Scenarios for Franco-German NC3:

On the Feasibility of Binational Nuclear Forces

Julian Heiss — jlh2287
Independent Research Study
Under the supervision of Prof. Cynthia A. Roberts
Columbia University
School of International and Public Affairs
May 10, 2024

Abstract

In this study, I examine the feasibility and strategic implications of establishing a binational Franco-German nuclear force, in addition to, but largely structurally separated from, a continued French national nuclear force. In doing so, I presume political will for such a binational component by operating under a scenario of fluctuating US commitments to NATO and rising geopolitical threat levels against the central European powers. The analysis engages with various conceptual frameworks, including deterrence credibility and technological constraints for a shared NC3 structure, to explore the conditions under which a Franco-German nuclear collaboration could be operationalized. I compare the advantages and disadvantages of the different hypothetical variations of a binational nuclear component and multinational nuclear force, drawing further implications about necessary conditions. Ultimately, this study aims to contribute to the discourse on European strategic autonomy by addressing the complexities of shared nuclear deterrence and providing a nuanced understanding of the conditions under which a Franco-German nuclear alliance could serve as a cornerstone of European security rather than engaging in guesswork about the extent of political will.

1 Introduction

The for and against a potential Europeanization of the nuclear umbrella is a debate that has been ongoing for decades. In the 1960s the notion of the Multilateral Nuclear Force (MLF) was advanced in the context of NATO (Kohl, 1965; Gregory, 1996). In the last decade, driven by the increased political instability of the US and increased uncertainty about its commitment to NATO (especially during the Trump administration), the debate has surfaced time and time again. This should not be surprising, as the concepts of extended deterrence and an American umbrella have always been contested ideas, and the success of nuclear non-proliferation is somewhat surprising in this sense.

The debate has revolved around a number of concepts: again, similar to the MLF, a NATO-wide shared bomb (Kohl, 1965; Bluth, 1995; Fulwyler, 1965; Slessor, 1965); an EU-bomb (Egeland & Pelopidas, 2021); or a Euro-bomb based on Franco-British extended deterrence (Kunz, 2020). Even a German bomb, the 'German option' was discussed, but routinely judged as unlikely (Müller, 2000; Kühn, 2024; Kühn & Volpe, 2017; Meier, 2020).

Time and time again, these advances of these concepts were countered. Criticisms can broadly be organized along the following categories: Political impossibility; the argument that exchanging one umbrella for the other would not change anything, or rather endangering the security of Europe rather than strengthening it (Kühn, 2024); and a general disagreement on the deterrent nature of nuclear force (Egeland & Pelopidas, 2021). Additionally, the weakening of the non-proliferation efforts is a commonly shared concern.

In this study, I set out to discuss the non-political hurdles of a Eurodeterrent, looking instead at the practical aspects (strategic and technological) of this type of proliferation. By this, I want to arrive at a discussion of hard constraints rather than a circular discussion based on uncertain assumptions of a political nature. Thus, in the following, I briefly consider these main strains of arguments against a European nuclear deterrent and argue that they systematically overemphasize the political dimension while leaving out technical arguments of feasibility.

Common Arguments against a European Nuclear Deterrent

A Weakening of the NPT The argument that a Franco-German push for the nuclear bomb is prohibited by the NPT and that breaking the treaty would lead to its inevitable weakening or complete dissolution does not weigh much in the scenario considered in this study. Instead, I will be discussing German proliferation under an assumption of a threat level at which other countries – like Japan or South Korea – could be presumed to be sprinting for the bomb themselves. Under sufficient threat, the Western European powers may decide that the only safe way in the new geopolitical reality is a pivot away from an NPT regime and nuclear zero aspirations.

Domestic Political Impossibility These lines of argument which are rooted in current domestic politics are peculiar, especially in functioning democracies – among which one should hope to count states such as Germany, France, and Britain. Geopolitical environments have heavily changed throughout time. The current French-German alliance was thought impossible less than a century ago. Threat environments have often catalyzed pragmatic change and it would be naive to discuss the pros and cons of nuclear questions solely on the basis of domestic politics.

Deterrence Power Security risks that stem from a potential Eurodeterrent certainly need to be considered. Yet, they largely depend on the implementation of such a European umbrella, especially the nuclear strategy of each deterrence scenario. This, in turn, is shaped considerably by the size and type of nuclear forces employed and how the command-and-control is designed. Hence, this will need to be discussed as part of each scenario to derive a cost/benefit estimate of such deterrents.

So why not ask what the real limitations of a nuclear force shared among European nations are? If the US undermines the extended deterrence it has been promising so far, Japan and South Korea are prepared to advance their nuclear capabilities in little time. Germany, historically slow and undecided in all things nuclear, would be left vulnerable. There is also no nuclear power between Germany and Russia that would stop a Russian advance. Let us consider then a threat scenario that unambiguously converges Germany and

France in their security concerns: A nuclear saber-rattling Russia, in its last efforts to leapfrog towards a Russian Empire; a USA that has withdrawn from giving NATO the support it needs to be fully functional. German and French political elite as well as society would be united in fear and in resolve to defend their states with a nuclear deterrent; Germany would be bankrolling what France was not able or willing to spend in past decades on an extension of its nuclear forces while it had been partly operating under a U.S. umbrella itself. Should one not prepare for such an event? This is the basis for the treatise that follows: to move beyond the political, which is malleable after all, and to look at the hard problem of shared nuclear deterrence between two sovereign notions: a shared NC3.

NC3 – nuclear command, control, and communications – is integral to the strategic use of nuclear force. Second-strike capabilities – central to a nuclear deterrence that is not at the outermost brink of first use – require not only concealment and hardening of the missiles themselves but also of the capabilities to control them in time of or after an attack, which in turn requires communication and a clear understanding of who commands them. Sharing NC3 responsibilities is certainly a big task in itself. Yet, one should not forget the challenge that lies in the modernization of NC3 systems. Cybersecurity, AI-enhanced subsystems, entanglement with conventional military systems. These are all aspects that will have to be considered when designing a Eurodeterrent.

Preparedness through Scenario Thinking

> "At the end of the day, the vagueness about the German nuclear debate—and proposals to receive security guarantees from Paris—reflects the widespread uncertainty about the future of European security in light of wavering American security commitments." (Kunz, 2020, p. 74)

This paper should also be seen as a break with the current dominant style of debate on European nuclear options. While academic literature gets down to the technicalities of deterrence, the debate at large is often circling about the incompatibility of French and German politics, the impossibility of bringing together their strategic cultures, or the missing support in the populace. All of these are legitimate criticisms, but they are surrounded by a lingering uncertainty as to how much they represent challenges – are Germany

and France actually incompatible when it comes to defense matters or can leadership and policy overcome this problem? Arguably, a more productive approach to stake out the challenges is to conceive a set of clear options, and then assess them each according to their weaknesses and advantages, their (technological and political) prerequisites and implications. Going away from a reductionist separation into good and bad policy will ultimately prepare politicians and citizens to react more flexibly when threat environments or political situations change. In this sense, this paper is an exercise in strategic foresight.

2 Scenario I – A Binational Nuclear Force

> *Russia, following a long, tiring stalemate in Ukraine and in an attempt to regain breathing space, uses increasingly nuclear language. Under a new administration, the U.S. has made increasingly vague statements about its resolve toward a continued extended deterrence for the European continent, focusing on the Indo-Pacific instead. German and French leaders, aware of the need to bolster both conventional and nuclear power, thus decided to shore up the existing French nuclear force, creating from it a central European nuclear deterrent, which is detached from NATO, but shared between the two powers.*

While I want to presume political will for moving toward a European nuclear deterrent, to be able to discuss its technical feasibility instead, it would be of little value if the scenario were detached from reality entirely. Thus, it should still resemble a future that is *possible*, if not even *plausible*. As such, it can be roughly located in the gray zone between *evolutionary* and *revolutionary* modes of prospection according to the framework introduced in Voros (2006). Explicitly, this means putting forth bold assumptions on the political feasibility of such grave changes in France and Germany, but ultimately anchoring them in the real requirements of these two nations[1] – and discussing to what degree they can or cannot be fulfilled in such a scenario.

