TECHNOLOGY FOR GLOBAL SECURITY

FRANCE : NUCLEAR COMMAND, CONTROL, AND COMMUNICATIONS

TECHNOLOGY FOR GLOBAL SECURITY SPECIAL REPORT

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I. INTRODUCTION

In this essay, Benoît Pelopidas outlines what is known about French NC3 and identifies discursive, sociological and temporal challenges to assessing the validity of claims on this topic. After reviewing the primacy of presidential nuclear authority, the nuclear chain of command, civilian control over the arsenal, tension between legitimacy and robustness of the chain of command, the role of military authority in the launch order, inadequate code transfer, and accidents and close calls, *he* concludes: "Beyond the problems of arbitrariness, mismanagement, incidents and accidents outlined above, there are key components of the French nuclear command and control system about which we either do not know much or have partial and conflicting accounts."

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II. TECHNOLOGY FOR GLOBAL SECURITY SPECIAL REPORT

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Summary

This paper engages with French nuclear command, control and communications, or NC3. It first lays out the situation of knowledge about French nuclear history and identifies three challenges to assessing the validity of claims on this topic: a discursive, a sociological and a temporal challenge. Therefore, it is composed of two sections: the first one offers the official rationale for the French NC3 system, its structure, and its performance while the second offers a critical assessment of the limits of validity of such claims. It is based on all the available open source literature in French and English on the topic and is based on elite interviews as well as archival research, and on a rigorous use of social scientific methods to keep the conditions of validity of such claims in focus at every point of the analysis.

1. Introduction: The challenges of getting to know about French command-and-control procedures and practices[1]

It is well established that command-and-control practices are highly classified and most discourse about them comes from the executive branch or the presidency of nuclear weapon states. Given that historical research has shown that the centralization of the ability to use nuclear weapons has been overstated in several instances,[2] any further investigation of the matter should start with a careful assessment of the conditions of production of the available information on nuclear weapons command and control and the limits of its validity. This will be the main purpose of the introductory section of this paper.

Indeed, the situation and modes of knowledge production in the other two NATO nuclear weapon states, the US and the UK, is likely to give a misleading picture of available knowledge regarding French command-and-control practices and procedures. In those two countries, an increasing amount of information has become publicly available over time.[3] This is true for mostly two reasons. First, processes do exist which allow citizens and researchers to request the declassification of documents in the name of a right to know. Second, NGOs and reputable independent scholars have investigated nuclear weapons issues for a long time and have developed methods allowing them to check and triangulate the validity of claims made by

[1] In text references about French NC3 can be found in full in the bibliography at the end of this paper. Other references not directly related to French NC3 will be indicated in full in footnotes. My warmest thanks go to the NK team, Peter Hayes and Steve Freedkin and in particular to Nari Shelekpayev and Roxana Vermel for making this paper better than it would have been.

[2] For instance, in 1964, candidate Lyndon B. Johnson campaigned on the fact that his political opponent could not be trusted with nuclear weapons and insisted on the fact that he would have sole authority on launching the weapons while he was organizing the delegation of such authority. See Bruce G. Blair *The Logic of Accidental Nuclear War* (Washington D.C., The Brookings Institution, 1993) ; Daniel Ellsberg, *The Doomsday Machine. Confessions of a nuclear war planner*, New York, Bloomsbury, 2017, p. 15-16.

[3] In the UK, information came from the documentary *The Human Button* released on the BBC in December 2008.

government officials or members of the weapons production facilities. Neither of those conditions applies to the French context. No Freedom of Information Act exists in French law. On the contrary, since February 2008, a law intended to prevent the proliferation of nuclear weapons allows the government to maintain the classification of documents, including any information relevant to the production and handling of such weapons, in perpetuity.[4] Scholarly writing about nuclear weapons related issues is very limited and has been dependent on the official discourse on the subject until the creation of the *Nuclear Knowledges* program in 2017 so that checking the validity of the available discourse on the topic was very challenging.[5] While good work of diplomatic history was conducted, it illustrates the limits of this particular practice and the concessions associated with the efforts at writing the first wave of historiography. Access to elite participants was a priority. Ability to check the accuracy and completeness of their claims because of lack of independent access to primary documentation was almost absent. As a result, the existing account of French nuclear history, most of which dates back to the 1980s and 1990s, revolves around a state-centric narrative of rational policymaking conducted by leaders who gave their testimony. A second wave of historiography engaging more critically with bureaucratic politics and shedding light on the inconsistencies that have been identified in all other nuclear weapons programs is still in the making.[6] Over the last twenty years, nuclear weapons related writings have been monopolized by experts coming from think tanks heavily dependent on state and industry funding; and most recently, nuclear weapons officials have been actively engaged in renarrating French nuclear history and introducing this official, uncritical and biased narrative in universities (Roche 2017; Mongin and Jurgensen 2018). This situation largely accounts for why core questions about command and control, overconfidence in the controllability of nuclear crises, the inconsistencies between Presidential speeches, the doctrine, the targeting policy and the arsenal, as well as the credibility of the French posture over time, have not been asked in any depth in academic circles.

