



## BRIEFING PAPER

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# Replacing the UK's strategic nuclear deterrent: progress of the Dreadnought class

By Claire Mills

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## Summary

This briefing paper examines the Dreadnought programme as it advances. It does not examine the Government's overall nuclear policies, the synergies between the civil and military nuclear sectors, or the UK's position on disarmament. Nor does it set out in detail the arguments for and against nuclear weapons.

### **The decision to replace the nuclear deterrent**

In a vote in July 2016 the House of Commons approved the decision to maintain the UK's nuclear deterrent beyond the early 2030s. After almost a decade of work on the project, that vote subsequently enabled the programme to move forward into its manufacturing phase, which will see the construction of four new *Dreadnought* class ballistic missile submarines over the next 15-20 years.

### **What is the Dreadnought programme?**

Although commonly referred to as the renewal or replacement of Trident, the Dreadnought programme is about the design, development and manufacture of four new Dreadnought class ballistic missile submarines (SSBN) that will maintain the UK's nuclear posture of Continuous at Sea Deterrence (CASD).

A Common Missile Compartment (CMC) for the SSBN, which will house the existing Trident strategic weapons system, is being developed in conjunction with the United States.

Under changes introduced in the 2015 Strategic Defence and Security Review (SDSR), the first Dreadnought SSBN is now expected to enter service in the early 2030s and will have a service life of at least 30 years.

Replacement of the Trident II D5 missile itself is not part of the programme. The UK is, however, participating in the US' current service-life extension programme for the Trident II D5 missile, which will extend the life of the missile potentially to the early 2060s.

Replacement of the nuclear warhead is also not part of the Dreadnought programme. After having deferred a decision on replacement in the 2010 SDSR, the Government recently confirmed that a replacement programme is underway. Transition to the new warhead, which will be compatible with the Trident missile system, is expected from the late 2030s onwards.

### **Delivery of the Programme**

Recognising that the Dreadnought programme is one of the largest Government investment programmes going forward, the 2015 SDSR made a number of changes to the structure of the project, specifically with reference to governance and oversight of delivery.

A new Submarine Delivery Agency has been established, which became an Executive Agency of the MOD on 23 April 2018. That agency will manage the procurement and in-service support of all current and future nuclear submarines, including Dreadnought. It will sit alongside the MOD's Defence Equipment and Support (DE&S).

In tandem, the MOD and its two key industrial partners on the dreadnought programme, BAE Systems and Rolls Royce, have formed a new commercial alliance in order to jointly deliver the programme.

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### **Where is the programme at?**

In May 2018 the MOD signed contracts for the second phase of the build programme. Delivery Phase 2 will run until March 2021. Under the management of the Dreadnought Alliance DP2 will continue the design and build of the first Dreadnought submarine and commence the build of the second, including furthering the design and manufacture of the nuclear propulsion power plant. According to the MOD's 2019 Annual Report, the programme remains on schedule.

### **Jobs and Industry**

BAE Systems, Rolls Royce and Babcock International are the Tier One industrial partners in this project. Although the MOD has contracted directly with BAE Systems and Rolls Royce for production, hundreds of suppliers across the UK are working on the Dreadnought programme. As the programme moves forward BAE Systems has estimated that 85 percent of its supply chain will be based in the UK, potentially involving around 850 British companies.

Yet, it is unclear how much of the value of the overall programme rests with that supply chain in the UK and how much will be spent overseas. To date BAE Systems has contracted for the specialised high strength steel required for the submarines from a French supplier. The use of foreign steel in the construction of the Dreadnought class has raised many questions over whether more can be done to promote the British steel industry within MOD programmes, and what the implications of Brexit will be for the programme in the longer term.

### **Costs**

The cost of the programme has been estimated at £31 billion, including defence inflation over the life of the programme. A £10 billion contingency has also been set aside. Once the new nuclear deterrent comes into service the annual in-service costs are expected to continue at approximately 6 percent of the defence budget (£2.4 billion in 2020/21)

In its 2019 Update to Parliament the MOD confirmed that the programme remains within its cost estimate and that £7 billion had been spent so far on the concept, assessment and early delivery phases of the project, to date.

In order to keep the programme on track, reduce risk and achieve cost efficiencies, additional investment for the early years of the programme was also announced as part of the Autumn 2018 budget statement and the 2019 Spending Round. This is not extra funding for the programme, but money that has been re-profiled. The Treasury has also granted the MOD access to the Dreadnought contingency fund in 2018/19, 2019/20 and 2020/21.

In line with convention, the Dreadnought programme will be funded from the MOD's core equipment budget. The National Audit Office has, however, raised concerns over the impact of the MOD's nuclear programmes, including Dreadnought, on the affordability of the Department's overall equipment plan.

# 1. Background

This briefing paper examines the Dreadnought programme as it advances. It does not examine the Government's overall nuclear policies, the synergies between the civil and military nuclear sectors, or the UK's position on disarmament. Nor does it set out in detail the arguments for and against nuclear weapons. Many of these issues are examined in Library briefing paper CBP7353, [Replacing the UK's 'Trident' Nuclear Deterrent](#), July 2016.

## Box 1: Suggested reading

The following reports also examine these broader issues in greater detail:

- Public Accounts Committee, [Defence nuclear infrastructure](#), HC86, Session 2019-21
- National Audit Office, [Managing infrastructure projects on nuclear-regulated sites](#), HC19, Session 2019-20
- HM Treasury, [Government response to the Public Accounts Committee](#), CP176, October 2019
- Public Accounts Committee, [Submarine defueling and dismantling](#), HC2041, Session 2017-19
- National Audit Office, [Investigation into submarine defueling and dismantling](#), HC2102, Session 2017-19
- House of Lords International Relations Committee, [Rising nuclear risk, disarmament and the Nuclear Non-Proliferation Treaty](#), HL 338, Session 2017-2019
- HM Treasury, [Government response to the Public Accounts Committee](#), Cm 9740, Session 2017-19, December 2018
- Public Accounts Committee, [Ministry of Defence Nuclear Programme](#), HC1028, Session 2017-19, September 2018
- National Audit Office, [The Defence Nuclear Enterprise: a landscape review](#), HC1003, Session 2017-19, May 2018
- Public Accounts Committee, [Hinkley Point C](#), HC393, Session 2017-19

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The Labour Government's 2006 White Paper *The Future of the United Kingdom's Nuclear Deterrent*, concluded that the international security environment does not justify complete UK nuclear disarmament and that, in terms of both cost and capability, retaining the submarine-based Trident system would provide the most effective nuclear deterrent for the UK.

