Nuclear weapons in Europe: British and French deterrence forces

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Bild/Cover: HMS Victorious returning to Clyde. Photo UK MoD.

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Summary

Questions about the meaning, role and utility of nuclear deterrence in a European context has come to the fore in recent years. Russia has reemphasized the role of a full-spectrum nuclear arsenal. This includes increased reliance on substrategic nuclear weapons for battlefield use, to compensate for its perceived inferiority in conventional armaments.

In Europe, the main multilateral and intergovernmental institutions and cooperation have been put under strain as a result of several negative developments. As a consequence the UK and France, Europe's two nuclear powers, are debating the role and composition of their respective deterrent forces. Multiple, complex security dilemmas, and the possibility that established alliances and partnerships might not be sufficiently reliable, inform the choices that have to be made.

The study concludes that while the current arsenals will remain fundamental to national security, their long term futures are far from certain. Budgetary constraints, domestic politics, and strategic perceptions informed by national nuclear mentalities are the main factors determining the outcome and composition of French and British arsenals beyond 2030.

Keywords: France, Great Britain, nuclear weapons, SSBN, deterrence, European security, United States, nuclear cooperation

Sammanfattning

Kärnvapen har under de senaste åren återkommit som en faktor i europeisk säkerhet. Ryssland betonar åter kärnvapen som en strategisk och operativ komponent i sitt försvar. I detta ingår inte bara vapen för strategisk avskräckning utan även slagfältskärnvapen. Detta motiveras bland annat med behovet av att kompensera för en upplevd konventionell militär underlägsenhet.

I Västeuropa är den politiska sammanhållningen av flera orsaker ifrågasatt. EU påvisar splittringstendenser och det finns frågetecken kring den transatlantiska länken. Som följd av omvärldsläget diskuterar Europas två kärnvapenmakter, Storbritannien och Frankrike, arsenalernas roll och sammansättning. Hur de multipla och komplexa säkerhetsdilemman de står inför utvecklas, kommer att vara avgörande för framtida vägval.

Studien drar slutsatsen att kärnvapenarsenalerna i båda länderna fortfar att vara av fundamental betydelse för nationell säkerhet i ett kort och medellångt perspektiv. Ekonomiska faktorer, inrikespolitisk utveckling samt fortsatt strategisk utveckling kopplat till nationella föreställningar kommer att avgöra vilken roll och sammansättning arsenalerna får bortom 2030.

Nyckelord: Frankrike, Storbritannien, kärnvapen, SSBN, kärnvapenavskräckning, europeisk säkerhet, USA, kärnvapensamarbete

Contents

Foreword

This study has been undertaken on behalf of the Swedish Ministry of Defence under the auspices of the Nordic and Trans-Atlantic Security Studies project (NOTS). It is part of a broader effort analysing nuclear issues in Europe. The security environment in Europe and surrounding regions are under transformation. Nuclear deterrence and issues of escalation control and warfighting have again come to the fore as a fundamental political and military question. Issues of strategic deterrence and conventional defence can no longer be seen as separate. The European nuclear powers are a central factor in this environment.

Several experts, within and outside of the FOI, have contributed with helpful advice and comments, for which we are deeply grateful. Jan Frelin commented on the final manuscript, Eve Johansson gave invaluable comments on the proper use of the English language, Lars Wedin provided excellent comments from the French perspective. Bruno Tertrais and Tom Plant provided us with insightful, expert comments on the respective national programmes.

Any remaining faults and weaknesses are the sole responsibility of the authors.

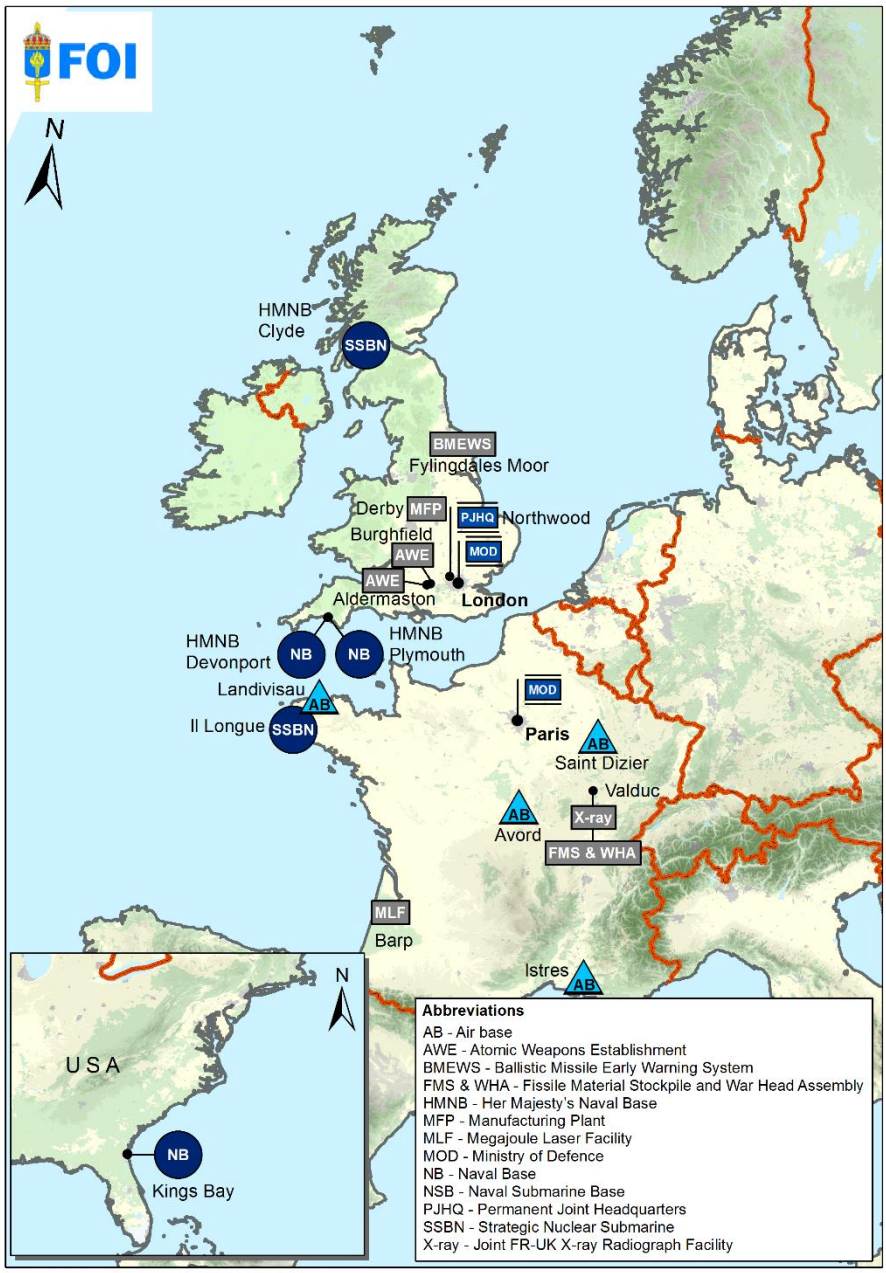
Stockholm in April 2018

Niklas Granholm and John Rydqvist

Abbreviations

ASMP	Air-Sol Moyenne Portée
ASW	anti-submarine warfare
ATL2	Dassault Atlantique 2, French long-range maritime patrol aircraft
AWE	Atomic Weapons Establishment, UK
bn	billion
CASD	Continuous At Sea Deterrence
CEA	Commissariat à l'énergie atomique et aux énergies alternatives, the French atomic and alternative energy agency
CTBT	Comprehensive Test Ban Treaty
DAM	Direction des applications militaires, the division for military applications of the CEA
EII	European Intervention Initiative, a French initiative launched in the 2017 Strategic Review
EMP	electromagnetic pulse
EPURE	Expérimentations de Physique Utilisant la Radiographie Éclair, joint UK-French X-ray radiograph facility in Valduc, France
EU	European Union
FMCT	Fissile Material Cut-Off Treaty
FOST	Force océanique stratégique, France's SSBN force
FREMM	Frégate européenne multi-mission, new French frigate class
FTI	Frégate de Taille Intermédiaire, forthcoming French frigate class
GBP	British pound
GDP	gross domestic product
HMNB Clyde	Her Majesty's Naval Base Clyde
IMF	International Monetary Fund
km	kilometre
kt	kiloton
LMJ	Le Laser Mégajoule, key facility for French nuclear simulation
MIRV	multiple independently-targetable re-entry vehicle
MDA	Mutual Defence Agreement
MPA	maritime patrol aircraft
NGO	non-governmental organization
NOTC	Nuclear Operations Targeting Centre

NPG	NATO's Nuclear Planning Group
NPT	Nuclear Non-proliferation Treaty
PESCO	EU Permanent Structured Cooperation Initiative
PINDAR	Defence Crisis Management Centre
PJHQ	Permanent Joint Headquarters
RN	Royal Navy
SDSR	Strategic Defence and Security Review (UK)
SLBM	submarine-launched ballistic missile
SNLE	Sous-Marin Nucléaire Lanceur d'Engins, first-generation strategic nuclear submarine
SNLE-NG	Sous-Marin Nucléaire Lanceur d'Engins de Nouvelle Génération, current French SSBN class (Le Triomphant Class)
SNP	Scottish National Party
SSBN	ship submersible ballistic nuclear, strategic nuclear submarine
SSN	nuclear-powered attack submarine
TDC	Technology Development Centre, joint UK-French facility at AWE
TNA	Tête Nucléaire Aéroportée, the current French cruise missile-delivered nuclear warhead
TNO	Tête Nucléaire Océanique, the current French SLBM-delivered nuclear warhead
VLF	very low frequency



British and French nuclear-related sites. Map by Per Wikström/FOI

1 Introduction

In recent years, questions about the meaning, role and utility of nuclear deterrence in a European context has again risen on the agenda. Some nuclear powers, specifically Russia, have re-emphasized the role of a full-spectrum nuclear arsenal meant to deter and defeat enemies.[1] This includes increased reliance on sub-strategic nuclear weapons for battlefield use. Russia's military rearmament, including the modernization of nuclear weapons, was undertaken partly to compensate for its increasing inferiority in conventional armaments, and funded by significantly higher oil and gas prices.[2]

At the same time, the international geopolitical situation has in many respects deteriorated. The main rationale for nuclear deterrence during the Cold War was the superpower competition between the United States and the Soviet Union. Russia's war with Georgia in 2008 marks a clear turning point compared to the previous post-Cold War decade. The resurgence of Russia manifested its martial traditions and a more assertive and aggressive foreign policy ensued. In the spring of 2014, Crimea was occupied and subsequently annexed. This was followed by a Russian-supported and still ongoing war in eastern Ukraine. With these actions towards her neighbours, Russia effectively threw away the rule book for European security that it had abided by since the early 1990s. In the long term, Russia's strategy aims to divide EU-Europe and break the transatlantic security cooperation.

Yet the Russian aggression in Europe, although significant, is but one of several contingencies that affect the European nations. The world has developed towards a multipolar system and the interaction of international trade and politics has led to ever increasing interdependency. Geography remains important but global matters far away potentially have greater impact than they used to from a security point of view. This has complicated the multilateral cooperative environment. State-centred power politics is on the rise throughout the globe. Regions and states will increasingly be forced to rely on themselves. New types of cooperation and alliances of convenience are likely to follow.

Nuclear proliferation continues. New nuclear weapons states have engaged in the aggressive build-up of arsenals. Although only India, Pakistan and North Korea are the only nuclear powers to have emerged since after the Cold War, their entry onto the world stage has been enough to radically upset the nuclear calculus of the legacy nuclear powers.

[1] Gudrun Persson (ed.): *Russian Military Capability in a Ten Year Perspective – 2016.* Stockholm, FOI-R--4326--SE (2016)

[2] Niklas Granholm and John Rydqvist (eds): *Kärnvapen för slagfältsbruk och europeisk säkerhet* [Nuclear Weapons for Battlefield Use and European Security], Stockholm, FOI-R--4430--SE (2017).

The United States under the Obama administration attempted to forge a better relationship with Russia, and in a 2009 joint statement with Russian President Medvedev the two leaders committed to achieving a world free of nuclear weapons. The so called “reset” with Russia was unsuccessful and the negative trends have continued. With the Iran nuclear deal framework of 2015 between Iran and the permanent members of the United Nations Security Council (the United States, the United Kingdom, Russia, France, and China) plus Germany and the European Union (EU), one trend towards more nuclear proliferation could be halted. However, the current US administration is putting the framework agreement into question, and with an increasing confrontation between Saudi Arabia and Iran the risk of further nuclear proliferation in the Middle East now forms part of the picture.

The emergence of China as a world power presents a challenge to the United States, not only in the Pacific, but in the longer term also for its dominant role in the world. How this changing power relationship between an established power and a rising one will develop is a key issue that will shape global strategic affairs during this century. Several other middle-sized powers, Brazil, Turkey and India, are also making a bid for regional great-power status. These powers, along with Russia and China, cooperate to unseat the dominant power of today in order to gain more influence in the world and reshape the existing global institutional arrangements and rules in their favour.

In Europe, the main multilateral and intergovernmental institutions and co-operation have been put under strain as a result of the accelerating developments. The euro crisis led to institutional strain, and the Middle East conflict led to a split over the issue of what was to be done, exacerbated by the refugee crisis from 2015 and onwards. The Schengen accords on the rules for free movement within the EU area had in effect been breached, increasing the strain between the EU member states. A spilt could be seen clearly between on the one hand the southern European member states, and on the other the East European and the northern member states. The decade of war on terrorism from 2001 and the Arab uprisings, beginning in 2011, set off a calamitous set of conflicts. In the Middle East and Africa this has created a breeding ground for radical Jihadi terrorists that now plague and attack European countries. This complicates the European security debate, where many of the Mediterranean powers focus their attention on the threat from the South while northerners tend to focus on the threat from the East.

In this complex and increasingly insecure milieu, the UK and France are debating and determining their current nuclear deterrence policy and making plans for retaining and developing their capability into the future. Complicated, multiple and divisive security dilemmas, budgetary constraints and the possibility that established alliances and partnerships might in the worst case not be sufficiently

reliable inform the choices that have to be made. Complicating the matter further are their strategic mentality and mindset: the UK and France define themselves as great powers. While the current view of nuclear deterrence in both nations will remain in the short to medium term, its longer-term future is far from certain.

1.1 The focus of this study

This study describes, analyses and discusses the nuclear deterrents of the United Kingdom and France. It outlines the main policies that underpin the possession of a nuclear capability, and the doctrines, forces and components that constitute their respective nuclear deterrent capability, as well as briefly outlining the two nations' nuclear history. The ambition is to provide a better understanding of why France and the UK judge that they must retain their nuclear deterrent, how that deterrent is structured and organized, and the posture communicated to achieve deterrence. It describes their nuclear forces and considers whether these can realistically achieve the deterrence the two nations seek, now and in the future. The study also highlights some key dilemmas and challenges looking ahead. Among these are domestic political support, affordability and credibility. The study uses publicly available information only.

Considerably less focus is given to disarmament policies and achievements. While this is an important part in any nuclear weapons analysis this question would require chapters or separate studies in its own right. To do this lies beyond the scope of this study.

Of necessity, the two chapters differ somewhat in content and structure. This is mainly due to the differences in national posture and capability. France retains a more diverse arsenal than the UK does. France also retains the full industrial capabilities to produce nuclear systems, while the UK uses a US-developed missile as a delivery vehicle for its domestically developed nuclear warhead. There are also some differences in what the two countries communicate publicly.

The report concludes with a short summary of the findings and what they mean for the future nuclear deterrents of France and the UK. The future nuclear relationship between France and the UK is also outlined in a brief discussion.

The UK SSBN HMS Vanguard returning to HMNB Faslane after patrol. Photo: UK MoD

2 The British Nuclear Deterrent

This chapter covers a brief history of the British nuclear programme, the current nuclear doctrine, the current system for the nuclear deterrent, the command and control arrangements, and the process towards renewal. A discussion of the strengths and weaknesses of the current and future British nuclear deterrent sums up the chapter.

2.1 Background

A decision on what shape and form a future British nuclear deterrent is to have faces a number of issues. This brief historical background and strategic context helps shed light on the "long lines" which are clearly one factor influencing today's policy decisions.[3]

The British apprehension about being without the nuclear deterrent was great. This is evident in the strenuous efforts the British government put into developing the nuclear programme after 1945. This was done in spite of the initial high cost of development and the weakness of the post-World War II British economy. The statement supposedly made by Foreign Secretary Ernest Bevin that "We've got to have this…We've got to have a bloody Union Jack flying on top of it" reflects the attitude that world status was worth a lot to retain "a seat at the top table" and remain a first-class world power, in spite of the loss of influence that World War II and the rise of the US as the dominant world power had brought.[4] That the UK saw itself as a first-rate world power – one of the nation's victorious in World War II – also helps explain this.

During the Cold War, the British nuclear deterrent is said to have been aimed militarily at Moscow, but strategically at Washington. The direct aim was to dissuade the Soviet Union from a direct attack on the UK; its purpose was also indirectly to retain the notion of equality with the United States. The 1956 Suez crisis, when it became clear that Britain could no longer play an independent role in world politics was in all likelihood a factor in changing British policy towards very close nuclear cooperation with the US. The "special relationship" became the formula for this process. It was realized that British interests had to be defended in Europe and in order to achieve this the US had to remain in Europe. A nuclear weapons-capable Britain became a part of this strategy alongside the development of NATO.