As a consequence of the problem of access, there is a problem of limits of validity of claims related to the degree of perfection of nuclear control practices (adequate information processing and transfer, operational technology, perfectly compliant personnel who do not make any mistakes) for three reasons: a discursive reason that has to do with the dual goal of claims on those issues, a sociological reason associated with the professional and patriotic duties of the sources, and a temporal reason making it more difficult to assess the independence of sources with regards to each other.

Discursively first, claims about nuclear weapons command and control serve two purposes, which are in tension with each other. On the one hand, the claims about command and control practices are analytical and *descriptive*: they are expected to tell how and how well the systems work. To achieve this goal, they should be accurate and complete. On the other hand, such

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[4] Sébastien-Yves Laurent, *Le secret de l'Etat.* Paris: archives nationales, 2015, p. 153.

[5] Detailed evidence of how expert nuclear discourse in France shares most assumptions of French official nuclear weapons policy can be found in Benoît Pelopidas, "Sortir du panglossisme nucléaire" [beyond nuclear panglossism], Thomas Meszaros (éd.), *Les stratégies nucléaires. Ruptures et continuités.* Bern, Peter Lang, forthcoming.

[6] Beatrice Heuser, *Nuclear Mentalities*. *Strategies and beliefs in Britain, France and the FRG*, London, Palgrave McMillan, 1998 chap. 5; Benoît Pelopidas, "The unbearable lightness of luck. Three sources of overconfidence in the controllability of nuclear crises" *European Journal of International Security* 2:2, July 2017: 240-262; Florent Pouponneau, L*a politique française de non-prolifération nucléaire. De la division du travail diplomatique,* Bruxelles, Peter Lang, 2015 [French nuclear non-proliferation policy].

claims are obviously and admittedly *performative*. They are aimed at several audiences to convince them that the system works perfectly so they should both believe the credibility of the pledge of nuclear retaliation and not fear accidental explosions, escalation, or a splendid nuclear first strike caused by a breach in the command and control protocol. Once those two goals are clarified, it becomes clear the performative goal of claims about nuclear command and control practices considerably limits what can be said about its flaws, weaknesses, and past instances of failures and mismanagement. This is most obviously true of any information channel that can be reached by a potential adversary. As a result, we as analysts should expect possible accuracy of such claims but certainly not their completeness.

While the two goals in tension of claims about command and control explored above prevents completeness, the sociological origins of such claims create a possible duty to hide or mislead on the part of the sources. In other words, information can only be gathered from individuals who have pledged, for professional and/or patriotic reasons, to serve institutions which have an interest in not displaying the limits and weaknesses of the national nuclear weapons infrastructure.[7] There is a professional or patriotic duty to hide or mislead as giving an accurate and complete picture of the situation, assuming that one single actor has it, would go against the institution's reputation and the perceived requirements of nuclear deterrence. In the best case scenario, claims will be sincere about their limits but this sincerity will be difficult to assess.

Third, as time passes and nuclear secrecy is maintained, a third, temporal difficulty appears, which has to do with a difficulty to check the independence of the additional sources one finds to make sure they do not result in an undue self-confirming bubble. The scarcity of sources makes it more likely that available testimonies are less independent from each other than they claim to be and the passage of time may remove the first layer of sources, which is where one would see how few they were. As time passes and publications multiply, it becomes less and less visible that they all depend on this single and, as such, unverified, account. A famous precedent is the narrative of Soviet fear of NATO surprise attack which has been presented as a point of consensus among scholars over the last decade but most accounts of which can be traced back to the testimony of KGB defector Oleg Gordievsky.[8]

Therefore, the discursive characteristics of claims about nuclear command and control as well as their sociological origins and the methodological challenges of continued nuclear secrecy and scarcity of sources make completeness impossible and accuracy harder to assess than in any other realm.

This is why this paper will be divided in two parts: the official statements about the organization and performance of French nuclear command and control systems first, and then a critical assessment of the imperfections, contradictions and incompleteness of this picture using rigorous social science methods. It engages French NC3 and leaves aside most practices of nuclear weapons policymaking which are not directly related to it. It is based on publicly available information, archival research in the debates at the French national assembly and interviews with high-level officials in the French nuclear weapons complex, with full awareness

[7] This tension is explored in full in Benoît Pelopidas, Nuclear weapons scholarship as a case of self-censorship in security studies", *Journal of Global Security Studies* 1(4), November 2016 and "Sortir du panglossisme nucléaire".
[8] See Simon Miles, 'The war scare that wasn't. Able Archer and the myths of the Second Cold War', paper presented at the *Nuclear Knowledges* workshop on nuclear close calls, Paris, November 16, 2018.

that the accuracy of the claims is much more likely than their completeness, given the problems exposed above.