[1] Slessor, for example, lists twelve points at the outset of his discussion of an *Atlantic Nuclear Force* (Slessor, 1965, p. 5).

The current geopolitical situation we are in is not the logical conclusion of a strategic plan of the last decades. While some strategic decisions were surely an input, much of the situation in which we locate ourselves now is due to the constant gradual adjustment to new developments – reactive, but often caught in path dependencies. If suggestions for a European nuclear deterrent seem impossible, it is partly because the path to such an end state is deemed unwalkable. The discussion in this section shows that some concerns are actually tractable. For some aspects, there are historical precedents or ways to make the process towards a European deterrent gradual – letting the involved actors take the path step by small step.

Command Authority

The question of authority in a binational setup is one that may be the most eye-catching at first. How can two sovereign nations share the burden of a nuclear decision?

First, in the scenario of a binational component next to a continued sovereign French nuclear force, France has little reason to object to sharing the authority on this joint component. France gains financial support, and the opportunity to advance the notion of European strategic autonomy by an initial step. Much on this has been written elsewhere, but at the least it will need a closer strategic alignment between the primary two European powerhouses.

Second, leaving aside the question of whether Germany should go nuclear given its historical burden, German policymakers should also have little reason to object to only being able to command nuclear weapons in tandem with France. After all, in case of the absence of a U.S. nuclear umbrella, some nuclear command is better than none to create a deterrent.

Ultimately, the answer to the above question of a set-up for the decision-making may be straightforward. As France continues to have its own component, mutual veto powers for the binational component are no impediment to having the requirement of a unanimous decision by the primary political and military leaders in both states before a launch. In situations where time permits, this needs little justification. It is the time urgency in crises or in the event of surprise attacks that raises the need for quick decision-making and thus the question of how small this circle of authority can be.

Currently, in France, the authority to order the use of nuclear weapons rests with the President (Tertrais & Lewis, 2019, p. 16). The responsibil-

ity to have the order carried out, then rests with the *Chef d'Etat-major des Armées* (CEMA, equivalent to the Chairman of the Joint Chiefs of Staff) (Pelopidas, 2019, p. 7). The role of the President's *Chef d'Etat-major Particulier* (Private Chief of Staff, CEMP) is unclear, being reported to have half of the nuclear codes (Pelopidas, 2019, p. 12). This may be a safety measure not needed in a binational setting, as the authority would be dispersed either way.

For Germany, no precedent of nuclear authority exists, but a mirror image of the French case would be to entrust the German Chancellor with the nuclear authority, with the order being carried out by the *Generalinspekteur der Bundeswehr* (Inspector General of the Bundeswehr), the highest ranking soldier in the German military. Given the Federal Republic of Germany's aversion to power concentration, in all likelihood at least the Vice-Chancellor or another political entity would have to be involved in addition to the Chancellor. The Minister of Defense would only be involved in advising if needed, as the command authority in time of war lies with the Chancellor. This leaves an absolute minimum of three persons involved in the decision-making process, while the need for consultation on the German side creates an upstream layer.

How realistic is it to have three or more people decide on a nuclear launch? Maybe in 15 minutes or less if warned of an attack, or, even worse, in the aftermath of an attack. It certainly is a good question, but one should also not overvalue the effect of an additional phone call between two leaders and underestimate the problems that exist already for the decision-making for the 'ordinary' one-state case with a singular nuclear authority. Even though command authority is the most eye-catching question at face value, it hides few surprises or problems. Ultimately, the time pressure it introduces is no characteristic of a binational force, but a general predicament for nuclear states. As Reagan is quoted about the fact that leaders have to make decisions about a nuclear launch in a mere few minutes: "How could anyone apply reason" in such short time spans (Leffler, 2018). It follows that planning and the availability of response options, including selections of targets, are important to be able to give credibility to a launch-on-warning posture. However, a launch-on-warning posture might not even be needed in the binational component. More on possible postures and the operational details of nuclear planning will be discussed later on.

Thus, more intricate than the question of authority are therefore the downstream facets of NC3. In the remainder of this section, I set out to

develop the characteristics of these facets, derived from the conditions that follow from the overall strategic goals of a Franco-German nuclear force. These are in turn prescribed by the outlined scenario and fundamental requirements as given above.

Squaring the Circle – French and German Strategic Approaches to Nuclear Deterrence

A binational nuclear force scenario, that is, nuclear weapons under the joint command-and-control of France and Germany, must acknowledge France's "head start" as a nuclear power and its continued need for a national, solely French, nuclear deterrent. This is also important to not undermine France's way of integrating conventional and nuclear force into a holistic deterrence stance (Tertrais, 2020). France is not part of NATO's nuclear planning group as "[its] nuclear deterrent guarantees the country's – national – strategic autonomy and national sovereignty" (Kühn, 2024, p. 118). So, France could include Germany if it strengthens the implicit European component of its force, but only if it also reserves a portion for its own strategic goals. Through this separation, compromises with Germany on strategic or operational matters of the binational component are in principle possible, yet trade-offs can still occur when the strategy or operation of each nuclear component undermines each other explicitly (rather than just one coming short of the goals of the other). Hence, the approach in this scenario is to build on France's experience as a nuclear power, leveraging its experience and existing infrastructure where possible, but separate the two components where needed.

Obviously, even with a continued national nuclear component, the French side will need to make some compromises under this scenario. Something that will not be able to be accommodated anymore, is for example the long-held conviction that Germany should not have command of nuclear weapons. A sufficient mutual threat might let France reconsider its hesitancy towards this point and while this is clearly a big assumption and while the opinions of whether a Federal Republic of Germany should be entrusted with nuclear military power might diverge widely, this does not seem to be something unthinkable in the event of an evaporating US nuclear umbrella. Japan's and South Korea's proliferation seems more likely, but Germany's not impossible.

Purpose of the Nuclear Force

Some academic voices go as far as to say that France and Germany are structurally incompatible in questions of defense cooperation. Kunz argues that the different starting points of the two countries and their different regional foci have created such distinctly diverging strategic cultures that even on command-and-control issues potential agreement seems "far fetched" (Kunz, 2020, p. 68). While nuclear power and nuclear weapons are "symbols of independence" in France, they are seen a "liability" in Germany (Meijer & Brooks, 2021, p. 78). At the same time, however, Germany has long been involved in NATO nuclear sharing, it deploys U.S. gravity bombs in the German air force base Büchel (Meijer & Brooks, 2021, p. 78) and has made the decision to upgrade the air crafts for that mission (Sprenger, 2022) – and is thus hardly a nuclear virgin.

It is true, that for the binational nuclear component, a common strategy has to be developed, with the top priority being the question of what the purpose of the binational component would be: What should and can be deterred by it? France has been deliberately ambiguous about the exact details of its nuclear doctrine, seeing the uncertainty in the opponent's mind as helpful for the deterrent power (Tertrais, 2020). Such ambiguity is arguably detrimental in the case of joint ownership of a nuclear force, as it hinders fast decision-making in crises. Even if there is some need for flexibility in such moments, in general, the deterrent nature of a shared nuclear force needs to be defined more clearly than that of a singular state.

What is difficult to deter under this condition? Cyber attacks still pose major hurdles for clear attribution to an attacker as well as for devising a proportional response (Dunnmon, 2017). Similar problems of attribution and consensus on proportionality surround biological weapons. Both these issues – attribution and proportionality – are exacerbated in a binational decision-making environment. The questions of how to respond could reveal rifts in the French-German understanding of the situation, and thus these matters do not lend themselves to be easily included in the set of deterrable attacks. It is important to note, however, that this does not undermine France's possibility to respond to such attacks on its own account. In fact, this continued cover of France's national component is crucial since an exclusion of these scenarios from the set of deterrable actions may promote the risk of biological or even chemical weapons being used: Signotaries of the conventions banning biological and chemical weapons cannot respond in (identical) kind to such

attacks, as rely on the threat of nuclear escalation to cover this gray zone (Tertrais, 2020, p. 28).

