Memorandum from Dr Lee Willett

1. The Strategic Context: Why the UK Needs a Strategic Nuclear Deterrent

1.1 Currently, the wrong debate being had, which is why many will welcome the HCDC debate - especially structured, focused, balanced and transparent as it is. There has been too much focus on the what, when and how much: these are very valid questions, but valid only after addressing the questions of `what is deterrence, what is it for, how do you do it, why do we need it, and what is its value to the UK?' In sum, the first question is why, not what.

1.2 Deterrence is a political, and not a military, matter.

1.3 Key value of strategic nuclear deterrence to the UK:

1.3.1 **Grand strategic deterrence**

· Political tool to deter other nuclear-capable powers, especially at a time of growing proliferation.

· The history of armed conflict is a history of wars taking people by surprise. From UK perspective, Falklands, Gulf War and 9/11 were all surprises. Cannot predict what threats will emerge in the next 50 years.[1]

· Threat is the sum of capability plus intent. Capability takes a while to develop. Intent can change much more suddenly.

· Common view that the UK does not face a threat today that can be offset by nuclear weapons. Nuclear materials, technologies, weapons and delivery systems are proliferating.

· While effective deterrence requires a range of options other than just nuclear weapons to deter a wider range of threats, strategic nuclear deterrence is designed to deter high-end threats to the survivability of the nation, only nuclear weapons can deter a nuclear weapon, and no other nuclear power is considering giving up its capability while many other nations - not to mention non-state actors - are looking to acquire the capability.[2]

· As long as other potential enemies possess nuclear weapons, the UK must retain its strategic nuclear deterrent. The challenges are to make the capability more relevant to new challenges with a more flexible - and perhaps smaller - inventory.

1.3.2 **International status**

1.3.2.1 It is an implied tenet of British security policy that being a nuclear power is fundamental to the UK's international status. A nuclear deterrent could be argued to provide the UK with:

· considerable authority in international political structures

· status in Europe and in the world as a whole

· a political balance in Europe

· a safeguard against US dis-engagement in Europe

· a balance against global instability

1.4 **Nuclear Disarmament**

1.4.1 Just because the UK may reduce or abolish its capability does not mean that others will follow suit. Each declared nuclear power - never mind those wishing to and trying to develop such a capability - has its own reasons for keeping theirs that are wholly unrelated to the implications of any UK decision to abolish its own capability and, even, to pressures for multi-lateral global nuclear disarmament.

1.4.2 However, the UK could make a contribution to disarmament, for example through reducing warhead or missile inventories, while retaining sufficient capability to provide a flexible deterrent.

2. Decisions

2.1 Once you have addressed the question of why, if the answer to that question is that the UK does require a nuclear deterrent capability, there are a variety of capability choices available- each with their own performance, time and cost implications.

2.2 What must the UK Government decide in this Parliament? There are, perhaps, three levels of decision, at the top end one major political decisions down to a series of capability decisions that can inform, shape or influence the major decision. The question is what decisions are required, and when.

· Level One - Retain or abolish the nuclear deterrent. There is a decision in principle to be made before any investment in retention is decided. A final conclusive decision could wait until there is commitment to major investment. This could be at: the Initial Gate, when the UK takes the decision to move into the investment phase; or conceivably not until the Main Gate stage of commitment by Government to the programme, when the major investment decision for development and manufacture is taken.

· Level Two - upgrade or extend the existing system, buy a direct replacement, or develop a new capability. This decision could be based initially on a Level One decision in principle. Final commitment to an answer would be at Main Gate stage although many options would be dispensed with at Initial Gate.

· Level Three - current capability decisions, including the investment of funds at the Atomic Weapons Establishment (AWE), Aldermaston, or funding designs for the next generation of submarine. Some of these decisions are already being taken. Others may be taken depending on any decision to invest in 'Concept Phase' work on refining capability options or in moving to Initial Gate. Even if the decision taken in this Parliament is only to move the main decision right as much as possible by extending the life of the current boats by five years, these decisions are critical to ensure that, when the decision eventually does have to be made once and for all, the Government still has all options open.

3. Capabilities

3.1 The capability issues have to be discussed in broad terms at this early stage because they relate to strategy, timelines and cost issues. These issues cannot be addressed independently of technology. What we need to replace and when is crucial.

3.1.1 The capability requirement should be established on the basis of an assessment of the likely effect required back to the delivery system needed to deliver that effect and to the affordability of those options.