2. The official rationale for the French chain of command: the nuclear monarchy[9]

The Primacy of the President

The official narrative of French nuclear history is built around a core rationale of non-delegation of the authority to launch the French nuclear arsenal beyond the President of the Republic.[10] The nickname of the "nuclear monarchy"[11] , originally meant to be critical when it appeared in the 1970s but quickly appropriated by the power in charge of the arsenal, offers a good illustration.

This common focus on the head of state is grounded in the French Constitution and two decrees from 1964 and 1996. Article 5 of the Constitution establishes the president as the guarantor of 'national independence' and 'territorial integrity' of France, two commonly stated justifications for the French nuclear arsenal. Article 15 establishes the president as the 'Commander-in-Chief of the Armed Forces' who presides over 'the higher national defence councils and committees'. The 1964 decree gave the president legal authority as the head of the armed forces to engage French strategic air forces which were, at the time, the only ones carrying nuclear warheads.[12] This was extensively interpreted as establishing Presidential authority over the use of any French nuclear weapons but this extended authority was only formalized in a June 1996 decree, which elevated the presidential authority over nuclear matters, a decision which requires the President's signature to be reversed.[13] Two institutions illustrate the President's primacy in terms of decision-making related to nuclear weapons use: the President's *Etat-major particulier* [private military staff], the existence of which is not established in any decree[14] and the defense council that later became the Defence and National Security Council. (Tertrais and Guisnel 2016: 165, 235, 237, 238, 250)

Three people in the nuclear chain of command: The President, the CEMA and the CEMP

A decision to engage French nuclear forces has to involve three personalities: the President, the *Chef d'Etat-major des Armées* (CEMA, the equivalent of the Chairman of the Joint Chiefs of Staff in its supervision over the French army, navy and air force) and his *Chef d'Etat-major Particulier* (CEMP, Private chief of staff). (Tertrais 2010: 112-113; Tertrais and Guisnel 2016:

[9] This section owes a lot to Tertrais 2010.

[10] Bernard Chantebout, « La dissuasion nucléaire et le pouvoir présidentiel » [Nuclear deterrence and executive power], *Pouvoirs*, no. 38 (1986), pp. 21–32 ; Scilla McLean (ed.), in the name of the Oxford Research Group, *How nuclear decisions are made*, London: Palgrave 1986, p. 179.

[11] Samy Cohen, *La monarchie nucléaire. Les coulisses de la politique étrangère sous la cinquième République.* Paris: Hachette, 1986; Beatrice Heuser, *Nuclear Mentalities*. *Strategies and beliefs in Britain, France and the FRG*, London, Palgrave McMillan, 1998 chap. 5.

[12] Décret no. 64-46 du 14 janvier 1964 relatif aux forces aériennes stratégiques [Decree no. 64-46 of 14 January 1964 relating to the strategic air forces].

[13] Décret no. 96-520 du 12 juin 1996 portant détermination des responsabilités concernant les forces nucléaires [Decree no. 96-520 of 12 June 1996 on the determination of responsibilities related to nuclear forces].

[14] It is composed of four generals plus staff, including most importantly the President's *Chef d'état major particulier*, [Private chief of staff, CEMP]

246-250; Tertrais and Lewis 2019: 17). The three representations we have of this chain of command are consistent.

The President would initiate the engagement order most likely from the Jupiter command post situated under the Elysée Palace (Giscard d'Estaing 1991: 205). If the President is away, s/he would use the light and mobile command post that is supposed to follow him at all time, the *PC léger déplaçable PCLD*. It is clear that this command center has been remodelled in 2015 but not much more has appeared on what that means (Tertrais and Guisnel 2016: 243). The order would first go to the chairman of the joint chiefs of staff who, since 1996, carries the explicit responsibility of "ensuring the execution of the order of engagement given by the president".[15] This transmission will take place via the *Centre opérationnel des forces nucléaires* (COFN, located in Paris in the îlot Saint Germain and created in 1993). After its validity is verified through means that will be explored later, the order will be sent to the nuclear units.

If the air launched weapons were to be delivered, the COFN would have to authorize the *Gendarmerie de sécurité des armes nucléaires* (GSAN; the branch of the military police, placed under the authority of the Minister of Defense, and responsible for the physical safety of the warheads. A two-person rule is in force when it comes to the release of weapons (Gregory 1990: 50; Tertrais 2010:112; Tertrais and Lewis 2019: 17).

