Underwater wars and washed up robots: how autonomous drones could undermine deterrence and turn oceans into invisible battlegrounds

Working Paper

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Introduction

From cyber threats to the lack of threat altogether, various arguments have been made to suggest that the UK's current Trident replacement plans will not be fit for purpose by the end of the 40 years that it will take to complete them.

This paper will question how advances in oceanic drone technology will affect the operation of nuclear-powered ballistic missile submarines armed with nuclear warheads (known as SSBNs).

I suggest that in the 21st century, technological developments will allow oceanic drones to locate, monitor and track nuclear submarines. This will have two effects. The first is to make continuous at-sea deterrent (CASD) unviable by rendering all nuclear submarine fleets visible and targetable, thereby undermining their second-strike guarantee.

Secondly, through the proliferation of submarine-hunting drones, and drones hunting these drones, our oceans could become a new kind of invisible battleground characterised by a state of secret, continuous at-sea skirmish.

Although the issues in this paper may seem far-off and provocative, and may even sound like science fiction to some people, I hope to convince you that they are issues which need to be debated thoroughly and today.

The effect of drones on deterrence

Fundamentally, nuclear deterrence rests on the idea of guaranteed second-strike capability. For example, if Russia were to carry out a nuclear strike against London, they would do so with the understanding that they could not prevent the UK from striking back using its continuous at-sea deterrent, the Trident missile system (ignoring NATO's potential, wider role). In order for deterrence to make sense – if we decide to buy into its logic at all – both states must therefore *believe* that there is a credible threat of an unpreventable retaliatory strike.

In addition to needing to be invulnerable from sabotage or cyber attack, at the heart of the UK's guaranteed second-strike capability is that the locations of its on-patrol submarines are secret. Once a submarine is located, deterrence is compromised, as the submarine can be damaged or destroyed simultaneously with the primary target.

While all five P5 members and others use SSBNs, the UK is the only member that uses solely a submarine-based delivery system for its nuclear weapons. Putting all its eggs in one nuclear basket, so to speak, therefore makes the UK's second-strike capability uniquely vulnerable.

Undermining deterrence is the aim of all nuclear states

It follows, whether at war or at peace, that states should be researching and implementing ways to locate and track SSBNs so as to give them a strategic advantage. Human spies have presumably fulfilled this role traditionally as, until recently, physically locating SSBNs has been considered a technological impossibility. SSBNs are covered in acoustic tiles that make them near-silent and undetectable by radar, and there are simply not enough 'eyes' in the oceans to make them transparent.

Such fears continue to be discredited from the highest level, and the paradigm remains in public discourse too: the BBC in January 2016 described the UK's nuclear fleet as always "gliding silently beneath the waves, somewhere in the world's oceans,"[1] an elegant turn of phrase that captures the almost mystical invisibility often attributed to Trident.

The technological paradigm is shifting

Drone technology, however, poses a threat to the paradigm. Though today drones may not be sufficiently developed to find submarines, the pace of technological change thwarts assumptions that this will remain the status quo. A number of civilian and commercial oceanic drones are already able to autonomously track moving underwater objects like fish and remain indefinitely at sea;[2] military research will likely have developed even further. In the twenty years it will take to launch the Successor Class,[3] it is very conceivable that drones could be developed that can indefinitely track submarines and permanently undermine their deterrent, if they have the following capabilities:

1. Renewable power source, using solar storage, wave, wind or a combination of the above.

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[1] "Corbyn: UK Could Keep Trident Submarines But Without Warheads - BBC News". *BBC News*. N.p., 2016. Web. 16 Mar. 2016.

[2] The commercially available Autonaut Unmanned Surface Vehicle, for example, is a solar powered drone that is being developed to track breeding patterns of fish from the surface. The Wave Glider, which uses wave and stored solar power, boasts that when functioning it is "persistently and continuously gathering data and streaming it in real-time," and it has been reported by IBT that this drone is already being used in classified missions for the Pentagon (IBT). OpenROV have even produced an open-source, low-cost underwater robot for exploration and education called Trident, which costs just over $1000.

[3] "Trident Is Vulnerable | British American Security Information Council". *Basicint.org*. N.p., 2016. Web. 16 Mar. 2016.

2. Capacity to move both on surface and underwater.
3. Energy efficient self-propulsion system able to outpace submarines (e.g. >25 knots).
4. Capacity for both autonomous and controlled movement.
5. Ability to operate continuously without needing to dock.
6. Relatively undetectable by radar.
7. Hypersensitive sensors and intelligent decision-making abilities.
8. Real-time data streaming to remote locations.
9. Low-cost production, launch and operation, allowing expendability.
10. Capacity to work in tandem with other drones.