[3] The brief historical background follows closely that in Niklas Granholm: *The Future British Nuclear Deterrent*. Stockholm, FOI, FOI Memo 2049, May (2007)

[4] Beatrice Heuser: *Nuclear Mentalities? Strategies and Beliefs in Britain, France and the FRG*. London, Macmillan Press (1998), p. 47

Initial reluctance on the part of the US was replaced with cooperation when it became clear from 1956 that the UK could produce and operate its own nuclear deterrent. The 1958 Mutual Defence Agreement (MDA) on cooperation in the nuclear field has been in effect since and has been renewed several times. The 1962 Nassau Agreement with the US meant that Britain could buy the Polaris system and nuclear submarine technology, and it gave Britain an operationally independent sea-based nuclear deterrent and enabled her to develop it further, but at the same time confirmed British dependence on the US. Despite having its ups and downs and at times being brought into question, the special relationship has remained special in the nuclear field to this day and cooperation remains an important part of it.

The UK strategic deterrent is today based on the Trident system. It succeeded the Polaris system, which had begun operational patrols in 1969. At that time the Royal Air Force V-bombers stood down and left the task of upholding the strategic nuclear deterrent to the Royal Navy, while still providing tactical nuclear capabilities.

After the end of the Cold War, the 1990s saw a drawdown of other parts of the nuclear arsenal that Britain retained; nuclear artillery shells were dismantled in the early 1990s and the free-fall bombs taken out of the inventory during the second half of the 1990s.[5]

In March 2007 the British Parliament voted to renew the nuclear deterrent. The government had in December 2006 laid out the reasons for renewal in a White Paper to retain the nuclear capability and build a new class of strategic nuclear submarines. The decision followed a debate where the battle lines had long since been drawn. The four main factors affecting the decision were, first, that it would have major ramifications for Britain's status as a nuclear state and would affect her defence and security policy goals. Second, it would have an impact on the role of nuclear weapons in the wider context of international politics. Third, it would affect and influence the rationales of other nuclear weapon states in their arguing for modernization of their own nuclear forces. The last factor was the effect renewal or non-renewal would have on the long-term viability of the Nuclear Non-proliferation Treaty, NPT.[6] The degree of openness in the White paper was significantly greater than during the Cold War, giving more opportunity for public debate.

During the run-up to the decision a number of non-governmental organizations (NGOs) argued the case for relinquishing the nuclear deterrent altogether. The arguments on this side differed from those during the Cold War. Instead, they were

[5] The procedures and routines for arming RAF aircraft with nuclear bombs were retained for some years after that.

[6] Nick Ritchie: "Replacing Trident: Britain, America and Nuclear Weapons." *Contemporary Security Policy*, 28:2 (2007), pp. 384-406.

linked to opportunity costs and the war in Iraq. The total cost of the renewal programme – where the replacement of the Vanguard Class is at the center – was then calculated to be in the order of £65–80 billion (bn) over a 25–30-year period. These funds, the NGOs argued, could be better spent on support and equipment for British conventional forces or on combating climate change.[7] "Let's make nuclear weapons work for us by dismantling them instead" ran one line of argument. Moral arguments from some church leaders and academics also featured – that nuclear weapons are immoral in themselves and therefore have to be relinquished.

The nuclear debate also fed into the contemporary security situation where there was considerable criticism of the Blair government's support for the US-led invasion of Iraq in 2003. This led to tensions within the Labour party where Trident renewal came to be seen as unquestioned support for a belligerent and interventionist US foreign policy.

The 2007 decision was the beginning of a long policymaking process where there would be opportunities for change. Concept design work on a new submarine would be followed by major decisions on procurement and possibly a replacement or modernization of the nuclear warhead.[8]

On 16 July 2016, the British Parliament voted again to renew the nuclear deterrent. The basis for the decision was the National Security Strategy and Strategic Defence and Security Review 2015, where the analysis underpinned the decision.[9] In the years leading up to the decision, a number of key investments in industrial infrastructure and the Atomic Weapons Establishment (AWE), as well as elsewhere, had been made in order to enable the design and future construction of the component parts in the nuclear deterrent. In 2013, the Trident Alternatives Review discussed possible alternatives to renewing Trident.[10] This mirrored the process leading up to the earlier decision, where a government White Paper on renewal in December 2006 was used as a basis for the parliamentary decision taken in March 2007.[11]

[7] Ibid., p. 397
[8] Ibid., p. 397
[9] *National Security Strategy and Strategic Defence and Security Review 2015. A Secure and Prosperous United Kingdom* (2015), https://www.gov.uk/government/publications/national-security-strategy-and-strategic-defence-and-security-review-2015 (retrieved 2017-10-30), pp. 34-37. The paragraphs follow closely the presentation in the strategy.
[10] *The Trident Alternatives review*, July 16 (2013), https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/212745/20130716_Trident_Alternatives_Study.pdf (retrieved 2017-10-30)
[11] *The Future of the United Kingdom's Nuclear Deterrent*, Government of the United Kingdom, December (2006).

2.2 Current British Nuclear Doctrine

The National Security and Strategic Defence Review of 2015 sums up the United Kingdom's nuclear policy in a few brief pages.[12] On the role of the nuclear deterrent, the clear statement that the UK will remain a nuclear power today and for as long as the international situation demands it, is laid out. The fact that nuclear arsenals continue to be held by other states in the international system constitutes the main reason for retaining the nuclear deterrent, since a nuclear threat is clearly there as a possibility. "…recent changes" in the international environment are quoted as a reason for why "…we cannot relax our guard".[13] Further shifts that exacerbate the threat and could put the UK, or our NATO allies "…under grave threat" cannot be ruled out.

The reason given for the renewal is the technical lifespan of the Vanguard Class submarines: they will have to be phased out by the early 2030s. Lead times for technical development and manufacturing the replacement mean that the process has to begin now. Anything else would be irresponsible. The UK cannot assume that it will not in the foreseeable future be faced with the kind of extreme threat to our way of life and security that nuclear weapons seek to deter. The argument is summed up with the key phrase that:

> …a minimum, credible, independent nuclear deterrent based on Continuous At Sea Deterrence and assigned to the defence of NATO, remains vital to our national security. We will therefore make the necessary investment to sustain our Continuous At Sea Deterrence.[14]

The assessment is then made that what is needed is the minimum amount of destructive power to deter any aggressor, which requires a system that is not vulnerable to pre-emptive action by potential adversaries. Given the alternatives considered, the conclusion remains that a four-submarine fleet is needed in order to keep at least one boat always at sea and undetected on patrol. A submarine on patrol will continue to carry 40 nuclear warheads and no more than eight operational missiles. The number of operationally available warheads will not number more than 120. By the mid-2020s, the total number of warheads will number no more than 180, which is in line with the commitments in the 2010 Strategic Defence and Security Review (SDSR 2010). The nuclear posture will be kept under constant review, where the international security environment and the actions of potential adversaries will be followed and analysed.

The UK government further states that its nuclear weapons would only be used in extreme circumstances of self-defence, including the defence of NATO allies. The

[12] *National Security Strategy and Strategic Defence and Security Review 2015.* Op.cit.
[13] What these changes were is not spelled out, but it is reasonable to assume that Russia's occupation of Crimea and the subsequent Russian-led war in eastern Ukraine is the main factor here.
[14] *National Security Strategy and Strategic Defence and Security Review 2015*.

resolve and capability to do so are not in doubt, and the UK will remain deliberately ambiguous about when, how and on what scale it would contemplate their use. An aggressor should not in a simple way be able to calculate the UK's response.

The SDSR 2015 further states that the UK will not use or threaten the use of nuclear weapons against any non-nuclear state that is a party to the NPT. Other non-nuclear states that are not signatories to the NPT are not covered by this assurance. The policy goes on to state that, while there are no current threats to the UK or its vital interests from states developing weapons of mass destruction, the UK will reserve the right to review the assurance if the future threat picture should any change or any development of these weapons make it necessary.

International cooperation with NATO, the US and France is set out where the nuclear deterrent is part of NATO's overall strategy. The UK continues to contribute to the overall capability of an ultimate guarantee of collective Euro-Atlantic security. Nuclear policy is an area where the UK cooperates with France and the US. The US-UK cooperation is supported by the recently renewed Mutual Defence Agreement of 1958 and the 1963 Polaris Sales Agreement. These agreements provide the UK with a cost reduction by enabling procurement of missiles and other components from the US while maintaining "full operational independence". The cooperation with France on nuclear issues is supported by the 2010 Teutates Treaty to develop technologies for safe and effective maintenance of both countries' nuclear stockpiles.[15]

While the UK has a long history of collaboration with the US in the nuclear weapons field, cooperation with France did not materialize until very recently. In 2010 the UK and France signed the Lancaster House agreement which opened the possibility of joint efforts in three distinct areas. These are "a) safety and security of nuclear weapons, b) stockpile verification, and c) counter nuclear and radiological terrorism".[16] This agreement paved the way for the Teutates project which will develop joint capability for stockpile verification and stewardship. Two facilities are being constructed as part of Teutates.

In Valduc, France, the Expérimentations de Physique Utilisant la Radiographie Eclair (EPURE) is being built. This is an X-ray radiograph facility used to test and monitor warhead hardware and related equipment. Two separate parts of the complex allow France and the UK respectively to conduct experiments independently. When completed in 2022 the facility will also house a joint part

[15] The Teutates Treaty between the UK and France concerns two main areas: simulation of nuclear detonations and simulation of nuclear warhead function. See Bruno Tertrais: *Entente Nucléaire: Options for UK-French Nuclear Cooperation*, Discussion Paper 3 of the BASIC Trident Commission, London, BASIC (2012); and Jeffrey Lewis and Bruno Tertrais: "Deterrence at Three: US, UK and French Nuclear Cooperation." *Survival*, 57:4 (2015)

[16] Bruno Tertrais: *Entente Nucléaire*, p. 14

where scientists from both countries can share results and undertake joint experiments.[17]

At the Atomic Weapons Establishment, AWE in Aldermaston in the UK, a Technology Development Centre (TDC) will be established. The primary function of the TDC is initially to house scientists working on the joint experiment for the third X-ray radiograph machine which will be installed at Valduc. Both countries have stated that the Teutates project is an important and money-saving endeavour in its own right. It has also for the first time opened up the possibility of expanded future collaboration.

Where nuclear warheads are concerned, this is focused on continued work regarding the optimum life of the stock and the range of replacement options. Replacement of the current generation of warheads is not required until the late 2030s, or perhaps later. The lead times are long, and this may require a decision during the life of this parliament or early in the next.[18] Just prior to Christmas 2017, the Ministry of Defence indicated that the decision on developing a new warhead would need to be taken during this parliament, which would mean 2022 at the latest. The defining of this timeline also fits in with the UK government being pre-briefed on the US Nuclear Posture Review, which includes a "low-yield" Trident option, underlining the close UK-US cooperation.[19] This in turn requires significant investments in the AWE in order to maintain knowhow and the nuclear stockpile and to develop a replacement warhead when needed.

The central component of the nuclear deterrent that needs to be replaced is the Vanguard Class of four nuclear-powered ballistic missile-capable submarines (SSBNs), which will be succeeded by a class of four new submarines.[20] The successor type is one of the largest national endeavours undertaken by the UK government in a financial sense.[21] The design phase of the submarine programme started in 2011 with cooperation between industry and government. The organization of the submarine programme will differ from earlier similar programmes, where the main changes concern a staged investment model instead of a "Main

[17] Bruno Tertrais: *Entente Nucléaire*, p. 15

[18] Since the strategy review was published in 2015 and the general election was held 2017, earlier than required, the decision referred to is probably meant to be read as around 2020.

[19] *The United Kingdom's Future Nuclear Deterrent: The Dreadnought Programme 2017 Update to Parliament*, (2017), https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/669771/20171220-2017_Annual_Update_to_Parliament-The_United_Kingdoms_Future_Nu_____002_.pdf (retrieved 2018-03-21)

[20] *Dreadnought Submarine Programme*: Factsheet. The Government, updated January 20 (2016), https://www.gov.uk/government/publications/successor-submarine-programme factsheet/successor-submarine-programme-factsheet (retrieved 2017-10-30)

[21] The successor was named the Dreadnought Class on 21 October 2016, Trafalgar Night.

Gate", which is not deemed appropriate for a programme of this scale and complexity. The construction of the new submarines started in October 2016.[22] The cost of the 20-year acquisition programme is currently estimated to be around £31 bn (an amount said to cover inflation, to ensure that possible price increases will not impoverish the programme) and the first submarine is to enter service by the early 2030s. In addition, a contingency sum of £10 bn has been set aside. The figures reflect a greater understanding about the design and manufacture of the submarines.

Lastly, nuclear non-proliferation and commitments to international arms control treaties remain an important part of the UK's nuclear policy. Trust and confidence have to continue to be built between nuclear and non-nuclear weapon states in order to take tangible steps towards a safer and more stable world where countries with nuclear weapons feel safe to relinquish them. The UK has reduced its nuclear forces by more than half since the 1970s peak. The UK, as a responsible nuclear power, having signed the NPT, recognizes its obligations under the treaty. Proliferation will be tackled and the UK plays a role in multilateral disarmament with international partners. It continues to press for entry into force of the Comprehensive Nuclear Test Ban Treaty and successful negotiations on a Fissile Material Cut-Off Treaty in the Conference on Disarmament.

2.3 Current British Nuclear Forces

2.3.1 Nuclear Components

The current system for the nuclear deterrent consists of several component parts.[23] The system is based on four Vanguard Class SSBNs. Each of the four boats can be equipped with 16 missiles, each carrying up to three warheads (multiple independently targetable re-entry vehicles, MIRVs), which adds up to a maximum of 48 warheads per vessel. While this is the maximum technical capability of missiles and warheads for the Vanguard Class, the UKs practical limitations with a maximum of 40 warheads, suggests some combination of missiles with high-yield warheads, low-yield warhead and decoys. The secondary armament is four

[22] *Building to start on new nuclear submarines as government announces £1.3 Bn investment*, The Government, October 1 (2016), https://www.gov.uk/government/news/building-to-start-on-new nuclear-submarines-as-government-announces-13-billion-investment (retrieved 2017-10-30)

[23] The following paragraphs are based on Stockholm International Peace Research Institute (SIPRI): *SIPRI Yearbook 2015*. Oxford, Oxford University Press for the Stockholm International Peace Research Institute (2015), pp. 484-487; *SIPRI Yearbook 2017*, Oxford, Oxford University Press for the Stockholm International Peace Research Institute (2017), pp. 427-429; *The Military Balance 2017*, International Institute for Strategic Studies (IISS), (2017), p. 170; and Peter Hennessy and James Jinks: *The Silent Deep. The Royal Navy Submarine Service since 1945*. London, Allen Lane (2015), p. 695

533-mm (21-inch) torpedo tubes armed with Spearfish torpedoes. The displacement (submerged) is 15 900 tons, the length is 149.7 metres (491 feet) and the crew complement is 135. The first SSBN in the Vanguard Class, *HMS Vanguard*, became operational in 1993.[24]

HMS Victorious, a missile-armed Vanguard Class ballistic missile submarine leaving its base at HMNB Clyde. Photo: UK MoD.

The missile component consists of the UGM-133 Trident II D-5 submarine-launched ballistic missile (SLBM). The total number of 58 missiles are jointly owned by the United Kingdom and the United States and are circulated from a joint stock based in the US at the Naval Submarine Base Kings Bay, Georgia, and shared with the United States Navy. At Kings Bay, there is also a Trident simulator jointly used by the UK and the US. The UK is part of the US programme of extending the service life of the Trident II D-5 missile from 2028 until 2042.

[24] HMS Vanguard, the first boat in the class, became operational in 1993 and the three others (HMS Victorious, HMS Vigilant and HMS Vengeance) followed. From 1999 the Vanguard Class is fully operational. Hennessey and Jinks: *The Silent Deep*, p. 695

The nuclear warheads are developed, manufactured and maintained at the AWE, at Aldermaston, England. Additional work is carried out at Burghfield establishment near Aldermaston. Rolls Royce in Derby constructs the naval reactors and fuel for the submarines. The warheads in use by the UK are based on the US-designed W76 and are believed to be very similar. There is close cooperation on nuclear warhead design and production with the US. This includes the sharing of warhead components as well as stockpile maintenance under the 1958 MDA, renewed in 2014. The AWE began a Nuclear Warhead Capability Sustainment Programme in 2005 in order to ensure that the warhead remains safe and operational during its remaining service life and following its withdrawal from service. While not a joint programme with the US, it is undertaken in cooperation with the US. While the maximum number of warheads that can be deployed on each SSBN is 48, it is believed that a number of missiles are deployed with a single warhead per missile. These single-warhead missiles are possibly configured with a reduced explosive yield in order to increase the flexibility of the targeting options.[25] The capability of the low-yield warheads are not publically available, but the full yield warhead is of about 100 kilotons (kt). The missile with warhead has a range in excess of 7 400 kilometres (km).[26]

The overall number of nuclear warheads in the British arsenal is about 215. Of these, around 120 are believed to be operational today, with about 40 deployed at sea at any given time.[27] The number fits with the Strategic Defence and Security Review of 2010, where a reduction of the number of operational warheads to 120 was announced. Of these, 40 will as before be continuously deployed. The total number of warheads is projected to fall to no more than 180 by the mid-2020s.[28]

At any given time, one Vanguard Class SSBN is deployed, with the second and third held at readiness to put to sea rapidly, while the fourth is undergoing maintenance and overhaul. The operational posture is known as Continuous At Sea Deterrence (CASD) and has been maintained since April 1969, currently named Operation Relentless. The readiness to fire a missile has been reduced since the end of the Cold War. The "notice to fire" is now measured in days, and since 1994 no state is targeted by the missiles.