The decision was therefore taken to maintain the UK's existing nuclear capability by replacing the Vanguard class submarines (SSBN) and participating in the current US service-life extension programme for the Trident II D5 missile.

A debate and vote in the House of Commons on the general principle of whether the UK should retain a strategic nuclear deterrent beyond the life of the current system was held on 14 March 2007. That motion was passed on division by 409 to 161 votes.

Work began immediately on the concept phase of the 'Successor' programme, with the project passing its Initial Gate in April 2011. A five-year assessment phase followed which largely focused on the design of the Successor platform. Several contracts were awarded to the main industrial partners on the project (BAE Systems, Rolls Royce and Babcock) in order to deliver on each of the stages of the assessment phase. Approximately £4.8 billion was assigned to the initial phases of the Successor programme.

In a vote in July 2016 the House of Commons once again approved the decision to maintain the UK's nuclear deterrent beyond the early 2030s.<sup>1</sup> After almost a decade of work on the project, that vote subsequently enabled the programme to move forward into its manufacturing phase, which will see the construction of four new Dreadnought class ballistic missile submarines over the next 15-20 years. The first submarine will enter service in the early 2030s.

Successive governments have expressed the belief that the programme to replace the UK's nuclear deterrent is compatible with the UK's obligations under the Nuclear Non-Proliferation Treaty (NPT), arguing that the treaty contains no prohibition on updating existing weapons systems and gives no explicit timeframe for nuclear disarmament.

### Explainer: Composition of the UK's nuclear deterrent

The UK is the only nuclear weapon state that operates a single deterrent capability: the submarine-launched Trident system, which is based at HM Naval Base Clyde. It has three main elements:

- Four Vanguard-class submarines, maintaining continuous at sea deterrence (CASD)
- Trident II D5 missile, deployed aboard the submarine, which is held in a communal pool with the US
- Mk4/A nuclear warhead deployed on the Trident II D5. The UK currently has a stockpile of 215, of which no more than 120 are operationally available.

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<sup>1</sup> [Division 46](#), 18 July 2016. Parliament had also voted in support of the Government's plans in response to SNP-led Opposition Day debates in January 2015 and November 2015.

## 2. What is the Dreadnought programme?

Although commonly referred to as “the renewal or replacement of Trident”, the Dreadnought programme<sup>2</sup> is about the design, development and manufacture of four new Dreadnought class ballistic missile submarines (SSBN) that will replace the current Vanguard class SSBN and maintain the UK’s posture of Continuous at Sea Deterrence (CASD).<sup>3</sup>

A Common Missile Compartment (CMC) for the SSBN, which will house the current Trident strategic weapons system, is being developed in conjunction with the United States.<sup>4</sup> The 2010 Strategic Defence and Security Review (SDSR) announced that the new submarines would deploy with eight operational missile tubes, instead of the planned 12. However, the design of the CMC will still comprise 12 tubes, with the remaining missile tubes configured with ballast to enable the submarine to dive.

Under changes introduced in the 2015 SDSR, the first submarine is now expected to enter service in the early 2030s and will have a service life of at least 30 years.<sup>5</sup> This is the third time the in-service life of the current Vanguard class SSBN has been extended<sup>6</sup> and will now result in an overall lifespan of the Vanguard class of approximately 37-38 years.<sup>7</sup> The MOD has refused to be drawn on specific dates for entry into service stating that “detailed planning assumptions for Service Entry are classified”.<sup>8</sup>

The four SSBN will be named HMS Dreadnought, HMS Valiant, HMS Warspite and HMS King George VI.<sup>9</sup>

### Trident II D5 missile and warhead

Replacement of the Trident II D5 missile itself is not part of the programme. The UK is, however, participating in the US’ current service-life extension programme for the Trident II D5 missile, which will extend the life of the Trident missile to the early 2060s.<sup>10</sup>

The current nuclear warhead is expected to retire in the early 2040s. The transition to a new nuclear warhead would therefore be required from the late 2030s. Planning

### Interesting Facts

At 152.9 metres long and with a displacement of 17,200 tonnes, the Dreadnought class will be the largest submarine ever built for the Royal Navy.

The first Royal Navy submarine to be built with separate female crew quarters, toilets and washing facilities.

130 crew members, including 3 chefs and 1 doctor.

<sup>2</sup> Previously referred to as the ‘Successor’ programme. The Ministry of Defence announced the name of the new class of SSBN on 21 October 2016 (HCWS206).

<sup>3</sup> The UK has maintained a posture of CASD (Operation Relentless) since April 1969. There had initially been considerable debate over whether it would be possible to procure three boats, and still maintain CASD. The intention had been to make a decision on the size of the fleet at Main Gate. However, in April 2015 the government committed to the procurement of a 4-boat fleet.

<sup>4</sup> The design for the Successor submarine’s common missile compartment (CMC) is being delivered under the 1963 Polaris Sales Agreement (PSA), as amended (HL Deb 11 February 2013, c92WA)

<sup>5</sup> Ministry of Defence, [Dreadnought submarine programme factsheet](#)

<sup>6</sup> The first time was in the 2006 White Paper when the service life of the submarine was extended from 25 to 30 years. The second was in the 2010 SDSR when the in-service date of the first submarine was earmarked for 2028.

<sup>7</sup> HMS Vanguard entered service in December 1994; while the last in class, HMS Vengeance, entered service in February 2001.

<sup>8</sup> PQ24643, *Trident Submarines*, 1 February 2016

<sup>9</sup> HMS King George VI will be the first ever naval vessel to bear that Royal title.

<sup>10</sup> PQ35764, *Trident*, 4 May 2016. In 2020, work is expected to begin in the US on a second life-extension project (Trident D5 LE2) that will keep the Trident missile in service until at least 2084, to match the life of the Columbia class SSBN currently being developed in the US.

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expectations are that it will take approximately 17 years to design, develop, certify and manufacture a new nuclear warhead.<sup>11</sup>

Since 2006 the MOD has been undertaking work on replacement options. In its [2018 Update to Parliament](#), the MOD confirmed that investment at the AWE continues under the Nuclear Warhead Capability Sustainment Programme, including projects to reduce technical, cost and schedule risks once a decision on the warhead has been made. The UK has also been undertaking work with the United States, through the UK-US Joint Technology Demonstrator project examining warhead safety, security and advanced manufacturing technologies.

