construction of civilian infrastructures (such as high-speed railways, waste management facilities and energy plants). The construction of facilities hosting land-based nuclear weapons would unlikely to attract any less protest. Furthermore, the diffusion and progress in sensing technologies has made land-based nuclear weapons the most vulnerable part of the nuclear triad (Lieber and Press, 2016). While there is a logic in pursuing nuclear modernisation in order to increase the number of targets and thus complicate the adversary's calculations, for Europe, the balance between costs and benefits does not look *prima-facie* convenient.

Given our focus on sea-based deterrence, we assess each option in terms of readiness, feasibility, credibility, capabilities and costs. Each option is analytically distinct: this permits us to assess the pros and cons. Empirically and practically, however, many options would likely be paired with others. Figure 2 provides a stylised summary of these options, while Table 1 sets out the advantages and disadvantages of those options involving European nuclear deterrence.

Figure 2: Options for European deterrence



Source: Bruegel.

4.1 Option 1: extending the Franco-British nuclear umbrella

The simplest and quickest response to the possible withdrawal of US nuclear guarantees from Europe would be an extension of French and British nuclear deterrence to the rest of Europe. In this case, France and the UK would update their declaratory policies and, likely, their nuclear doctrines, to

provide a nuclear umbrella to the rest of Europe[6]. European countries could contribute to jointly finance the French and British nuclear deterrent forces (Fayet *et al*, 2025: 137).

The main advantages of this proposal are readiness, non-proliferation and costs. This option would be much readier than alternatives, since a political decision would likely be enough. Similarly, this option presents substantially less legal jeopardy as it would not require any new treaty and would pose no legal problems from a nuclear-proliferation perspective. Additionally, a Franco-British extended nuclear deterrent would be significantly cheaper because it would leverage existing arsenals.

These advantages explain why this option has been highlighted in the media[7]. However, this option also has shortcomings. First, while joint deterrence could be provided from the French and British arsenals, there would be some questions about capabilities and credibility. France and the UK cannot realistically signal and deliver the same commitment as the United States because of their smaller strategic and, especially, tactical nuclear arsenals, their higher population densities and their lack of strategic depth. Consequently, even early in a crisis, both countries would face the possibility of suffering enormous costs and being able only to deliver massive responses (because of the lack of tactical nuclear weapons) – this would not be very credible. The collective-action problem related to extended deterrence would further undermine the credibility of this solution (ie France and the UK would bear the costs of a crisis involving primarily another allied country but not themselves directly).

A related issue deserves attention: the UK nuclear deterrent has experienced significant problems in recent years, with failed missile tests and limited operational availability of its strategic missile submarines (NAO, 2015)[8]. Thus, while on paper, a Franco-British nuclear umbrella might be viable, in practice, this solution faces challenges.

4.2 Option 2: jointly support the expansion of Franco-British nuclear forces

Currently, France and the UK have around 500 nuclear warheads, while Russia has over 5,500, or 11 times more[9]. France and the UK operate, combined, eight ballistic nuclear submarines. France also operates dual-capable Rafale jet fighters that can carry nuclear-armed cruise missiles, but whose capabilities might however be limited[10]. Russia has 12 ballistic missile submarines, but its nuclear

[6] It is worth noting that, unlike the French system which is completely autonomous, the British nuclear programme relies on the US for the leasing and refurbishment of the ballistic missiles carrying British warheads.
[7] See for example The Economist, 'Europe thinks the unthinkable on a nuclear bomb', 12 March 2025, https://www.economist.com/international/2025/03/12/europe-thinks-the-unthinkable-on-a-nuclear-bomb, or Daniel Michaels, Noemie Bisserbe and Micheal R. Gordon, 'Trump Prompts European Calls for a Homegrown Nuclear Umbrella', *Wall Street Journal*, 24 March 2025, https://www.wsj.com/world/europe/europe-nuclear-umbrella-france-britain-nato-10c78d15.
[8] See also William Alberque, 'The UK's Trident launch failure: a cause for concern?' *Online Analysis*, 28 March 2024, IISS, https://www.iiss.org/online-analysis/online-analysis/2024/03/the-uks-trident-launch-failure-a-cause-for-concern/.
[9] Hans Kristensen, Matt Korda, Eliana Johns, Mackenzie Knight-Boyle and Kate Kohn, 'Status of World Nuclear Forces', *Federation of American Scientists*, 26 March 2025, https://fas.org/initiative/status-world-nuclear-forces/.
[10] There have been reports of Rafale jets being unexpectedly downed in the May 2025 aerial clashes between India (operating Rafales) and Pakistan (operating jets equipped with Chinese-made air-to-air missiles and advanced radars). See for example *France24*, 'Chinese weapons get rare battle test in India-Pakistan fighting', 20 May 2025, https://www.france24.com/en/live-news/20250520-chinese-weapons-get-rare-battle-test-in-india-pakistan-fighting.