'Seeker' drones with these capacities could roam the seas until they come across an unidentified submarine, after which they could remain on its tail, call in further seekers to form a swarm or even attach themselves to the hull and continuously transmit their location. Once a submarine is located, the seeking state is likely to have it for at least the remainder of its patrol. A recent briefing by Paul Ingram, Chief Executive of the British American Security Information Council (BASIC), suggested that the combination of these technologies would be "foreseeable in the next two decades."[4]

Criticisms of underwater drones

Critics may call this idea science fiction. The UK's Admiral of the Fleet the Lord Boyce suggests that it is unlikely that even future sensors will be able to locate or track a submarine effectively in the vastness of the ocean.[5] However, history has shown that even the relatively small number of submarines currently in the seas are capable of colliding. In 2009, the UK's *HMS Vanguard* and France's *Le Triomphant* collided while submerged in the Atlantic Ocean, apparently unable to detect one another. Following the incident, the nuclear engineer John Large told the BBC "that navies often used the same 'nesting grounds' […] quiet areas, deep areas, roughly the same distance from their home ports [which…] have got quite a few submarines, not only French and Royal Navy but also from Russia and the United States."[6] Similarly, in 1992, the USS Baton Rouge was hit by a Russian submarine trying to surface in the Baring Sea.

The evidence therefore suggests that if submarines are able to collide by accident, then a swarm of seeker drones looking to do it by design would need only to algorithmically distribute themselves around ports – for the UK, Her Majesty's Naval Base *Clyde* – as well as strategically around known submarine routes, or around geological features and currents suspected to provide cover, and wait.

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[4] "Trident Is Vulnerable | British American Security Information Council". *Basicint.org*. N.p., 2016. Web. 16 Mar. 2016.
[5] Boyce, Lord Michael. "Emerging Vulnerabilities To Nuclear Deterrent Forces". Lecture. 24th Feb. 2016. Lecture.
[6] "BBC NEWS | UK | Nuclear Subs Collide In Atlantic". *News.bbc.co.uk*. N.p., 2016. Web. 16 Mar. 2016.

Underwater wars

How might things progress? Let's extrapolate the same logical path. No state with SSBNs will simply allow oceanic drones to track its submarines unchallenged. Therefore, it can be safely assumed that measures will be, or are already being taken to counter that threat, perhaps in the form of a second fleet of automated drones (let's call them 'counter seekers') specifically designed to find and disrupt, or destroy seekers. A third type might even be programmed to undermine the efforts of that second fleet.

Around ports in particular, there may also be a permanent fleet of counter-seekers engaged in preventing seekers picking up submarines leaving port. However, it will become increasingly difficult to prevent seekers from finding a submarine as it moves away from port and national waters. Moreover, attacks on seekers could alert a state to a submarine's rough location.

What is likely to occur is a low-cost, underwater arms race for nuclear supremacy, that would turn our oceans into an increasingly militarised space characterised by a state of continuous, low-level and largely invisible conflict. As one fleet upgrades its technologies, so others would have to upgrade theirs, or find other ways to win out. Just as birds of prey are now being trained to take out aerial drones,[7] might military dolphins or sea lions be employed to disrupt underwater drones? Could this be why Russia this month decided to revive its sea mammal military programme?[8]

Implications

What are the implications of this vision?

There are moral issues. Do we really want our global commons, the oceans, to be increasingly militarised for the sake of nuclear supremacy? Could the automation of drones to destroy drones underwater pave the way for a similar scenarios becoming commonplace on land or in the air? Might manned crafts become the next targets?

There are regulatory and legal issues. How do we regulate the deployment of stealthy, autonomous drones in international and national waters? Would such technologies be covered under existing international law, and could it catch up in time? How do we go about enforcing these rules?

Security is another concern. Any nuclear force that does not have a guaranteed second-strike capability fails to fulfil the criteria of mutually assured destruction and therefore fails to be a credible deterrent. In this instance, nuclear weapons risk creating more, not less, instability.

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[7] Thielman, Sam. "Eagle-Eyed: Dutch Police To Train Birds To Take Down Unauthorised Drones". *the Guardian*. N.p., 2016. Web. 23 Mar. 2016.
[8] "Russia Looks To Buy Five Dolphins With Perfect Teeth And Killer Instinct". *the Guardian*. N.p., 2016. Web. 16 Mar. 2016.

And of course, there are financial and opportunity costs to the replacement of SSBN systems.

Regrettably, the opaqueness of the seas and of military technology is likely to make this an issue with which citizen engagement is low. Last Wednesday, it was announced that the MOD is putting together its first ever "Robo-Wars" exercise for the autumn, which promises to offer a "tactically representative environment of maritime autonomous systems."[9] It can be expected that other militaries for other states are doing the same. Yet it is essential that these scenarios are played out not just in military exercises but in the public sphere – comprehensively, carefully and seriously – and that informed choices as to the future of submarine-based nuclear deterrents are made. A £40bn submarine-based deterrent programme that has no ability to deter is as useful as a fleet of rubber ducks.

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[9] MacAskill, Ewen. "Ministry Of Defence Military Exercise Will Feature 'Killer Robots'". *the Guardian*. N.p., 2016. Web. 18 Mar. 2016.