In February 2020 the Government confirmed that a replacement warhead programme was underway<sup>12</sup> after US officials inadvertently revealed that work on its new W93 warhead was being conducted in parallel with a British programme.<sup>13</sup>

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<sup>11</sup> Executive Summary, para 18. The long lead time is largely based around the length of time required to certify a new nuclear warhead, in the absence of live nuclear testing. The UK signed the Comprehensive Test Ban Treaty in 1996 and ratified it in 1998. Although the treaty has yet to enter into force the UK is committed to its principles.

<sup>12</sup> HCWS125, [Nuclear Deterrent](#), 25 February 2020

<sup>13</sup> The replacement warhead programme is examined in greater detail in Library Briefing, [CBP8941, Replacing the UK's nuclear deterrent: the long-awaited warhead decision](#)



## 3. Delivery of the Dreadnought programme

The Dreadnought programme has been described as “the largest UK submarine project in a generation and will be one of the most complex undertaken by British industry”.<sup>14</sup>

### 3.1 Governance

Recognising that the Dreadnought programme is one of the largest Government investment programmes going forward, the 2015 SDSR made a number of changes to the structure of the project, specifically with reference to governance and oversight of delivery.

New organisational and managerial arrangements for the UK’s defence nuclear enterprise as a whole, and for delivering the Dreadnought programme specifically, were subsequently outlined in SDSR15. A new team within the MOD (Director General Nuclear), headed by a commercial specialist, would be established to oversee all aspects of the nuclear enterprise; while a new delivery body would be established in order to deliver the procurement and in-service support of all nuclear submarines, including Dreadnought.

Initial speculation among the media and other commentators suggested that the Treasury had been looking to bring the new delivery body under its own remit.<sup>15</sup> The justification for doing so was reportedly the historical failure of the MOD to manage large and complex projects, with subsequent equipment being delivered several years late and vastly over budget.<sup>16</sup>

In a Parliamentary debate on 24 November 2015, however, then Minister for Defence Procurement, Philip Dunne, refuted suggestions that the Treasury would assume oversight of the programme:

On the governance of implementing a delivery organisation to make sure we deliver the Successor programme on time and to budget over the years to come, I can confirm that this will remain subject to oversight by the MOD [...]

As the Prime Minister and the Secretary of State have made clear, this will be reporting through the MOD structures to the Secretary of State, and of course the Treasury will take its interest in the delivery of major programmes as it does in all our category A programmes, of which this will obviously be the largest.<sup>17</sup>

That position was reconfirmed by the MOD in December 2015.<sup>18</sup>

### The Submarine Delivery Agency

The new Submarine Delivery Agency (SDA) was initially established within the MOD’s Defence Equipment and Support (DE&S) organisation on 3 April 2017. The long term

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<sup>14</sup> Ministry of Defence, *2016 Update to Parliament*, December 2016

<sup>15</sup> See for example: “[George Osborne issues Treasury ultimatum over Trident](#)”, *The Daily Telegraph*, 12 November 2015

<sup>16</sup> The most comparable programme is the Astute class submarine which, in 2015 was £1.4 billion over budget and several years late (National Audit office, *Major Projects Report 2015*, HC488-II, October 2015)

<sup>17</sup> HC Deb 24 November 2015, c1254

<sup>18</sup> PQ HL3927, 3 December 2015

intention was for this new body to achieve Executive Agency status, and sit alongside DE&S. The SDA subsequently achieved Executive Agency status on 1 April 2018.<sup>19</sup>

The SDA will manage the procurement, in-service support and decommissioning of all current and future nuclear submarines, including Dreadnought.<sup>20</sup> It will have the authority and freedom to recruit and retain the best individuals to manage the submarine enterprise. The SDA currently employs around 1,450 people, both civilian and military.<sup>21</sup>

The MOD appointed Ian Booth as the Chief Executive of the SDA in August 2017. The CEO is supported in programme delivery by the Director Submarines Acquisition (DSMA) and the Director Submarines Support (DSMS):

- DSMA will be responsible for the delivery and future in-service support of Dreadnought, Astute and the Maritime Underwater Future Capability. They also lead the relationship with BAE Systems.
- DSMS will be responsible for in-service submarines, including the current SSBN delivering continuous at sea deterrence. They will also lead the relationship with Babcock for the Maritime Support Delivery Framework and submarine support, and Rolls Royce for nuclear propulsion.<sup>22</sup>

### A commercial alliance

In tandem with the creation of a new delivery body, the MOD also established a new commercial alliance with its two key industrial partners on the dreadnought programme: BAE Systems and Rolls Royce, on 1 April 2018.<sup>23</sup> The intention of a joint management team approach is to improve collective performance on the programme, provide greater assurance of progress, with supporting risk and reward arrangements.

In its report on the *Defence Nuclear Enterprise*, the National Audit Office described how the 'Dreadnought alliance' will operate for the immediate future:

The arrangements have evolved and differ from the Department's initial aspiration. The new ways of working, effective from April 2018, consist of:

- the SDA continuing to agree bilateral contracts with contractors;
- a managing director, supported by a management committee, responsible for the day-to-day running of the alliance and accountable for delivering Dreadnought. They will set cost and schedule baselines, authorise under/overspends, challenge contractor performance and develop a procurement strategy;
- a leadership board, involving all three organisations, to govern the alliance on behalf of all the parties and hold the managing director to account;
- a shared cost model; schedule and breakdown of work; and reporting arrangements; and

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<sup>19</sup> A copy of the SDA Framework Document, outlining the governance structure of the SDA is available [online](#).

<sup>20</sup> Including the in-service fleet of Trafalgar, Astute and Vanguard class submarines and the ongoing Astute and Dreadnought procurement programmes. The Maritime Underwater Future Concept (MUFC) project will also fall under the remit of the SDA.

<sup>21</sup> Ministry of Defence, *Submarine Delivery Agency Corporate Plan 2019- 2022*, November 2019

<sup>22</sup> Ibid

<sup>23</sup> A Heads of Agreement was signed by the Secretary of State for Defence and the CEOs of BAE Systems and Rolls Royce in November 2016 outlining the intent to establish an Alliance to deliver the Dreadnought programme. This approach was adopted in relation to the Queen Elizabeth II aircraft carrier project with the creation of the [Aircraft Carrier Alliance](#), which is a partnership between the MOD and BAE Systems, Thales UK and Babcock.

- an incentive scheme, linked to an agreed percentage profit variation, weighted to achieving milestones where two or more members need to work together.

The Department believes these arrangements will improve information-gathering, cost control and contractor performance. It hopes to move towards a more integrated model as the Dreadnought programme matures.<sup>24</sup>

On 1 September 2018 Sir Peter Gershon was appointed as the Independent Chair of the Alliance Leadership Board.