The reaction to aggression with tactical nuclear weapons poses a tough case as well, given the lack of flexibility due to the small size of a potential nuclear force and the many nuances that such employment could take (Kühn, 2024, p. 118). Historically, France also perceived nuclear weapons to be distinctly different from conventional weapons, and President Macron explained in a speech in 2020 that France would not engage in nuclear warfare or other forms of "graduated response" (Tertrais, 2020, p. 16). Generally, such musings about flexible responses would also need a more mature "strategic culture" than Germany could readily offer anyway, making it an unlikely issue for friction between the two partners when building the binational component.

Clearer cases are the use of strategic nuclear weapons and conventional invasions. In France, the strategic view prevails that the purpose of nuclear weapons is to deter "major state aggression" (Tertrais, 2020, p. 16). It makes sense for the binational component to leave some ambiguity as to whether this is to include only nuclear use or to include also conventional attacks, similar to current French doctrine, such that Germany's territorial integrity is covered in the deterrence insurance. Especially since Germany is likely to be reached and attacked by an adversary before France would be. A buildup of conventional power will be a prerequisite to be able to reduce this ambiguity bit by bit, reducing the risk of inadvertent escalation at the same time.

Uncertain is the extent of extended deterrence to NATO allies' territory. Politically, this question is tied to the power balance in Europe. A Franco-German nuclear umbrella for the rest of their allies in Europe is likely the option that most partners would prefer in the case of a retreating U.S., as opposed to the alternatives of a purely French umbrella (which could upend the European balance with Germany) or no extended deterrence (which would only leave the waning NATO umbrella or deterrence based on conventional military strength). In terms of nuclear strategy, it is a question of credibility. For the same set of aggression scenarios outlined above (major state aggression, nuclear or conventional, and not gray zones or aggression acts which are tough to attribute to a perpetrator), an extended deterrence posture seems credible – at least to the same extent that the current U.S. umbrella is. Arguably, France and Germany would value European allied countries' security even higher than the U.S., which has more theaters to attend to. A caveat is

the question of whether France and Germany would also strike preemptively, when not their own, but other countries' territories are threatened. Such a level of credibility would be harder to convey. Some scholars argue that the smaller size of the French arsenal and the limits with respect to flexible responses, mean that France would need to respond to a conventional attack on allied territories with strategic nuclear weapons. This, in turn, comes at a higher risk of a retaliatory strategic strike as a limited response would have induced, undermining the credibility of such a deterrence stance against conventional attacks (Horovitz & Wachs, 2023; Verstraete, 2024, p. 92). For the binational component, this caveat applies as well. It is left to the reader to decide whether these two effects on credibility – having more skin in the game, but being caught in the dilemma of inflexibility – cancel each other out. In any case, given Russia's LNOs, a Eurodeterrent does not relieve the European countries from the burden of upgrading their conventional forces.

The binational component is set up as the little sibling of the French national component. It would be smaller, dependent, and mimic the behavior of the older. As the little sibling of a strictly sufficient force it must have smaller objectives. Going for the same as France's deterrent would mean the binational component would be dangerously, recklessly overreaching compared to its capabilities – as little siblings unfortunately often do. Thus, such behavior needs to be constrained, a clear set of objectives, and a clear set of scenarios that are sought to be deterred, in accordance with the strategic objectives of the French deterrent, will be the starting point of building out this binational force.

Operational Aims

After this discussion on the high-level strategy decisions, I next address the operational policies that follow from them. The above deterrence goals must naturally be reflected in the way the force is set up.

Counterforce or Countervalue? While the German public, and thus German leaders, are likely to favor a counterforce posture, due to its seemingly more ethical nature, such a posture would require a more sizeable nuclear force (Kühn, 2024, p. 126). This is not achievable in the short to medium term and also at odds with the pre-existing French notion of *strict suffisance* (Kühn, 2024, p. 118), which ironically stems from a similar wish for an ethical nuclear force, only that the *fewer warheads is less evil* trumps

the *bombing military targets is bombing cities* approach.[2] Thus, while even though the countries would pool their financial resources, a resulting nuclear force would not be orders of magnitude bigger than what France is currently fielding.[3] Quite the contrary, a binational component would, at least for a good while, be smaller even. First, because it will be built out of the existing French nuclear weapons systems (unless quantities of nuclear bombs are bought), and second, because it needs to be small scale to both allow for a realistic path for France to warm up to the idea, and to keep the intricacies of a binational nuclear set-up manageable (more on this below).

No-First-Use French doctrine has not explicitly ruled out a first use, but there are also no indications that it has considered such a move (Tertrais, 2020, p. 29). Given it is operating under the strict sufficiency regime with a small force, hence a refusal to engage in a counterforce strategy, such an attack would be highly risky. Hence, French strategy does also not center around the concept of launch-on-alert.

The French notion of strict sufficiency, and the continuation of such in a binational setting, thus leads to a counterforce strategy being excluded for both the national and the binational nuclear component. A lack of counterforce means that neither doctrine nor force characteristics permit a preemptive, disarming first strike. Instead, it introduces the need for a survivable nuclear force – and while not unique to this scenario, this need is underlying all subsequent decisions about the NC3 of a binational setup.

Joint Responsibility vs. Joint Ownership There are several levels of intensity through which a common resolve about deterrence can be signaled. Joint ownership, for example, can be understood as a co-financing of a nuclear force. This does not necessarily include joint staffing, let alone joint commanding. A fundamental assumption in this scenario is therefore, that joint ownership is not sufficient to make a binational deterrent credible, but that it needs a level of joint responsibility that includes some form of joint command-and-control. The details of this are the subject of the following

[2]The tension between a counterforce and countervalue posture with respect to strategic, practical, and ethical dimensions was for example recently discussed in Glaser, Acton, and Fetter (2023).

[3]For a recent assessment of the French nuclear force see Kristensen, Korda, and Johns (2023).

discussion, as higher levels of integration naturally come with trade-offs – be it from a national perspective or with respect to practicality of such integration.

Guiding Principles for NC3 Structure The above conditions arose from political and strategic considerations, generating the frame in which the operational structure has to be designed. Within the set of possible structures, there are realizations that achieve the operational aims more effectively – for example guaranteeing communication even after a nuclear attack, and there are realizations that present the inherent trade-offs between concurring aims, such as the one between negative and positive control.

To guide the selection of those realizations that fulfill the former condition, there are additional principles: Central to the successful integration of two state apparatus into a binational NC3 structure is keeping the nuclear arsenal simplistic/simple. To counterbalance the increase in complexity through the binational nature, the underlying organizational composition needs to be simplistic. Seng (1997) describes the advantages and disadvantages of smaller nuclear states. While some of his proposed strategies are more applicable for cases such as either side of the Pakistani-Indian dyad and less so in the case of Franco-German deterrence against a major nuclear power like Russia, other parts remain useful guidance for conceiving a joint NC3 structure.

The Question of Delegation Within effective deterrence, a number of inherent tensions are hidden. To be able to deter a first strike, one needs to ensure the capability of retaliation, that is, ensuring the survivability of the nuclear arsenal, but also the NC3 capabilities. To retaliate, there is also a need for intelligence about the situation, and being able to establish communications between decision-makers and those close to the weapons who execute the orders. To be able to retaliate even when the political leadership was killed or is unreachable because of a breakdown of communications, some nuclear states delegate the authority to use nuclear weapons to other political leaders or military commanders. The tension between ensuring a launch when ordered and never having any accidental launch or malfunction is also called the *always/never dilemma* (Charles Glaser, Austin Long, & Brian Radzinsky, 2022).