Three networks are meant to guarantee the adequate transmission of the order from the President to the officer who will actually launch the weapon : : (1) Jupiter connects the President to the Joint Chief of Staff, (2) RAMSES (acronym originally meaning *Réseau Amont Maillé Stratégique et de Survie* or Strategic and Survival Network is the channel through which the units would receive their orders, and (3) SYDEREC (acronym for *Système de Dernier Recours* or System of Last Resort) to be used if France has been hit by a massive nuclear strike. RAMSES has been in place since 1988 and its latest iteration, RAMSES IV, operational since 2014 but constantly expanded and to be completed in 2019, is hardened and protected against electromagnetic waves (Tertrais and Guisnel 2016: 247, 299) and SYDEREC is said to be based on inflatable balloons dispersed on the French territory (Tertrais and Guisnel 2016: 251; Tertrais and Lewis 2019: 17).

If the order must be transmitted to planes, it will be sent to one of the *Bases à Vocation Nucléaire* [Bases with a nuclear purpose]. The pilot and the navigator of the nuclear capable aircraft are then expected to sit in a "*salle de guerre"* [war room] where they would see files about their mission. They would then get to the plane with a pod in which they are supposed to find the "*enveloppes d'engagement"* [engagement envelopes] allowing them to authenticate the Presidential order. That would mean that the plane takes off with navigation and target coordinates. There is a division of labor between the navigator and the pilot, with the former unlocking a *boitier de contrôle gouvernemental* (BCG) [government controlled case] and the latter actually firing. The *Forces aéronavales nucléaires* [Aeronaval nuclear forces or FANU] based on the aircraft carrier Charles de Gaulle only have planes with one pilot on board so the protocol is different for them, but only little is known about it. Refueling planes KC-135 are also used as intermediaries to communicate with FAS and FANU Rafales (Tertrais and Guisnel 2016: 248). If the order has to be transmitted to SSBNs, this will be done via one of the *centre de transmission marine* [Navy transmission center] of the *Force océanique stratégique* [SSBN force] (see below for the largest of the four existing centers) through very low frequency waves

[15] Decree no. 96-520 of 12 June 1996.

(VLF). A system of satellite transmission (Syracuse III) can also be used but this requires that the SSBN surfaces first (Tertrais and Guisnel 2016: 248-9).

Two pictures of the *Centre de transmission de la marine* at Rosnay (36) in 2018. This site has hosted the antennas designed to transmit orders to French SSBNs since the early 1970s[16]

[16] Jean-Michel Bonnin, « La force dissuasive s'immerge en Brenne », *La Nouvelle République*, 3 March 2018, available at https://www.lanouvellerepublique.fr/indre/la-force-dissuasive-s-immerge-en-brenne?queryId%5Bquery1%5D=57cd2206459a452f008b4594&queryId%5Bquery2%5D=57c95b34479a452f008b459d&page=0&pageId=57da5ce5459a4552008b469a.

Modernization programs of the transmission to the French Air Force (Transaéro) and Navy (Transoum) are under way (Tertrais and Guisnel 2016: 248).

Civilian control over the arsenal

The civilian control over French nuclear weapons and the related fissile material is manifested at three levels: (1) the custody of warheads and fissile material, (2) positive and negative control over warhead release, and (3) control of the implementation of approved plans (Tertrais 2010: 111). This is incarnated in one particular role, the *inspecteur des armements nucléaires* (IAN, nuclear weapons inspector), a position created under General de Gaulle, which has evolved over time. The general officer who now holds it is directly accountable to the Head of State and ensures civilian control over French nuclear forces in all three of those aspects (Tertrais 2010: 111; Tertrais and Guisnel 2016: 173, 179; Gadal 2009: 303; interview with a former head of the *Forces aériennes stratégiques*). The other civilian personality who plays a crucial role in the civilian control of nuclear weapons is the Minister of Defence. Former French CEMA General François Maurin (1971–75) explained that his responsibilities included the coding of hard disks to be mounted on the warheads (Institut Charles de Gaulle 1985: 231; Theleri 1997: 261). The person in charge of the coding procedure is said to be part of the Minister's personal staff (Tertrais 2010: 112). Analyst and former member of two commissions in charge of writing the French white paper on defense and national security Bruno Tertrais claims that, "No weapon can physically be detonated without this code. No French nuclear weapon can be physically moved without civilian executive authorization, and the president personally approves any change in alert status. Unlike their US counterparts, for instance, French SSBN commanders have never been able, technically, to launch armed missiles on their own." (Tertrais 2010: 114)

The military intervenes in that within the *Forces aériennes stratégiques*, a *gendarme* has to guard the plane and the warhead and to certify to the Minister of Defense the physical reality of the alert and the presence of the nuclear core (Gadal 2009: 303; interview with a former head of the *Forces aériennes stratégiques*). However, as I will show in the subsection below, the military is not involved in the devolution process in case of incapacitation of elected officials. Finally, the 1996 decision to put all French nuclear weapons under the category of strategic weapons practically limits the military's agency in the timing or scale of a nuclear strike the way they could have at the time of tactical weapons (Tertrais 2010: 112).