The nuclear deterrent system depends on a number of other components apart from the submarines, missiles and nuclear warheads. One of the central facilities is Her

[25] Austin Long: *Discrimination Details Matter: Clarifying an Argument About Low-Yield Nuclear Warheads*, War on the Rocks, (2018) https://warontherocks.com/2018/02/discrimination-details-matter-clarifying-argument-low-yield-nuclear-warheads/ (retrieved 2018-03-21)

[26] The explosive yield of nuclear weapons is measured in kilotons (kt), where 1 kt equals the explosive force of about 1 000 tonnes of TNT. The range of the missile is described as "indicative" and varies according to flight profile and load.

[27] The *SIPRI Yearbook 2017* puts the figure at 120 warheads, while the IISS' *The Military Balance 2017* sets the figure at "…not more than 160".

[28] *SIPRI Yearbook 2017*.

Majesty's Naval Base Clyde (HMNB Clyde), also known as Faslane.[29] Here, the maintenance of the Vanguard Class is undertaken, and all munitions, including nuclear warheads and missiles, for all Royal Navy submarines are handled at a facility in Coulport nearby. The measuring function for the submarine's magnetic signature is also part of the base's functions. A number of support ships, a diving group, and a security unit from the Royal Marines make up the support functions of HMNB Clyde. US Navy submarines can also dock at Clyde. From 2020, all British submarines will be home-ported at HMNB Clyde.

A Trident II D-5 ballistic missile launched from a US SSBN. Photo: U.S. Department of Defense.

[29] *HMNB Clyde. Her Majesty's Naval Base*, https://www.royalnavy.mod.uk/our-organisation/where-we-are/naval-base/clyde (retrieved 2017-11-01)

Command and Control

The details of the command and control system for the nuclear deterrent are for operational reasons a closely guarded secret. However, some data have been released in recent years that form a picture of how the system is led and who controls the nuclear trigger.

It is clearly stated in the unclassified policy documents that the Prime Minister alone has authority to order a launch of the nuclear missiles, in order to ensure political control at all times.[30] It is also stated that "…we will be deliberately ambiguous...on when, where, how and at what scale we would contemplate their use…".[31] The purpose of this stated policy of ambiguity is to complicate the calculations of a potential aggressor.

A standing order currently named Operation Relentless, is designed to ensure a year-round, round-the-clock nuclear deterrent and has been in effect since June 1969.[32] Within the operation the firing chain of the nuclear weapons, from the Prime Minister to the submarine patrolling somewhere in the North Atlantic, are covered. The operation is led by the Chief of the Defence Staff, and it is the duty of the components in the Royal Navy to execute the operation. Exercises for the nuclear capability are the most frequently held by the UK's armed forces.

The Prime Minister plays a central role in the nuclear decision-making system, partly due to the British set up of the political system. On taking office, every new Prime Minister gets a briefing on the nuclear release procedures. The decision to launch the nuclear missiles rests exclusively with him or her. The authority is not a collective Cabinet decision or a House of Commons vote. The Prime Minister also chooses two or three nuclear deputies personally, rather than according to Cabinet hierarchy. He or she does not need to be in any particular place to give the order to start the release procedures, as long as the right people are with him/her. The right people for briefing purposes, two nuclear-code authenticated officers and the cryptographic equipment to encode the message for release, are needed. This set-up seems similar to what other nuclear powers have to ensure a credible round-the-clock deterrence.

In the event of an order to release the nuclear weapons being given, the coded message goes from the Prime Minister to the Nuclear Operations Targeting Centre, NOTC, situated under main building of the Ministry of Defence in Whitehall, London. The NOTC is located next to the Defence Crisis Management Centre (PINDAR). The NOTC also contains the targeteers, responsible for all the nuclear targeting. It is also linked to NATO's Supreme Headquarters Allied Powers

[30] *National Security Strategy and Strategic Defence and Security Review 2015*, pp. 34-35
[31] Ibid, pp. 34-35
[32] The following paragraphs on the command and control of the nuclear deterrent follow Hennessy and Jinks: *The Silent Deep*, pp. 673-676.

Europe at Mons in Belgium (SHAPE). At the NOTC, the PM's coded message – the National Firing Directive – is then transferred to the Permanent Joint Headquarters (PJHQ) at Northwood, Hertfordshire, where it is received by the Commander of Task Force 345 (CTF 345), which commands the nuclear submarine operations. From the moment the NOTC receives the Prime Minister's instructions, it takes about 40 minutes for the instructions to reach the submarine on patrol. The submarine itself takes about 15 more minutes to complete the authentications and drills.[33] Soon thereafter, the 60-ton D-5 missile bursts out of the sea. About 30 minutes after that, impact would take place somewhere within a 4 000 nautical mile radius. Given that readiness today is lower than before 1994, it would have to be raised in order to contain the time constraints indicated above.

One of the more exotic components of the command and control is the letter that each Prime Minister writes to the captain of each of the four Vanguard Class submarines. When a change of government takes place, a new letter is written and the former letter is destroyed. If all communication with the UK should be lost, the crew is instructed to listen to the BBC Radio 4 Today show. If that cannot be heard, the conclusion is that the UK has ceased to exist. It is believed that the commander is given one of four alternatives:[34]

1. Put yourself under US command.
2. Make your way to Australia, if it still exists.
3. Take out Moscow, or the capital of whichever country has initiated the attack.
4. Use your own judgement.

British nuclear doctrine is clear in that it is the Prime Minister who has exclusive authority to order a launch. In the case of taking Britain into a conventional conflict, Parliament has to be consulted. Britain can thus go to war in different ways, and the most destructive force is not in the hands of those directly elected by the British people. This may seem like a paradox, but behind it lies an assessment of what type of conflict is at hand: is it major war, a discretionary intervention or just responding to an aggression? Given the nuclear doctrine, it would be highly unlikely that Britain would open a conflict with a nuclear strike, even though there is a stated ambiguity written into it. If there is time, Parliament would be consulted on going to war, but not on its conduct.[35]

[33] A drill to launch nuclear missiles onboard a submarine or at least part of a drill can be seen at a filmed documentary from 1995, 1996 or 1997: Trident Submarine HMS Victorious. Minute 23-28, https://www.youtube.com/watch?v=cxwy98HKe0Q&feature=youtu.be

[34] Peter Hennessy: *The Secret State. Whitehall and the Cold War*. London, Allen Lane (2002), pp. 191-192

[35] I am grateful to Professor Sir Lawrence Freedman, King's College, London, for clear and insightful comments on this part of the analysis.

Britain has a long tradition of the "Royal Prerogative" which allows the Prime Minister to take the country to war without any formal approval of Parliament. For some years this prerogative has increasingly been challenged. Under the pressure of the Afghan wars from 2001 and the Gulf War in 2003, the Conservative opposition voiced concerns that Parliament would need to be consulted before taking Britain to war. The decision to take Britain to war was to be made more democratic. In government, the Conservative Cabinet under David Cameron acted upon this. A motion in late August 2013, deciding on a military strike against Syria after the regime had used chemical weapons, was put to the vote and defeated. As a consequence, a decision to take Britain to war now rests with Parliament.[36] But the Prime Minister's prerogative regarding nuclear weapons remains unchanged.

2.3.2 Non-nuclear Components

To support the Vanguard Class during operations, maritime patrol aircraft (MPAs) play an important role in upholding operational and situational awareness. During a patrol with a Vanguard Class submarine avoiding detection is central. If an opposing force (typically a submarine, a surface ship, an aircraft or a combination thereof) is attempting to locate the submarine, early detection is vital. The decision that followed from the SDSR 2010 to retire the Nimrod MPAs led to a loss of this capability. Air crews did continue to fly on operations with their Australian, Canadian, New Zealand and US MPA counterparts under Project Seedcorn. In May 2017 a contract for the purchase of nine P-8A Poseidon MPAs from the US was signed, with delivery of the first two aircraft due in 2019, to be operational from 2020.[37] Until then, this capability gap is made up for by deploying a Type 23 frigate as a towed array patrol ship, year round.

The nuclear deterrent also depends on up-to-date ocean survey data that support oceanographic modelling. This is provided by the two Royal Navy Echo Class ships, *HMS Echo* and *HMS Enterprise*, both commissioned in 2003.[38] Their role is to provide a range of oceanographic data in support of submarines and amphibious operations. This is a fairly modern capability and can be expected to serve in support of submarine operations for another 20 years. In addition, MPAs and land-based measuring stations play a role in providing data on the earth's magnetic field and gravitational field in order to support operations. Taken together, the oceanographic support functions seem reasonably well supplied and

[36] James Gray and Mark Lomas: *Who Takes Britain to War?* Stroud, The History Press (2014). Gray and Lomas discuss the past, present and future of British decisions to go to war and suggest a solution that would be based on Just War theory as a basis for new legislation.

[37] George Allison: "First two British P-8 Poseidon Maritime Patrol Aircraft ordered." May 5 (2017), https://ukdefencejournal.org.uk/first-two-british-p-8-poseidon-maritime-patrol-aircraft-ordered/ (retrieved 2017-11-01)

[38] Echo Class Hydrographic / Oceanographic Survey Vessels, http://www.naval-technology.com/projects/echoclasssurveyvesse/ (retrieved 2017-11-01)

organized to support submarine operations for the foreseeable future. Ongoing efforts at conceptual development indicate that autonomy and "off-board systems" will be part of the future capabilities and affect the designs and manufacture of coming generations of platforms in a financially restricted situation.[39]

A critical component in the nuclear deterrent system is trained personnel. Here, a shortage of trained specialists, especially in the submarine service, presents the Royal Navy with a problem. There is a considerable problem of undermanning in respect of sailors with an engineering specialty (10% shortfall), submarine engineering (7%), logistics (5%) and medical services (9%).[40] The indications are that the Royal Navy and the Royal Air Force in particular have problems in retaining qualified personnel. Recently, ethical problems in the SSBN fleet have come to the fore. The commander of *HMS Vigilant* and his second in command were relieved of their duties after accusations of improper relationships with subordinate female members of the crew; and nine sailors were dismissed from the submarine service after testing positive for drug abuse.[41] These two events may have been unique and/or unusual, but they raise the question of the stability of the SSBN force, which relies on being seen as credible. While they are not an immediate operational problem, events like these can over time gradually erode the outside world's view of a credible nuclear deterrent.

2.4 Issues for the Future

In this section, the various strengths and weaknesses of the British nuclear deterrent are discussed, followed by a summarizing assessment. There are several factors, different in character, developing simultaneously and according to their own logic and speed that will have an impact on the future of the UK nuclear deterrent. The key words in the British nuclear doctrine are: credible, affordable and independent.

The Changing North Atlantic

The North Atlantic situation is evolving into a more confrontational environment than before. This is due to two main developments. First, climate change, leading to accelerating ice-melt in the Arctic region, on land and at sea, means that there will be an increase in human activity in general and that these activities will move

[39] Paul Doherty: *UK MCM & Hydrography Programme*. Dstl Presentation, 2011
[40] *The Military Balance 2017*, IISS (2017), p. 86
[41] "Nine British servicemen removed from HMS Vigilant after testing positive for cocaine." *The Telegraph*, October 27 (2017), http://www.telegraph.co.uk/news/2017/10/27/nine-british-servicemen-removed-hms-vigilant-testing-positive/ (retrieved 2017-11-01)

north.[42] Shipping, fisheries, and the extraction of oil, natural gas and minerals are three factors that are changing. A new Arctic region is emerging and as a follow-on effect, the North Atlantic region faces several challenges, among them possible changes in sovereignty among some aspiring nations. Greenland, Scotland and the Farœ islands are all in different ways at the forefront in this respect. The character, speed and nature of these processes will have an impact on the general security situation in the region and will interact with the naval and maritime situation.

Second, the Russian policy of a more assertive and aggressive stance also affects the North Atlantic. Russia's aspiration is for a "bastion", behind a line in the Barents Sea and Arctic Ocean from the North Cape north-west towards the north-eastern coast of Greenland, where a safe zone for Russia's submarine-based nuclear second-strike capabilities is envisaged. Here, the aim is for sea control. To the south of that line, into the North Atlantic, sea denial is sought. The Russian focus is on building up and employing air and naval resources to this end. Given that the West's resources for meeting the Russian challenge are few and in some respects barely or not at all available, and in addition that the West currently lacks a suitable command and control arrangement, the naval strategic situation currently lacks balance.[43] While NATO has recently announced changes to the command and control set-up for the region, no clear arrangement or outline of how tasks are to be resourced has been made public at the time of writing. Warnings have also been given recently that the underwater cables handling much of the information for trade and finance are under increased threat.[44]

Given the changing North Atlantic context, the British nuclear deterrent, it is assumed, operates "somewhere in the North Atlantic".[45] While this may be a deliberate attempt at operational subterfuge, it probably gives a rough indication of where the operational "boxes" of the nuclear deterrent are to be found. It seems likely, then, given what is currently known, that using the North Atlantic as the operational area for the nuclear deterrent may pose more of a challenge than previously. What measures need to be taken to address this in order not to undermine the credibility of the nuclear deterrent?

[42] Niklas Granholm, Märta Carlsson and Kaan Korkmaz: *The Big Three in the Arctic. China's, Russia's and the United States' strategies for the new Arctic*. Stockholm, FOI, FOI-R--4296--SE (October 2016)

[43] John Andreas Olsen (ed.): *NATO and the North Atlantic. Revitalising Collective Defence*. RUSI Whitehall Paper 87, London (2017)

[44] Lecture by Air Chief Marshal Sir Stuart Peach, Chief of the Defence Staff, RUSI, December 14 (2017), https://rusi.org/event/annual-chief-defence-staff-lecture-2017 (retrieved 2017-12-15)

[45] Hennessy and Jinks: *The Silent Deep*, pp. 673, 682. The operational area of the Vanguard Class submarines is for obvious reasons not disclosed. References to where the Vanguard Class operates can be found in *The Silent Deep*, referring to it as "in the silent deeps of the north Atlantic" and "…somewhere in the north Atlantic".

The Scottish Question – Impact on the Deterrent Capability

The second challenge to the credibility of the deterrent emanates from the aspiration for Scottish independence. Devolution in the late 1990s did not lessen the appetite for full independence as had been assumed. After the referendum of 2014, when a majority of Scots voted to remain in the United Kingdom, the British vote to leave the European Union in June 2016 reignited the debate on independence and a second referendum for independence may follow from this. The argument made by the Scottish National Party (SNP) is that in Scotland a clear majority voted to remain in the EU. The previous referendum in 2014 was held, they argue, under the premise that the UK would remain in the EU. This is a new situation that calls for a new vote, the Scottish nationalists claim. This may not be imminent, but should the right opportunity present itself, a second referendum – an "Indyref 2" – may well take place. The SNP are also strongly opposed to nuclear power and nuclear weapons.

An independent Scotland may seek to remove the home base of the nuclear deterrent at HMNB Clyde. As described in the previous section, the whole of the base complex is central to the nuclear deterrent, with its docks, shipyards, stores, fortified tunnels and security apparatus needed to make the deterrent function as a system. In addition, the whole of the Royal Navy's submarine forces is to have HMNB Clyde as its home base from 2020.[46] As Malcolm Chalmers and William Walker have shown, the devolution of powers to Scotland makes it possible under the current state of devolved governmental competencies for the government in Edinburgh to oppose the transport of nuclear material in Scotland on grounds of environmental safety.[47] An example is the transport of nuclear warheads back and forth between HMNB Clyde and the AWE in Aldermaston. If a future independent Scotland were to decide not to allow home basing of British submarines on its territory, it would mean a new base would have to be built somewhere else, at huge cost.

Alternatively, a leasing arrangement of HMNB Clyde could be agreed on with an independent Scotland, also at a cost. What could slow or stop such a process is the question of jobs in a relatively poor region. With the move of the entire UK submarine force to HMNB Clyde and the investments to be made by the UK government, the number of employees will rise from today's 6 800 to about 8 000 in 2020. This could make it difficult for the Scottish government to say no to future basing there. The challenge that Scottish independence poses to the credibility of the nuclear deterrent will continue to haunt the planners of the British nuclear deterrence.

[46] "Entire UK submarine fleet to be based in Scotland", https://navaltoday.com/2017/02/02/entire-uk-submarine-fleet-to-be-based-in-scotland/ (retrieved 2017-12-14)

[47] Malcolm Chalmers and William Walker: *Uncharted Waters. The UK, Nuclear Weapons and the Scottish Question*. East Linton, Scotland, Tuckwell Press (2001)

Personnel: Recruitment, Retention and Morale

The skills needed to operate and maintain the technical systems on the SSBNs are of a high level and the qualified personnel needed to operate them are in short supply. The Royal Navy, like most naval services in the Western world, has problems in retaining skilled personnel. The level of undermanning in the RN submarine service engineering branch is about 7%. In the British case this is compounded by the limits in public sector pay rises to 1%, while average growth in wages in the private sector has been about twice that. Added to that are the poor conditions of the accommodation for service families: complaints have increased sharply. The Armed Forces' Pay Review Body also clearly detects a decline in morale. The net effect is qualified personnel leaving for the private sector, leading to the risk that it "…placed some operational capability and branch structures at risk".[48]

Precisely what effects this situation will have on the nuclear deterrent is harder to assess from the outside, but the events involving personnel – commanding officers as well as sailors – leading to their dismissal from the service, are another indicator that morale issues can have an effect on operational credibility and perhaps also safety. What will be done to attempt to remedy the situation remains to be seen.