Instead of only relying on survivability by riding out a first strike, some

states, like the U.S. have had their forces on constant alert, ready to "launch on warning" or to "launch in alert" (Charles Glaser et al., 2022). Such a posture exacerbates the described dilemma as there is only a little time frame that is given to make decisions, increasing the possibility of more mistakes or accidents. According to Tertrais, France does not operate under such a strategy, as it also does not employ silo-based missiles (as the U.S. does with its Minuteman III ICBMs). Instead, it relies heavily on survivability of the sea-based leg of its nuclear force, as the submarines are easier to obscure from adversaries and therefore safer in case of an attack. The same will be true for a binational component. Due to its proximity to Russia, the smaller size, and the increased complexity of ensuring protected communications between not one, but two capitals, with the rest of the nuclear weapons systems after an attack, some form of pre-delegation is likely to be part of the binational component, to retain credibility. However, pre-delegation in a setup of sharing between two states is arguably more vulnerable to loss of control than in the one-state case.

Currently, however, there is ambiguity as to whether the crews on France's SSBNs have full operational control over the nuclear-tipped missiles on board or whether they need codes to enable them (Arceneaux & Feaver, 2023, p. 194). The path chosen here by France would significantly influence the choices for the binational component, yet the final policies might not be as binary as presented so far. Arceneaux (2021) introduced a temporal framework regarding the question of (pre-)delegation – as opposed to the static notion of an *assertive/delegative* framework that was prevalent during the Cold War – classifying delegation types according to when delegation is happening with respect to the onset of a crisis. The next section thus discusses the immediate control of nuclear weapons on different delivery platforms and how these details could shape command and delegation.

A Nuclear Dyad

Land-based Missiles In contrast to the U.S. nuclear triad, France's nuclear force has only two complementary components, an airborne and a sea-based component (Tertrais, 2020; Kristensen, Korda, & Johns, 2023). Given the French strict sufficiency notion and problems with survivability concerning non-mobile silo-based missiles, but especially because of the path dependency when building out a binational component by expanding the current French force, a binational component is unlikely to have a land-based com-

ponent. In the following, I therefore focus on the details of the other two legs of a potential binational nuclear force, and especially on the sea-based leg.

Submarine Mission So what should a joint ownership of a binational version of the *Strategic Ocean Force*[4] look like? Currently, FOST consists of four SSBNs of which at least one is at sea at all times. Retaining a solely French portion of this sea-based leg means that either new SSBNs need to be added to the fleet, or a second, joint fleet needs to be created. The former would allow the creation of a joint portion at a significantly lower cost, using existing maintenance infrastructure at the Île Longue naval base (Kristensen, Korda, & Johns, 2023).

If this SSBN would be included in established structures, a mixed-manned operation seems the smoothest way to include German sailors in the mission. There is historical precedent for a mix-manned nuclear mission. In the 1960s, Western allies toyed with the concept of a NATO multilateral nuclear force (MLF). As part of that concept, American submarines were to be given to SACEUR[5], under their authority to launch, and, in a second phase, the creation of a fleet (surface ships) with mix-manned crews (Gregory, 1996, p. 26). Such a crew was aboard the USS Biddle for an experimental training mission (Kohl, 1965, p. 91). However, the MLF never became operational.

While enabling a quick way to integrate the two nation's forces, mixed-manning is not necessarily a permanent need in the long term. A a later time, a solution with a new fleet of which some submarines were fully manned by French sailors while the other half was German-manned, could be imagined. Given that there will be an element of predelegation to these crews, such shared, but not mixed, staffing, would show a higher level of trust and commitment to this joint force, while not ceding any additional authority to the German side. Both set-ups are thus conceivable and depend on additional external variables. For example, both types of manning could exist in the fleet in peacetime, and when risk levels increase and predelegation measures are installed (in line with the temporal framework or delegation by Arceneaux), the fleet could switch to an all-mixed fleet.

Further, mixed-manning the means of delivery, at the level of soldiers, is not the decisive factor, and should instead be seen as a confidence-building measure. Rather, it is the control itself that has to be shared. Where these

[4]From French *Force Océanique Stratégique*, also FOST

[5]*Supreme Allied Commander Europe*

two overlap (when control is partly physical control within a delivery system, e.g. in a submarine under predelegation), such joint sharing will be through mixed-manning the systems. But in itself, mixed-manning is not an end in itself and has never created real political problems (Slessor, 1965, p. 6).

For the time being, however, Germany would financially contribute to adding another submarine to the force, deferring to the current French structures. In this case, these submarines should also possess dual NC3 systems, allowing them to be switched out seamlessly between the national and binational components, such that maintenance of a submarine does not threaten to make either component nonoperational.

It is notable, that while the outlined guidance principles above – organizational simplicity by having small and simple nuclear forces – are derived from Seng (1997), Seng himself considers submarines not to be of such nature. They are expensive, "big ticket items", which are hard to build and difficult to control, as they operate as lone wolfs, potentially thousands of miles away from other national structure. They do not always allow for "direct, centralized communication and supervision" (Seng, 1997, pp. 65, 72-73). This is a trade-off that is willingly made in this case. First, because the stealth capabilities of the submarines ensure greater levels of survivability, and second, because of the path dependency. Given French experience with this platform, there is little reason to downgrade to other mobile land-based platforms.

It is also worthwhile to consider the command structure onboard a mixed-manned SSBN in the binational component itself. The overall structure of the nuclear forces in this scenario is based on a French primacy with compromises to incorporate German contributions, be it at the levels of decision-making, delivery platforms, or everything between[6]. A split in two crews, as it is practiced now, would allow for a German and a French crew to take the helm in turns (Tertrais, 2020, p. 55). Yet this seems to be a middle-path solution that is set to bring most of the problems with mixed-manning but none of the advantages, namely the creation of an integrated force and a natural, mutual control. Instead, a truly mixed set-up, with both crews being binational, is advisable. In normal times, the command structures could be just based on merit, regardless of nationality, while in times of crisis, either these submarines get substituted out of rotation (as described above), or there is a French primacy at the commander level, leaving the ultimate responsibility of launch order in French hands. At least in the initial period

[6]Truly left out are the Germans only when it comes to production of nuclear weapons.

of this scenario, such arrangements would make it easier for France to accept a binational component. After trust and German capabilities are built, the French primacy could be phased out gradually.

In general, even though the binational component is dependent on French structures, as a military service, it should be set up as independently as possible; a branch largely detached from German and French military structures in personnel matters. While at the beginning, it can only be slowly spun out for other matters, and ultimately it needs legislative creativity for such a binational effort, independence would let this component steer away from many systemic problems in the military of either side. It surely will become a plaything for the politics of either country, it should not also become one for the politics of the militaries themselves.

Airborne Component While Germany has little experience to bring to the table concerning the sea-based leg, there is more to draw from when it comes to nuclear bombers. As it is taking part in the US-NATO nuclear sharing, Germany is hosting U.S. nuclear bombs on its air base in Büchel. This hosting is governed by an Atomic Stockpile Agreement, addressing custody and release of the weapons (Kristensen, Korda, Johns, & Knight, 2023). These weapons are already operated in a joint manner, by the U.S. and Germany (Afina, Inverarity, & Unal, 2020).

As in the case of the submarine missions, there is the question of whether the air wings of a binational mission would be made up of mixed crews for each aircraft or whether this condition should be dropped for the sake of simplicity, having instead an air wing by each country contributing to the entirety of the joint force. For a mixed-manned setup, a dual-seat airframe would be a logical consequence. The German government decided to buy F-35 fighters to replace the aging Tornado fighters it currently employs (Sprenger, 2022). It also decided on the single seat version (Lockheed Martin, 2024). Yet, a common dual-seat airframe for a joint nuclear air force would be a preferable setup. 'Sunk cost', however, should not be an argument against instead introducing the FCAS *Next-Generation Fighter* – a project by Germany, France, and Spain – in the next decade, replacing again both Rafales and F-35 on either side (Hemler, 2023). Such a change should include also the single-seat Rafales deployed on the French aircraft carrier *Charles de Gaulle*, yet such a trade-off would likely mean a reduction in number of the fighters on board of the carrier.

In contrast to the case of the submarine mission, however, a sole German air wing would give Germany a portion of nuclear force at least under its physical control, and maybe even command. For a truly shared command, the weapons themselves would need to have similar electronic locks as is the case in the current NATO nuclear mission, enabling the weapons only after a shared directive. Historically, Germany hosted such weapons even without such electronic locks, only with an American sentry guarding against a rogue use (Gerzhoy, 2015, p. 110).