Delegation of nuclear authority vs delegation of war powers in case of incapacitation

Historically, the institutional arrangement of the nuclear chain of command was made possible by the idea that the distinction between war time and peace time no longer applies and that national defense has to be "permanent". This is explicitly stated in the 1959 ordinance.[17]

It is important to note, though, the chain of delegation of nuclear authority differs from that of delegation of war powers. In the latter, the authority is delegated to the President of the Senate if the President is incapacitated, then to the Prime Minister and if the Prime Minister is not able to exercise his/her responsibility either, then the Minister of Defense would be next. The official list is longer but the published part stops there.[18] In nuclear matters, the delegation of authority

[17] Ordonnance no. 59-147 of January 7, 1959 on the general organisation of defense, Article 1.
[18] Ordonnance no. 59-147, Article 14.

is different. The President of the Senate is bypassed and in case of an incapacitated President, the authority directly goes to the Prime Minister. (See the testimonies of Michel Rocard, who was Prime Minister from 1988 to 1991 in Rocard 1997: 14-15). The Minister of Defense is next in case of incapacitation. (Messmer 1992: 320 and Institut Charles de Gaulle 1985: 335). Former Defense Minister Messmer stated in his memoirs that beyond those three names, the list was secret (Messmer 1992: 320). However, several sources suggest that the fourth name would be a civilian authority designated by the President, who reviews and possibly modifies the list. (Theleri 1997: 263; Cohen 1994: 79; Tertrais and Guisnel 2016: 253-254).

3. Critical assessment of available information of the French command and control practices

While the previous section presented the French nuclear command and control system from the perspective of those who conceived it, and how it *should* and *is expected to work*, this section confronts those claims to the historical record. It focuses on the following aspects: the problem of arbitrariness and possible lack of legitimacy of the person whom the President can designate to carry the launch order if all the members of the official chain of command have been incapacitated, the crucial role of the military and possibly limited agency of the President in situations of crisis, the cases in which protocol has been broken when it comes to carrying the launch codes, the cases of accidents involving components of the arsenal carrying nuclear weapons and, finally, the aspects about which we have no or contradictory information.

The problem of arbitrariness of the delegation at the bottom of the chain?

In 2016, a controversy followed the broadcast of a documentary suggesting that an unknown person designated by the President could be given the authority to launch nuclear forces. Former Defense Minister Paul Quilès (1984–45) and his colleagues from *Initiative pour le Désarmement Nucléaire* [Initiative for nuclear disarmament, IDN] denounced the absence of legitimacy of the person who could be arbitrarily designated by the President to give the order to launch French nuclear weapons and kill hundreds of thousands of people if no one in the chain of command was able to give it.[19] This is odd, however, given this possibility seems as old as 1964. On April 24, 1964, then Prime Minister Georges Pompidou explained in an ordinary session of the French National Assembly that in case of international crisis, the unique nature of nuclear war required to have a "qualified" person able to immediately launch nuclear retaliation. This logic in turn led to appointing a person "who may be out of Paris"[20] and, as a consequence, could not possibly be holding any of the positions in the chain of command described above. In sum, this arrangement is not new. The arbitrary choice of the President in those matters seems to have been normalized but not discussed with the other members in the chain of command. Indeed, the President of the French Senate, Gérard Larcher, was approached

[19] Their blog publications can be found here http://paul.quiles.over-blog.com/2016/03/la-dissuasion-c-est-moi-dit-l-inconnu-de-province.html also published on mediapart at https://blogs.mediapart.fr/paul-quiles/blog/240316/nucleaire-le-retour-du-docteur-folamour and https://blogs.alternatives-economiques.fr/collin/2016/03/18/la-bombe-le-president-et-l-inconnu

[20] Georges Pompidou, Journal officiel de la République Française, débats parlementaires. Assemblée Nationale, deuxième législature, deuxième session ordinaire de 1963-4, compte rendu intégral de la séance du vendredi 24 avril 1964, p. 946.

by IDN and said he was not aware of that procedure and considered it abnormal.[21] In that case, there is a tension between legitimacy and robustness of the chain of command as the arbitrariness of the presidential choice, while being problematic from a legitimacy standpoint, decreases the vulnerability associated with the concentration of the decision to retaliate in the hands of the President or in a known list of targetable people (Gregory 1990: 58).