### 3.2 Where is the programme at?

In addition to changes in governance, SDSR15 also announced that “due to the scale and complexity” new commercial arrangements would be established between Government and industry that will see the programme subject to several stages of investment, with multiple control points, instead of the traditional single ‘Main gate’ approach.<sup>25</sup> Adopting such an approach will allow the MOD to more effectively regulate and control programme funding and achieve delivery targets.

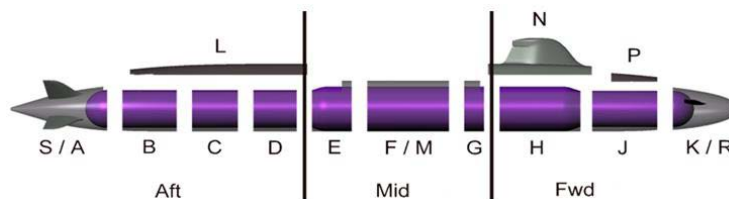
The programme entered Delivery Phase 2 in May 2018, which is expected to be a three-year period of work.

Following the vote in the House of Commons in July 2016 the programme moved forward from its assessment phase, into “risk reduction and demonstration”, or what was termed Delivery Phase 1. That phase officially began on 9 September 2016; and construction of the first submarine formally began on 5 October 2016 with the cutting of the steel for the first submarine.<sup>26</sup> With the Dreadnought class entering the build phase, the UK is now manufacturing two classes of submarine simultaneously for the first time since the 1990s.<sup>27</sup>

The build phase for the entire class of SSBN will take approximately 20 years.

In May 2018 the MOD signed contracts for the second phase of the build programme, Delivery Phase 2, which will run until March 2021. Under the management of the Dreadnought Alliance,<sup>28</sup> DP2 will continue the design and build of the first Dreadnought submarine and commence the build of the second,<sup>29</sup> including furthering the design and manufacture of the nuclear propulsion power plant.<sup>30</sup>

The submarines will be built in 16 units, grouped into three “mega units” (Aft, Mid and Forward) in order to shorten the overall build timeframe:



Source: MOD, 2016 Update to Parliament

<sup>24</sup> National Audit Office, *The Defence Nuclear Enterprise: A landscape review*, HC1003, 22 May 2018

<sup>25</sup> The procurement of defence equipment in the UK is largely conducted in accordance with the generic CADMID cycle, which comprises six phases in a project and two main investment decision points, or ‘gates’: Concept and feasibility phase followed by Initial Gate; an assessment phase followed by Main Gate; demonstration; manufacture; in-service and disposal. This new staged approach was also adopted in the QEII aircraft carrier programme.

<sup>26</sup> HCWS206, 21 October 2016

<sup>27</sup> The other being the Astute class SSN. MOD, *Submarine Delivery Agency Corporate Plan 2018/19*

<sup>28</sup> Ministry of Defence, [The United Kingdom’s Future Nuclear Deterrent, 2019 Update to Parliament](#), p.2

<sup>29</sup> Construction work on HMS Valiant officially started in September 2019.

<sup>30</sup> MOD press release, 14 May 2018

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Contracts for the third Delivery Phase are expected in 2021. At present there is no indication of how many stages of investment there will be overall, or when they might be implemented. In answer to a Parliamentary Question in February 2018 the MOD stated:

The number of investment stages throughout the 20 year acquisition programme will be defined as the build progresses.

The phases of Dreadnought construction comprise: major steelwork being formed into units; installing and outfitting of systems and plant; integration and testing of systems; and sea trials culminating in acceptance into service.<sup>31</sup>

In its 2019 Annual Report the MOD confirmed that the programme was on schedule for the first of class to enter service in the early 2030s.<sup>32</sup> In order to keep the programme on track in the longer term, however, contingency funding has been made available in the earlier years, in order to reduce risk and achieve efficiencies (see below).

In its 2019 Annual Report the Government's [Infrastructure and Projects Authority](#) (IPA) changed its confidence assessment of the Dreadnought programme from Amber/Red<sup>33</sup> to Amber. The IPA thus considers the successful delivery of the project to be feasible, but that significant issues remain. The IPA's report stated that "the programme has continued to gather at pace in the first year of Delivery Phase 2, the design has matured substantially and build activity escalated significantly...".<sup>34</sup>

Concerns have been raised that any delay in bringing the Dreadnought class into service could impact on the ability to deliver continuous at sea deterrence (CASD). The Vanguard class SSBN has already had its service life extended by over a decade. The need to extend it even further would be costly and put availability of the deterrent in doubt.<sup>35</sup>

### 3.3 Jobs and Industry

BAE Systems, Rolls Royce and Babcock International are the Tier One industrial partners in this project.

As with previous SSBN, the submarine will be built by BAE Systems in Barrow-in-Furness and the PWR3 propulsion system will be built by Rolls Royce at Raynesway, Derby.

Although the MOD has contracted directly with BAE Systems and Rolls Royce for production, hundreds of suppliers across the UK are working on the Dreadnought programme. As the programme moves forward BAE Systems has estimated that 85 percent of its supply chain will be based in the UK, potentially involving around 850 British companies.

At present the number of people working directly on the programme is approximately 3,000. More than half of those are designers and engineers. The programme as a whole is expected to support up to 6,000 jobs. As the MOD has noted:

The nuclear deterrent represents a significant national undertaking, which is drawing on cutting edge capabilities, innovation, design and engineering skills available in the

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<sup>31</sup> PQ126895, *Trident submarines*, 13 February 2018

<sup>32</sup> Ministry of Defence, [The United Kingdom's Future Nuclear Deterrent, 2019 Update to Parliament](#), p.2

<sup>33</sup> Successful delivery of the project is in doubt, with major risks or issues apparent in a number of key areas. Urgent action is needed to address these problems and/or assess whether resolution is feasible (IPA [Annual Report on Major projects 2018-19](#), Annex A)

<sup>34</sup> Infrastructure and Projects Authority, [Annual Report on Major Projects 2018-19: Consolidated Data and Narratives](#), July 2019

<sup>35</sup> This concern was raised numerous times in the [Commons debate on CASD](#) on 10 April 2019. Toby Fenwick also examines the risks to CASD in his September 2018 publication, [\(Dis\)Continuous Deterrence](#), BASIC, September 2018

UK, and is providing employment opportunities and development prospects for a substantial number of apprentices, trainees and graduates in a wide range of technical and other disciplines.<sup>36</sup>

Ensuring that a skilled workforce is available has, however, been identified as a risk by the National Audit Office. In its report on the *Defence Nuclear Enterprise*, the NAO recognised:

Having insufficient skilled staff remains a risk across the Department, and mitigating this risk is one of the Navy's top three priorities. The Enterprise depends on civilian and military staff within the Department and industry to design, build and safely operate nuclear submarines, systems, weapons and the supporting estate. These people have a wide range of skills and expertise, including those skills specific to the Enterprise. Since 2014-15, the Defence Nuclear Safety Regulator has identified that sustaining sufficient civilian and military nuclear staff remains one of the Enterprise's top strategic issues.<sup>37</sup>

## Value of the supply chain to the UK

It is unclear how much of the value of the overall programme will be spent with the supply chain in the UK, and how much of it will be spent overseas.