While it would be the easiest to keep using the nuclear bombs that are in Büchel to facilitate a quick transition of the force, there could be problems with taking over these particular bombs. Germany and France could for example be skeptical whether the electronic locks are properly deactivated or in their control, especially in a case where the U.S. lets the two countries proliferate only begrudgingly. If their ownership cannot be transferred, at least for an initial period only the sea-based component would be operational. While this is not a problem per se, a slower transition could introduce more friction in the international system than a step-change into a binational deterrence.

While the airborne component is secondary to the sea-based component in survivability, it introduces more flexible responses, even in the limited framework of strict sufficiency. The priorities in the strategic objectives will decide how integral this component is, yet if it is deemed necessary, it may need more preparation than the sea-based component, where a quick option for transition is the transfer of an existing, operational French submarine into a joint command.

Other Technical Aspects of NC3

NC3 is comprised of more than means of delivery and the decision-making process. Other elements that are necessary for the operation of a nuclear force are further upstream, for example, early warning and planning. Lastly, ensured communication is an integral part between all of these elements.

Early Warning As stated earlier, a launch-on-alert posture is unlikely for the binational component. Yet, commanders would not like operating blindly, just waiting for a nuclear attack. Obviously, early warning is also an important factor in ensuring the survivability of the nuclear forces. With a U.S. withdrawal, the support for such operations would be waning. Germany

and France would need to invest heavily in their own early warning system, likely at least partly based on satellites in addition to radar-based detection. As for the U.S., to prevent problems of dual-use entanglement, these would need to be solely for the nuclear forces (Dunnmon, 2017; Acton, 2018).

Communications French communication in its NC3 network are using the "Jupiter" network[7] (Tertrais & Lewis, 2019; Pelopidas, 2019). Such a network would need to be expanded, such that it connects both capitals and the military command of the binational component.

In communications with the delivery platforms, submarines, and aircraft, two-way communication capabilities are additional safeguards against inadvertent nuclear use or more flexible posturing. With these capabilities, bombers could be recalled before a strike. However, for submarines, these might prove impossible at times, especially during crises and because French submarines may operate isolated as opposed to under a bastion principle like other nations' fleets (Tertrais, 2020, p. 55). Communication with submarines is notoriously difficult, due to the physics of seawater and problems of disclosing their location, and feasibility and implications of the technical aspects of communications on a binational setup need further investigation than given in this study for the time being.

For matters of trust, both countries might want to employ liaison officers that report back to respective governments whether governmental control over the weapons is ensured (similar to the French nuclear-weapons inspector who carries out that function within the French system itself) (Tertrais & Lewis, 2019, p. 17). In practice, however, this could mean that German officers would have to accompany the French president at all times, together with a French counterpart. It is unlikely that France would grant such open access to a German officer, even if he were not inside the room with the President.

The French also employ a two-man rule in the entire nuclear command chain which would need to be replicated in the binational force structure. The smaller the national parts that are interlinked with the binational structure (i.e., if they are just decision-making components at the top of the system), the easier is the practical setup for such joint control measures.

[7]The name "Jupiter" is used for both the command post as well as the communications network at large.

Nuclear Planning Nuclear planning will be even more important than it is for current nuclear powers due to several reasons: i) given proximity there are higher time pressures, even if no launch-on-alert posture is taken; ii) joint responsibility means joint authority and more involved people in deriving a consensus, which prolongs the decision-making process; iii) dual structures and the possibility of entanglement with France's national deterrent raise the need for clear procedures; iv) the focus on survivability and the small size introduces pressures for predelegation which needs clear guidance v) the mutual trust and mutual strategies will need to be developed during the planning.

In creating their planning institutions, the countries can draw from U.S., NATO, and French examples. The convergence of strategy, even if decided upon on the level of political leadership, will be happening in these settings. Target sets, delivery routes, predelegation procedures. All these concepts, the compromises the two states are willing to engage in, will be fleshed out by the nuclear planning. Much of this could happen as soon as now, and arguably it needs to happen before any proliferation of the German side can occur. Such planning may also need to address some questions left open here through simulations, for example questions such as whether a shared nuclear authority is practical in a way that both states can agree on.

It should also be expected that NC3 will be compromised, and as such, there needs to be planning not only around nuclear attack scenarios, but also how to handle attacks below the threshold that merits nuclear response (Matteucci, 2021).

Further Considerations for a Binational Scenario

Mitigating Cross-effects The more integrated the two French components are, the less believable the extension of deterrence to Germany: does the participation of German soldiers in a French system make it believable, that France would act on Germany's behalf? Arguably, for many threat scenarios, this might be sufficient, given that there is a substantial overlap in the vital interests of the two Central European powers. Yet, to give Germany a bigger part in the command-and-control, the interlinkage needs to be reduced, creating parallel structures on the French side.

Having to employ a binational component in parallel to an existing national structure is not only burdensome for France, but it also introduces risks for accidental use of nuclear weapons. While the binational compo-

nent strives to be independent, it cannot be so from the start, and even in the medium-term – at least not if it is to be built in response to a sudden U.S. withdrawal from its nuclear sharing agreements in NATO. As described in the individual sections above, even though a potential modernization of NC3 systems opens up possibilities to create new structures, much of this is limited by the fact that the pragmatic technical solutions are shaped by the path dependency of current French technology, such that can integrate smoothly and create a deterrent power early on after inception. And even if both components were completely detached from one another in hardware, at least on the levels of strategy and decision-making, they are interlocked.

These interactions could create uncertainty in several levels of the NC3 system. When not completely detached, for example in the case of a submarine that could be fielded either by a binational or French component, there could be problems with the trust in the signals that arrive from higher French command. Are the orders coming from France's national system because the binational structures broke down? Only when the national structures do not have access, such a question could be definitively discarded, albeit at some cost in survivability through redundancy.

It could also be uncertainty introduced by human behavior. What happens when a French commander orders preparations for a launch, because he received indications of an attack or threats against the vital interests of France, maybe their territories overseas? Would this not automatically make commanders in the binational component follow suit?[8] However, without clear communication of what the threats are, communicated down to the level of the field commanders, the binational forces might overreact to information during that time of heightened sensibility, even if there is no immediate threat for which it is designed to react. But inadvertently the risk of a nuclear accident is substantially heightened, too.

The Role of Modernization Given the changing threat environment to NC3 systems specifically and the need to overhaul systems from Cold War times, there is a need to modernize current systems (Dunnmon, 2017; Hecla, Krentz-Wee, & Reddie, 2019). Hecla et al. describes three options for the modernization (although for the American case): *minimal*, *mixed-upgrade*, and *maximal*. For a Franco-German binational component, that is built out of existing French capabilities, there are incentives to keep the general

[8]Compare to the scenario in Seng (1997, p. 73)

structure, but modernize within where needed – as described by the *mixed-upgrade* option. Yet, as some parts may need to be built entirely new, to enable a system that incorporates two leaderships the answer might not be able to be generalized in such a way and depend on more detailed, sector-specific deliberations.

Red Teaming Red teaming, the practice of having rigorous challenges to test the existing systems by adopting adversarial approaches, might be the most efficient policy approach to generate lasting change to strategic cultures in organizations that structurally resist change. Certainly, it is important to test the positive and negative control elements in nuclear weapon systems, especially as the threat types are in constant change (Matteucci, 2021). In a binational partnership, there have to be conscious decisions to be made on how to integrate this into the force setup, such that neither side feels threatened by the constant challenges and thus the red teaming approach can come to full fruition. This can be done, for example, by having those red teams mixed-manned as well, similar to the staffing in the submarines

Relation to Conventional Military Historically France integrated its conventional and nuclear forces toward a holistic deterrence stance (Tertrais, 2020). However, as the binational component is best operated with separation from France's other forces, this change might also substantially affect its conventional forces. On the German side, it will be a great effort to build up a second military branch and might weaken its conventional forces as initially a lot of personnel will have to come from there.