Defence Economics – Possible Impact on the Future Nuclear Deterrent?

The financing of defence for the UK will face a number of uncertainties in the coming years.[49] The main, though far from only, source of this uncertainty is the effects of the June 2016 referendum on British EU membership. On the macroeconomic level, this contributes to uncertainty on overall economic growth. British economic growth rates have gradually and continually declined from 3.1% per year in 2014 to 1.7% in 2017, and will continue to fall to perhaps 1.3% in 2018.[50] While the defence budget was around £38.3 bn in 2016, and will increase by about 0.5% a year, the result of the referendum has a number of effects. Brexit seems thus likely to have a negative impact on the defence budget, and possibly also impact on the modernization of the nuclear deterrent.

In the coming ten years, the current defence budget has a strong focus on procurement. About £178 bn is to be spent during 2016-2025. The bulk of the spending – £21.7 bn – is for future submarines and for the AWE. More broadly, combat aircraft (£10.4 bn), naval vessels (£9.6 bn), P-8 MPAs, Protector unmanned aerial vehicles (UAVs) and a reduced number of Type 26 global combat ships are on the list for procurement. A squadron of F-35s will be brought into

[48] *The Military Balance 2017*, IISS, (2017), p. 86

[49] This section is based mainly on the IISS *The Military Balance 2017* and an exchange with FOI's defence economics analysts Bengt-Göran Bergstrand and Juuko Alozious.

[50] *IMF World Economic Outlook database*, October (2017); and: *The World in 2018*, The Economist (2017), p. 112

service faster than planned, and new combat vehicles for the new type of army brigades – Stryker – are also on the list.[51]

The basis for the procurement is the SDSR 2015 and the Spending Review, which estimated economic growth at 2.4% and 2.5% for 2016 and 2017, respectively. Lower growth, which seems likely, has put the plans in the SDSR 2015 under pressure. The target of 2% of gross domestic product (GDP) for defence set by NATO will also make a dent in the budget. Another problem is the slide in the value of the pound as a consequence of Brexit, which will make procurement more expensive.[52]

During 2016, the pound was at its lowest level against the US dollar (USD) since 1985. In 2016, the rate was about 1.36 GBP : 1 USD. The slide had begun already before the referendum on EU membership. According to the International Monetary Fund (IMF), the value of the pound will probably slide further in the next few years. The IMF estimates that the rate will be about 1.24 GBP : 1 USD in 2022, reducing the purchasing power of the pound further. Less goods and services can be bought for the sums budgeted. The UK defence budget was clearly drawn up under more favourable conditions, and this will have an impact on the acquisition of new big-ticket defence systems. The renewal of the nuclear deterrent will in turn be more expensive than estimated.

Several major weapons platforms are bought from the US, and in the context of the nuclear deterrent the P-8A MPAs play a central role. If the procurement and/or delivery of these aircraft is delayed, it would weaken the overall system of British nuclear deterrence, as was the case when the Nimrod MPAs were scrapped as a result of the SDSR 2010.

As a result of the mounting uncertainties, an overview of the SDSR 2015 is being conducted. The National Security Capabilities Review is looking at the implementation of the SDSR and how to mitigate the shortfall of funding that has resulted from lower growth than expected and the fall in the value of the pound. The report was expected by the end of 2017, but after the resignation of Secretary of Defence Michael Fallon, the date for publication seem to have been put back for later in the first half of 2018.[53] It is also unclear whether the report will be made public.[54] The armed forces' service chiefs have also asked the Ministry of

[51] IISS: *The Military Balance 2017*

[52] The IISS *The Military Balance* puts the slide against the US dollar at about 10% in September 2016.

[53] Tim Ripley: "UK's national security capability review delayed." *Janes' 360*, http://www.janes.com/article/75633/uk-s-national-security-capability-review-delayed (retrieved 2017-12-14)

[54] Andrew Chuter: "UK launches new mini defense and security review". *Defense News*, https://www.defensenews.com/global/2017/07/26/uk-launches-new-strategic-defence-and-security-review/ (retrieved 2017-12-06); and Deborah Haynes: "Backbench Tories threaten rebellion over defence cuts", *The Times*, November 20 (2017)

Defence for a full-scale SDSR process instead of a National Security Capabilities review and an additional £4 bn to avoid deep cuts in the current defence structure.[55]

Domestic Politics

The domestic political situation can also play a part in the plans to renew the nuclear deterrent. The current Conservative minority government after the last general election depends on parliamentary support from the Northern Ireland DUP. The main issue consuming a lot of the available political energy is the negotiations surrounding Brexit. Splits within the Conservative party led on 13 December to the government losing a motion and it will now be forced to put the result of the Brexit negotiations before Parliament, once they are concluded.[56] The divisions within the government can lead to the government being weakened or even falling. If that should happen, it might open the way for a Labour government. Since Labour's policies have changed and its leadership and much of the party's base is now firmly against the nuclear deterrent, the current CASD-policy might, at a minimum, be put into question. Alternatively, a fresh general election might be called, with an unknown outcome.

2.5 Conclusion: Neither Credible, nor Independent or Affordable?

The design and production of the new Dreadnought Class SSBNs are probably not in doubt. But several scenarios with a likeliness greater than zero that may put the modernization process under threat can be envisaged.

In one scenario, the nuclear deterrent system is completely "ring-fenced" in the defence budget, and the savings, delays in procurement and scrapping of systems or units will be made exclusively on the conventional side of defence. This could be supported by a move to change the budgetary allocations, moving the cost of the nuclear deterrent outside of the defence budget. The argument between the service chiefs and the inevitable inter-service rivalry would in this case have less of a chance of affecting the nuclear deterrent and thereby protecting it. But the scenario would probably also lead to a conflict between the service chiefs and the government, in that this would be seen as funding to be used elsewhere. Several

https://www.thetimes.co.uk/edition/news/backbench-tories-threaten-rebellion-over-defence-cuts-ffrbdhndm#top (retrieved 2017-12-08)

[55] "Defence chiefs seek new review and £4bn bailout." *The Times*, December 11 (2017), https://www.thetimes.co.uk/article/defence-chiefs seek-new-review-and-4bn-bailout-b3dgk8tb9 (retrieved 2017-12-15)

[56] "Tory Brexit rebels inflict major defeat on Theresa May." *The Guardian*, December 13 (2017), https://www.theguardian.com/politics/2017/dec/13/tory-brexit-rebels-inflict-major-defeat-on-theresa-may (retrieved 2017-12-14)

conventional components that today support the nuclear deterrent would be difficult to de-couple in defence planning.

In a second scenario, some procurement is delayed and a “make-do-and-mend” policy is followed. Life-extension programs for components in the system are set up, and maintenance is delayed for as long as possible, leading to higher operational risk. This scenario over the longer term eats into the aim of presenting the deterrent as credible.

It is also possible to envisage a third scenario with a combination of the factors discussed above: the economics of defence, personnel shortages and morale deficiencies, changing operational circumstances, a move towards Scottish independence and domestic political developments may also reinforce or cancel each other out in ways which are hard to foresee. It would lead to a slow decline of the nuclear deterrent – the factors in combination act as “death by a thousand cuts”, leading to a point where it comes to be seen as neither credible, independent or affordable. The outcome would in effect mean the end of the British nuclear deterrent.

A Rafale dual-capable fighter carrying the French nuclear armed cruise missile ASMP-A. Photo: reproduced courtesy of the French Air Force

3 The French Nuclear Deterrent

The French nuclear deterrent came into being during the 1960s to secure France and ensure her continued national independence. The Soviet threat drove this development, but so did dynamics amongst the North Atlantic allies. During the course of the 1960s and 1970s France developed a robust arsenal with strategic and sub-strategic components. The dissolution of the Soviet Union removed one primary motive for retaining nuclear weapons, yet others remained. France has since made significant reductions in force numbers, but a deterrent capability has been retained. In the current international environment, with deteriorating security in Europe as well as globally, France considers its deterrent force fundamental to ensuring national security and maintaining France's major-power status. The force is therefore being modernized to ensure continued capability beyond 2030.

This chapter briefly outlines the genesis and evolution of the French nuclear deterrent. It covers current French nuclear policy, doctrine, and existing nuclear assets. Retaining and maintaining a nuclear complex is a long-term undertaking involving many challenges and great cost. These are the focus of the penultimate part of the chapter. Finally some conclusions are drawn.

3.1 Background

The mainstream nuclear debate often views nuclear weapons issues from a contemporary perspective. In part this is also true for France. Variously, it is described as a good, deplorable, or understandable fact; its force posture seen as well-defined. France is not prepared to give up its arsenal and plans to modernize its capabilities to ensure a future force similar to the one it has today. No surprises and no major change to the existing concept of nuclear possession are foreseen.

However, this is only a partially true characterization. France's arsenal and posture are constantly being reviewed and rebalanced in accordance with the Fifth Republic's assessment of world affairs, the threats it faces and the dynamics of its alliances and partnerships. More importantly, an overemphasis on the current situation might confuse all but the narrow specialists as to the fundamental reasoning, ideas, and military planning behind France's nuclear policy. There are distinct intellectual legacies and arguments from the beginning of the nuclear age that still influence French thinking about nuclear weapons and their role in the defence of France.

To promote a better understanding of why France possesses an independent nuclear deterrent this chapter begins with a short outline of the dynamic political and technical circumstances under which France took the decision to acquire and pursued the development of a nuclear arsenal.

The Rationale for Nuclear Acquisition

The French nuclear programme was initiated in the 1950s as a hedge against the multitude of uncertainties the near- and mid-term Cold War future presented – a time when the great contest between the liberal, democratic transatlantic powers and the Soviet-dominated Eastern bloc was relatively new. The evolving dynamic between the blocs had a deep influence on policy and politics in the West. The Iron Curtain and the division of Europe were by this time established facts. How the Western allies would organize themselves to counter the Soviet challenge was, however, still being explored.

NATO had been formed in 1949, but this by no means settled the interrelationship between allies. Rather, it signified the start of a continuous process of political and military recalibration, intertwined with – but not in all respects coupled to – the East–West conflict, which was to last for decades. The Soviet threat and intra-alliance policy were thus two main drivers of policy in the transatlantic setting.

This period coincided with the rapid technical development of nuclear arms, the weapon par excellence of the post-war world. The special significance of these weapons had been realized already in 1945, but exactly how they would affect international affairs and the great East-West conflict was still a widely debated issue in the mid-1950s. As new weapon systems of longer range and greater yield were being developed, more countries found themselves faced with a grave nuclear threat.

The dynamic was further exacerbated by the introduction of nuclear arms in more countries. The first Soviet device was detonated in 1949. By 1956 the UK had joined the nuclear club and several more countries, Sweden and Switzerland amongst them, were beginning seriously to debate atomic arsenals of their own. The reliance on US forces and nuclear arms in the defence of Europe and European interests was a critical issue in the proliferation debate.

While the US had used nuclear threats to enforce the Korean War armistice in 1953, it failed to intervene explicitly with such threats on behalf of France at a critical juncture of the colonial Indo-Chinese war. In 1954 the anti-colonialist Viet Minh forces conquered Dien Bien Phu which the French defended in an attempt to draw out and defeat the enemy. This spelled the end of French control and influence in its former Asian colony. This was the first deterrence failure France encountered in the post-World War II era. With it the hope that America would remain committed to the well-being and status quo of France, including its colonial possessions, began to fade.

Doubts about US support of France were reaffirmed in 1956 when Washington actively thwarted French-British-Israeli operations against Egypt to secure continued control of the Suez Canal zone. The conclusion in Paris was that in matters of key national interests, France could not count on US support.

Furthermore there were no guarantees that Washington might not again act in ways harmful to France and her security.

The French realization that NATO and the transatlantic link would serve as no security panacea and might not suffice to ensure national self-determination became a key policy driver. The Republic, so the conclusion was reached, would have to take steps of its own, the single most important one being to move ahead with an independent nuclear programme. In this undertaking France had hoped to receive US help. French scientists had participated in the Manhattan project and, after some initial reluctance, the UK had been given substantial US support for its weapons programme. But France was frustrated on this point as well. Although the Eisenhower administration did contemplate giving help, in the end it decided not to. Abandonment, both politically and militarily, was in Paris's view a fact. In 1958 the French government signed the order to prepare for a nuclear test, which was scheduled for 1960.[57]

The 1962 Cuban missile crisis presented another problematic development for France and Europe. The perceived US failure to consult allies reinforced earlier concerns about alliance cohesion and the US commitment to its European partners. In a similar situation in Europe, would the US bypass its NATO allies and make a grand bargain with the USSR at the expense of West European interests? This was a serious enough question in itself. But coupled to this suspicion were concerns about the implications of the evolving intercontinental nuclear vulnerability which, by virtue of the advances in long-range missile technology, was being established in the mid-1960s. Would the capability of the US and the USSR to attack each other directly compromise extended deterrence?

According to Henry Kissinger, there was always the secret hope amongst Americans that in a nuclear conflict between East and West, nuclear war would be limited to the European theatre. European leaders nursed similar hopes, that strategic nuclear exchanges would be conducted between the Soviets and the Americans, leaving Europe out.[58]

By this time French politics had gone through a decisive change. The coming to power of Charles de Gaulle and the transformation from the Fourth to the Fifth Republic ushered in a new and distinct foreign policy priority. The experience of abandonment was coupled with nationalist political and ideological preferences and France adopted a policy of self-sufficiency. For who, paraphrasing an alleged statement by Charles de Gaulle, could be sure that "in an hour of peril…a President

[57] Beatrice Heuser: *NATO, Britain, France and the FRG: Nuclear Strategies and Forces for Europe*. London, Macmillan Press (1997), p. 95
[58] Ibid, p. 23

of the United States would immediately risk having New York or Chicago destroyed in order to save Hamburg or Copenhagen"?[59]

Building an Independent Nuclear Force

During the course of the 1960s and 1970s France pursued the development of its first-generation nuclear arsenal. It soon decided to construct a triad of air-, sea- and land-based weapons, both strategic and tactical.

The first strategic nuclear system to be available, the Mirage IV fighter carrying high-yield nuclear gravity bombs, became operational in 1964. The Mirage IV was designed primarily to penetrate Warsaw Pact defences and deliver payloads in Eastern Europe. In 1986 an upgraded version of the Mirage IV armed with a cruise missile, the Air-Sol Moyenne Portée (ASMP), a predecessor to the missile currently in use, was declared operational.

At one site, the Plateau d'Albion in south-eastern France, a missile base was built. Eighteen missile silos were constructed and the base became operational in 1971. At first the silos housed the S2 ground-to-ground ballistic missile with a reported range of around 3 000 km. A new missile, the S3 with a slightly longer range, was introduced in the early 1980s.[60] The armament was a high-yield thermonuclear warhead.

France began replacing the Mirage IV with the Mirage 2000N in the mid-1980s. The first jet was declared operational in 1988. Initially it had the capability of carrying both France's strategic bomb and the ASMP missile. From the mid-1990s the ASMP remained the sole airborne weapon in use.

Work on the most complex of the nuclear delivery systems, the seaborne part of the *triade* (known as the Force océanique stratégique or FOST in French), commenced in the mid-1960s. The first SSBN (known as the Sous-Marin Nucléaire Lanceur d'Engins or SNLE in French), *Le Redoutable*, was declared operational in late 1971.[61] Through the 1970s and 1980s France built six boats of the Redoutable Class which remained operational after 1990.

The de Gaulle presidency emphasized some key concepts related to nuclear weapons and their role in overall defence doctrine but this did not mean a lack of debate. One key issue influencing nuclear thinking was the relationship between the defence of France and of Europe. Through the 1960s France moved from a

[59] André Fontain: "De Gaulle's View of Europe and the Nuclear Debate." *The Reporter*, July 19 (1962)

[60] *Visit to the Plateau d'Albion. 18 June 2015*, Government of France (2015), http://www.francetnp.gouv.fr/IMG/pdf/albiongb150616hd.pdf (retrieved 2017-11-18)

[61] Jacques Bisson: "Il y a cinquante ans… Le Redoutable." *Revue Défence Nationale*, Tribune no. 875 (2017), http://www.defnat.fr/pdf/Bisson%20-%20Redoutable%20(T%20875).pdf (retrieved 2017-10-30)

military concept of offence to defence and protection of France proper.[62] In its extreme version the idea was to pursue a policy that kept France apart from the rest of Europe; to view France as a sanctuary that should be defended separately and which might also be kept outside of a European conflict. As a consequence of this line of thinking deterrence and war avoidance came to the fore.

Nuclear deterrence, in de Gaulle's view, would only be credible if it concerned national defence, that is to say, if the threat of nuclear retaliation was coupled to potential attacks on France's vital interests and territory. This reasoning also applied to the other nuclear powers. Thus, from a defence point of view, extended US deterrence was not a credible concept France could count on. Only a French weapon could deter aggression against France. By extension this logic meant that the French deterrent could not be credibly extended to other nations or allies.