The crucial role of a military authority in the launch order and the agency of the President[22]

Contrary to the assumption that the President makes the decision on his own and, as a result, possesses the codes which are necessary to authorize it, former Presidents and their private chiefs of staff have testified that the President only has one half of the nuclear code and the CEMP the other. Then, the CEMA authenticates the Presidential order and passes it on to nuclear forces. Similarly, the military aide to the President has been said to carry a copy of the presidential code at all times (testimony of Admiral Flohic, who was an aide to de Gaulle, in Institut Charles de Gaulle 1985: 336) and, later, under President Mitterrand (1981–96), only a portion of the code, given that President's fear of terrorism (Cohen 1994: 161). Beyond the issues of uncertainties related to the suitcase and the code itself (see below), the testimony of former President Valéry Giscard d'Estaing makes one question the agency of the President in situations of crisis. In the second volume of his memoirs published in 1991, Giscard remembers a simulation of massive invasion by Soviet troops moving towards Western Europe that he asked his CEMA, Général Méry, to prepare for him, on May 13–14 and 20–21 (Giscard d'Estaing 1991: 203-211). In it, the agency of the President is challenged three times.

First, when General Méry briefs him about the simulation so that the President understands how much time he needs to set aside for it, he identifies a phase in the process in which the President will simply give his order. When Giscard corrects him and insists that he will be asked *whether* he wants to give his order, the General is clear about the need for the system to anticipate the President's decision to use nuclear weapons.

Second, in the first phase of the simulation, when the Commander of the French 1st Army asks the President for the authorization to use tactical weapons "if he deems it necessary" and Giscard decides not to grant it as Soviet troops are not yet in contact with allied units, Méry informs him that the Commander did not intend to use his authorization anyway. The President explicitly wonders why he was asked, but this story also illustrates a larger degree of agency of the commanders in the field than is usually acknowledged.

Third, in the last phase of the simulation, when the Soviets attack again and the President considers we have reached a situation in which the French doctrine of *ultime avertissement* may apply before Soviet troops invade the national territory, the head of the first army shares with the President his analysis of the situation and his proposed course of action, which does not involve any nuclear option, and does not ask for any authorization. The President does not hide his surprise and explicitly asks which authorization he is asked to give. Méry's answer to this question is that he is not asked for any authorization since the commander is not considering a nuclear option. Of course, this was only a simulation that involved specific personalities and a specific context, which is now outdated. However, the extent to which the President's agency was challenged or bypassed is staggering. The fact that the President himself had confessed his

[21] E-mail correspondence with General Bernard Norlain (2S), vice-President of IDN and former head of the military cabinet of Prime Ministers Jacques Chirac and Michel Rocard, 12 January 2019.
[22] All unsourced claims in this section come from Tertrais and Guisnel 2016: 235, 247.

"inexperience" in those matters when he was elected a few pages earlier does not make this any less staggering (Giscard 1991: 178).

Codes that do not get transferred adequately

The election of a new President is a crucial moment in which nuclear weapons related information needs to be transferred. However, it is commonly acknowledged that such transfer did not ever take place adequately before 1981. After de Gaulle left office in 1969, three days passed before the President of the French Senate Alain Poher, who had become the interim President sought to find the information related to French nuclear forces as his CEMP did not have it and de Gaulle was unreachable. He did receive the information from Minister of Defense Pierre Messmer in an envelope (Tertrais and Guisnel 2016: 238-240). There are conflicting accounts about how Poher transferred the code to the incoming President Georges Pompidou three weeks later. Five years later, Poher had to receive the codes again after Pompidou passed away but he claims that the medallion where the codes were supposed to be was empty. At that time, according to General Pierre Caubel, the *Forces aériennes stratégiques* received a message asking them to ignore any order from the presidency as the President was dead and no one knew where the code was (cited in Gadal 2009: 335-336). As the story goes, the code was in the President's safe, the pin of which had been modified the previous week. So it took a locksmith from French intelligence services to recover it. In 1981, despite conflicting accounts of the object President Mitterrand receives from his predecessor, a widely shared anecdote suggests that Mitterrand placed the object in his jacket's pocket… but the jacket was taken to the dry cleaner so someone had to be sent to pick it up immediately. At least for some time, the amount of which is disputed, the President was unable to give the order to engage nuclear weapons forces.[23]

Accidents and close calls

Command and control practices also assume that the delivery vehicles can accomplish the mission, that the planes in charge of the nuclear mission do not crash and that the submarines do not collide with other submarines. However, those two types of situations did happen.

The accidents we review in this section do not directly involve nuclear weapons but their delivery vehicle, in the last thirty years.[24] Mirage 2000N, which carries this initial because it is nuclear capable, among other types of mission, has been involved in at least 15 serious accidents. This includes two incidents during air refueling leading to the ejection of the pilots, eight collisions with birds or motorized ultralights as this plane was designed to fly at a very low altitude and three recent mechanical incidents: an engine problem in 1996, a fuel pump problem in 1998 and a fuel flow problem in 2008.[25] In September 2017, another Mirage 2000N crashed in N'Djamena, Chad, during takeoff.[26]

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[23] Jacques Séguéla, « La clé atomique » ['The Atomic Key'], *Le Nouvel Observateur*, 5–11 January 2006;, Victoria Gairin, « Derrière les murs du Château » ['Behind the Walls of the Castle'], *Le Point*, 29 March, 2012.

