



Short policy brief

Will Trident Still Work in the Future?

Developments in anti-submarine warfare could be decisive

Paul Ingram, BASIC Executive Director, 22 January 2016

The challenge

Emerging developments in technology that are transforming our lives and already revolutionising the battle-space in air and on land *could* ensure that submarines will no longer be stealthy in the foreseeable future, however silent they are. This is undeniable, and claims that these risks are minimal to Trident's future are patently false. The judgement comes in assessing this risk and when it becomes operational, based upon the speed of technology development today, and what countermeasures that could be developed. This briefing outlines the risk and its consequences to the programme.

Importance of stealth

The submarine is widely seen as the most effective platform to carry intercontinental ballistic missiles. Hidden under the oceans, one as sophisticated as the UK's Vanguard class discloses its location only once it has launched its first missile. The Vanguards carry the highly accurate and reliable Trident II D5 missiles, with an extraordinarily accurate first strike capability and a near-certain second-strike retaliatory option. This forms the bedrock of the UK's nuclear deterrent posture and is the only nuclear weapon platform, ensuring that any aggressor has to account for the UK's ability to respond with massive devastation. The Trident system - the submarines, missiles and warheads - involves extraordinary technology (described as superior to that used in space travel) and is the most sophisticated nuclear weapon delivery system on the planet. It is for these reasons, as well as the UK's legacy commitment to this technology and its relationship to the United States, that other nuclear weapon options have been so clearly rejected.

But the integrity of Trident depends critically upon the stealth of the submarines and the effectiveness of systems that protect them. If adversaries can confidently track them, submarines are a very poor platform to carry strategic weapons. They are slow and vulnerable once detected, and can be immobilised even with indirect explosions under the water. Prompt strikes can be delivered from long distance once coordinates are determined. And immobilising a submarine in the ocean does not carry the same strategic risk as attacking the UK itself, making it a far more attractive proposition for any aggressor seeking to neutralise the UK's nuclear deterrent.

Growing threat

There have been steady developments in anti-submarine capabilities over the decades, but advances in stealth and reactor technologies have ensured (so we are assured) that the Trident submarines have stayed one step ahead, and undetected. Because sound travels so well under water much has focused upon active and passive sonar: detecting and shielding acoustic signatures. The technologies are as highly classified as the design of the warheads the submarines carry because of the strategic impact from this competition. Confidence in the ability of submarines to evade detection up until this point has been high, and the threat from anti-submarine warfare (ASW) is not generally seen as new. Ideas of the seas becoming transparent with the emergence of new technologies have long been imagined, but they have not been forthcoming. But assumptions that this will be the case in future are complacent and go against the newly emerging evidence.

What we are witnessing now are likely disruptive steps in the development of a range of technologies and systems using detection methods that could render submarines visible and therefore highly vulnerable. Totally silent submarines may evade passive sonar, but they leave other signatures such as water movements that may be picked up by certain sensors under development. Active sonar for detection of stealthy objects continues to rapidly develop. Acoustic technologies and lasers are fast developing as reliable methods of underwater communication over significant distances.

Aircraft, ships and hunter-killer submarines have long been involved in ASW operations, with satellites contributing a good deal more recently, but their combined capabilities are significantly improving using these detection technologies, operating with rapidly-developing computing capabilities and algorithms. Perhaps the most eye-catching emerging development is in the field of autonomous and semi-autonomous drones (unmanned underwater vehicles), able to patrol a defined area looking for submarines; these have for some years been used in the commercial space. When communicating and operating in packs or swarms they could change outcomes considerably and mean high-confidence submarine detection and tracking across large areas of ocean. Submarines could be picked up and tracked soon after leaving port or when discovered in the open ocean. Underwater drones, far smaller than their prey, do not require the same levels of power as large manned submarines, and it cannot be long before they will be able to match the (walking to jogging) speed of the Vanguards on patrol for months on end, using solar or other rechargeable battery sources.

Countermeasures

Of course technologies available to the ASW mission are also available to those defending the submarine. It is possible to imagine armies of drones defending submarines or creating decoy signatures, submarines deploying technologies to disable drones or sensors. The problem remains that when considering large numbers of drones, a plethora of sensors and the utility of significant computing power, it seems inevitable that the location of the submarine - a very large metal object with a nuclear reactor in it - will be compromised. This is a similar function to the tendency for the world to feel smaller and more connected in our everyday lives. The oceans will always be massive, but the capabilities to hide in them are rapidly diminishing.

Broader context

Driven by developments in our everyday world, the decisive military systems of the near future look very different from those of the recent past. The trends favour those systems that are small, mobile, networked and integrated, open source, often employing remote or autonomous control, and increasingly cheap and disposable. Increasingly expensive platforms acquired in very small numbers, designed and constructed over many years, and involving technologies out of date before the systems come into service, are deeply vulnerable to those systems that will have undergone a large number of generational developments in that same lead-time.