The concept of strategic separation was, however, complicated by European force postures, geography and NATO alliance obligations. In one sense France was seen as separate from Europe. On the other hand the physical approaches to the homeland, for a Warsaw pact opponent, would be through Frances NATO allies to the East, notably Germany. Thus, for all practical purposes, the defence of France was intrinsically and inseparably linked to West Germany. This might prompt or force France to extend its defence efforts beyond its own territory. The defence of France and the defence of Western Europe thereby converged, which was also reflected in the dual view on nuclear strategy ultimately held by President de Gaulle himself. The Gaullist government also made rhetorical commitments to allies, commitments that could be seen as contradictory to the strategic concept of sanctuarization.[63]

The solution to the contradicting strategic concepts was to define "France as Europe", which in the words of Beatrice Heuser, "cut the Gordian knot, at once preserving the French national nuclear monopoly and satisfying the anxieties of allies".[64] During the late 1970s and early 1980s statements suggesting a larger French role in the defence of Europe became more common. The extended concept of territorial defence, which included territory in the rest of Western Europe, was the distinct preference of the Giscard d'Estaing presidency, which actively promoted a strategy of "enlarged sanctuarization".[65] Yet at the same time the option of remaining a non-belligerent in a war on the European continent, remained an important declaratory option, underlining the continued and inherent tensions and paradoxes of French Cold War defence policy.

[62] David Yost: "French Deterrent Posture and Security in Europe Part 1: Capabilities and Doctrine" *Adelphi Papers 194*, IISS. London, Winter (1984/5), p. 5
[63] Yost: "French Deterrent Posture and Security in Europe Part 1"(1984/5), p. 12
[64] Beatrice Heuser: *Nuclear Mentalities?* (1998), p. 107
[65] Sten Rynning: *Changing Military Doctrine: Presidents and Military Power in the Fifth Republic 1958-2000*. Westport, Praeger (2002), pp. 65-97

Before its departure from NATO's military structures in 1966 the French Army had been given access to American tactical systems (Honest John rocket artillery).[66] Under NATO planning these were to be used in battlefield roles to compensate for the Warsaw Pact's conventional superiority. Although France objected to the flexible response concept promoted by the US, French planners agreed that tactical nuclear capability was necessary, and that France should proceed to build "tactical" systems of its own. Consequently in 1963 the development of short-range, low-yield nuclear weapons was initiated.[67] These systems would not be available before the early 1970s at the earliest.

When France decided to withdraw from NATO's military structures it lost access to the designated American weapons. Given overall French strategy this might have been acceptable. Yet developments indicate otherwise. In 1967 a secret agreement between France and NATO negotiated by French Chief of Staff General Ailleret and NATO Supreme Commander General Lemnitzer was reached. The Ailleret-Lemnitzer agreement has, as far as the author has been able to discern, not been made public and the exact content cannot be confirmed. Allegedly it mainly concerned how French forces, specifically the French corps in Baden-Baden, in exercises and possibly also during hostilities would be integrated into NATO land warfare operations, should France choose to join a military conflict alongside the alliance.[68] But at least one source, in turn citing interviews with General Francois Valentin, at the time commander of the First Army, claims that the accord also covered circumstances under which France would have access to Honest John tactical nuclear weapons beyond 1967.[69] By the mid-1970s the first French tactical systems were coming into service. Jaguar A and Mirage IIIE attack jets carried France's first low-yield free-fall bomb, soon to be followed by the Navy's Super-Étendard.[70] Later the Mirage 2000N was given the capability to carry the low-yield system.

From 1974 France deployed the vehicle-mounted Pluton, a tactical ballistic missile with a maximum range of 120 km. The missiles had 10-kt or 25-kt warhead options. The Pluton was mounted on the AMX-30 tracked vehicle. Five regiments were based in northern France.

[66] Ibid, p. 54
[67] Yost: "France's Deterrent Posture and Security in Europe Part 1", p. 48
[68] Ibid, p. 9
[69] Ibid, p. 54 and Fredrik Wetterqvist: *French Security and Defence Policy: Current Developments and Future Prospects*, FOA-Report C-10325, Stockholm, FOA (1991), pp. 15-16
[70] Sten Rynning: *Changing Military Doctrine*, p. 79

The AMX-30/Pluton displayed at Oberhoffen-sur-Moder (France). Photo: Pierre-Olivier Buan

The limited range of the missile did not allow for strikes into Warsaw Pact territory and it could only be used against advancing formations in West Germany. This was a hotly debated issue and from the German point of view seen as highly controversial. For this reason France began work on a follow-on missile called Hadès, which was to have considerably longer range and thus could be used to strike targets inside Warsaw Pact territory from French Army staging areas in north-eastern France and western Germany.

The introduction of French "tactical" systems was paralleled with a continued and contentious debate about defence postures and the role of tactical/pre-strategic nuclear systems. A dominant idea from the late 1960s was that France needed "to be able to 'constrain' and 'warn' the adversary" in the event of aggression in Europe. This was the foundation of the operational doctrine of a "final warning" which has remained in place since the 1970s.[71] The operational concept was to strike advancing Warsaw Pact formations, with the objective of forcing the enemy to take a political decision to back down in face of the prospect of unrestrained nuclear war. This differed to some degree from the NATO concept of battlefield use to defend against the superior conventional Warsaw Pact forces in Central Europe.

Would France have defended its vital interests beyond the national territory and would it have been done as part of counteroffensives on German territory? Had Giscard d'Estaing idea of "enlarged sanctuarization" been fully accepted this might have meant a greater French emphasis on extended deterrence as well as battlefield nuclear use in support of offensive defence beyond French territory.[72] This was however not to be and in the late 1970s France distinctly settled for a doctrine of retaliatory strategic deterrence with a de-escalatory, pre-strategic test strike as the only option below full-scale nuclear exchange. The doctrine remained focused on France and deterrence was not extended to other countries.

[71] Ibid, p. 26
[72] Ibid, pp. 65-97

Post-Cold War Downsizing of the Arsenal

After 1990 France made significant reductions in its nuclear arsenal. The number of warheads was cut from approximately 540 in 1990 to under 300 in 2010.[73] Several weapon systems were dismantled altogether and the number of delivery vehicles and platforms reduced. These reductions were undertaken as a function of the improved global and regional security situation after the Cold War confrontation ended as well as for financial reasons. But they were also made possible by qualitative improvements of the arsenal.

The first step was initiated in 1991 when France decided to decommission the tactical free-fall bombs. The Pluton missiles were withdrawn in 1991 and in 1992 France mothballed the planned replacement system, the Hadès missiles. The S45 missile programme, the system that was slated to replace the silo-based S3 ballistic missiles at the Plateau d'Albion site, was terminated. Furthermore France decided that the lead ship of the SSBN fleet would not be substituted. The fleet would be reduced to five boats instead of six.

In 1996 a more substantial restructuring of the nuclear forces was announced by President Chirac in a speech. The ground-based force would be eliminated and by 1999 the strategic ground-to-ground component based on the Plateau d'Albion had been decommissioned.[74] The submarine force was reduced again, from five to four boats, and the number on patrol reduced to one. The short-range, low-yield Hadès missiles which had been mothballed in 1992 would be terminated, and by 1999 all parts of the system had been eliminated.[75] France also took steps to continue a process begun in 1991 and further de-alert its arsenal. In 1997 France announced it had de-targeted its weapons as a confidence building measure.

At this time France was conducting a nuclear test campaign to validate new warhead designs. During the course of 1995 and 1996, six tests were conducted. But after the series was completed France announced that it would stop testing and dismantle its test facilities. The Comprehensive Test Ban Treaty (CTBT) was signed and ratified in 1996 and 1998 respectively. It was also decided that France would stop production of fissile material and since then France has been an active advocate of negotiating a Fissile Material Cut-Off Treaty (FMCT).

In 2008 President Sarkozy in a speech dedicated to the nuclear dissuasion force confirmed many of the drawdowns decided on in 1996.[76] He stated that France

[73] Clair Mills: *The French Nuclear Deterrent*, Briefing Paper No. 4079, House of Commons, June 29 (2016)
[74] *Visit to the Plateau d'Albion, 18 June 2015*, p. 2
[75] "Hadès." *Military Today* (2017), www.military-today.com/missiles/hades.html (retrieved 2017-11-16)
[76] *White Paper on Defence and National Security 2008*, Government of France (2008), p. 162, http://merln.ndu.edu/whitepapers/France_English2008.pdf (retrieved 2017-05-22)

possessed fewer than 300 warheads, down from 540 in 1990.[77] He also announced further reduction of the land-based air component, from three squadrons and around 60 aircraft to two squadrons and approximately 40 aircraft, although the number of these, in effect, dual capable fighters have not been publicly announced.

Thus, since 1991 France has made considerable reductions to the number of weapons and platforms. It has also eliminated its ability to physically test nuclear devices and produce fissile material. Yet the smaller and leaner force is more accurate, with new systems benefiting from better precision, longer range, and better survivability.

3.2 Current French Nuclear Doctrine

The current foundation of and justification for France's continued possession of a nuclear deterrent is based on threat perceptions and views on the international environment as expressed in official policy declarations. The latest Strategic Review issued in October 2017 assesses that there is a "rapid and lasting deterioration of the strategic environment" overall and from many directions.[78] The capabilities and ambitions of troublemakers and adversaries are augmented by the "overall improvement in military capabilities, fuelled by technological dissemination".[79] France faces a grim and dangerous world which it must protect itself from.

The European security architecture is being undermined and challenged by Russia. The "re-emergence of a major state threat [to France and its European allies and partners] …cannot be ruled out" and possible conflict must be vigorously prepared for.[80] At the same time "the cohesion of the European Union has been weakened and questions have arisen about the credibility of alliances". In a corollary to the 1960s, France is not inclined to put its trust in the US commitment to European security. Strategic autonomy, not only for France but for Europe as a whole, must therefore be strengthened. Significantly, France emphasizes a new initiative called the European Intervention Initiative (EII) in the Strategic Review in addition to the EU Permanent Structured Cooperation (PESCO) initiative. It is obvious that France will seek to promote a more flexible European defence architecture, one

[77] "Transcript: France's Sarkozy Talks Nuclear Security." *CBS News* (2010), http://www.cbsnews.com/stories/2010/04/12/eveningnews/main6389488.shtml (retrieved 2016-12-13)

[78] *Defence and National Security Strategic Review 2017*, Government of France (2017), p. 16

[79] Ibid, p. 85

[80] *Defence – Nuclear deterrence – Visit to the Strategic Air Forces – Speech by M. Francois Hollande, President of the Republic*, 25 February (2015), p. 4, http://basedoc.diplomatie.gouv.fr/exl-doc/FranceDiplomatie/PDF/baen2015-02-25.pdf (retrieved 2018-01-19)

that transcends the EU and is more ad hoc in nature, as a way of bypassing the lack of EU cohesion and achieving quicker results.

For Northern Europe, France underlines "the major concern" it has about increased Russian activity and forward deployment of strategic assets in the North Atlantic. This is now seen as a contested area which is "vital for NATO's collective defence, the economic interests of Europe and the freedom of action of French forces, including for nuclear deterrence".[81]

Concurrently, new and unpredictable nuclear powers have emerged during the last 20 years and "tactical nuclear arsenals are growing, giving rise to the fears of a reduction in the usage threshold of nuclear weapons".[82] "That is why the time of the nuclear deterrent is not a thing of the past."[83]

France concludes that in this volatile, more insecure and quickly transforming world "there can be no question of lowering our guard" and sees no other option than to "maintain its nuclear deterrent based on two complementary components [sea- and air-based]" for the foreseeable future.[84] Nuclear deterrence remains "the cornerstone" of the defence strategy and protects France "from aggression against our vital interests emanating from a state, wherever it may come from and whatever form it may take".[85]

The declaratory policy and doctrine of France are communicated through several channels. French presidents routinely give keynote speeches solely devoted to the nuclear deterrent. The most recent have been by presidents Chirac (1996 and 2006), Sarkozy (2008), and Hollande (2015). French defence White Papers (the latest from 2017 is instead called a Defence and National Security Strategic Review) also include parts on nuclear deterrence. UN declarations, for example in connection with the Nuclear Non-proliferation Treaty (NPT) review conferences, also convey French nuclear policy to the public.

Parliamentary reports and committee hearings are also informative as are formal or semi-formal publications. For example, Bruno Tertrais, an experienced and insightful nuclear expert, published a detailed and officially sanctioned volume on the nuclear deterrent in 2017.[86]

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[81] *Defence and National Security Strategic Review 2017*, p. 23
[82] *Defence – Nuclear deterrence – Speech by M. Francois Hollande*, p. 2
[83] Ibid, p. 3
[84] *Defence and National Security Strategic Review 2017*, p. 51
[85] Ibid, p. 69
[86] Bruno Tertrais: *La France et la dissuasion nucléaire: concept, moyens, avenir*. Paris, La documentation Française (2017). An example that is less obvious, not formally approved but still reflecting thinking within government, is the work of Nicolas Roche who is currently Director of Strategic Affairs, Security and Disarmament at the Ministry of Foreign Affairs and has previously had several posts at the ministries of Foreign Affairs and Defence and at the Energy Agency but

The move to a more transparent policy has been a long process and one influenced by several needs. The shifting security landscape and France's evaluation of it is one. For example the rising threat of state-sponsored terrorism in 2006 compelled President Chirac to declare that:

> …nuclear deterrence is not intended to deter fanatical terrorists. Yet, the leaders of States who would use terrorist means against us, as well as those who would consider using, in one way or another, weapons of mass destruction, must understand that they would lay themselves open to a firm and adapted response on our part. And this response could be a conventional one. It could also be of a different kind.[87]

Adding and emphasizing terrorism sponsored by regional actors as a possible scenario that would trigger nuclear retaliation was at the time seen as a novel approach and one very much influenced by the era of 9/11 and war on terrorism. It was also in line with earlier French thinking about the circumstances under which and against whom France could contemplate the use of nuclear weapons. The Chirac doctrine shows that French nuclear thinking is dynamic and closely coupled to the overall defence policy France pursues.

The Chirac administration's approach is no longer underscored, but France has not issued negative security guarantees, that is, it retains the right to retaliate with nuclear weapons against state adversaries that are not nuclear-armed. There are however negative security guarantees for those non-nuclear countries that are party to and honour their commitments under the NPT. Potentially, then, nuclear retaliation could be used in response even to a conventional attack if it were serious enough. The French arsenal is sometimes described as a *tous azimuts* or 360° capability but the official language in President Hollande's 2015 speech reads:

> "The nuclear deterrent aims to protect our country from any aggression by a state against its vital interests, wherever it comes from and in whatever form."[88]

The definition of vital interests is to some extent kept deliberately vague. Two central features are however mentioned by President Hollande, "the integrity of our territory and protection of our people".[89] Vital interests need not be related only to the defence of French territories. Throughout official documents vital interests are coupled to France's ability to retain political and economic independence, the refusal to be blackmailed and, one might also argue, the protection of French culture. Ultimately it is the prerogative of the president to determine what are to be considered vital interests in any given situation.

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who wrote a book during a stint as teacher at the Ecole Normal Supérieure. He was later the Foreign Ministry representative to the Defence Review Committee.

[87] *Speech by Jacques Chirac, President of the French Republic, to The Strategic Air and Maritime Forces at Landivisiau / L'Ile Longue*, January 19 (2006), http://www.elysee.fr (retrieved 2017-05-21)

[88] *Defence – Nuclear deterrence – Speech by M. Francois Hollande*, p. 3, emphasis added

[89] Ibid, p. 4

France views its nuclear deterrent as a strictly defensive force. Furthermore nuclear weapons are not weapons that "aim to provide any advantage in a conflict".[90] Nuclear use would by definition be strategic and France rejects battlefield or non-strategic use. Use is only to be considered "in extreme circumstances of self-defence".[91] This last expression is a direct quote from the 1996 advisory opinion on the legality of nuclear weapons issued by the International Court of Justice, one which France has aligned its declared posture with.[92]

France does however continue to reiterate the concept of a final warning strike that could require nuclear first use. The argument is that if deterrence fails and an aggressive adversary miscalculates what France sees as red lines, it may "as a last resort, underline its willingness to defend its vital interests through a warning of nuclear nature, with the aim to re-establish deterrence".[93] During the Cold War this was thought of as a nuclear mission targeted against a Soviet military formation or key military centre of gravity.

Today France is likely to have more options available. As an example, in 2006 a military official stated that the air component can eliminate "all the centres of power (of a regional adversary) with very limited collateral damage", indicating that political targets could be considered for a pre-strategic strike.[94] In 2015 President Hollande mentioned possible nuclear missions as being to "inflict absolutely intolerable damage" on an adversary's centres of political, economic and military power.[95] The final warning shot is likely to target military power nodes. There might also be the option of detonating a device at high level in order to strike at an adversary's electronic infrastructure via an electromagnetic pulse (EMP). It is less likely that a warning strike will be conducted as a pure 'demonstration shot' where it has no effect against an adversary's capabilities. It has long been a doctrinal understanding that the warning must target the enemy if it is to have the intended effect in an ongoing and escalating armed conflict.

In 1997 France declared that it had de-targeted its weapons and President Sarkozy reaffirmed this in 2008. Such measures have long been seen as key stabilizing measures by arms control advocates. This declaration was not repeated by President Hollande in 2015. It is unclear if this amounts to any tangible difference in posture.

[90] Ibid., p. 3
[91] Ibid., p. 4
[92] *Legality of the Threat or Use of Nuclear Weapons: Advisory Opinion of 8 July 1996*, International Court of Justice (1996), p. 94
[93] *Defence – Nuclear deterrence – Speech by M. Francois Hollande*, p. 4
[94] Chief of the Defence Staff 2006, quote found in Bruno Tertrais: *La France et la dissuasion nucléaire*, p. 150
[95] *Defence – Nuclear deterrence – Speech by M. Francois Hollande*, p. 4

The principle of "strict sufficiency", meaning that the number and type of weapons deployed are kept to a minimum, remains a key feature of the French doctrine. This principle is invoked as an argument in support of the official position; that France continues to adhere to and honor its disarmament obligation under the NPT.