forces also include strategic bombers and land-based intercontinental ballistic missiles. Thus, a second option could entail European countries funding an expansion of Franco-British nuclear forces.

Realistically, the goal could be for Europeans to join forces and collectively finance an increase in the number of delivery vehicles, and in the types (ie more tactical nuclear weapons) currently available to France and the UK, in exchange for protection. The main advantage of this option would be that, all else being equal, its *legal and political feasibility* is probably greater than option 1. It has the advantage of being politically less challenging for France and the UK (which would not be required to share their existing assets), and furthermore they would see additional orders for their shipyards and weapon manufacturers. From a *capability* standpoint, it would also help reduce the quantitative gap with Russia better than option 1, since option 2 implies both a widening of existing arsenals (even though this improvement will likely be marginal in absolute terms) and an expansion of tactical arsenals, which in the European context are essential to reduce the risk of nuclear blackmail. However, ballistic nuclear submarine production cannot be easily ramped up, as shipyards have limited workforces and berth space. The same applies to nuclear warheads, production of which cannot be increased massively in a short time.

This option also has other, more significant, pitfalls. First, as mentioned in section 4.1, both the current UK nuclear deterrent programme and its successor have faced various challenges, which have reduced operational availability and led to delays (NAO, 2015). Second, this option would be substantially more expensive than the previous option, because it requires procuring and purchasing of new submarines and warheads; this will also likely take time to be completed. Finally, in terms of *readiness,* this option implies a much more extended timeline, since new orders would have to be placed for both submarines and weapons. Given current timelines for the delivery of new French and British submarines, with deliveries beginning after 2035, this option would likely become operational only in the 2040s.

4.3 Option 3: absorbing Franco-British capabilities into a European organisation

To ensure the credibility of an extended nuclear deterrent, provided by France and/or the UK (separately or jointly) to the rest of Europe, European countries could absorb French and British nuclear capabilities into a new organisation. Currently, it is highly unlikely that either France or the UK would ever agree to allow *all* capabilities to be absorbed because of their *"strict sufficiency principle"* (Fayet *et al*, 2024). Given that not all submarines are seaborne all the time (France, for instance, usually rotates its operational submarines, maintaining one or two seaborne and two in harbour for refurbishment and repairs), this approach would reduce the simultaneous operational capabilities of both countries to one submarine each, which might be seen as an unacceptable risk. However, we cannot rule out this option *a priori*, and France may agree to share part of its capabilities while maintaining a residual, fully autonomous component.

Readiness-wise, this option could be achieved relatively quickly. Furthermore, it would keep costs under control, since this option does not imply the development of new arsenals or launch vehicles,

but only joint control over some existing capabilities. Joint control would, however, require a new institution. Setting this up would likely be time-consuming and difficult, not least because of the challenge of nuclear command, control and communications (Guerrier and Feaver, 1994).

This option would also bring substantial additional challenges. From a legal and political standpoint, it would be politically complex to achieve, as it would require France and/or the UK to relinquish or share control of all or a part of their nuclear assets. It would also require a new treaty to establish a decision-making centre, possibly embedded in a dedicated organisation in charge of the fleet, and will create issues under existing non-proliferation treaties, even though it remains a preferable alternative to uncontrolled proliferation, as discussed in section 3.2. Finally, it would not help in easing the capability issue of quantitative competition with Russia: as discussed, both France and the UK have significantly smaller nuclear arsenals, and have very few tactical nuclear weapons. This force structure undermines the flexibility and credibility of the two countries' nuclear forces.