To date BAE Systems has contracted for the specialised high strength steel required for the submarines from a French supplier. The use of foreign steel in the construction of the Dreadnought class has raised many questions over whether more can be done to promote the British steel industry within MOD programmes. In answer to a Parliamentary Question in October 2016 the then Minister for Defence Procurement, Harriet Baldwin, stated:

The management of the steel procurement process for the Successor Programme is the responsibility of the Prime Contractor, BAE Systems. The Ministry of Defence's involvement with suppliers was limited to conducting a technical assessment during the tendering process to ensure bids met specifications.

The tendering process was progressed and concluded by the Prime Contractor, no viable UK bid was received for this part of the Successor submarine manufacture. Other stages of construction will include grades of steel manufactured by British suppliers and I encourage them to take the opportunity to bid.<sup>38</sup>

The Common Missile Compartment for the submarine is also a collaborative programme with the United States. American company General Dynamics is the prime contractor for the CMC and is working in co-operation with BAE Systems to ensure that the design accommodates UK requirements for the Dreadnought class. In October 2016 Babcock International was awarded a contract by General Dynamics to manufacture 22 tactical missile tubes as part of the CMC project. That work is taking place in Rosyth, securing approximately 150 jobs. Whether work on the CMC forms any part of the remaining 15 percent of BAE Systems supply chain, however, is also unclear.

## Impact of Brexit

With various elements of the supply chain based in the EU, Brexit is expected to have an impact. The 2018 Annual Report to Parliament acknowledged this issue:

For those elements of the supply chain that are based in the European Union, the Department is continuing to work with the Cabinet Office, Department for Exiting the European Union and others to ensure that the implications for the defence sector are considered in the future UK-EU partnership. The political declaration between the UK and the EU sets out an ambitious vision for a future partnership that includes a new

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<sup>36</sup> MOD, *2016 Update to Parliament*

<sup>37</sup> National Audit Office, [The Defence Nuclear Enterprise: A Landscape Review](#), HC1003, Session 2017-19, p.42

<sup>38</sup> PQ48618, *Trident submarines: iron and steel*, 18 October 2016

free trade area that facilitates trade through a new customs arrangement, deep regulatory cooperation, and avoids any tariffs or quotas with a view to facilitating the ease of legitimate trade.

## A wider jobs perspective

In his [submission to the BASIC Trident Commission](#) in March 2012, Professor Keith Hartley assessed the industrial implications of the nuclear deterrent replacement programme. He suggested that if both construction and in-service support of the nuclear deterrent are taken into consideration:

A Trident replacement will support almost 26,000 jobs over its life-cycle (based on four boats and including some 1,850 Navy personnel jobs). The totals comprise the following employment numbers:

|                           |        |
|---------------------------|--------|
| BAE at Barrow-in-Furness: | 6,045  |
| BAE suppliers:            | 5,017  |
| AWE:                      | 4,500  |
| AWE suppliers:            | 4,500  |
| Devonport:                | 1,590  |
| Devonport suppliers:      | 1,590  |
| Operations and support:   | 2,700  |
| TOTAL                     | 25,942 |

However, he went on to caution that this estimate of employment would be at the upper-end of the scale and makes no allowance for issues such as improvements in labour productivity. Equally he argued that cancelling the replacement programme would not necessarily result in an equal number of job losses as many companies would seek alternative markets or contracts, particularly in the supply chain. Direct job losses, he argued, would be more likely to affect BAE, Rolls Royce, AWE and Devonport.<sup>39</sup>

The link between jobs and replacing the nuclear deterrent has, however, been disputed by CND and the Scottish Trade Unions Congress. A 2007 report by CND *Trident and employment: the UK's industrial and technological network for nuclear weapons* argued that:

Replacing Trident, at a cost to the British public of at least £76 billion over the system's lifetime, represents a very poor rate of return in terms of generating jobs. The report finds that if you started with a blank slate and wanted to make such a multi-billion pound investment of public money to maximise employment, the last thing you would do is build nuclear weapons.

A decision not to replace Trident could be the catalyst for a stronger, diversified economy in those few localities with a residual dependency on nuclear weapons work.

This emphasis on defence diversification was also the subject of an April 2015 report by CND and the STUC entitled [Trident and Jobs: the case for a Scottish Defence Diversification Agency](#). That report argued in favour of a Scottish Defence Diversification Agency to plan and resource the diversification of jobs away from military programmes such as Trident and promote a greener Scottish economy.

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<sup>39</sup> Professor Keith Hartley, *Defence Industrial Issues: Employment, Skills, Technology and Regional Impacts*, Discussion Paper No.2 of the BASIC Trident Commission, 2012

The Scottish GMB stated, however, that “the successor programme going ahead is welcome as it is crucial to jobs in Scotland” and suggested that any notions of defence diversification are “based on Alice-in-Wonderland politics promising pie in the sky alternative jobs for workers who are vital to our national security”.<sup>40</sup>

## 3.4 Costs

### Overall acquisition and in-service costs

The 2015 SDSR confirmed that the costs of design and manufacture of a class of four submarines will be £31 billion, an increase of £6 billion on estimates set down in the programme’s Initial Gate report in 2011 (at outturn prices). This cost estimate includes all costs associated with acquisition including feasibility studies, design, assessment, demonstration and manufacture (including the US-UK Common Missile Compartment project).<sup>41</sup> It also accounts for expected defence inflation over the life of the programme<sup>42</sup> and investment in new facilities at BAE Systems in Barrow, which in 2013 the MOD suggested would be “limited to the modification of existing infrastructure to accommodate the differences between the Vanguard and Successor designs”.<sup>43</sup>

The estimated cost of the design and manufacture of a class of four SSBN is £31 billion, including inflation over the life of the programme.

A £10 billion contingency has also been set aside.