The French deterrent remains strictly independent but at the same time it is acknowledged that it cannot be regarded in isolation. France does not extend deterrence to its EU, NATO or European partners. But a definite link to overall European deterrence and defence is made. The French view it as an important contribution to the strength, peace and stability of the continent. "By its existence, it contributes to the security of the Atlantic Alliance and that of Europe".[96] The French calculus is that nuclear weapons will play a defining role in any European conflict in the future. Planning for the defence of Europe is inseparable from nuclear planning in the French view.

The core policy vis-à-vis NATO remains what it has been since the 1960s. France does not participate in the alliance Nuclear Planning Group (NPG) and nuclear planning is not shared.[97] In 2009 France did reintegrate into the military planning structure of NATO, from which it had departed in 1966. In his 2015 speech President Hollande reiterated that France will continue to remain outside of NATO's nuclear planning process but that collaborating more actively to formulate nuclear policy within the Alliance is in Frances interest.[98] In private, French officials confirm that today there is frequent and substantial consultation with NATO pertaining to nuclear policy and deterrence postures.

As for disarmament undertakings, France remains a proponent of bringing the CTBT into force as soon as possible and continues to supports the adoption of an FMCT as outlined above.[99] France professes to be a strong proponent of arms control and arms reductions. In the best case, other powers would follow France's example and make drawdowns equivalent to that which it has done, but this is regrettably not the case.

[96] *Defence and National Security Strategic Review 2017*, p. 70
[97] NATO: "Nuclear Planning Group" (2016), http://www.nato.int/cps/en/natohq/topics_50069.htm (retrieved 2017-02-16)
[98] Michael Moran: *French Military Strategy and NATO Reintegration*, Council on Foreign Relations, March 12 (2009), http://www.cfr.org/france/french-military-strategy-nato-reintegration/p16619 (retrieved 2016-12-13)
[99] Bruno Tertrais: *Entente Nucleaire,* (2012)

3.3 Current French Nuclear Forces

3.3.1 Nuclear Components

The current French force structure relies on a mix of submarine-launched ballistic missiles (SLBMs) and fighter aircraft carrying nuclear-armed cruise missiles. France decommissioned all of its tactical systems in the 1990s and only retains a strategic capability.

This dyad is dependent on a wide variety of support systems. These include non-nuclear military assets and capabilities which ensure that the force is secure, retains operational integrity, and is protected in the operational environment. A robust command and control system needs to be in place as do relevant intelligence functions. Finally an industrial complex is maintained to support existing systems and ensure development of future ones.

The Strategic Submarine Component – Force océanique stratégique (FOST)

The submarine arm or Force océanique stratégique (FOST) of the French nuclear deterrent operates from the Í Île-Longue naval base near Brest on the Atlantic coast (see map, page 9). A command centre, which is responsible for overseeing all operational aspects of the FOST, is located in Brest. As of early 2018 the FOST operates four relatively new Triomphant Class SSBNs (known as SNLE-NGs, or Sous-Marin Nucléaire Lanceur d'Engins de Nouvelle Génération in French). The French SSBNs carry a maximum of 16 ballistic missiles.

The Triomphant Class replaced France's first-generation SSBNs, the Redoutable Class, the first of which was declared operational in 1971 and the last decommissioned in 2008. The lead boat of the SNLE-NGs, *Le Triomphant*, was launched in 1994 and entered service in 1997 with new boats commissioned in 1999 (*Le Téméraire*), 2004 (*Le Vigilant*) and 2010 (*Le Terrible*). The three first were equipped with the M45 missile, an older design with a range of around 5 000 km according to official French sources.[100]

When entering service in 2010 *Le Terrible* was the first boat to employ a version of France's new intercontinental ballistic missile, the M51.1. This new missile has been long awaited. The original design project commenced in the late 1980s but in 1996 the programme was restructured and specifications "adjusted downwards" as a result of budgetary constraints.[101]

[100] Bruno Tertrais: *La France et la dissuasion nucléaire*

[101] Jean-Marie Collin: "The M51 missile failure: where does this leave French nuclear modernization?" *BASIC*, June 27 (2013), http://www.basicint.org/blogs/2013/06/m51-missile-failure-where-does-leave-french-nuclear-modernization (retrieved 2017-11-21)

Le Triomphant SNLE-NG at sea in 2009. Photo: Marine Nationale/TT

It would henceforth be an incremental development of a missile family with consecutively improved range and capability. Thus "there will be no M6 nor M52 missile" but an M51.2, an M51.3 and possibly a M51.4 version.[102]

French sources specify the range of the M51.1 as being considerably beyond that of the M45.[103] Other sources qualify the range as beyond 6 000 km, several thousand kilometres less than originally planned.[104] As with any nuclear system the officially disclosed specification should be viewed only as indicative; the exact characteristics will remain a closely guarded secret. Range also varies with payload weight as well as several other factors.

The M51.1 missiles carry up to six nuclear warheads of the older TN75 design. These are reported as having a yield of around 100 kt. A first successful underwater launch of the M51.1 was conducted in early 2010 from *Le Terrible*.[105] Once all Triomphant Class boats had been launched a cycle of upgrades to the existing boats

[102] Bruno Tertrais: *La France et la dissuasion nucléaire*, p. 148
[103] Bruno Tertrais: *La France et la dissuasion nucléaire*, p. 148
[104] "Missiles balistiques stratégiques (MSBS)." *Ministère des Armées*, December 8 (2016), http://www.defense.gouv.fr/marine/equipements/missiles/missiles-balistiques-strategiques-msbs (retrieved 2017-12-21)
[105] "SSBN Triomphant Class Ballistic Missile Submarines, France." *Naval Technology*, http://www.naval-technology.com/projects/triomphant/ (2011-02-04); and Pierre Tran: "French Sub-Launched M51 Missile Test-Fired." *Defense News*, 27 January (2010)

commenced. Most importantly, the rest of the SSBN fleet was to be retrofitted with the M51.1 missile. In 2013 *Le Vigilant* had undergone modification and a test to ensure operational capability of the M51 missile was conducted.[106]

Reports confirmed that the test was a failure.[107] At a hearing in the defence committee of the National Assembly roughly a year later, the Director General of Armaments at the time, Laurent Collet-Billion, elaborated on the failure, citing cybersecurity issues at the missile producer as one possible problem.[108] Whether this should be viewed as an authoritative explanation remains unclear. One newspaper report mentioned the missile as being of the latest type "which will carry the new generation of nuclear warheads", thus indicating this may have been a test of the new M51.2.[109] This is probably a misunderstanding as officials rarely make references to the M51.1 or M51.2 versions.

The latest reported submarine-launched flight test was carried out in mid-2016 from *Le Triomphant* which by then had become the third SSBN to undergo overhaul since 2010.[110] Based on information offered in an official report it is likely that this was the first operational submarine-based test of the M51.2. If that is correct the M51.2 missile is now operational.[111] Some sources report the range to be truly intercontinental, or between 8 000 and 9 000 km.[112] The M51.2 missile is mated with the new Tête Nucléaire Océanique (TNO) warhead, a design which was validated during the French test series in 1995-96. The number of TNO warheads mated to the M51.2 missile has not been publically disclosed and neither has the yield.[113] Some reports have it that the M51.2 missiles carry fewer than six warheads to allow for longer range and/or space to house more penetration aids. In his 2015 speech President Hollande declared that France has "three sets of 16

[106] "Un missile balistique M51 détruit lors de son lancement." *Ministère des Armées*, January 6 (2017), http://www.defense.gouv.fr/english/salle-de-presse/communiques-de-presse/communiques-du-ministere-des-armees/cp-un-missile-balistique-m51-detruit-lors-de-son-lancement (retrieved 2017-12-21)

[107] Jean-Marie Collin: "The M51 missile failure: where does this leave French nuclear modernization?" *BASIC*, June 27 (2013), http://www.basicint.org/blogs/2013/06/m51-missile-failure-where-does-leave-french-nuclear-modernization (retrieved 2017-11-21)

[108] *Compte rendu: Commission de la défence nationale et des forces armées – Audition de M. Laurent Collet-Billion, délégué général pour l'armement, sur la dissuasion nucléaire*, Assemblée Nationale, April 30 (2014), http://www.assemblee-nationale.fr/14/pdf/cr-cdef/13-14/c1314047.pdf (retrieved 2017-11-23)

[109] Nathalie Guibert: "Pourquoi le tir du missile nucléair français M51 a-t-il échoué?" *Le Monde*, May 13 (2014)

[110] "Baie d'Audierne. Les images exclusives du missile tire vendredi." *Le Télégramme*, July 1 (2016), http://www.letelegramme.fr/bretagne/pointe-bretagne-le-missile-tire-ce-matin-vers-9h30-01-07-2016-11131531.php (retrieved 2018-01-09)

[111] "M51 – Missile mer-sol balistique stratégique." *Ministère des Armées*, March 24 (2013), http://www.defense.gouv.fr/dga/equipement/dissuasion/m51-missile-mer-sol-balistique-strategique (retrieved 2018-01-09)

[112] Bruno Tertrais: *La France et la dissuasion nucléaire*, p. 148

[113] Ibid., p. 149

submarine-borne missiles".[114] This is an absolute minimum to be able to have one set on a boat permanently on patrol.

The development of the M51.3 version was decided on in 2014.[115] There are few specifications declared for this missile upgrade other than that it will share most of the characteristics of the M51.2 but have an upgraded third stage. This will extend the range further. Like the M51.2 it will carry the TNO warhead. The French note that the M51 is less accurate than the American Trident-2 missile, which is also employed by the UK.[116]

To summarize, as of early 2018 the FOST operates three active boats. A fourth is undergoing overhaul which is likely to be completed during 2018. In early 2018 two of these boats carried up to 16 M51.1 missiles mated with the older TN75 warhead and one boat, up to 16 M51.2s mated with the new TNO warhead.

The FOST is operated in CASD mode, like its British counterpart. For France this means the directives state that at least one boat must always be at sea. This would mean that at any one time one is being made ready or transferring to its designated operational area while the third is in transfer back from patrol or in harbour allowing for repairs. If needed France thus has a capability to relatively quickly launch a second boat.

The French employ a patrol concept emphasizing the SSBN's ability to remain hidden, more so than other nations that use operational concepts that rely more on the "principle of a bastion" concept.[117] A submarine leaving for patrol is protected by conventional forces such as the surface fleet, nuclear-powered attack submarines (SSNs) and airborne reconnaissance platforms with anti-submarine warfare (ASW) capability. At some point along the way where navigation permits, and the supporting force are sure that the SSBN can leave without being followed or detected, it slips away and is left on its own. After having been relieved it heads back to base and an escort joins the submarine at some point to provide protection. Patrols last around 70 days.

The role of the FOST is to ensure that France has a reliable second-strike capability. To project deterrence and dissuade any adversary from attacking France or its vital interests there can be no interruption in this capability; otherwise an adversary could hypothetically use a window of opportunity when it does not risk nuclear retaliation. The fleet could theoretically be employed for signalling escalation, but this might on the other hand be perceived as too threatening a signal considering the destructive power a submarine carries; it might be taken to mean imminent full-scale nuclear war. This means the FOST is not a tool for flexible

[114] *Defence – Nuclear deterrence – Speech by M. Francois Hollande,* p. 9
[115] "M51 – Missile mer-sol balistique stratégique." *Ministère des Armées*, March 24 (2013)
[116] Bruno Tertrais: *La France et la dissuasion nucléaire,* p. 149
[117] Bruno Tertrais: *La France et la dissuasion nucléaire,* p. 148

signalling. Should an escalating armed conflict arise where France needs flexible options to "up the ante" in an attempt to make an adversary back down, another capability is needed and France indeed has one, the airborne nuclear force.

The Airborne Nuclear Component

Since 2010 the airborne component of the French nuclear force has also been upgraded and modernized. New aircraft, a new upgraded version of the nuclear delivery cruise missile and a new warhead have been introduced. The number of aircraft has also been reduced. One squadron of Mirage 2000N jets and one squadron of Rafales now make up the land-based air component of France's nuclear dyad. The first nuclear-capable Rafale was declared operational in mid-2010. These two squadrons can operate from the three nuclear-capable air bases, Saint-Dizier (midway between Reims and Nancy in northern France), Istres (40 km north-west of Marseille in southern France) and Avord (central France, see map page 9).[118] Exact numbers of what in effect are dual-capable air craft has not been publicly announced but should amount to approximately 40 aircraft.

In 2009 the new and improved medium-range supersonic cruise missile known as the ASMP-A was introduced on some Mirage 2000Ns.[119] By 2017 all nuclear-capable aircraft had been equipped with this missile. Compared to its predecessor (the ASMP) the ASMP-A is said to have an improved range of "greater than 600 km".[120] It is also reported to have greater accuracy than its predecessor, as well as improved manoeuvrability, improving survivability and penetration of enemy air defences. The ASMP-As have been or are in the final stages of being refitted with a new warhead, the Tête Nucléaire Aéroportée (TNA) which replaces the older 300-kt TN81 warhead. The yield of the new warhead has not been disclosed publicly. The exact number of operational air-delivered cruise missiles and warheads is not known either, but President Hollande in his speech of 2015 mentioned that France possesses 54 ASMP-A launchers. Some of these are dedicated to training, testing and validation.[121]

The air component differs from the sea-based submarine component in that it is more visible, flexible, and useful as a tool for sending signals to an adversary. It can be deployed and put on alert status in a deteriorating military conflict to make clear to an adversary that any further aggression or escalation of the conflict will threaten France's vital interests and result in devastating consequences should aggression continue. It can also be used to make a limited nuclear strike of a final warning nature, a concept which has long been a part of the French doctrine. Its flexibility is such that it can be recalled even after a launch order has been given,

[118] Bruno Tertrais: *La France et la dissuasion nucléaire*, p. 150
[119] "Actualité: Mise en service opérationnelle: Rafale/ASMP-A." *Ministère de la Défense et des Anciens Combattants*, 13 July (2010)
[120] Bruno Tertrais: *La France et la dissuasion nucléaire*, p. 150
[121] *Defence – Nuclear deterrence – Speech by M. Francois Hollande*, p. 9 (retrieved 2017-02-16)

if the threat of imminent use is enough to restore deterrence and halt further aggression. Thus France assesses that the airborne component of the dyad is essential to create space for "politico-military manoeuvre" in a critical escalatory situation.[122]

The ASMP-A is also said to be much more accurate than the submarine-based missiles, which cannot be used to strike targets very precisely. Thus the ASMP-A is a complement, increasing flexibility and expanding planning options. In 2006 a military official stated that the air component can eliminate "all the centres of power (of a regional adversary) with very limited collateral damage".[123] France can conduct long-range operations with an upper limit of about 12 hours and a proven range of over 8 000 km (in 2014 two aircraft flew a mission to the island of Réunion featuring five refuellings and 8 800 km distance covered in ten and a half hours).

The ASMP-A on a marine version of the Rafale taking off from the French aircraft-carrier Charles de Gaulle. Photo: Dassault Aviation 2008, reproduced with permission from MBDA-systems.

[122] Bruno Tertrais: *La France et la dissuasion nucléaire*, p. 150
[123] Chief of the Defence Staff 2006, quote found in Bruno Tertrais: *La France et la dissuasion nucléaire*, p. 150

France also operates a nuclear-capable naval air component. Although the numbers have not been made public it is thought to consist of around ten naval versions of the Rafale. These can be operated from the *Charles de Gaulle*, the French aircraft carrier. France is alone in possessing the ability to base nuclear-capable aircraft on a carrier. These jets carry the same missile as the land-based air component.

To summarize, as of early 2018 France possesses an airborne nuclear force consisting of approximately 20 Mirage 2000Ns, as many land-based Rafales and around ten naval Rafales that can be based on land or on the *Charles de Gaulle*. All these carry the ASMP-A medium-range cruise missile, most or all of which are armed with the TNA, a new warhead. The missile is reported to have a range greater than 600 km. The yield of the warhead is not known but like counterparts is likely variable.

The naval component operates much like its groundbased counterpart. Carrier basing however adds some extra elements that help diversify modes of employment and add flexibility for planners. For instance it can be used to further challenge enemy defences by approaching targets from alternative axes.

It also gives France another set of tools for nuclear signalling. It can demonstrate will and capability far away. This gives France an escalation control element beyond the European theatre if need be. In practice it enforces the credibility of France's global nuclear posture. A counterpart must always plan for the carrier having nuclear weapons on board, but France may also move forward nuclear assets in a show of force to strengthen deterrence and hinder escalation. That France retains territories far away, such as those in the Caribbean, the Indian Ocean and the South Pacific, is one factor affecting this posture.

Command and Control

The President of the Republic is the sole person authorized to increase the alert level of the nuclear forces or order a nuclear strike. Plans for nuclear strikes are drafted by a special planning authority and submitted for review to the Minister of Defence. The order to launch is relayed via a special strategic communication system.[124] Several very low frequency (VLF) radio transmitters relay the launch order to the SSBN fleet.

France also keeps alternative and redundant communication system to ensure communication is possible under any conditions. Weapons are equipped with control systems that make use impossible without the proper verification codes having been received. Execution of the launch requires two people's consent. On the SSBNs these are the commanding officer and his second in command, and on aircraft the pilot and the navigator. Although exact safety and security systems are

[124] Bruno Tertrais: *La France et la dissuasion nucléaire*, p. 152

not known, these procedures seem to resemble what the other advanced nuclear states have put in place.