Relation to NATO The binational component will not only be in parallel to national structures on the French side, but also to NATO structures. While the French are not integrated into the NATO nuclear sharing, Germany is. The deliberations on this issue depend much on the NATO environment during a build-up of a binational component: has the U.S. already retreated or not? In the latter case, how would Germany handle the nuclear weapons it currently takes care of? Would they be given up, or could they be transferred into the binational component by buying them? Would France and Germany trust the U.S. that they are functional and that ownership can be transferred? Or would the U.S. be worried about leakage of know-how? These are more detailed, but practical issues. Answers to this could give just as much insight

into the feasibility of the scenarios outlined in this study as the previous discussion of strategic matters. They may be more obscure in nature but could give hard constraints when it comes to designing a new nuclear security guarantee for Germany.

Managing Two Democracies Another complication comes from the simple fact that the two potential partners are both democracies, each with their electoral cycles, and each with their own culture of civilian-military relationships. Electoral cycles could add stress to their nuclear sharing agreement. It might have to be renewed by the respective legislative authorities, potentially making it a bargaining chip part of the political haggling. In setting up the agreement to produce this binational nuclear force, many legislative issues are unanswered, and there will be some safeguards needed to not let it become a bargaining chip – while still retaining flexibility to adjust processes if they have had unintended side effects or the external situation changed.

Proliferation Strategy Another area that needs closer attention is the transformation period from the current state of affairs into any outlined scenario. Can France protect Germany reliably while they are proliferating? The risk associated with the perceived provocation of handing Germany command over bombs is real, especially vis-à-vis a trigger-happy Russia while it is fighting a war in which it made nuclear threats. Kunz and Kühn rightly state that "deterrence is not merely a status that can somehow be switched on" (Kühn, 2024, p. 121). A possibility for this proliferation could also be to not do so in reaction to a U.S. withdrawal, but rather in cooperation. A concerted hand-over of the nuclear baton could happen with the U.S. as a patron, as part of a restructuring of the U.S. foreign policy focus and a restructuring of the burden-sharing within NATO.

Scenario Conclusion

As the discussion so far has shown, a binational nuclear component, as an addition to a French nuclear component, could be either an alternative or a stepping stone to a more integrated, multinational nuclear deterrent. While this setup introduces new facets of the known dilemma around the credibility of a deterrent threat, they are quite manageable. Especially French primacy and a smaller set of acts against which the force is supposed to

deter are low-hanging fruits to create a believable extended deterrence posture that includes Germany's interests. Changes to this minimal version, e.g. a more equal footing of the two nations when it comes to command structures or physical control of weapons, can make the threat more believable, but introduce trade-offs with respect to national authority in the command-and-control of the nuclear weapons, and thus need this initial step as a trust-building exercise. And ultimately, this trade-off is the motivation for the conception of such a binational component. It should strive for as much binational integration as possible while separating it from the national components. At the same time, this means that control needs to be tighter than for single-state solutions.

In general, joint nuclear responsibility produces need for simplicity, less ambiguity, more preplanning, and it will still constrain flexibility to react. This means the deterrent nature will be more narrow but quite strong within those imposed boundaries. It will be more credible deterrence for any potential attacks on the higher end of the force spectrum, possibly including any nuclear use. Such a credible deterrent would be a great step forward for the European continent. The weaknesses in the gray zones this setup leaves in the middle, below nuclear threshold and above conventional retaliation means, mean that with a merging of forces comes the need to extend the conventional power as well.

Germany would gain much in this scenario for a comparably small effort, given that it is being guided in many aspects. As such, the gains are proportionate to the investments, at least on the country level. For political parties or politicians, this might not be the case, given that there will inevitably be political backlash. For France, it is a more difficult cost-benefit analysis. Yet, keeping a national component should ultimately let benefits outweigh the costs if an orderly transition can be made into this dual nuclear regime. The biggest hurdles would be the navigation of the proliferation process, both due to geopolitical security risks such as the provocation against Russia and other nuclear states and provocation against the countries who are party to the NPT or the TPNW.

3 Scenario II – Equal Footing

The previous scenario contains elements of the considerations of an MLF as discussed in the first decades after WWII. However, it becomes manageable

by reducing the number of participants from many to two. Consultations and voting about nuclear weapons launches, with varieties in how the exact mechanism is structured, all seem to lack credibility (Michaels, 2023; Kohl, 1965, p. 99)[9]. Scenario I got around this mostly by leaving a French national component and reducing the number of scenarios for which the binational component's deterrence is relevant. Yet, if one were to talk only about France and Germany, could one imagine such a unanimity – could one imagine an equally shared nuclear force?

Ideally, such a scenario would have to be imagined both in parallel to national components as well as on its own, given the issues arising from parallel structures explained in the previous section. As I discussed some problems with parallel nuclear forces in the first scenario, I will focus here on the case of a singular, fully integrated, binational nuclear force. As such, it can only realistically be imagined as an end state of a transformation that included scenario I as an intermediary step. For an immediate, step-change transformation, the gap between the two states' strategic cultures and "nuclear experience" is too big to overcome. It is important to note at this moment, however, that seeing a fully binational scenario as a possible end state does not imply that scenario I (or a variant thereof) could not be a longer-lasting status itself. Starting to interlink the two countries' nuclear programs does not imply a natural progression toward France giving up its national component. As discussed, there are good reasons for France to continue partly on its own and one can certainly argue that nuclear sharing should always leave room for such national sovereign nuclear authority.

It is mostly the necessity of strategic alignment and the question of joint decision-making that introduce difficulties for an equal nuclear force. Technical hurdles can be overcome easier as in the previous scenario, as there are fewer problems with sharing sensible information. There is no problem with giving German soldiers physical control over nuclear weapons. For one, this would be the intentional purpose of this scenario, strongly increasing the credibility of the deterrent threat when it comes to Germany's security interests. Instead, the main problem in this case would be the *always/never dilemma* as it is for other nuclear forces.

Unique to this scenario is how survivability concerns like decapitation play out. If decision-making is based on consensus between leadership in Paris and Berlin, the decapitation risk is doubled. By integrating the nuclear

[9]Klaus Knorr is a scholar who worked extensively on this issue.

forces, but leaving a binational decision-making process at the top, there are more vulnerable links in the NC3 system than for a one-state set-up which can be exploited by adversaries. This increases the tendency towards pre-delegation in such a scenario compared both to the one-state solution or the previously discussed scenario if a consensus is a strict requirement. On the other hand, the same characteristic increases survivability, if there is a clear procedure of how one leadership could decide on behalf of both when communications are severed. While not much different in outcome than pre-delegation to military commanders, a pre-delegation to another state's political leadership is different in nature. Arguably, the U.S. nuclear umbrella creates a similar situation for the European countries, yet this is born out of a position of weakness and a transfer of authority between equals would have to be designed more carefully and more in more detail.

4 Scenario III – Central Deterrence

French Authority with German Input

Another option, which is more often mentioned in the current debate, would be a version of a French nuclear umbrella that extends over Germany. Short of taking part in force deployment, and having control of nuclear weapons, Germany could contribute to the French component in similar ways it does within the NATO nuclear sharing agreements.

At a minimum, Germany would contribute significantly to the financial aspects of the nuclear force. It could, however, also participate in planning or NC3 aspects like early warning or the conventional assets that would be needed for strike missions (Veit, 2004, p. 14).

Such a scenario would leave most control-and-command in French hands, but it is still at odds with current French doctrine. France historically never fully trusted the concept of extended deterrence, rather it followed the notion of *central* deterrence, which is among the reasons why it developed its own nuclear force and stayed independent from NATO in all things nuclear (Jurgensen, 2019). Even if it is well possible that France could want or could be convinced to have Germany contribute to its nuclear force, it remains questionable whether such a scenario would represent a credible deterrent that includes the security interests of Germany.