A contingency of £10 billion has also been set aside. This contingency represents approximately 35 percent of the submarine cost to completion and according to the MOD “is a prudent estimate based on past experience of large, complex projects, such as the 2012 Olympics”.<sup>44</sup> However there is no guarantee whether all of this money will be spent. If it were then it would provide an upper-end acquisition estimate of £41 billion. Spread over the 35- year life of the programme, this represents 0.2 percent of Government spending.

The MOD has stated that “the revised cost and schedule reflect the greater understanding we now have about the detailed design of the submarines and their manufacture”.<sup>45</sup>

The years of peak expenditure are expected to be principally 2018 through to the mid/late 2030s, as the programme moves into full production.

Investment in HM Naval Base Clyde,<sup>46</sup> the Trident II D5 Service-life Extension programme,<sup>47</sup> infrastructure projects related to the Atomic Weapons Establishment (AWE),<sup>48</sup> and work

<sup>40</sup> [GMB Trident Successor Programme Conference](#), 25 February 2016

<sup>41</sup> HC Deb 4 June 2009, c627W

<sup>42</sup> Defence inflation is often one of the largest sources of additional costs on a procurement programme.

<sup>43</sup> The Department is building new facilities at Barrow which will allow a modular build approach for the Dreadnought submarines, which are larger than the Astute or Vanguard class. The Primary build facility programme has a current forecast cost of £240 million and is expected to be completed in 2022. The NAO also examines this programme in [Managing infrastructure projects on nuclear-regulated sites](#)

<sup>44</sup> PQ24652, *Trident Submarines: Finance*, 2 February 2016

<sup>45</sup> HM Government, *National Security Strategy and Strategic Defence and Security Review 2015*, Cm9161, November 2015, p.34

<sup>46</sup> The announcement on 31 August 2015 of £500 million of investment for HM Naval Base Clyde, over a ten-year period, is part of the MOD’s ongoing programme of work to establish a submarine centre of excellence at HM Naval Base Clyde once the entire Royal Navy submarine fleet is based there from 2020. In February 2017 a further £1.3 billion was announced for upgrades at HM Naval Base Clyde, including the waterfront, engineering support, accommodation and physical security. PQ112914 of 21 November 2017 confirmed the separate funding arrangements.

<sup>47</sup> PQ121632, *Trident*, 16 January 2018

<sup>48</sup> The projects being undertaken through the Nuclear Warhead Capability Sustainment Programme (NWCSP) at AWE are covered within the annual in-service costs of the deterrent. The MENSA project is examined by the NAO in its report, [Managing infrastructure projects on nuclear-regulated sites](#), HC19, Session 2019-20

on the options for replacing the nuclear warhead,<sup>49</sup> are not part of the Dreadnought programme spend.

### **In-service costs**

Once the new nuclear deterrent submarine comes into service the annual in-service costs are expected to continue at approximately 6 per cent of the defence budget. Under the current defence budget, adjusted for the 2019 Spending Round, 6 per cent of spending will equate to approximately £2.3 billion in 2019/20, rising to 2.4 billion in 2020/2021.

Calculating overall in-service costs, however, is fraught with difficulty as assumptions have to be made about the state of the British economy and projected levels of defence spending over the next 50-60 years. As such this paper does not attempt to do so.<sup>50</sup>

### **Alternative cost estimates**

Studies by the [Nuclear Information Service](#) and the [Campaign for Nuclear Disarmament](#) have suggested that the MOD's cost analysis for the replacement programme is vastly under-estimated and that the true cost is in the region of £172 billion or £205 billion respectively. However, these cost estimates also consider in-service costs over the 30-year life of the deterrent, and additional factors such as infrastructure investment, the Trident SLEP programme, warhead replacement and decommissioning, among other things.

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<sup>49</sup> It is unclear at present whether the Replacement Warhead programme will be part of NWCSP spending, or whether it will be funded as a separate programme. This is examined in greater detail in Library briefing, [CBP8941, Replacing the UK's nuclear deterrent: the long-awaited warhead decision](#)

<sup>50</sup> A more detailed explanation of the difficulties in determining in-service costs over a 30 year period is available in Library briefing paper CBP8166, [The cost of the UK's strategic nuclear deterrent](#). It is also one of the reasons why so many differing cost estimates for the nuclear deterrent exist.



## What has been spent so far?

### Concept and Assessment Phase

Approximately £4.8 billion had been allocated to the concept and assessment phases of the programme (£905 million and £3.9 billion respectively). Several long-lead items, including the steel for the first submarine and items relating to the propulsion system, were contracted for under this phase of spending.<sup>51</sup> In its 2016 [Update to Parliament](#) the MOD confirmed that payments for some of the long-lead items procured during the assessment phase would continue through to 2023.

Up to the end of 2019, £7 billion had been spent on the concept, assessment and early delivery phases of the programme.

### Demonstration and Manufacture phase contracts

At the start of Delivery Phase 1 two contracts were awarded for work going forward:

- £986 million for platform construction
- £277 million for continuing design work, purchasing materials and long lead items and investing in facilities at Barrow.

Money has been re-profiled into the earlier years of the programme in order to reduce risks and achieve cost savings.

As outlined above, contracts for Phase 2 of the build were awarded on 14 May 2018. BAE Systems was awarded a further £900 million to “support ongoing design and build activities, procurement of materials and investment in new and existing facilities for a further 12 months”; while a £60 million contract was awarded to Rolls Royce to further the design and begin manufacture of the nuclear propulsion power plant. Commitments made under DP2, thus far, have totalled approximately £2.5 billion.<sup>52</sup>

£600 million of the £10 billion contingency fund was made available by HM Treasury in 2018/19. Access to the fund has also been granted for 2019/20 and 2020/21.

### Re-profiling of allocated resources

Concerns have been raised over the long-term affordability of the Dreadnought programme, and its impact on the MOD’s overall equipment plan. In January 2018 the [National Audit Office](#) stated:

Nuclear-related projects (the nuclear enterprise) represent around a quarter of the Plan. They are inherently complex projects and, because of their size, have the potential to destabilise the wider plan. In particular, the Dreadnought project accounts for a significant proportion of the estimated cost of buying equipment in the Plan. It is at an early stage in its life cycle and consequently forecast costs are immature and have continued to increase from the original estimation. Growth in costs in the early years of the project has created affordability pressures within the Plan. In July 2016, the Department approved costs to begin building the first Dreadnought submarine, even though it was unaffordable in the early years of the project...<sup>53</sup>

To that end, in February 2018 £300 million was brought forward into the Dreadnought programme, from elsewhere in the defence budget, in order to keep the programme on track.<sup>54</sup> This is not additional money for the programme, and as the Secretary of State said in evidence to the Defence Select Committee at the time:

What is important to emphasise is that we are not talking about the whole cost of Dreadnought changing. What we are talking about is that it is important to get the

<sup>51</sup> A full list of long lead items is discussed in Library briefing paper CBP7353, [Replacing the UK’s ‘Trident’ Nuclear Deterrent](#), p.52-53

<sup>52</sup> Ministry of Defence, [The United Kingdom’s Future Nuclear Deterrent, 2019 Update to Parliament](#), p.2

<sup>53</sup> National Audit Office, [The Equipment Plan 2017 to 2027](#), HC717, Session 2017-19

<sup>54</sup> This is discussed extensively in the Secretary of State’s evidence to the Defence Committee on 21 February 2018

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profile correct for when the money flows into the system and when it is needed. At the moment it is not as we would wish it to be.<sup>55</sup>

Indeed, in March 2018, the Director General of Finance at the MOD suggested in evidence to the [Public Accounts Committee](#) that, going forward, a further £1.2 billion of expenditure would need to be brought forward in the programme:

**Cat Little:** The DG Nuclear has concluded quite an extensive piece of assurance work on costing and is still of the view that it will not cost more than £31 billion, based on the exercise we have just completed. But it is absolutely profiled in a different way from what we think the profile of costs need to be to deliver the first boat in 2030. In the same way that we have brought forward £300 million into this financial year, we think there is a further £1.2 billion of expenditure, compared to the original profile, that needs to be brought forward.

Q82 **Chair:** So you are re-profiling it?

**Cat Little:** Yes.

Q83 **Chair:** But the total will stay the same?

**Cat Little:** The total will stay the same, but we think we need to spend more in the earlier years, mainly because we need to ensure that we are driving as much productivity as possible in our supply chain to build in the early stages, and to make sure that we fund it at the level we believe is necessary.<sup>56</sup>

The need to re-profile was subsequently reflected in the allocation of an additional £1 billion to the defence budget over the next two years in the Chancellor's Autumn 2018 budget statement. Intended to boost the UK's cyber capabilities and support the Dreadnought programme, the MOD confirmed in December 2018 that £400 million of that additional money would be invested in the project. The move was welcomed by many commentators, including Malcolm Chalmers of RUSI who observed:

The added Dreadnought allocation should allow the programme to proceed at a more optimal and cost-effective pace, taking advantage of opportunities for cost-saving investments when they arise while accepting new costs when judged necessary. This flexibility will shield other MOD procurement programmes from the destabilising effects which fluctuations in Dreadnought costs might otherwise have imposed on them. This is a welcome response to the dual risk that either other defence programmes would otherwise have been squeezed to pay for the deterrent, or the pace of Dreadnought construction would have had to be slowed, incurring significant additional costs in the long term.<sup>57</sup>

In 2018/19 HM Treasury also granted the MOD access to £600 million from the Dreadnought contingency fund during this period.<sup>58</sup> Again, the justification for doing so is to allow the MOD to eliminate cost and risk from later in the programme and to keep the project on track.

### *2019 Spending Round*

Further funding was allocated to the MOD in the 2019 Spending Round. HM Treasury has made an additional £300 million available to the MOD in 2019/20 for priority capability programmes. That will be followed by an additional £1.2 billion for capabilities in 2020/21. Dreadnought was identified as one of the priority programmes that will benefit

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<sup>55</sup> Defence Committee, [Oral evidence: departmental priorities](#), HC814, 21 February 2018. Q.78

<sup>56</sup> Public Accounts Committee, Oral evidence: defence equipment plan 2017-2027, HC880, 14 March 2018, Q.81-83

<sup>57</sup> Malcolm Chalmers, RUSI Commentary, 30 October 2018

<sup>58</sup> HC Deb 28 March 2018, c756

from that funding, although it is unclear exactly how much will be allocated to this specific project.<sup>59</sup> In October 2019 the MOD stated:

This additional funding will enable our world-class Armed Forces to begin to modernise and meet the intensifying threats and risks we now face, including prioritising investment in key capabilities such as shipbuilding, offensive cyber and the nuclear deterrent. We will decide on the allocation of this funding as part of our normal financial planning and budgeting process.<sup>60</sup>

In addition to funding set out in the 2019 Spending Round, a further one-off allocation of up to £200 million for additional Dreadnought costs has been made available from the contingency fund in 2020/21, should programme exceed its expected costs this year.<sup>61</sup>

### Overall spend so far

In its [2019 Update to Parliament](#) the MOD confirmed that the programme remained within budget and that £7 billion had been spent so far on the concept, assessment and early delivery phases of the project, to date.

- £1.2 billion of that total spend was in the 2017/18 Financial Year.<sup>62</sup>
- £1.5 billion was spent in the 2018/19 Financial Year.

The most recent [annual report](#) of the Infrastructure and Projects Authority (IPA) also concluded that the programme remains within its overall £31 billion forecast.

### Who will pay for it?

There has been a longstanding debate over the budgetary responsibility for the nuclear deterrent.<sup>63</sup>

However, in line with convention, the Dreadnought programme will be funded from the MOD's core equipment budget.

This was reiterated by the MOD in answer to a Parliamentary Question on 14 November 2017, amidst calls for spending on the Dreadnought programme to be taken out of the MOD budget as part of the Department's then review into defence capabilities:

**Lord West of Spithead:** To ask Her Majesty's Government whether, in their current review of defence options, they will review whether or not the Vanguard class submarine replacement programme should be dealt with outside the defence budget.

**Earl Howe:** The Dreadnought programme is rightly funded as part of the Ministry of Defence's budget. We remain on track to deliver this programme within the £31 billion budget, with the first in the Dreadnought class entering service in the 2030s.<sup>64</sup>

The then Defence Secretary, Gavin Williamson, clarified his Department's responsibility for funding the deterrent in a Written Statement on 7 December 2017,<sup>65</sup> and on 11 December a Treasury Minister confirmed "The Government has no plans to transfer the costs of upgrading or replacing the UK's nuclear deterrent from the Ministry of Defence to another Government accounting department at this time".<sup>66</sup>

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<sup>59</sup> HM Treasury, Spending Round 2019, Table 2.7: Ministry of Defence

<sup>60</sup> PQ290758, *Armed Forces: Finance*, 1 October 2019

<sup>61</sup> Ministry of Defence, [The United Kingdom's Future Nuclear Deterrent, 2019 Update to Parliament](#), p.3

<sup>62</sup> Ministry of Defence, *The United Kingdom's Future Nuclear Deterrent, 2018 Update to Parliament*