3.2 Platform options

3.2.1 Land-based system

3.2.1.2 A ballistic missile deployed on UK soil.

3.2.1.3 The system would give the UK global reach.

3.2.1.4 The UK would need to develop - indigenously or in partnership - an Intercontinental Ballistic Missile (ICBM), a new warhead, a new launch site, and supporting infrastructures. Perhaps some of these costs could be offset with a joint programme with the US, especially if the offensive capability could be put in place under the umbrella of a US ballistic missile defence (BMD) system on UK soil.

3.2.1.5 However, the lack of a US programme would mean that the UK would need to bear a large proportion of the costs for this option. This option also would represent a huge political cost, and would turn part of mainland UK into a potential target. Lastly, a land-based system would be liable to pre-emption, therefore undermining deterrent.

3.2.2 Air-based system

3.2.2.1 Aircraft-deployed options: a nuclear-armed cruise missile; or a free-fall nuclear bomb.[3]

3.2.2.2 An air-launched system would provide a degree of flexibility.

3.2.2.3 However, this option would require: a new aircraft; a new warhead; a base on mainland UK; and other infrastructure support.

3.2.2.4 Aircraft options

· The UK does not have a strategic bomber (as announced in the Quadrennial Defense Review, the US is looking to develop a future strategic bomber programme: however, the emphasis for this programme is on conventional munitions).

· The UK could consider basing the weapon on existing transport and surveillance aircraft, but this option risks these assets being required for other tasks at other times.

· A shorter-range aircraft might need to be based overseas for some operations, and this risks denial of basing rights.

3.2.2.5 Aircraft and any missile would need overflight rights for most missions. Air-based options also are liable to pre-emptive attack, thus undermining deterrent.

3.2.3 Sea-based (surface system)

3.2.3.1 Nuclear-armed cruise missile fitted to UK escort flotilla (UK surface ships do not have the capacity to carry a ballistic missile). A neat fit with any potential sea-based BMD capability.

3.2.3.2 However, a surface ship is visible and thus can be targeted. The UK escort flotilla is also tasked with many other roles.

3.2.4 Sea-based (sub-surface system)

3.2.4.1 Unique benefit of the sub-surface option is the invulnerability required to guarantee the survivability of the deterrent. If a system can be seen, it can be hit and will not deter.

3.2.4.2 The UK already has a submarine platform and missile system programme, and the infrastructure support already is in place.

3.2.4.3 Options:

· Nuclear-armed cruise missiles on UK SSNs. UK SSNs already fitted for *Tomahawk* cruise missiles, and submarine support infrastructure exists already. However, the SSNs are tasked with other missions.

· Hybrid submarine, capable of conducting both SSN and SSBN operations and carrying a variety of payloads. Main driver here would be affordability of two classes of nuclear-powered submarine.[4] The UK's *Astute* class submarine would need to be re-designed before it could carry such a payload, however.

· Continue with a dedicated SSBN. By threatening to exert the most catastrophic use of force from an independent, autonomous, invulnerable platform deployed in a Continuous At-Sea Deterrent cycle, SSBNs are the most effective form of deterrence. SSBNs have the flexibility to carry a variety of nuclear and conventional systems - SLBMs, *Tomahawk* cruise missiles, Intermediate Range Ballistic Missiles (IRBMs), each of which with either nuclear or conventional warheads. A deterrent system deployed in a continuous cycle also underlines commitment to the deterrent, reduces risk of escalation (if a boat is seen to sail during a period of tension) and also - most critically - guarantees the survivability so fundamental to effective deterrence.

3.3 Weapon System options

3.3.1 Cruise Missiles

3.3.1.1 Much debate focused on cruise missiles on the grounds that their capabilities are more credible in light of today's threats, but - perhaps most importantly - under the perception that they are cheaper.

3.3.1.2 Host of problems associated with total reliance on cruise missiles.

· Cost: design and test of new warhead (thus violating the Comprehensive Test Ban Treaty).

· Cost: only single warhead weapons, a much larger number of missiles would be needed to carry the current inventory of warheads.

· Capability: slow speed means that they can be shot down, so deterrent impact not credible.[5]

· De-stabilizing: dual nature of weapon risks escalation as adversary will not be able to tell if missile is nuclear or conventional until it hits.[6]

· UK does not have an indigenous capability. *Tomahawk* is a US-made weapon. UK *Storm Shadow* conventional only, air-based only and short-range. France is developing a longer-range, sea-based version.

· Nuclear cruise missile: US has no Block V *Tomahawk* funding, nor is it looking at a nuclear warhead option. All R&D would be down to the UK.

3.3.2 Ballistic Missiles

3.3.2.1 Ballistic missiles are only system that deliver the global effect at place and time of choice, with autonomy through national and international air space.