Hence, in terms of vulnerabilities, this scenario bears much fewer uncer-

tainties in the NC3 setups, rather its weakness stems mostly from strategic considerations. France could either continue with its doctrine as is, including Germany in its statements about what its vital interests are and accept that there is a chance of adversaries testing its resolve, or it could adjust its doctrine, reducing the ambiguity, and being more explicit about what scenarios it would respond to with nuclear retaliation. In the end, this is a much easier scenario to implement, but it leaves less strategic maneuverability than the binational component as developed in scenario I above.

Other scholars even disagree with the notion that the French nuclear deterrent was always imagined as a central, national deterrent. Tertrais argues that it had a European dimension from the outset, a claim which is backed up by the FIG project which sought to develop military applications of nuclear energy in a joint undertaking (Tertrais, 2020, p. 39). If this European dimension can be revived again, it should best not stop at a symbolic inclusion of other states but have tangible sharing of the pros and cons of being a nuclear power.

5 Assessment

5.1 Limitations of Analysis

There are obvious limitations to the analysis as presented in this study. The scenarios are based on the open literature on NC3 systems. Because much is classified, these can only give partial perspectives into the reality of the nuclear weapon systems as they exist nowadays. While the strategic discussions are more easily accessible, there may be blind spots when it comes to the capabilities or vulnerabilities of the hardware. Such blind spots could potentially skew the assessment of the risks of a binational nuclear component systematically. For this reason, this study has a deeper discussion of strategic considerations but simply presumes the feasibility of some technical requirements, such as interoperability between the military equipment or at least the development of new joint standards. Creating a new binational military branch is certainly a grand undertaking and depending on how long it would take, it could change the cost-benefit calculus considerably or give much time for adversaries to intervene.

5.2 Feasibility

Naturally, as stated in the beginning, the main prerequisite for the outlined scenarios is political will. Sometimes, such will might be closer than the skeptics of a European nuclear deterrent let on. In 2020, Meier stated that "Germans these days are more distrustful of Donald Trump than Vladimir Putin" (Meier, 2020, p. 78). Russia's full-scale invasion of Ukraine may have flipped this sentiment since or may have created a situation in which the German public does not trust either leader sufficiently, instead making it look toward France due to a lack of security alternatives – especially since German conventional forces are not deemed sufficient for defending the country even from conventional attacks.

Much focus, especially by German scholars, is given to either the diverging strategic goals or the lack of strategic culture in Germany when it concerns nuclear matters (Kunz, 2019, 2020; Meier, 2020; Kühn, 2024, Ch. 5). Yet, even if one agrees with this assessment, there are good arguments for why these are the easiest problems to fix. Urgency, for example by a different threat scenario, will act as a catalyst for convergence between these two countries. Geographically as well as geopolitically, both are situated similarly. A stronger threat from Russia would certainly bring them closer together, as it has been done since 2022, no matter the fact that they currently disagree on what European strategic autonomy should look like. Arguably, the countries' leaders disagree on how the future will play out, but will agree once a scenario becomes reality – for example a withdrawal by the U.S. under a second Trump administration. Additionally, by keeping a French national component, keeping the binational component lean and having a sort of French primacy in some aspects of command-and-control, there is a much smaller gap to bridge, and much of the convergence will have to come from the German side.

With respect to Germany's inexperience in all things nuclear, its lack of strategic IQ, I do not weight the problem as much as the scholars mentioned above. Just because it took earlier nuclear powers decades and many glitches along the way to come to terms with the practicalities of security dilemmata with a nuclear dimension does not mean that Germany will need as many years of apprenticeship. It has years of "lessons learned" to draw from – even if they are not its own. Germany, as well as France, would need to prepare wisely for such a deviation from the current path, that is the motivation for research like this.

On the technical side, it seems that many hurdles can be solved by expanding the French NC3 systems. It can also be an advantage that Germany is part of the NATO sharing, take lessons from there, and bring them to the table when creating the binational structure. The countries can take the best from both systems.

Modernization of nuclear weapon systems opens also possibilities to make the transformation smoother, expanding different subsystems during their modernization phases and thus avoiding risky step changes when including Germany. However, this might prolong the transformation period, which is strategically a risky one, inviting potential preventive attacks by adversaries (which are not necessarily nuclear in nature, but for example also sabotage through cyber-attacks).

6 Conclusion

Looking at these scenarios, what are the implications for today? Even if there would be sufficient political will right now, a transition to another nuclear security arrangement would not be possible on a timeline within the next U.S. legislative period. The European continent will have to ride out a potential second Trump administration either way. Yet, on time scales beyond this, the question of a Eurodeterrent remains relevant, even if some scholars call it a "Zombie debate" (Egeland & Pelopidas, 2021). The realities of a multipolar world – both in geopolitics at large as well as in the nuclear dimension – are currently foreshadowed. On top, the United States and other major democracies, including nuclear powers like France, have revealed their weaknesses and their volatility. Any war termination of the Russian invasion of Ukraine will result in a changed security landscape in Europe. There are good arguments that adjustments in the nuclear realm should be part of this change.

The scenarios in this study represent different political understandings – of the respective nations' vital security interests, of strategic cultures, and of Europe's place in the geopolitical world order. They also represent different technical challenges, on the level of hardware as much as on the practical level of deterrence theory. Diving into each scenario helps sharpen the line between hard and soft limits, but also where uncertainty remains. While the study has shown that some obstacles to European proliferation are 'merely' political (and that at times historical precedents exist), it also hinted at potential new

avenues for unwanted escalation, be it inadvertent or accidental.

Ultimately, this study only marks a starting point. There are several ways in which this research can be continued. On the technical details, some of the details that need further investigation were outlined in section 2. On the path to an answer to what a multilateral nuclear force could look like, instead of jumping to the end and looking at a scenario including most of the EU and NATO, there are important intermediary steps one could take in the analysis. First, by adding the UK, one would get a first feeling of how consulting between three powers could look like and study the side effects deriving from multi-actor interactions. Comparing a scenario where the UK retains its own force as well with a scenario where instead of the UK another non-nuclear state (for example Poland) takes part in a secondary nuclear component in addition to France's national component, would shed light on the questions which of these avenues is more sustainable in a pan-European context – a multilateral force akin to earlier iterations of suggestions, with different types of mechanisms to build consensus, or a multilateral force where some of the major powers retain national components in addition to the shared component. For the European continent, the question of how many states would need to proliferate to substitute the U.S. nuclear umbrella is one of the most important. Protecting all Western allies on the continent will raise different requirements than just protecting Germany and France. The answer to this question naturally depends on the scenario of proliferation and the deterrence strategies chosen within.

References

Acton, J. M. (2018). Escalation through Entanglement: How the Vulnerability of Command-and-Control Systems Raises the Risks of an Inadvertent Nuclear War. *International Security*, *43*(1), 56–99. Retrieved 2023-11-15, from https://direct.mit.edu/isec/article/43/1/56-99/12199 doi:10.1162/isec_a_00320

Afina, Y., Inverarity, C., & Unal, B. (2020). *Ensuring Cyber Resilience in NATO's Command, Control and Communication Systems* (Research Report). Chatham House. Retrieved 2024-03-15, from https://www.chathamhouse.org/2020/07/ensuring-cyber-resilience-natos-command-control-and-communication-systems-0/3-nuclear

Arceneaux, G. D. (2021). Command and Control in Regional Nuclear Powers. College of Arts and Sciences Mershon Center. Retrieved from https://mershoncenter.osu.edu/sites/default/files/2021-04/Arceneaux%20-%20Command%20and%20Control%20in%20Regional%20Nuclear%20Powers%20%28OSU%202021%29.pdf

Arceneaux, G. D., & Feaver, P. D. (2023). Chapter 7 The Fulcrum of Fragility: Command and Control in Regional Nuclear Powers. In *Chapter 7 The Fulcrum of Fragility: Command and Control in Regional Nuclear Powers* (pp. 182–208). Cornell University Press. doi:10.1515/9781501767036-008

Bluth, C. (1995). Nuclear Sharing and the MLF Controversy. In C. Bluth (Ed.), *Britain, Germany, and Western Nuclear Strategy*. Oxford University Press. doi:10.1093/acprof:oso/9780198280040.003.0003

Charles Glaser, Austin Long, & Brian Radzinsky. (2022). *Managing U.S. Nuclear Operations in the 21st Century*. Washington, D.C.: Brookings Institution Press.