4.4 Option 4: building a complementary European fleet

European countries could try to develop a submarine-based nuclear deterrent. There are two types of submarine: conventional (diesel-electric) and nuclear-powered, ie they are powered by a nuclear reactor (Lautenschläger, 1986). Conventional submarines are smaller, cheaper and quieter. Since underwater detection exploits sound propagation (Stefanik, 1984), the quietness of conventional submarines is a critical advantage. In the past, conventional submarines had more limited autonomy as, like any other engine, they ran out of fuel or energy battery. However, in recent years, air-independent propulsion (AIP) technology has significantly offset this disadvantage (Cotè, 2019). Because of their limited size, conventional submarines carry only cruise missiles: relatively small and slow missiles with a maximum range of 1,000km and a horizontal flight path.

Nuclear-powered submarines are bigger, more expensive and noisier (Friedman, 1984). However, they are faster, can remain submerged for extensive time without any need to refuel/recharge and, because of their bigger size, can carry bigger munitions, including submarine-launched ballistic missiles, ie missiles with a range of 12,000km, very high speed and a parabolic trajectory (Cotè, 1991). Nuclear-powered submarines are probably the most complex weapons system on earth, and given their futures they are considered the more secure nuclear delivery vehicle (Polmar and Moore, 2003).

In Europe, only France and the UK produce nuclear-powered submarines, at procurement costs of roughly two to three times a conventional submarine. Were other European countries to get involved, they would need 20-to-30 years of investment and would face a fundamental challenge: unless they aim to produce several submarines each, the fixed costs would not be sustainable. Conversely, several European countries produce conventional submarines: France, Spain, Sweden, Italy and Germany (Fischbach, 2024). These countries could thus jointly develop either a new class of conventional submarine for deterrent purposes. or the technologies to upgrade their existing fleets and turn them into a deterrent capability, ie developing/integrating submarine-launched cruise missiles armed with

nuclear warheads. Israel reportedly operates this option with the German-made Dolphin-class conventional submarine[11].

Table 1: Pathways to European nuclear deterrence

Option	Pros	cons
Option 1: extending the French and British umbrella	• **Readiness:** short term, readier than any other option • **Costs:** relatively cheaper than other options • **Legal bases:** does not require treaty reform or exit from NPT	• **Credibility & strategic autonomy:** postpones but does not solve the issue of relying on external guarantees. Issues of trust & credibility of commitments remain • **Capabilities:** does not address the quantitative problem of imbalances relative to the Russian arsenal
Option 2: Extending and jointly financing the expansion of French and British umbrella	• **Legal bases:** does not require treaty reform or exits from NPT • **Capabilities:** it would represent a widening of the existing European capabilities, since it would complement the existing French and British arsenals	• **Credibility & strategic autonomy:** postpones but does not solve the issue of relying on external guarantees. Issues of trust & credibility of commitments remain • **Costs:** more expensive than other options except option 4 • **Readiness:** long development prior to deployment
Option 3: European absorption of French/British deterrent	• **Costs:** relatively cheap • **Readiness:** short term, readier than any other options except option 1 • **Credibility & strategic autonomy:** addresses issues of credibility, trust and externality of guarantees	• **Feasibility:** politically complex, as France is unlikely to part with its independent nuclear deterrent. • **Legal bases:** requires a treaty reform or a new treaty, and might require EU countries leaving the NPT • **Capabilities:** does not address the quantitative problem of imbalances relative to the Russian arsenal
Option 4: New European deterrent using French/British nuclear design, and /or diesel-powered designs	• **Credibility & strategic autonomy:** addresses issues of credibility, trust and externality of guarantees • **Capabilities:** it would represent a widening of the existing European capabilities, since it would complement the existing French and British arsenals	• **Legal bases:** requires a treaty reform or a new treaty, and might require EU countries leaving the NPT • **Costs:** more expensive than other options • **Readiness:** long development prior to deployment

Source: Bruegel.

[11] Eric Wertheim, 'Dolphin-class Submarines: Israel's Undersea Arsenal', *Proceedings*, June 2024, U.S. Naval Institute, https://www.usni.org/magazines/proceedings/2024/june/dolphin-class-submarines-israels-undersea-arsenal.

If European countries want to opt for nuclear-powered submarines, the most viable solution would be to buy and operate French or British submarines. If they wish to rely on conventional submarines, they could either upgrade part of their fleets or, more realistically, procure new upgraded platforms or directly launch a new class. If both options are pursued, European countries would address part of the quality and quantity gap in the nuclear imbalance with Russia. If they opt only for nuclear-powered submarines, they run the risk of clogging Franco/British production, as nuclear submarines are complex machines, production of which cannot be scaled up easily. If they opt only for conventional submarines, they would primarily address the qualitative gap, with submarine-launched cruise missiles carrying low-yield nuclear warheads, but they would not address the strategic imbalance with Russia.