[24] For earlier accidents on Mirage IV, see Galan 2014: 71-75; 103-110.

[25] Laurent Lagneau, « Le Mirage 2000N prend sa retraite, après 30 ans passés au service de la dissuasion nucléaire », *Opex360*, 26 June 2018, available at http://www.opex360.com/2018/06/21/mirage-2000n-prend-retraite-apres-30-ans-passes-service-de-dissuasion-nucleaire

[26] Jean-Dominique Merchet, « Un mirage 2000N s'écrase à N'Djaména », blog *Secret Défense*, 21 september 2017, available at https://www.lopinion.fr/blog/secret-defense/mirage-2000n-s-ecrase-a-n-djamena-134946

Beyond those incidents, a story suggests that a pilot of the *Forces aériennes stratégiques* took off with nuclear weapons under his wings thinking he had received an order to go when actually that was not the case. This apparently took place in 1966 on the Air base of Orange and due to a short circuit on a screen which produced an erroneous message of "*décollage de guerre*" (war-time take-off). The pilot took off and the first requests to return to base he received were not according to protocol so he declined to answer them. As he was waiting for the confirmation of the engagement order, he ran out of fuel and had to go back. (Tertrais and Guisnel 2016: 235[27]) As expected, the story is told as evidence that the process is robust because the plane was effectively recalled. But former FAS pilot Robert Galan insists that the landing back was indeed very dangerous because of the sensitivity of this first generation of bombs (Galan 2014: 69). Most interestingly, the Private chief of Staff of General de Gaulle, admiral Philippon, admitted in his memoir that he never reported this accident to the President and assumes that it is the one which would have been assessed as the most serious of all.[28]

During the night of 3-4 February 2009, France's SSBN *Le Triomphant* collided with a UK SSBN, *HMS Vanguard,* in the Atlantic Ocean.[29] What is known about the incident is the outcome of a UK Freedom of Information (FOI) request from 27 February 2009, investigative journalism, and statements from government officials. According to the UK government's account of the incident, obtained through the FOI request, "Two submerged SSBNs, one French and the other UK, were conducting routine national patrols in the Atlantic Ocean. The two submarines came into contact at very low speed. Both submarines remained safe and no injuries occurred." The statement added that "[a]t no time was nuclear safety compromised and the Strategic Weapon System remained inside tolerable limits at all times.' The French first official statement, on Febuary 6, that *Le Triomphant*, equipped with 16 ballistic missiles, 'collided with an immersed object (probably a container)."[30] The French government later acknowledged that the collision had involved another nuclear-armed submarine.

The first account of the 2009 collision, alongside Admiral Philippon's testimony above, reminds us that our knowledge of technological failures, accidents, and incidents is most certainly an underestimation of the record due to mistakes and institutional and professional interests in covering them up.[31]

What we do not know

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[27] Jean-Dominique Merchet, «Le jour où le Mirage IV décolla avec une vraie bombe nucléaire », blog *Secret défense*, 8 June 2015, available at https://www.lopinion.fr/blog/secret-defense/jour-mirage-iv-decolla-vraie-bombe-nucleaire-actualise-3-25009

[28] Amiral Philippon, *La Royale et le roi*, Paris, éditions France Empire, 1982, p. 154.

[29] This paragraph is adopted from the co-authored study *Too close for comfort: cases of near nuclear use and options for policy*, London: Chatham House, 2014 (with Patricia Lewis, Heather Williams and Sasan Aghlani), p. 21.

[30] Laurent Zecchini, « Une collision entre deux sous-marins nucléaires en toute discrétion », *Le Monde*, 26 février 2009. Available at https://www.lemonde.fr/europe/article/2009/02/26/une-collision-entre-deux-sous-marins-nucleaires-en-toute-discretion_1160669_3214.html and BBC News, 'Nuclear subs collide in the Atlantic', 16 February 2009, available at http://news.bbc.co.uk/2/hi/7892294.stm.

[31] Eric Schlosser documented the plans having to cover up nuclear weapons related accidents in the US case. I am not aware of research into other nuclear weapon states' attempts at doing the same. *Command and Control*, New York: Allen Lane, 2013. On the French case, he also interestingly claims that in the early 1950s, when US nuclear weapons were first transferred to French Morocco, the French government was not told about them (p. 165).

Beyond the problems of arbitrariness, mismanagement, and incidents and accidents outlined above, there are key components of the French nuclear command and control system about which we either do not know much or have partial and conflicting accounts.