Nuclear Testing and Stockpile Stewardship

After its last test series in 1995–1996 France discontinued nuclear testing and dismantled its test infrastructure. Instead the Direction des applications militaires (DAM) of the Commissariat à l'énergie atomique et aux énergies alternatives (CEA), which is responsible for maintaining and refurbishing the French nuclear warheads, is operating and constructing new facilities for stockpile stewardship and detonation simulation. One key part of this infrastructure is the Laser Megajoule (LMJ) laser facility in Barp near Gironde which commenced operation in 2014. The LMJ is used to test "the behavior of materials under extreme conditions similar to those reached during the operation of nuclear weapons".[125] The other key part of France's detonation simulation programme is a powerful 100-teraflop computer.[126]

Part of the stockpile stewardship infrastructure is being built in close collaboration with the UK under the Lancaster House agreement and operationalized in the Teutates project, outlined in greater detail in chapter two, p. 19-20 of this report.

3.3.2 Non-nuclear Components

Nuclear platforms and nuclear payload do not exist independently but are part of a complex "ecosystem" of critical capabilities that jointly ensure the security and credibility of the deterrent force.[127] These include conventional forces in support roles, and a robust command, control, and communication system, as well as intelligence, surveillance and early warning systems.

While some of these serve and enable both the air- and the seaborne components, others are tailored to the specific needs of the particular component.

To ensure the submarine component's second-strike capability it must be protected from enemy detection while on operational patrol. This is firstly done by using concealment, but any nuclear deterrent is routinely contested by the anti-submarine capabilities of adversaries. France therefore has to counter the threat posed by attack submarine activity, as well as surface and air-based anti-submarine warfare units. This requires maintaining a fleet of attack submarines. It also means France must maintain a fleet of anti-submarine warfare platforms.

[125] *The Megajoule Laser* (2018), http://www-lmj.cea.fr/index-en.htm (retrieved 2018-01-24)
[126] Bruno Tertrais: *La France et la dissuasion nucléaire*, p. 154
[127] Corentin Brustlein: "Forces nucléaires françaises : quel renouvellement?" *Politique étrangère*, vol. 82, no. 3, autumn 2017, Institut français des relations internationales, IFRI (2017), p. 123

This section highlights some of the modernization programmes France is investing in to ensure a stable future "ecosystem" in support of its deterrent.

Air Refuelling

To achieve sufficient operational range and combat radius to effectively carry out deterrence missions in Eastern Europe/Russia or against other possible targets planned for by the French Strategic Command, the Air Force depends on robust air refuelling capabilities. For deterrence sorties in the European theatre it is likely that a typical nuclear sortie will need to refuel at least twice, once en route to target and once going back.

France has long operated 14 C135s (a Boeing 707 derivate) but these are getting very old and expensive to maintain. In fact their faltering operational reliability is seen as a major liability to maintaining the credibility of the airborne deterrent. In 2014 France therefore took the decision to commission work on a new multi-role tanker-transport from Airbus, the A330 MTRR, in France referred to as the Phénix.[128] This is a larger, more capable, and more operationally flexible aircraft than the C135s. In addition to its refuelling capabilities it will be able to act as transport and it will also be given ground-attack capability. The first aircraft flew its maiden flight in September 2017.[129] The plan is to commission two Phénix in 2018. France originally planned to order a total of 12 A330 Phénix, an ambition declared by President Hollande in 2015.[130] In the February 2018 draft of the 2019–2025 military programming law the planned fleet was increased to 15 aircraft, 12 to be delivered by 2023 and the last three no later than 2025.[131]

Air lift and refuelling capability is a known deficit not only in France but more generally in Europe. It may be the case that lack of dedicated refuelling capacity earmarked for the Air Force's strategic missions may remain or re-emerge as a vulnerability in the future if the need to support missions and operations in Africa or elsewhere becomes pressing.

[128] *Defence – Nuclear deterrence – Speech by M. Francois Hollande*, p. 9 (retrieved 2017-02-16)

[129] "First A330 MTRR Phénix for France makes maiden flight." *Airbus*, September 7 (2017), http://www.airbus.com/newsroom/press-releases/en/2017/09/First-A330-MRTT.html (retrieved 2017-12-20)

[130] "Le Phenix (sic): France Modernizes Its Aerial Refueling Fleet." *Defense Industry Daily*, May 5 (2015), https://www.defenseindustrydaily.com/france-modernizing-its-kc-135s-05259/ (retrieved 2017-12-20); and *Defence – Nuclear deterrence – Speech by M. Francois Hollande*, p. 6

[131] Pierre Tran: "France proposes big defence budget hike." *Defence News*, February 9 (2018), https://www.defensenews.com/global/europe/2018/02/08/france-proposes-big-defense-budget-hike/ (retrieved 2018-02-09)

Anti-submarine Warfare (ASW) Capabilities

The French ASW capable forces are multi-role assets which can perform carrier group and surface fleet protection, sub-surface situational awareness and tracking of foreign submarines as well as an assortment of anti-submarine missions. From a FOST operational point of view, they constitute key assets. Even though the French SSBNs operate independently, hidden at patrol locations, they do so in contested areas, for example in the North Atlantic. While on patrol, the submarine is dependent on remaining hidden. Communication with the boat is likely very limited, but it is possible that the SSBN receives updates on enemy forces that operate in the patrol area.

This is achieved by collating a common operational picture from information collected by all French assets in the general area the submarine is operating in. Long range patrol aircraft are especially suitable for this as they cover large areas. Because of the flexible patrol patterns they are capable of flying they are less likely to give away the SSBNs patrol area. As the North Atlantic has again become more contested, it may be that information on non-NATO submarines, especially Russian ones, is shared among some NATO partners.

As described above the sea and airborne ASW assets coordinate to cordon off a sufficiently large area for the outbound submarine so that it can disappear to its patrol area without being detected. The cordon is physical but also depends on knowing that no hidden enemy assets, such as attack submarines, are present and can pick up the trail of the outbound SSBN. A combination of surface ships, short and long range airborne assets ensure this is the case.

Airborne assets. Since the 1990s France has operated 22 long-range maritime patrol aircraft of the Navy Dassault Atlantique 2 (ATL2) type whose primary role is to support the deterrence mission of the FOST, the SSBN force France deploys. In 2013 a contract to further upgrade existing aircraft was awarded. New radar and acoustic sensor systems will be installed in order to keep them modern and operational beyond 2030.[132] The ATL 2 has a range in excess of 9 000 km and can operate for up to 18-hour stints. By means of sonobuoys it detects enemy submarines and if necessary can engage them with MU90 torpedoes.

Delivery of 27 new NH-90 helicopters (called the Caiman Class in France) with ASW capability is currently under way. The French Navy can operate these helicopters from several French ship types, among them the new FREMM ASW frigates detailed below. The first NH-90 ASW-capable helicopter became operational in 2013 and the Navy will have received all 27 by 2020.[133] Like its

[132] "Atlantique 2 upgrade contract signed." *Dassault Aviation*, October 4 (2013), https://www.dassault-aviation.com/wp-content/blogs.dir/1/files/2013/10/PR_ATL2-upgrade_ENG.pdf (retrieved 2017-12-03)

[133] "French Navy NH90 NFH Caiman Achieves IOC for ASW with MU90 Torpedo." *Navy Recognition*, May 13 (2015), http://www.navyrecognition.com/index.php/news/defence-

fixed-wing cousin, the NH-90 is equipped to detect and defeat subsurface threats. For this purpose it uses a range of sensors and weapon systems. In standard configuration it has an operational time of about four hours during which it can either conduct area-specific search, detect and defeat operations or surveil larger areas.

Surface ships. A new multipurpose frigate with ASW capability is currently being introduced. The FREMM (Frégate européenne multi-mission or European Multi Mission Frigate), known as the Aquitaine Class in France, is being co-developed with Italy. These are large frigates of 140 metres and 6 000-ton displacement. The first vessel was commissioned by the Navy in 2012 and there are currently four Aquitaine Class ships in operation, while a fifth has concluded sea trials and will be commissioned during 2018.[134] All five are reportedly configured for an ASW role.[135] France has ordered a total of eight frigates as part of its current defence acquisition decision, the 2014–2019 military programming law. Although the Aquitaine Class is a multipurpose asset with high-end capability for electronic warfare, air defence, sea, and land attack systems, the first six ships will reportedly have a special ASW configuration focus. The hull and towed sonars are said to have sub-surface area coverage of long range. The last two ships will be optimized for an air defence role.[136] The FREMM-NH90 combination substantially increases the range and area coverage of France's surface ASW fleet, thereby improving surveillance capability, operational efficiency, and survivability.

In April 2017 the French Ministry of Defence ordered the construction of five new smaller frigates known as the FTI (Frégate de Taille Intermédiaire). The FTI will be a mid-sized frigate of about 4 000 tons and 120 metres. It will also be given a multi-role capability, including a strong ASW component.[137] Delivery dates are set for 2023 with commissioning for initial operation in 2025. The FTI will replace the older and less capable La Fayette Class frigates currently being operated by the Navy.

news/year-2015-news/march-2015-navy-naval-forces-defense-industry-technology-maritime-security-global-news/2508-french-navy-nh90-nfh-caiman-achieves-ioc-for-asw-with-mu90-torpedo.html (retrieved 2017-11-21)

[134] "French Navy's Fifth ASW FREMM Frigate Concludes Sea Trials." *Baird Maritime*, November 23 (2017), https://www.bairdmaritime.com/work-boat-world/maritime-security-world/1033-french-navy-s-fifth-asw-fremm-frigate-concludes-sea-trials (retrieved 2017-12-14)

[135] French Navy FREMM Auvergne embarks on first operational deployment." *Navaltoday.com*, August 22 (2017), https://navaltoday.com/2017/08/22/french-navy-fremm-auvergne-embarks-on-first-operational-deployment/ (retrieved 2017-12-19)

[136] "Aquitaine class – Guided Missile Frigate." *Military Today.com* (2017), http://www.military-today.com/navy/aquitaine_class.htm (retrieved 2017-12-19)

[137] "France stars construction of five FTI frigates." *Navaltoday.com*, (2017) https://navaltoday.com/2017/04/21/france-starts-construction-of-five-fti-frigates/ (retrieved 2017-12-18)

France has concurrently decided to upgrade three of the existing La Fayette Class frigates, comparable in size to the FTI, and add an advanced ASW capability, something these ships were missing in their original configuration.[138] Among the retrofits will be a new hull-mounted sonar and a new combat management system.[139] Renovation is due to start in 2020 and take about a year for each ship, this being in order to "maintain a format of 15 front-line frigates" before the FTIs become fully operational.

SSN force. France operates a force of nuclear-powered attack submarines (SSNs), one of its key missions being the protection of the FOST. Currently France has six older Rubis and Amethyst Class SSNs which were commissioned between 1983 and 1993. These are nearing the end of their life cycle and France is in the process of building a new class of SSNs, internationally known as the Barracuda nuclear submarine project. Procurement of the first submarine, named Suffren (consequently the French SSN will be known as the Suffren Class SSN) was decided on in 2006. Initially the Suffren was due to be launched in 2017 but this has been pushed forward to 2020. From 2020 to 2027 the Suffren Class is slated to operationally replace the six older boats of the Rubis and Amethyst Class.

Substantial investments in multi-system ASW capability mean that up to and beyond 2025 France is set to have a very capable and competitive force for submarine surveillance, screening and protection operations. In turn this will ensure and possibly enhance the future survivability and credibility of France's sea-based nuclear deterrent, including both the SSBN and the carrier force.

3.4 Issues for the Future

The current deterrent force of France from most perspectives seems to be robust, capable, and tailored to the missions required of it. In comparison with the situation in the early 2000s the French have improved the quality of the nuclear arsenal and the armed forces are probably in a position to use more flexible and diverse plans to ensure that the nuclear posture and doctrine can be implemented even while adhering to the policy of a strictly sufficient and minimum arsenal. Thus France has improved the credibility of its nuclear deterrence in the last 15 years. There is also a perception that there is nuclear consensus and substantial support for the deterrent force throughout society.

[138] "La Fayette (F710)." *Marine Nationale* (2018), https://www.defense.gouv.fr/marine/equipements/batiments-de-combat/fregates/type-la-fayette/la-fayette-f-710 (retrieved 2018-02-07)

[139] "DCNS Wins French Navy La Fayette-class Frigate Upgrade Program." *Navy Recognition*, May 4 (2017), http://www.navyrecognition.com/index.php/news/defence-news/2017/may-2017-navy-naval-forces-defense-industry-technology-maritime-security-global-news/5180-dcns-wins-french-navy-la-fayette-class-frigate-upgrade-program.html (retrieved 2018-01-04)

Yet France faces several debates about the future of the deterrence force. There are four main issues which could evolve in a way that puts the future deterrent posture in a different light.

- First, although less likely at the moment, there could emerge a fundamental and public debate about France's continued reliance on nuclear deterrence, one which could have some effect on the nuclear concensus.
- Second, the role of nuclear deterrence in the future national defence strategy could be re-evaluated. The 2017 Strategic Review and the debate surrounding it highlight some key dilemmas that France will need to tackle in this respect.
- Third, and closely coupled to the second point, it is not clear that funding for the ambitious force modernization programmes now decided on can be afforded in the future should financial crisis strike again. Although a priority now, it is not unthinkable that a high level of spending on nuclear modernization will remain uncontested.[140]
- Finally there is the question of the French deterrent in the European perspective. Can and will France retain its arsenal as a purely national asset or will the evolution of the European defence architecture prompt France to somehow extend its deterrent to partners and allies in Europe?

A 2012 French Senate report on the future of the nuclear forces makes a similar distinction, citing the three points of dispute as 1) the focus on disarmament, 2) military inutility, and 3) financial cost.[141]

Maintaining the Nuclear Consensus

There is a widely held perception that support for France's continued possession of nuclear weapons remains strong both at the political and at the public levels; that a nuclear consensus and mentality nurtured since the 1960s has remained intact. Support among the political class remains solid and opinion polls show that public support has fluctuated between 60% and 70% between 2012 and 2015.[142]

Closer scrutiny however complicates the picture. The reason why the consensus remains in place, some argue, is that any serious public debate has been lacking for a long time. At the end of the Cold War there was a "growing indifference"

[140] Paul Soyez: "Can France Still Afford Nuclear Weapons?" *The Strategist*, ASPI, November 3 (2016), https://www.aspistrategist.org.au/can-france-still-afford-nuclear-deterrence/ (retrieved 2017-11-13)

[141] *L'avenir des forces nucléaires françaises*, Rapport d'information, No. 668, Sénat Session extraordinaire de 2011-2012, July 12 (2012), http://www.senat.fr/rap/r11-668/r11-668.html (retrieved 2017-10-23)

[142] Corentin Brustlein: "Forces nucléaires françaises : quel renouvellement?" *Politique étrangère*, vol. 82, no. 3, autumn 2017, Institut français des relations internationales, IFRI (2017), p. 123

amongst the public on both issues of defence and nuclear matters.[143] Budgetary cuts during the 1990s resulted in strategic reorientations. Yet France continued to rely on its deterrent to retain a military insurance "just in case". This policy was never questioned or publicly debated in any substantial way, and this is still true today.[144] There "is no genuine debate, even in the Parliament. And as to public opinion, it is just a game, like asking a television audience a question such as 'do you consider nuclear weapons are necessary'?"[145]

Are there any signs that support in the short or long term would falter? One indication might be that the Catholic Church is becoming more critical. This is however unlikely to have any decisive effect. Renewed hope of nuclear disarmament – symbolized by President Obama's 2009 Prague speech and the more recent push for the nuclear ban treaty could perhaps in the future have some effect, but hitherto this has not been the case.[146] Journalists and analysts more frequently "argue that the 'nuclear consensus' could very well be swept away by postmodern winds".[147] But such debates, lest they expand beyond opinion pieces in the newspaper, are not likely to have a decisive impact either. Should a wide public and political debate on nuclear weapons possession and the defence of France arise, it might have some impact on opinion, although it is difficult to predict if there would be any significant consequences and what those would be. The existing consensus and tacit support that French decision makers rely on for retaining the nuclear deterrent is thus likely to continue bar extreme circumstances of some kind.

Debating the Future Nuclear Posture and the 2017 Strategic Review

The second key issue concerns what the future posture of France should be and the dilemma of what critics term the inutility or military uselessness of these expensive weapons. Critics highlight some key features of world affairs which require a re-examination of the role of nuclear weapons. While the weapons might have had their use in the bipolar contest of the Cold War, today the nuclear deterrent fulfils much less of a function. According to this line of thinking the only real challenge to France is that of non-state actors attempting to spread their fundamentalism.[148]

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[143] Clément Larrauri: *The French Nuclear Order: The French nuclear weapon as a structure of consensus*, IFRI, master's thesis, September (2014), p. 11; and Pierre Tran: "France adds $2B to defense budget, moving closer to NATO spending target." *Defence News*, September 27 (2017), p. 11

[144] Clément Larrauri: "The French Nuclear Order", p. 12

[145] Paul Quiles: "Dissuasion Nucléaire: Vouz Avez Dit Concensus", *L'Express*, January 4 (2012) as quoted in Clément Larrauri: "The French Nuclear Order"

[146] Lars Wedin: *Minnesanteckningar: Dissuasion nucléaire. Enjeux pour le 21ième siècle*, November 8 (2017)

[147] Clément Larrauri: "The French Nuclear Order", p. 12

[148] Alain Juppé, Bernard Norlain, Alain Richard and Michel Rocard: "Pour un désarmement nucléaire mondial, seule réponse à la prolifération anarchique, MM. Juppé, Norlain, Richard et Rocard." *Le Monde*, October 14 (2009), http://www.lemonde.fr/idees/article/2009/10/14/pour-un-

But most non-state actor will not be deterred by nuclear threats and targeting such actors with nuclear weapons is both ineffective and difficult if not impossible to justify. While such views do not reflect mainstream thinking they are important enough to influence the debate.