Politically, the pros and cons for option 4 are the same as for option 3: the issue of credibility would likely be addressed by the joint command under the new organisation, but this would be obviously very complex to set up. A key difference would be *readiness,* which would be much more uncertain under option 4 than under option 3, especially if nuclear-powered submarines are pursued.

4.5 Europe without nuclear weapons? Exploring non-nuclear deterrence

Finally, European countries could pursue deterrence through non-nuclear means. To articulate this option, it is necessary to step back to the fundamentals of nuclear weapons. There are two main theories about nuclear weapons. One holds that nuclear weapons represent a revolution as, in the words of Bernard Brodie, they turned the logic of strategy upside down, from winning to avoiding wars (Brodie, 1946; Waltz, 1981; Jervis, 1984). The other theory holds that nuclear weapons are not revolutionary and thus not particularly effective as deterrent instruments: countries, in fact, do not accept being held hostage and thus systematically look for technologies, capabilities, doctrines and strategies that will give them the upper hand over adversaries (Lieber and Press, 2016; Long and Rittenhouse Green, 2016; Rittenhouse Green, 2018). Building on the latter interpretation, European countries could consider deterring Russia through conventional alternatives that would both complement their nuclear capabilities and compensate for temporary gaps or political obstacles to acquiring or developing nuclear forces. With these premises, European countries could develop a robust, defensive conventional posture, relying on existing French and British assets to provide *"a minimal nuclear force"* (Fayet *et al*, 2025: 127).

In this scenario, European countries could invest in strategic cyber forces, hypersonic missiles and space weapons to threaten both punitive and denial strikes against Russia, if needed. To some extent, this option would mimic China's strategy over the past two decades relative to the United States. China has aimed to develop an alternative deterrent to nuclear weapons (Cunningham, 2025). Second, this option has the merit of forcing Russia to invest in defensive capabilities, ie to spread its resources thinly across a wider set of instruments. Finally, this option would address some of the challenges we have discussed, such as nuclear proliferation.

There are, however, risks. China was able to develop non-nuclear deterrent capabilities because the US was not inherently aggressive. Russia is an inherently aggressive actor and it is uncertain if non-nuclear deterrence would be enough. The political economies of cyber warfare, hypersonic missiles and space weapons are different and further research would be needed to assess whether joint development is feasible and efficient. Finally, should if joint development is not possible, the paradox could be that new, non-nuclear technologies would incentivise national developments that are at odds with a more concentrated European defence policy.

5 Political and economic considerations

Developing a European nuclear deterrent presents, of course, political challenges. To start with, substantively, the eventual development of a European deterrent is in itself a form of proliferation. However, such proliferation would be under the control of a limited number of actors, depending on the model chosen. The ultimate control of the nuclear deterrent would either be in the hands of a centralised European command, in the case of a Europe-wide scheme, or remain under control of current nuclear powers in the case of a nuclear sharing agreement, which in the short term is more likely than the former option. When it comes to nuclear sharing, a 2017 German parliament legal report stated that the Treaty on Non-Proliferation of Nuclear Weapons *"only prohibits the acquisition of sole control over nuclear weapons by a nonnuclear weapon state"* (Bundestag, 2017). Accordingly, European nuclear sharing, or absorbing (part of) the pre-existing French deterrent into a European one would not violate the treaty, nor would *"a mere stationing of nuclear weapons on the territory of a non-nuclear-weapon state"* (Bundestag, 2017). Uncontrolled proliferation with multiple European states seeking their own deterrents, would most certainly violate the treaty – and have implications for strategic stability.

Option 1, an extension of the Franco-British nuclear umbrella to the rest of Europe, offers an almost off-the-shelf path forward, but suffers from credibility challenges (section 4.1). Options 2-4, entailing different forms of Europe-wide deterrent capabilities, would require deep rethinking of European institutions, since creating a European nuclear deterrent is not possible under current treaties. The EU has neither the legal bases nor the political mandate to directly take over military functions, let alone a nuclear deterrent. The credibility of a joint deterrent under options 2-4 implies and requires a single decisional node with the military and political authority to launch a nuclear strike. In the US, this is vested in the Commander in Chief, ie the President; the same applies in France. The Soviet Union first, and then the Russian Federation, opted instead for assured retaliation by means of a semi-automatic retaliation system, Perimeter, partially aiming at removing humans from the loop, but any such design is excessively risky and implausible in Western democracies (Gilli and Gilli, 2020). It follows that any joint nuclear deterrence would require the highest possible level of political legitimacy and direct oversight by the military branches responsible for carrying out the strike. No such institution exists under current treaties; the military control requirements and the political legitimacy requirements for authorising such action makes options 2, 3 and 4 conditional on a leap forward in political integration among participating countries.