The latest publication from MoD's team responsible for long term strategic trends on the defence context includes the following observation:

Pursuing niche technological dominance will need to be constantly assessed and balanced against cheap, often commercial, low-tech systems that provide effective, and sometimes asymmetric, capability. Constrained budgets will demand that Defence balances the cost of current capability against a range of possible new threats. This will require a highly agile procurement process.¹

¹ *Future Operating Environment 2035*, DCDC Strategic Trends Programme, MoD, 14 December 2015, Radical reform of our acquisition process, p.38:
https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/484861/20151203-DCDC_FOE_35.pdf

The point is, technologies evolve and adapt, and the pace of this is speeding up. Submarines may well have been the ideal platform in the past, but they will not be in future. It is only a matter of when that future emerges, and the evidence suggests that it is closer than many would have us believe.

MoD lack of confidence, or overconfidence?

The Trident Alternatives Review of 2013 went into considerable detail comparing different platforms and delivery vehicles in terms of cost, effectiveness, vulnerability and other criteria. Though criticised for some extraordinary assumptions, particularly around the expected time it would take to design new warheads, the report gave some significant detailed picture of the thinking within MoD. It did not mention the vulnerability of ballistic missile submarines except to say, 'the ability to track a submarine may improve over time but it is still likely to be significantly harder to do than for ships or fixed sites such as silos or air bases.'² This neglects to mention the significant disadvantages for submarines once detected, mentioned at the start of this briefing.

The Strategic Defence and Security Review was released on 23 November 2015. It increased the budget for submarine construction by £6bn (the estimate at Initial Gate in 2011 was £25bn)³ and added on top a contingency of £10bn (an extra 32%) as a result of 'the greater understanding we now have about the detailed design of the submarines and their manufacture'.⁴

It also announced that the in service date for the first new submarine, originally planned in 2006 for 2024 (18 years on) and extended in 2010 to 2028 (18 years on), would now be 'the early 2030s' (18 years on).⁵ This in the face of previous protestations in the 2013 Trident Alternatives Review that 'any further extension [of the current Vanguard submarines] would require replacement through an extremely expensive and high-risk reconstruction of the submarines'.⁶ Notice too the move from clear dates (2024, 2028) to a vague range of dates (early 2030s).

So is this all illustrative of a lack of confidence in the project? The words of the review would suggest otherwise. It described this project as 'a national endeavour... one of the largest government investment programmes, equivalent in scale to Crossrail or High Speed 2'.⁷ Comparison to such controversial projects shows confidence. But this show of confidence was dented a little in the announcement of a departure from established defence procurement practice: 'moving away from a traditional single *Main Gate* approach, which is not appropriate for a programme of this scale and complexity, to a staged investment programme', and to

² *Trident Alternatives Review*, The Cabinet Office, 16 July 2013, p. 25,

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/212745/20130716_Trident_Alternatives_Study.pdf

³ *The United Kingdom's Future Nuclear Deterrent: The Submarine Initial Gate Parliamentary Report*, May 2011, p.10
https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/27399/submarine_initial_gate.pdf

⁴ *National Security Strategy and Strategic Defence and Security Review 2015*, HM Government, 23 November 2015, p. 34:

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/478933/52309_Cm_9161_NSS_SD_Review_web_only.pdf

⁵ *Ibid.*, p.36

⁶ *Trident Alternatives Review*, The Cabinet Office, 16 July 2013, p. 38,

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/212745/20130716_Trident_Alternatives_Study.pdf

⁷ *National Security Strategy and Strategic Defence and Security Review 2015*, HM Government, 23 November 2015, p. 35:

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/478933/52309_Cm_9161_NSS_SD_Review_web_only.pdf

‘finalise investment proposals to begin the next phase, focused on risk reduction and demonstration’.⁸

Any idea that this project was simply an upgrade of components and design modifications for a submarine whose operations are well understood is surely now discredited. This is a bigger project, with greater challenges to that faced the designers of Vanguard. This is almost certainly down to a dramatically changed underwater operating environment for the submarines.

Conclusion

The debate that rumbles on in British politics over the renewal of Trident involves legacy issues, assumptions over commitment to defence, Alliances and Britain’s role in the world. Some use it to ascertain individuals’ trustworthiness or their ability to govern, the willingness to stand up to bullies or the guts to deploy forces abroad. Whilst some question the utility of nuclear deterrence, the assumption until now shared by all is that the Trident system, whilst hugely expensive, is the most effective means of rapidly and reliably delivering nuclear weapons at vast distances with extraordinary accuracy from platforms that remain hidden. That assumption is about to be challenged, something that should concern anyone convinced of Trident’s importance to the security of the UK. There needs to be an urgent review of the risks involved in relying upon a system that may not work within the next 20 years, before any further major investment is committed to the programme.

⁸ Ibid., p. 36