Even as the Strategic Review reasserts the role of nuclear deterrence, as outlined earlier, the preamble makes clear the increased threat emanating from the South – non-state actors and the areas in which they muster and from which they operate. Obviously this is influenced by the hideous terrorist attacks France has been a target of during recent years. "The threats and risks identified in the 2013 White Paper have materialised faster and with greater intensity than anticipated….Jihadist terrorism remains the most direct threat our country faces today."[149]

This partial shift of focus has prompted a debate and raised concern over what this may mean for the future of France's deterrent force and the defence of France in general. Currently any concerns seem unwarranted as made clear by the latest draft defence planning law 2019-2025.

Budgetary Issues

In September 2017 the contested French defence budget for 2018 was approved. Cuts had been discussed but France ultimately added 1.8 bn €, increasing the budget to 34.2 bn € or 1.82% of GDP.[150] This is a substantial increase compared to the 2017 defence budget of 32.7 bn € or 1.77% of GDP, a budget which the new French government under President Macron unexpectedly cut by 850 million € to help reduce the budget deficit. In July this reduction, and the fierce debate concerning the coming budget, triggered the resignation of Army Chief of Staff General Pierre de Villiers.

The 2018 budget is the first step in an ambitious plan communicated by the Ministry of Economy and Finance to gradually increase the defence budget over the next five years. Military spending will be raised by 1.7 bn €, reaching 41 billion € by 2022. By 2025 the plan is to reach 2% of GDP or an estimated 50 bn €. Funds for overseas operations will rise to 1.1 bn € over the five years from the current 450 million €. This is a fiscal sign that underlines the priorities laid out in the Strategic Review – that the most pressing threat to France itself emanates from terrorism.

In 2017 the French and European economy were doing well, yet budgetary constraints remained an issue and President Macron pledged to further reduce

desarmement-nucleaire-mondial-seule-reponse-a-la-proliferation-anarchique_1253834_3232.html#e4yWBAgK7qhZzxhe.99 (retrieved 2017-10-27)

[149] *Defence and National Security Strategic Review 2017*, Government of France (2017), p. 9

[150] Pierre Tran: "France adds $2B to defense budget, moving closer to NATO spending target." *Defence News*, September 27 (2017)

France's deficit.[151] If or when France and Europe experience another economic downturn the ambitious plans to increase defence spending may not be possible to implement.

At the same time the cost of modernizing the deterrent force is predicted to rise considerably in the coming years. The annual cost in 2017 was 3.9 bn € or around 10% of the defence budget. With the current plan this will rise to 6 bn € by 2025, at the minimum 12% of the defence budget if the 50 bn € mark is reached.[152] An average 300 million € will have to be added for seven consecutive years to meet these needs.

Competing priorities between the southern and eastern threats are voiced in the 2017 Strategic Review. If terrorist attacks against France continue and "forward deployments" to prevent attacks on French territory remain the defence priority, this may have consequences for the ability to fund planned nuclear modernization projects.[153] This was an issue of concern voiced by expert in the autumn of 2017 after the Strategic Review was released. "Sacrificing nuclear deterrence at the altar of the fight against terrorism would be a fatal mistake."[154]

The draft military budget for 2019–2025 seems to alleviate some of the concerns regarding sufficient spending on the future nuclear deterrent forces. The spending increase seen as needed to maintain force readiness is included. In the 2019-2023 time period 25 bn € is earmarked for initial studies of the next-generation nuclear-armed cruise missile and initial concept studies of the replacement for the Triomphant Class, the next-generation SSBN.[155]

In addition to these challenges there are several organizational and technical issues that could threaten the future nuclear force. One pertains to maintaining a cadre of technical experts and other human resources in the nuclear field. This is a matter of keeping the technical/industrial capability, of being able to operate the forces efficiently, and of strategic thinking to inform policymakers. Maintaining the nuclear culture and support of the deterrence forces within the armed forces writ large will be important.

Some modernization programmes are especially important and will present particular challenges from an economic as well as a technical perspective. In the late 2030s the current SSBN fleet will need to be replaced. A decision on the acquisition of a next-generation submarine will have to be taken by the mid-2020s

[151] Guillaume Lasconjarias and Florent de Saint-Victor: "Chasing grandeur? What you need to know about the 2017 French strategic review." *War on the Rocks*, October 27 (2017)
[152] Corentin Brustlein: "Forces nucléaires françaises : quel renouvellement?", p. 121
[153] *Defence and National Security Strategic Review 2017*, p. 86
[154] Corentin Brustlein: "Forces nucléaires françaises : quel renouvellement?", p. 113
[155] Pierre Tran: "France proposes big defence budget hike." *Defence News*, February 9 (2018), https://www.defensenews.com/global/europe/2018/02/08/france-proposes-big-defense-budget-hike/ (retrieved 2018-02-09)

at the latest. In the late 2020's a decision on a new missiles and possibly a new aircraft will have to be taken. Thus moving into the 2030s France will have to devote large amounts of money to its next-generation nuclear deterrent. Support for and financial ability to undertake this next modernization effort cannot be taken for granted.

One specific future technical challenge to guaranteeing the penetration capability of the next ballistic and cruise missiles (the M51.3 and ASMP-A follow-on) in the light of the advances in missile defences and other novel defence capabilities.[156]

A European Nuclear Force?

The previous chapter asked whether the British deterrent could be put into jeopardy should Scotland become independent which might come as a result of the impending Brexit. Once Brexit is concluded France will be the only nuclear weapons power in the EU. Should Britain, because of Scottish independence or any combination of factors discussed in chapter two, choose or be forced to disarm France would be the only nuclear weapons power in Europe save Russia. This begs the question what this might mean for France's deterrent posture. The situation is very different from that in the 1960s but the fundamental question is the same; given known and possible future developments, could and should the French deterrent be given a broader European role?

The consequences of Brexit and possible British nuclear disarmament is not the only issue. Fundamentally it will have to do with France's own view of what security and strategic stability in the European theatre is and needs to be today and in the future. This includes what cooperative formats will be preferred by Paris. How will PESCO, EII and the Franco-German cooperation formats evolve and relate to one another? Could there be a development where consultation turns into nuclear coordination which establishes a division of labour between NATO and France on deterrence? Finally and possibly most important – how will France view the relationship between its vital interests and the evolving security architecture in European? Could a version of the 1970s approach of "defining France as Europe" be envisioned, an approach that allows France to preserve its nuclear independence and at the same time satisfy the needs, wishes and anxieties of partners and allies?[157]

France is actively seeking discussions with a broad range of European partners on this topic. For Northern Europe and the Baltic Sea region, one hypothesis is that the French airborne deterrent, in some scenarios might be the quickest, most flexible and best tailored capability to perform deterrence missions. France is devoting attention and being attentive to the views of the European powers, as any

[156] Bruno Tertrais: *La France et la dissuasion nucléaire*, p. 152
[157] Beatrice Heuser: *Nuclear Mentalities?* (1998), p. 107

extension or expansion of the deterrence posture would affect other states. This is a line of inquiry that poses questions and is worthy of a study in itself.

3.5 Conclusion: Grandeur, Defence and the Nuclear Deterrent

The French nuclear weapons arsenal has been an independent force since its operationalization in the 1960s. France's strategic and doctrinal posture emphasizes the defensive and deterrent value of nuclear weapons and deems them a necessary instrument for ensuring continued national sovereignty in a peaceful environment in its neighbourhood. Since the end of the Cold War, France has scaled down its deterrent force and in public presidential communications has declared that it has slightly fewer than 300 operational warheads. The ground-to-ground component, including lower-yield weapons for battlefield use, so-called tactical or non-strategic weapons, has been decommissioned and free-fall nuclear bombs have been removed.

France's global commitments to security and stability and its bid to retain great-power status are important arguments for retaining a deterrent force. As doubts about transatlantic, EU and European cohesion and commitment to defence in any circumstance deepen, France sees an increasing role for itself as a security leader in the European context and a guarantor of a national and independent, but European-based, deterrent. The "rapid and lasting deterioration of the strategic environment" forces France to "maintain its nuclear deterrent" for the foreseeable future.[158]

France recently (2009) rejoined the integrated military command structure of NATO and consultation between France and NATO is expanding in the area of nuclear planning as well. Yet there have been no moves to join the NPG and France is not likely to participate in the NPG in the near future. This is one of many signs that France is not ready to compromise its independent capability to deter adversaries.

Another key issue is what role the French deterrent will have in an era that is more challenging and where alliance cohesion is put into question. Under what circumstances could and should the French deterrent be given a broader European role? Are there strategic and operational approach that would allow France to preserve its nuclear independence and at the same time satisfy the needs, wishes and anxieties of partners and allies? This is a key issue that France is exploring. European partners of France will have to understand her deterrence posture and appreciate the finer details of the evolving strategic and nuclear debates.

[158] *Defence and National Security Strategic Review 2017,* pp. 16, 51

The current French force consists of four strategic submarines (SSBNs) of the Triomphant Class armed with and attack aircraft of the Rafale and Mirage 2000N classes carrying nuclear-armed cruise missiles. France is the only country with a sea-based nuclear air component. In addition to the two land based squadrons, a non-specified number of the naval versions of the Rafale are certified to carry out nuclear missions. These can be deployed on and operate from the aircraft carrier Charles de Gaulle.

France's nuclear capability has strong support in the political class and amongst the public. There is little that suggests this would change in the near term. The nuclear complex is being devoted considerable funds and despite a focus on non-state actors and terrorism in strategic documents, is being fiscally prioritised. But this is no insurance against future problems and challenges. Technical innovation in the nuclear industry is a constant challenge. It remains to be seen if France can overcome the hurdles needed to develop the new systems and ensure a credible deterrent beyond the 2030s. This is also a matter of funding. France and Europe could run into economic difficulties. If there is a serious enough financial and economic crisis the defence budget now being decided on could be contested and cut, affecting nuclear funding and the size and composition of the system.

4 Conclusion and Discussion

The backgrounds to the British and French nuclear programmes differ. While the UK chose to proceed with acquiring nuclear weapons right after the end of World War II, France decided a decade later. From the outset the UK cooperated closely with the US. The Suez crisis of 1956 was a watershed for both nations. Diametrically opposing conclusions were drawn from this. No longer could either nation play an independent role in world affairs. The US was now the dominant world power.

The conclusion in London was that a very close relationship with the US was the way to ensure continued US strategic support and involvement in British and European security. In Paris the US actions in the Suez crisis were viewed as a strategic betrayal, leading to the conclusion that France could never again rely on America. France had to aim for complete self-reliance in strategic affairs. France therefore had to develop a robust nuclear deterrent of its own.

The strategic postures of the UK and France are key to explaining the differing nuclear doctrines today. Post-Cold War, both the UK and France have retained their respective nuclear capabilities. While both countries have undertaken considerable drawdowns of their arsenals and capabilities, neither sees that it can go ahead with total nuclear disarmament. France retains a dyad consisting of air-launched cruise missiles and a submarine-based strategic deterrent. There are no plans for war-fighting capability, although France retains a capability and doctrine for conducting "pre-strategic", de-escalatory operations that may target enemy military formations or facilities. It is keeping the entire infrastructure for design, construction and maintenance of the nuclear systems. The UK has opted to retain a submarine-based strategic deterrent only. All other types of nuclear weapons (air-launched or land based) have been dismantled. While the UK cooperates closely with the US on the missile component, the design, development and construction of warheads and submarines remains a national endeavour.

From a threat perspective the two countries now have more similar views on strategic affairs. The first two post-Cold War decades offered hopes of reduced tension and possible disarmament. Both powers undertook reductions in warhead and weapon numbers, removed classes of weapons, including sub-strategic systems, de-targeted, and at least in the British case lowered readiness of existing weapons. Yet the preconditions for total disarmament did not materialize. Proliferation remained a problem and between 1998 and 2006 three new nuclear weapons powers had demonstrated capability.

Today, both nations assess that the global security situation is quickly deteriorating and new, irresponsible nuclear powers are aggressively arming themselves. A further complication is that some actors, like Russia and Pakistan, are again planning for nuclear use as part of military campaigns. Had these developments

not taken place, further drawdowns could well have been envisaged, but defence and security realism has dominated policy in both nations. Vulnerability to nuclear blackmail in a situation where France and the UK would lose the ability to pursue their own foreign policy will not be accepted. This is why both countries place emphasis on the continued utility of nuclear weapons and the strictly defensive nature of their doctrines.

Their views are converging not only where threat perceptions are concerned but also in relation to security cooperation and alliance formation: the French and British views are arguably closer today than they have been for a long time. First, both nations assess the European security architecture as being under severe strain. Power politics is underlined by the use of military assets in open conflicts in and around Europe that distinctly affect policy in Western Europe. Currently foreign policy based on a more narrow definition of national interest is a factor that influences European affairs. This in effect is a partial re-nationalization of security patterns in Europe and it remains to be seen if this will constitute a dominant trend going forward. The two most visible and direct threats emanate from a resurgent, aggressive Russia and the threat of terrorism from increasingly volatile areas in the Middle East and Africa.

Second, doubts about the transatlantic alliance continue to inject uncertainty in defence planning for both countries. The Trump administration has exacerbated doubts about when and in what scenarios the US will commit itself to European security. This is a continuing and strong theme in France, and has reignited a debate as to whether Europe needs to consider a more independent and stronger defence posture. This also includes a debate about an independent European nuclear deterrent.[159] Suggestions include Germany financing parts of the French force in exchange for extended nuclear guarantees, and a future French-British merger – complete or partial – of their nuclear forces. In the Franco-British case some initial steps have already been taken. The prospects for substantially expanded cooperation has so far neither been endorsed nor agreed upon.

The increased importance again attached to nuclear issues and the initial debates on possible cooperative European efforts, also highlight the important role nuclear deterrence plays in an alliance context. The UK has committed its nuclear deterrent to NATO, while France does not do so formally. The UK and French independent arsenals also play the role of an insurance against US withdrawal. Should the US decide to opt out and fail to honour its commitments in a situation where deterrence has failed, either of these countries can act, thus drawing the US into the nuclear dimensions of a crisis or conflict.

[159] Max Fisher: "Fearing U.S. Withdrawal, Europe Considers Its Own Nuclear Deterrent." *New York Times*, March 6 (2017)

The closer alignment of the British and French positions raises questions about the future role and composition of European nuclear forces. One relates to British-French nuclear collaboration. As described earlier the two countries have now, under the Lancaster House agreement, for the first time taken steps to collaborate in the nuclear field. How might the agreed cooperation evolve and could it expand into other areas? This question has largely been debated amongst pundits and experts, and has been voiced officially as well. For example, at least one semi-official French report discusses the future possibility of a UK-France nuclear merger or close force cooperation.[160]

One far-reaching suggestion would be to expand operational cooperation for the SSBN fleet either jointly or in close coordination, thus being able to uphold CASD while reducing the number of submarines. This would also enable pooling of supporting systems and assets. Such cooperation would have the potential of substantial budgetary savings in a very costly area of defence. However, such close coordination of a defence system, viewed as vital to deterrence, national security, national prestige, and power would be a daunting political undertaking.

What speaks in favour of closer cooperation are current and future budgetary constraints in both nations and continued convergence of strategic perspectives and postures. What speaks against any further integration are ingrained habits, long-established national nuclear mentalities and strategic cultures based on competition. The evolution of the transatlantic relationship and the NATO alliance will not necessarily bring the UK and France closer. The effect could just as well be to scuttle trends towards further cooperation.

Drawing on the analysis in this study, the current trends and strategic environment point towards continued and in some way increased UK-French nuclear cooperation. Budgetary restrictions and possible increased public pressure for further drawdown are important factors. But the key issue is political. Strategic convergence, common threat perceptions and *raison d'état* are facts that cannot be overlooked. Closer cooperation on a nuclear deterrent force for Europe may be less unlikely than previously thought. In what ways this could come about hinges on how the UK-US nuclear relationship develops and if further trilateral nuclear collaboration between the UK, France, and the US is initiated, as well as whether and how Germany will take active part in such a development. These are issues for further research.

[160] Bruno Tertrais: *La France et la dissuasion nucléaire: concept, moyens, avenir*. Paris, La documentation Française (2017), p. 150

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Questions about the meaning, role and utility of nuclear deterrence in a European context has come to the fore in recent years. Russia has reemphasized the role of a full-spectrum nuclear arsenal. This includes increased reliance on substrategic nuclear weapons for battlefield use, to compensate for its perceived inferiority in conventional armaments.

In Europe, the main multilateral and intergovernmental institutions and cooperation have been put under strain as a result of several negative developments. As a consequence the UK and France, Europe's two nuclear powers, are debating the role and composition of their respective deterrent forces. Multiple, complex security dilemmas, and the possibility that established alliances and partnerships might not be sufficiently reliable, inform the choices that have to be made.

The study concludes that while the current arsenals will remain fundamental to national security, their long term futures are far from certain. Budgetary constraints, domestic politics, and strategic perceptions informed by national nuclear mentalities are the main factors determining the outcome and composition of French and British arsenals beyond 2030.

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