In this context, whether or not political support for European nuclear weapons and European military and political integration is sufficient remains an open question. Certainly, conventional military integration – including very ambitious, federal-like versions of it – are strongly supported in principle by European publics (Burgoon *et al*, 2023; Nicoli *et al*, 2025; Hoffmann, 2024). However, it is unclear whether public enthusiasm for EU-level military instruments is transferable to the nuclear domain. Data on attitudes to nuclear deterrence is limited. A 2018 YouGov survey for the International Campaign for the Abolition of Nuclear Weapons (ICAN) suggested that respondents in Italy, Belgium, Germany and the Netherlands were largely against nuclear sharing, or the stationing of US nuclear weapons in their countries (Fihn, 2018) (even though the way the survey phrased questions was odd and somewhat leading). A 2022 YouGov survey found similar levels of rejection of nuclear weapons among UK adults[12].

Onderco (2024) found that German respondents are very much against use of nuclear weapons, but generally supportive of basing nuclear weapons in their country, since it can produce positive deterrence effects. An online survey by UCE Research[13] with a sample of over 1000 adult Polish respondents in February 2025, indicated strong support (over 50 percent) for stationing of nuclear weapons in Poland under a nuclear sharing programme.

However, systematic evidence in relation to European-level instruments is lacking, especially since the return of President Donald Trump to the White House. On our behalf, IPSOS carried out in April 2025 a representative poll in Germany, Italy, France, Poland, Spain and the UK, finding quite large support for an independent EU nuclear deterrent (Table 2), an idea that obtains absolute majorities in all countries. However, any genuine European instrument cannot be considered independently and separately from questions of deeper political integration of European countries, for which the appetite is lower, even among these survey respondents.

Table 2: Level of support for EU-level nuclear deterrence

"Are you in favour of or against an EU joint nuclear deterrent, independent of the United States?"

	Italy		Germany		The UK		France		Poland		Spain		Total	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Against	205	*13.67%*	302	*20.08%*	144	*9.60%*	176	*11.57%*	151	*10.06%*	144	*9.60%*	1,122	*12.43%*
Neutral	515	*34.33%*	450	*29.92%*	451	*30.07%*	390	*25.64%*	411	*27.38%*	452	*30.13%*	2,669	*29.57%*
In favour	780	*52.00%*	752	*50.00%*	905	*60.33%*	955	*62.79%*	939	*62.56%*	904	*60.27%*	5,235	*58.00%*
Total	1,500		1,504		1,500		1,521		1,501		1,500		9,026	

Source: Bruegel based on IPSOS/Politecnico di Torino data (April 2025).

[12] See 'YouGov / Nuclear Education Trust Survey Results', https://docs.cdn.yougov.com/z2yz7bykv9/NuclearEducationTrust_220705_W.pdf.

[13] *Onet*, 'Czy Polska Powinna Dysponować Bronią Atomową? Jest Sondaż', 21 February 2025, https://wiadomosci.onet.pl/kraj/czy-polska-powinna-dysponowac-bronia-atomowa-jest-sondaz/htfpq9w.

5.1 The costs of a European deterrent

Regardless of the political design, a fundamental question is: how much would a European nuclear deterrent cost? We can start by assuming that a minimal, credible European deterrent could be roughly equivalent to the British Trident or the submarine element of France's Force de Dissuasion. The British deterrent is entirely submarine-based; the UK has four Vanguard submarines and is procuring four Dreadnought submarines to replace the aging Vanguard class. The French deterrent has both an airborne and submarine component. The latter consists of four Triomphant-class submarines, with two deployed simultaneously since 2022 (Kristensen *et al*, 2023).