Dunnmon, J. (2017). *Nuclear Command and Control in the Twenty-First Century: Maintaining Surety in Outer Space and Cyberspace* (Research Report). Center for Strategic and International Studies (CSIS). Retrieved 2024-05-10, from https://www.jstor.org/stable/resrep23162.5

Egeland, K., & Pelopidas, B. (2021). European nuclear weapons? Zombie debates and nuclear realities. *European Security*, *30*(2), 237–258. doi:10.1080/09662839.2020.1855147

Fulwyler, N. J. (1965). *Nuclear Armaments for NATO: The Mul-*

tilateral Problem of Command, Control, and Sharing (Master's thesis, The American University). Retrieved 2024-03-28, from https://www.proquest.com/docview/302309925?pq-origsite=gscholar&fromopenview=true&sourcetype=Dissertations%20&%20Theses

Gerzhoy, G. (2015). Alliance Coercion and Nuclear Restraint: How the United States Thwarted West Germany's Nuclear Ambitions. *International Security*, *39*(4), 91–129. doi:10.1162/ISEC_a_00198

Glaser, C. L., Acton, J. M., & Fetter, S. (2023). The U.S. Nuclear Arsenal Can Deter Both China and Russia. *Foreign Affairs*. Retrieved 2023-10-11, from https://www.foreignaffairs.com/united-states/us-nuclear-arsenal-can-deter-both-china-and-russia

Gregory, S. R. (1996). Nuclear Command and Control in NATO. In S. R. Gregory (Ed.), *Nuclear Command and Control in NATO: Nuclear Weapons Operations and the Strategy of Flexible Response* (pp. 51–79). London: Palgrave Macmillan UK. doi:10.1057/9780230379107_3

Hecla, J., Krentz-Wee, R., & Reddie, A. W. (2019). The Next Generation NC3 Enterprise: Opportunities and Challenges. *Journal of Science Policy & Governance*, *14*(2).

Hemler, J. (2023). *BRIEFER: Future Combat Air System (FCAS).* Retrieved 2024-05-09, from https://dsm.forecastinternational.com/2023/06/28/briefer-future-combat-air-system-fcas/

Horovitz, L., & Wachs, L. (2023). France's nuclear weapons and Europe: options for a better coordinated deterrence policy. *SWP Comment*. Retrieved 2024-05-10, from https://www.swp-berlin.org/10.18449/2023C15/ doi:10.18449/2023C15

Jurgensen, C. (2019). Europe, France and nuclear deterrence. *Revue Défense Nationale*. Retrieved from https://www.geographie.ens.fr/IMG/pdf/europe_france_and_nuclear_deterrence_-jurgensen.pdf

Kohl, W. L. (1965). Nuclear Sharing in Nato and the Multilateral Force. *Political Science Quarterly*, *80*(1), 88–109. Retrieved 2024-03-27, from https://academic.oup.com/psq/article/80/1/88/7177714 doi:10.2307/2147185

Kristensen, H. M., Korda, M., & Johns, E. (2023). French nuclear weapons, 2023. *Bulletin of the Atomic Scientists*, *79*(4), 272–281. doi:10.1080/00963402.2023.2223088

Kristensen, H. M., Korda, M., Johns, E., & Knight, M. (2023). Nuclear weapons sharing, 2023. *Bulletin of the Atomic Sci-*

entists, *79*(6), 393–406. Retrieved 2024-02-24, from https://doi.org/10.1080/00963402.2023.2266944 (Publisher: Routledge _eprint: https://doi.org/10.1080/00963402.2023.2266944) doi:10.1080/00963402.2023.2266944

Kunz, B. (2019). Why Franco-German leadership on European defense is not in sight. *4*. Retrieved 2024-04-23, from https://nupi.brage.unit.no/nupi-xmlui/handle/11250/2599512

Kunz, B. (2020). Switching Umbrellas in Berlin? The Implications of Franco-German Nuclear Cooperation. *The Washington Quarterly*, *43*(3), 63–77. doi:10.1080/0163660X.2020.1814007

Kühn, U. (2024). *Germany and Nuclear Weapons in the 21st Century: Atomic Zeitenwende?* (1st ed.). London: Routledge. doi:10.4324/9781003341161

Kühn, U., & Volpe, T. (2017). Keine Atombombe, Bitte. *Foreign Affairs*, *96*(4). Retrieved 2024-05-10, from https://www.foreignaffairs.com/germany/keine-atombombe-bitte

Leffler, M. P. (2018). *Ronald Reagan and the Cold War: What Mattered Most.* Retrieved 2024-05-08, from https://tnsr.org/2018/05/ronald-reagan-and-the-cold-war-what-mattered-most/

Lockheed Martin. (2024). *Germany.* Retrieved 2024-05-09, from https://www.f35.com/f35/global-enterprise/germany.html

Matteucci, K. T. (2021). *Protecting Nuclear Command, Control, and Communications Below the Threshold of Armed Conflict: Don't Count on Deterrence* (IDA Paper No. NS P-14360). Institute for Defense Analyses (IDA).

Meier, O. (2020). Why Germany won't build its own nuclear weapons and remains skeptical of a Eurodeterrent. *Bulletin of the Atomic Scientists*, *76*(2), 76–84. doi:10.1080/00963402.2020.1728967

Meijer, H., & Brooks, S. G. (2021). Illusions of Autonomy: Why Europe Cannot Provide for Its Security If the United States Pulls Back. *International Security*, *45*(4), 7–43. doi:10.1162/isec_a_00405

Michaels, J. H. (2023). "No annihilation without representation": NATO nuclear use decision-making during the Cold War. *Journal of Strategic Studies*, *46*(5), 1010–1036. doi:10.1080/01402390.2022.2074405

Müller, H. (2000). *Nuclear Weapons and German Interests: An Attempt at Redefinition* (Research Report). Peace Research Institute Frankfurt. Retrieved 2024-05-10, from https://www.jstor.org/stable/resrep14507.1

Pelopidas, B. (2019). *France: Nuclear Command, Control, and Communications* (Research Report). Retrieved from https://sciencespo.hal.science/view/index/identifiant/hal-03456118

Seng, J. (1997). Less is more: Command and control advantages of minor nuclear states. *Security Studies*, *6*(4), 50–92. doi:10.1080/09636419708429322

Slessor, S. J. (1965). Command and Control of Allied Nuclear Forces: A British View. *Adelphi Papers*. doi:10.1080/05679326508448034

Sprenger, S. (2022). *Germany to buy F-35 warplanes for nuclear deterrence.* Retrieved 2024-05-09, from https://www.defensenews.com/global/europe/2022/03/14/germany-to-buy-f-35-warplanes-for-nuclear-deterrence/

Tertrais, B. (2020). *French Nuclear Deterrence Policy, Forces, and Future: A Handbook* (Monograph). France. Retrieved from https://www.frstrategie.org/en/publications/recherches-et-documents/french-nuclear-deterrence-policy-forces-and-future-handbook-2020

Tertrais, B., & Lewis, J. (2019). *OP #45: The Finger on the Button* (Research Paper). Middlebury Institute of International Studies at Monterey: James Martin Center for Nonproliferation Studies. Retrieved 2024-04-02, from https://nonproliferation.org/op-45-the-finger-on-the-button/

Veit, B. S. (2004). *NATO's Nuclear Forces: The Way Ahead* (Research paper). U.S. Army War College. Retrieved 2024-04-01, from https://apps.dtic.mil/sti/citations/ADA424072

Verstraete, W. (2024). Anticipating Europe's Nuclear Futures. *The Washington Quarterly*, *47*(1), 85–100. doi:10.1080/0163660X.2024.2327821

Voros, J. (2006). Introducing a classification framework for prospective methods. *Foresight*, *8*(2), 43–56. doi:10.1108/14636680610656174