3.3.2.2 Current D5 missiles have planned life of 25 years. In service 1994.

3.3.2.3 US developing a new version of the D5 missile, the D5 LE, which includes upgrading existing missiles.[7] These missiles will remain in service until 2040s. UK has not yet determined whether to opt for this improved version.

3.3.2.4 US plans for conventional warheads for ballistic missiles carry same dual nature/escalation risks that cruise missiles carry (see above).

3.2.3.5 However, UK extending current capability may also mean buying into the programme to ensure UK has missiles available for an extra five years.

3.2.3.6 No evidence to suggest US is looking at the D5 as a land-based option.

3.3.3 Nuclear Weapons

3.3.3.1 Current UK Warhead Issues

· UK looking at research, capability and stockpile issues.

· An upgraded warhead would not need to be re-tested.

· Critical step: the investments in the AWE at Aldermaston to ensure sufficient support for the current deterrent system and to retain the capability to develop an upgraded warhead if the Government requires it.[8] The current warhead design can be maintained in service at least into the 2020s, with some relatively minor upgrading and refurbishment during the first half of the next decade.[9]

3.3.3.2 Reports suggest UK discussing with US options for more accurate, smaller and cheaper nuclear weapons:

· Part of logic here appears to be that smaller weapons are potentially more useable, and are therefore more effective as a deterrent against some of the new threats.

· These should be seen as one component in a deterrent package.

3.3.4 Conventional Weapons Options

3.3.4.1 As well as the conventional options noted above, UK could look at other options such as kinetic energy warheads.

4. Timelines

4.1 The UK national strategic deterrent is a system of systems, including the missile, warhead, the submarine, and the supporting infrastructure. Extending, upgrading or replacing these components represent the timeline challenges which are driving the UK debate.

4.2 **Critical decision element: lead time to design and build a new submarine**

4.2.1 The key timeline in this debate relates to the submarine. Warhead exists already. Missile/s exist already. Infrastructure support largely in place. No decision yet taken on the out of service dates for current deterrent platforms.

4.2.2 Can service life of current boats be extended?

· The key timeline is when HMS *Victorious* comes out of service around 2019-2020. *Victorious* is the second boat in the class, and when she withdraws from service the UK will no longer be able to carry out Continuous At Sea Deterrence unless a replacement boat is in service.

· This time period can be extended if the decision is taken to extend the life of the submarines. However, extending the life expectancy of current boats by five years does nothing more than defer the decision.

· If service life of SSBNs is extended by five years from the current service life of 25 years, whole system has a life-cycle of up to 30 years.

· Beyond this, meeting UK's safety requirements for the hulls may require an investment that no longer delivers value for money given the age of the hulls themselves, with costs of running the boats increasing and availability likely to reduce. At that point, building a new boat simply delivers better value for money.

4.3 Some argue a new submarine design is needed: others argue that the *Astute* SSN design could be developed for an SSBN programme. Key here is what the capability requirement will be: speed, what weapons/how many, number of tubes. Also, even though new nuclear reactor cores have been developed (meaning that cores do not replacing during the life of the submarine), the propulsion system design may need to be refreshed to ensure it will still be sufficiently current in the 2050 timeframe.

5. Costs

5.1 Costs of a replacement (whether by renewal or refurbishment) cannot be known until a decision is taken and when programme requirements and parameters are known. Also highly relevant to cost is the chosen deterrent strategy which will define among other things the number of warheads and the nature and readiness of delivery systems.

5.2 Like *Polaris* before it, ***Trident*** came into service on time and under budget. ***Trident*** absorbs around 3-4% of the UK's defence budget for each year.[10]

5.3 Who will foot the bill for any new system? One the one hand, the UK strategic deterrent is a political tool that should be paid for by the Government. On the other hand, allocating the replacement system to the defence budget might put at risk other key programmes.

5.4 Timelines and costs - potentially could be reduced by increasing co-operation with the US. However, significant political issues on both sides here.

6. Conclusions

6.1 The three key capabilities for a credible independent deterrent are: a survivable platform; a survivable weapon system; and the autonomous ability - from a sovereign platform in international waters, through international airspace to a point in the sky and on to a latitude/longtitude point on the earth's surface - to deliver effect at place and time of choice.

6.2 Assuming the Government decides that the UK continues to require a strategic deterrent, a submarine-based option is the only one which guarantees the survivability which is fundamental to effective deterrence.