<sup>63</sup> The history of this debate is set out in Library briefing paper, CBP8166, [The costs of the UK's strategic nuclear deterrent](#)

<sup>64</sup> PQ HL2751, *Procurement: Trident submarines*, 14 November 2017

<sup>65</sup> HCWS328, 7 December 2017

<sup>66</sup> PQ116056, *Trident*, 11 December 2017

However, the allocation of additional funding for the MOD in the Autumn 2018 budget statement and the 2019 Spending Round, in part to fund the early years of the Dreadnought programme, has once again opened up the argument about which Department should be funding the nuclear deterrent. In a similar vein to the disagreements which arose following the 2007 Comprehensive Spending Review, these allocations of additional funds have been viewed by many as an indication of the Treasury's role, and responsibility, in part-funding the capital costs of the programme. In a debate on the budget on 13 November 2018 Lord West commented:

If the two tranches of money from the Treasury into the Dreadnought programme are an indicator that there is an acceptance that the capital cost of the new deterrent submarines should be funded outside the defence budget, I welcome it. That will make a dramatic difference to the MoD programme. This of course was the plan until changed by George Osborne in 2010. Can the Minister tell us whether it is now the plan again? I hope that it is.<sup>67</sup>

In March 2020 the Chairman of the Defence Select Committee, Tobias Ellwood, also expressed his support for taking deterrent funding out of the defence budget.<sup>68</sup> In response to questioning Sir Stephen Lovegrove, Permanent Secretary at the MOD, commented:

I think there is a very good argument for applying some form of ring fence around the biggest elements of nuclear. When the cost profiles move, which they inevitably do, they do have the ability, just because of their sheer scale, to impact the rest of Defence quite a lot.

The best example, again, is to look across to America. In America, the nuclear component of the DOD's budget is about 6% or 7%. When we are at the height of the recapitalisation that I talked about earlier, the nuclear component of the Ministry of Defence's budget is going to be up at around 18% or 19%. It is a very, very big swing factor, and that is an active subject of conversation with the Treasury.<sup>69</sup>

### Comparison to other Government spending<sup>70</sup>

Assuming the entirety of the £10 billion contingency fund is spent, at potentially £41 billion the Dreadnought programme is one of the most expensive Government projects going forward. It is a project that has around twice the budget of Crossrail, and three times the budget of the London Olympics.<sup>71</sup>

With respect to departmental spending, the running costs of the nuclear deterrent (presently around £2.3 billion per year) is often compared to the benefits bill, or NHS spending.

In 2018/19, for example, the estimated cost of maintaining the nuclear deterrent would be around 1 percent of total planned Government expenditure on UK social security and tax credits expenditure in that year.

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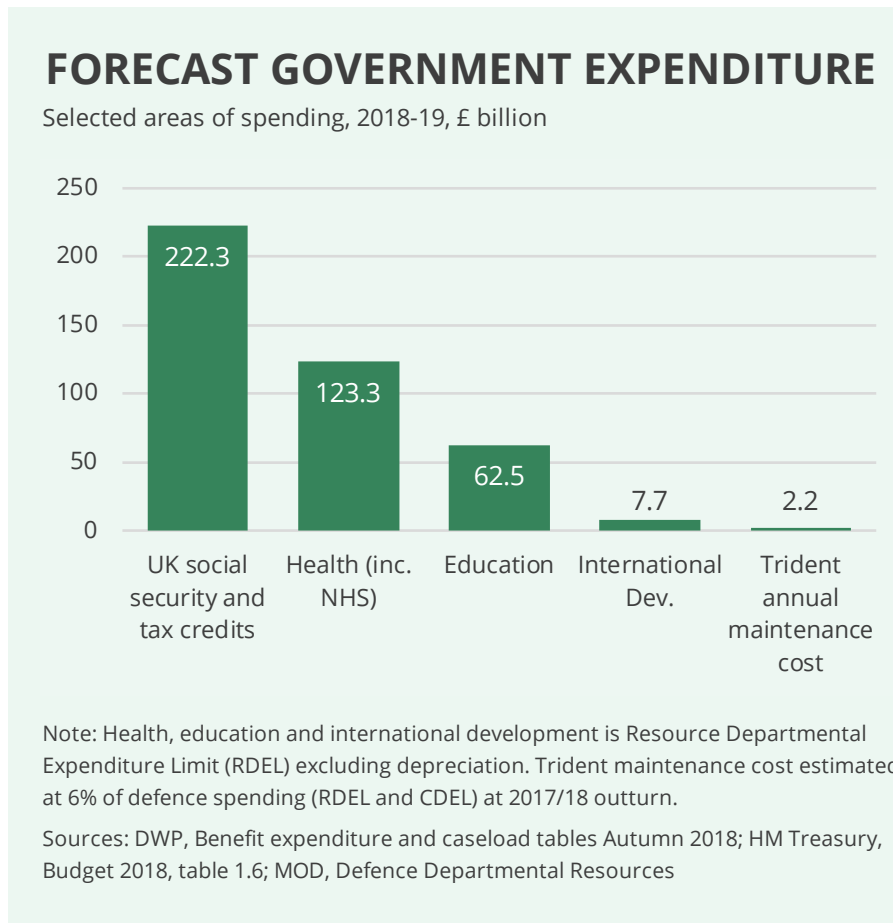
<sup>67</sup> HL Deb 13 November 2018, c1819

<sup>68</sup> Public Accounts Committee, Oral evidence, Defence Nuclear Infrastructure, HC86, 11 March 2020, Q.107

<sup>69</sup> Ibid, Q.108

<sup>70</sup> With thanks to Noel Dempsey in the Social and General Statistic Section of the House of Commons Library.

<sup>71</sup> Michael Fallon [speech](#) to a reception of the Keep Our Future Afloat Campaign, House of Commons, 21 October 2015.



The £2.3 billion spent on maintaining the nuclear deterrent per year is roughly equivalent to £44 million per week, or around £35 per person per year.<sup>72</sup>

Alternatively, £2.3 billion a year is roughly equivalent to what is spent on Income Support, Statutory Maternity Pay, Carer’s Allowance, or Winter Fuel Payments (each of which are around £2 – £2.9 billion per year).<sup>73</sup>

According the Treasury’s 2018 Autumn Budget, the planned spend on the costs of providing health care (including the NHS) in 2018/19 was £123.3 billion. This equates to around £2.4 billion per week.

<sup>72</sup> Based on ONS 2017 mid-year population estimate for the UK.

<sup>73</sup> DWP, Benefit Expenditure and Caseload tables 2018, Table 1b.

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