The British and the French deterrents both have three main cost elements: the initial investment carried out in the 1970s and 1980s, annual management costs and current modernisation costs for the next-generation programme. Mills and Kirk-Wade (2024) estimated for the UK House of Commons the initial costs of the Trident programme at nearly €30 billion in 2024, with annual management costs of approximately €3.6 billion and a full modernisation programme (which includes replacing all four submarines) at €50 billion. The French nuclear budget is less transparent. The actual costs of nuclear deterrence are classified, and French budgetary practice includes a multiannual Military Planning Law covering both investment and public expenses, as well as annual budgets including both air and submarine components. The total expenditure for the 2019-2025 period on nuclear-related activities was planned to be €37 billion, with annual budgetary appropriations ranging from a low of €4.9 billion in the 2015-2018 period, to €5.6 billion in 2023 (Tertrais, 2020; Kristensen *et al*, 2023; Assemblée Nationale, 2023).

France is also engaged in building four new third-generation submarines (SNLE-3) which should enter service by 2035. While the programme cost is a national secret[14], anonymous defence sources have placed it at approximately €47 billion (2024 euros)[15]. Conversely, the cost of building the second-generation submarines – the last of which entered service in 2010 – was revealed by an audit of defence programmes in 2010 and actualised to €24.13 billion (2024 euros; Cour de Comptes, 2010).

Even though information is scarce, it is plausible that these estimates cover the costs of the submarine component and the management of the entire force, but do not include the procurement cost for the weapons themselves.

[14] Jean-Dominque Merchet, 'Sous-marins: Le Coût des SNLE Français est Secret', *L'Opinion*, 19 February 2021, https://www.lopinion.fr/secret-defense/sous-marins-le-cout-des-snle-francais-est-secret.
[15] Philippe Chapleau, 'Quatre nouveaux sous-marins nucléaires lanceurs d'engins pour la France en 2035', *Ouest-France*, 19 February 2021, https://www.ouest-france.fr/politique/defense/de-nouveaux-sous-marins-pour-la-force-oceanique-strategique-en-2035-7160150.

Table 3: Comparing European nuclear deterrent costs

	Initial investment (€ billions)	Management costs (€ billions/year)	Modernisation costs (incl. replacement) (€ billions)
Trident	28.75	3.6 (only submarine)	50.69
Force de Dissuasion (submarine)	24.13	4.9 to 5.6 (submarine and air component)	47.42*

Source: Bruegel based on Mills and Kirk-Wade, 2024; Assemblée Nationale, 2023; Cour des Comptes, 2010. Note: *as estimated by anonymous military sources (see footnote 15). All figures in 2024 euros.

France's M51 missiles, developed by ArianeSpace, had a development cost of about €8 billion (2024 euros) and a total procurement cost of €4.68 billion[16]. This likely covered only the initial tranche of 16 M51.1 missiles (Kristensen *et al*, 2023) but not the subsequent 36 M51.2 and M51.3. Moreover, these estimates exclude warheads, the costs of which are hard to gauge.

In summary, even a limited European deterrent that is comparable in size to the French Force de Dissuasion and makes use of 'off the shelf' French or British technology, is likely to cost at least €50 billion for submarines, €5 billion for missile procurement and €5 billion in yearly management costs, without yet including the cost of warheads. These are sizeable numbers, which rely on the generous assumption that French technology can be used for the endeavour; European-level procurement would in any case be needed for common capabilities (Beetsma and Nicoli, 2024).

It is clear that smaller EU countries could not afford anything on this scale, but the effort might be sustainable if done at European level. Moreover, the development of a European nuclear deterrent only makes sense under an American withdrawal scenario. The same scenario would also require the development of European conventional capabilities, which have been estimated as a permanent increase in European military expenses of €250 billion/year, half of which could be financed centrally (Burilkov and Wolff, 2025). Assuming a 10-year development horizon, the total envelope for European defence (conventional and strategic) would therefore likely increase to €265 billion to €270 billion per year, though most of these additional expenses would be one-off items (eg the submarines and missile stock), which would qualify for debt financing.

Notably, our calculations do not account for the potential need to finance not only new capabilities, but also technological advancement, in particular hypersonic and space-based weapons[17]. Hypersonic

[16] *Associated Press*, 'France announces euro3 billion nuclear missile deal', 23 December 2004, https://web.archive.org/web/20150924172113/http:/www.highbeam.com/doc/1P1-103695206.html.