6.3 Dan Plesch argues that `it is unrealistic to consider that the world can continue indefinitely with uncontrolled armaments and not see a nuclear war.'[11] However, given the changing nature of the threat, the logical solution for the UK Government would be to

retain a minimum strategic nuclear deterrent and to deliver a more flexible range of capability options in the submarine package, while perhaps making a contribution to disarmament by reducing warhead and missile levels, and while delivering this capability for the same or less cost than the original ***Trident*** programme.

6.4 Until the decision is no, the UK must continue to plan as if it is a yes. This includes taking key capability decisions to ensure system remains current and to ensure all options are available to Government. If the decision is no, could take boats out of service today. However, in Government statements there has been no mention of abolishing capability - only to `modify, replace, update or diminish', or `reduce'.

6.5 Delay in making decision/s also risks a potential increase in costs. Risk of losing skill base in Barrow. Hard point of 2019 for when replacement system needs to be in service, and development and manufacture phase will take a set amount of time: thus, delay in making decision/s means that assessment phase may need to be truncated; doing this increases risk and, possibly too, costs. Any gap in programme also, arguably, denies UK ability to re-constitute programme in time.

6.6 Defence Industrial Strategy underlines UK need to retain sufficient - and independent - understanding of all the elements of a nuclear deterrent, including the complex weapon systems and platforms (notably submarines) that form a core part of this capability.

6.7 Given the length of time required to bring a new system into service, the Government should currently be at the stage where it is looking to fund concept phase studies, such as capability and user requirement studies, to define capability and cost issues for all options, and - if required - developing a submarine design for a new SSBN.

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[1] Any successor system to ***Trident*** will be in service for 30 years from 2020 or so.

[2] In 2002, the Atomic Energy Commission (AEC) declared that as many as 35 states had the knowledge to build nuclear weapons. In 2005, the Nobel Peace Prize was awarded to International Atomic Energy for their work in halting those trying to convert civil nuclear programmes into military capabilities.

[3] Under the 1998 Strategic Defence Review, the UK withdrew the air-based WE177 freefall bomb.

[4] The US has developed four of its *Ohio*-class submarines for a conventional role, and is considering adapting its *Virginia*-class SSNs to carry SLBMs as well as fitting conventional warheads to ***Trident*** D5 ballistic missiles.

[5] In combat, several US *Tomahawk* cruise missiles have been shot down using surface-to-air missile systems. In test firings, *Tomahawks* are regularly tailed by a chase plane, indicating that they can be tailed and shot down by aircraft.

[6] This risk, with the implication that the adversary might push the nuclear button just in case, was precisely the reason why the US and the Russian Federation gave up their sea-based nuclear cruise missile programmes under the START negotiations.

[7] This process includes replacing some specific missile components, including the re-entry vehicle, or `bus' (see: Youngs, T. & Taylor, C. `***Trident*** and the Future of the British Nuclear Deterrent.' House of Commons Standard Note SN/IA/3706. 5 July 2005. pp.11-12; `US Navy to Extend Life of ***Trident*** Force', in *Jane's Missiles and Rockets*, 1 September 2000). For additional reference, see: House of Commons Select Committee on Defence. *Memorandum Submitted by the Ministry of Defence*. 20 January 2006.

Available on-line: http://www.publications.parliament.uk/pa/cm200506/cmselect/cmdfence/835/835m04.htm .

[8] In 2005, the MoD announced a £2bn upgrade (see: MoD, Press Notice. `Facilities Upgrade for Atomic Weapons Establishment.' Press notice 146/2005. 19 July 2005; Ingram, RtHon Adam, MP. Response to Written Questions, 7 June 2005, column 464W. Available on-line: http://www.acronym.org.uk/uk/written.htm). An investment of a further £5.3bn had been announced in 2003 (see: Reid, Rt Hon John, MP. House of Commons Hansard Written Answers, 3 November 2005, part 7. Available on-line: <http://www.publications.parliament.uk). For further reference, see also: House of Commons Select Committee on Defence. *Memorandum Submitted by the Ministry of Defence*. 20 January 2006. Available on-line: http://www.publications.parliament.uk/pa/cm200506/cmselect/cmdfence/835/835m04.htm .

[9] House of Commons Select Committee on Defence. Ibid..

[10] ***Trident***'s acquisition cost reached just under £15bn, it has through life costs of around £280m per year, and has occasional additional expenditure at Aldermaston and elsewhere. This gives a total cost of under £25bn over its potential 30 year life-expectancy.

For reference on ***Trident***'s acquisition costs, see: Hansard, 18 Jan 2005 - Written Ministerial Statements, column 27WS.

[11] Plesch, D. (2006). `The Future of Britain's WMD'. London: The Foreign Policy Centre. p.i.

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