For instance, we do not know the scope or number of presidential nuclear options and the details of command and control procedures on board French SSBNs. On the former matter, the assumption is that there is more than one available nuclear option, which is why one of the missions of the command and control system is to adequately transmit the order about the type of engagement required from the nuclear forces (Tertrais and Guisnel 2016: 234). We do not know either how the chain of command would operate on board an SSBN in crisis situation (Tertrais and Guisnel 2016: 254).

The April 1961 nuclear situation in Algeria is now considered to have not been dangerous, but this deserves further investigation. (The most recent and synthetic work is Tertrais 2013.) On April 21, 1961, as a result of a referendum on the self-determination of Algeria, four generals organized a coup and took over the city of Algiers. At that time, the French nuclear test site was in the region of Reggane, in Algeria. While classic US accounts of the nuclear situation in French Algeria at the time of the *putsch des généraux* [military coup] have long suggested that French authorities decided to detonate the device that was there at the time for fear that the insurgents might capture it. A more recent account based on discussions with French intelligence officials led the analyst to dismiss the case entirely as a relevant precedent to think about nuclear terrorism. Most recently, and predictably given the three challenges identified in the introduction of this essay, Bruno Tertrais concluded that "the device was never at risk of being controlled by the rebels" (2013: 44) and that the coup was mostly independent from any nuclear considerations. In his view, this is the case because (1) contrary to original accounts, the device was not in the base controlled by the rebels, (2) he found no evidence of willingness to seize the device on the part of the units around it, (3) the rebels had no way of knowing whether the components of the device were stored at the based or had already reached the testing ground, (4) the timing of the test in the early morning is the usual time, and (5) detonating it would have been extremely challenging anyway because the assembling process was partly automated and the device was not meant to be moved and detonated at will. However, even he acknowledges that security at the base was limited to one platoon of *gendarmes* and a company of soldiers, with another one some fifty kilometers away, and that the security culture was lax, given how remote the base was. Moreover, his study is only based on secondary sources which were not originally focused on the nuclear dimension of the coup and a few interviews. Archival investigations may reveal dangers that have not yet surfaced.

Conflicting versions of the content of the French "nuclear suitcase" are also available. Colonel Peer de Jong, military aide in charge of carrying it between 1994 and 1997, treats it as mostly symbolic and empty of the crucial "object" that is supposed to be used to authenticate the order. Speaking with journalists in 2015, he considers that having a critical piece of technology in the suitcase would actually make the system more fragile and that keeping the crucial object in it would be risky too. However, General Henri Bentégeat, CEMP between 1999 and 2002, contradicts this version and asserted in 2013 that the football included "a coding machine and other complex and secret systems." But three years later, he confessed that he himself never looked into the football carried by the military aide (cited in Tertrais and Guisnel 2016: 237, 244; my translation). Those conflicting accounts suggest that, in the end, we do not know either about the command and control procedure on board French SSBNs or the exact content of the

French nuclear suitcase, which would be crucial if a nuclear crisis takes place at a time when the President is away from the Elysée Palace and has to react before getting back to the Jupiter command post.

A final area to be investigated, which may reveal practices which differed from what is expected, has to do with the health of leaders. While we know that Kennedy's heavy medication may have clouded his judgment at key moments of nuclear diplomacy,[32] the implications of French Presidents' declining health and heavy pain related to it on nuclear command and control has not yet been properly investigated.[33] One has to remember that Georges Pompidou died in office and that François Mitterrand suffered from prostatic cancer and kept it secret from the public for eleven years while he was the President of France.[34]

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[32] See Rose McDermott, *Presidential Leadership, Illness and Decisionmaking*, Cambridge, Cambridge University Press, 2008, pp. 116-158 and my "unbearable lightness of luck" fn 34 p. 246 for a detailed discussion of the other sources on the case.

[33] Interestingly, a medical doctor is now proposing that Marshall Philippe Pétain, who was the head of the Vichy régime from 1940 to 1944 and died senile, may have suffered from Alzheimer's disease earlier than previously assumed. The argument is still debated by historians and Pétain predates the nuclear age but the relevant point is that this hypothesis only appears now, sixty seven years after his death. « Pétain malade d'Alzheimer? C'est la thèse d'un gériâtre », *L'Obs and l'AFP*, March 23, 2019, available at https://www.nouvelobs.com/histoire/20190322.OBS2273/petain-malade-d-alzheimer-des-le-debut-du-regime-de-vichy-c-est-la-these-d-un-geriatre.html?fbclid=IwAR3vLtCBDzV0aZ1mSWWSOkSm-7T_mq-uC_JBnygjN0RKLJ5SlGyVVXLnHqw

[34] A summary of Mitterrand's health and secrecy around it can be found at https://www.lepoint.fr/societe/mitterrand-atteint-d-un-cancer-depuis-1981-meurt-le-8-janvier-1996-08-01-2016-2008014_23.php

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III. ENDNOTES

IV. TECH4GS INVITES YOUR RESPONSE

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