[17] Space-based nuclear weapons are prohibited by the Outer Space Treaty. However, a US Congress House Intelligence Committee report (2024) has revealed that Russia is actively developing a space-based nuclear weapon regardless of its obligations under the OST (see White House press briefing of 15 February 2024 (https://bidenwhitehouse.archives.gov/briefing-room/press-briefings/2024/02/15/press-briefing-by-press-secretary-karine-jean-pierre-and-white-house-national-security-communications-advisor-john-kirby-3/). See also Berkowitz and Williams (2024).

weapons are already part of the Russian[18] and, probably, the Chinese arsenals (Bernstein and Hancock, 2021). The costs of developing such weapons are high. While data on the Russian and Chinese programmes is not available, the US programme is estimated to cost up to $18 billion, according to the Congressional Budget Office (Kramer, 2023). These costs would be in addition to those already given, considerably increasing the initial investment needed.

6 Conclusions

This paper discusses options for solving Europe's nuclear dilemma, which will emerge if two things happen: the US withdraws from Europe and Russia uses its nuclear arsenal proactively to exert blackmail. While both of these conditions are possible (and the second is even likely), neither is certain. Obviously, European countries should do what they can to strike a new transatlantic bargain with the US in order to preserve its nuclear umbrella over Europe. While this would, in terms of strategic autonomy, keep Europe fundamentally dependent on the United States, this solution would have the benefit of contributing to non-proliferation while containing costs and avoiding national sovereignty compromises. Granted, European countries will likely have to pay some form of fees to the US (direct transfers, more favourable legislation for US companies or other options), but the costs would remain relatively modest.

A new nuclear deal with the US could also take the form of enlarging the NATO nuclear-sharing agreement. Currently, five NATO allies host tactical nuclear weapons on their territories and deploy dual-capability aircraft that can carry and, if needed, deliver them over a target. In this case, other NATO allies could join the programme: Poland, Czechia and possibly Finland and Sweden might be interested in joining. However, the willingness of the current US administration to strike such deal, and whether the US will fulfil any new commitment it enters into, remains in doubt. If doubts about a new nuclear deal with the US remain, European countries will have to either face blackmail, accept proliferation or find ways to jointly provide security.

Relatedly, it cannot be discounted that, at some point in the future, a Russian administration might be willing to engage in negotiations to reduce nuclear arsenals and favour détente over deterrence in Europe. If, and only if, Russia agrees to cooperate – which we can neither predict nor assume – nuclear disarmament may improve non-proliferation, would likely have widespread public support and would be cheaper than the alternatives, as it would not entail additional defence investments. However, arms-control negotiations have historically taken several years. While the Conventional Forces Europe (CFE) required about one-and-a-half years, and the Strategic Arms Limitation Talks (SALT) I took two-and-a-half years, the Intermediate-Range Nuclear Forces (INF) and SALT II took six years and Strategic Arms Reduction Treaty (START) I took nine years. Furthermore, the risks of Russian violations are high.

[18] Maxim Starchak, 'Russia's Hypersonic Missile Attack on Ukraine Was an Attempt at Blackmail', *Carnegie Politika*, 29 November 2024, https://carnegieendowment.org/russia-eurasia/politika/2024/11/russia-oreshnik-nuclear-blackmail?lang=en.

Russia has in fact violated all previous agreements and treaties, starting from the Intermediate-Range Nuclear Forces Treaty.

These considerations notwithstanding, we assessed a number of options available to European governments should they need to develop independent and joint nuclear capabilities. We assessed these options on the basis of readiness, feasibility, credibility, capabilities and costs. No option is both easy to achieve and high scoring against all parameters. The more ambitious options would require substantial effort in financial and technological terms, and also in political and institutional terms. Nonetheless, more ambitious options may help address the quantitative and qualitative gap that separates European countries from Russia, which has a strategic and tactical superiority that should cause concern if the US withdraws its guarantee of protection.

In the short term, a guarantee provided by Europe's current nuclear powers – France and the UK – is likely to be an attractive option to make up for increased uncertainty about the continuation of the US nuclear umbrella. However, any form of external guarantee would pose long-term challenges; we presented several options that may address these pitfalls. It is also important to note that while we have set out these options as distinct, they could be combined or linked in a sequence, as trust between partners grows, and the institutional and technical groundwork is done. Either way, any European nuclear deterrent, if it is to be fully credible in its dissuasive power and if it is to provide added value over extending the French (and perhaps UK) umbrella, would have to be genuinely supernational, and would therefore require a leap forward in political integration among the participating countries.

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