

A DISTURBANCE IN THE FORCE

Debating Continuous At-Sea Deterrence

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Royal United Services Institute

OCCASIONAL PAPER

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Other papers within this series include an analysis of the pressures shaping the future of the UK's nuclear warheads; a discussion of the UK's approach to replacing its nuclear forces; and an analysis of the role of UK's co-operative nuclear relationships in this process.

Each paper presents these factors within their historical context, and examines both the political and technical issues that drive them. Their role in shaping the future of the UK's nuclear forces is then discussed with reference to archival sources, research interviews and technical studies.

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Occasional Paper, January 2014

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A Disturbance in the Force

The traditional theory of deterrence suggests that the most effective way of dissuading an enemy from hostile action is with the certainty that such action would be promptly followed by devastating retribution. For the past forty-five years, the UK has provided this certainty by maintaining a nuclear-armed submarine on patrol at all times, ready to fire if required.

However, it is also accepted that in practice such certainty is not always achievable.¹ The fleet of *Vanguard*-class submarines that currently operates this tag-team patrol, known as continuous at-sea deterrence (CASD), will eventually retire to be replaced by a successor. While current UK policy states that a replacement fleet will take up this baton and maintain CASD for the foreseeable future, this will not be without cost.

The UK government has stated that maintaining CASD will require a fleet of at least four submarines, one of which will patrol while the remaining three undertake training, undergo maintenance, or sit in reserve (see Figure 1). Current estimates suggest that such a fleet would require up to £18 billion in capital investment, in addition to running costs which may ultimately increase the total through-life cost to £80 billion.²

Figure 1: Indicative Continuous Patrolling Cycle with Four Submarines.

1	Patrol	Repair	Training	Reserve
2	Reserve	Patrol	Repair	Training
3	Training	Reserve	Patrol	Repair
4	Repair	Training	Reserve	Patrol

Note: Periods are illustrative only; a period may be longer or shorter than others.

Pointing to concerns about these costs and limited public support for the ‘like-for-like’ replacement of the Trident system, the Liberal Democrat Party secured a review of possible alternatives when they entered government in 2010, which was conducted by the Cabinet Office and released in July 2013. To the chagrin of disarmament advocates, this review did not consider the the UK’s unilateral abdication of its nuclear status. However, it did consider abandoning CASD; a move that would allow the UK to shrink the size of its future submarine fleet and mitigate a portion of its cost, whilst simultaneously making a gesture towards nuclear disarmament.³

Abandoning this long-held patrol structure would place the UK in a unique position amongst all nuclear-weapon states, none of which have voluntarily adopted a single, non-continuous nuclear force. Furthermore, the civil servants and armed forces that develop and implement the UK’s

nuclear-weapons policy have spent their entire careers working within the constructs of CASD. For them, a step away from CASD would be a step (both bureaucratically and philosophically) into the unknown.

The Trident Alternatives Review (TAR) outlines three primary issues that would determine the desirability of non-continuous patrolling postures. First, it questions whether back-to-back patrolling can be sustained long enough with a smaller fleet of submarines to cover any emergent crisis. Second, it questions whether the UK could activate an inactive fleet in time to deal with any such crisis. Finally, it questions whether a potential aggressor would launch an attack against an inactive fleet without presenting the UK with an opportunity to deploy and protect its forces.

There are two broad camps in the debate. On the one hand, it has been argued that initiating patrols as a crisis emerged would be difficult, clumsy, and could alarm adversaries, inciting a destabilising spiral of escalation.⁴ Furthermore, some believe that introducing any period of inactivity will cast uncertainty into the minds of adversaries as to the probability of retribution, thereby significantly reducing the deterrence such a force might provide.⁵ On the other hand, it has been argued that initiating patrols is not necessarily a tripwire of catastrophic escalation, and that 'even a modest chance of a huge penalty can have great deterrent force'.⁶

As always, the devil is in the detail. While on the surface the UK seems to face a simple binary choice, there are in fact a variety of patrolling options that could bring it closer to or take it further away from CASD.⁷ Furthermore, the non-continuous options that have been discussed so far have only been publicly outlined in principle. There is little information to suggest how these postures would be realised in practice.

This paper contributes to the debate over CASD by discussing how the practical application of non-continuous patrolling can affect the three main issues outlined in the TAR. To do so, it presents the role CASD currently plays in the UK's nuclear posture, and describes the alternatives that have been proposed so far. It then addresses the three issues described above in turn, by detailing how the risks of inactivity and vulnerability evolve in smaller submarine fleets, and discussing how the fleet's activation or deactivation might affect, and be affected by, the broader international context. In doing so, this paper argues that if the UK can develop procedures for activating, sustaining, deactivating and repairing a smaller fleet of nuclear submarines, which are simultaneously flexible and reliable, then many of the risks of non-continuous patrolling postures could, in principle, be mitigated.

However, questions remain over how achievable this aim really is. Having spent forty-five years maintaining a continuous patrol, the UK has very little

experience dynamically adjusting its patrolling schedule in line with an evolving threat environment. Furthermore, developing procedures to do so would naturally have to draw from an understanding of when the UK might wish to call upon its nuclear force: something the UK has so far only outlined in the vaguest possible terms.

Comfort in Continuity

The UK is not alone in its continuous deployment of nuclear submarines. Of the four nuclear-armed states with operational submarine-based forces, three (the UK, France and the US) are known to maintain at least one submarine at sea at all times.⁸ While suspicions remain over its ability to maintain continuous patrols, Russia announced in 2012 that it would also return to CASD.⁹ This raises the question over the apparent appeal of continuous submarine patrols.

Tim Hare, former head of UK nuclear policy within the Ministry of Defence (MoD), argues that ‘if we are to pay such a large sum of money as an insurance policy against nuclear threats, then it is a given that such a capability should be effective. For a deterrent to be effective, it must be credible.’¹⁰ The TAR introduces five criteria by which it judges the credibility of the UK’s nuclear forces: their readiness, reach, survivability, destructive potency and the UK’s resolve to use them. Maintaining a continuous nuclear patrol contributes to three of these – readiness, survivability and resolve.

To launch its missiles, the *Vanguard*-class submarine ejects them from its missile compartment with compressed air until they reach a safe distance from the boat to ignite. While in principle this approach should allow a submarine to safely launch a missile from under water or from the surface, in practice surface launches have not been explored for current or future generations of submarine. Once surfaced, both the UK’s current and future submarine forces will not be able to fire their missiles.

Therefore, by maintaining a continuous patrol, submerged submarines can launch a nuclear attack as quickly as the firing chain and the completion of any secondary tasks (such as running repairs or training exercises) will allow. Current UK policy restricts these factors such that a submerged submarine can always launch an attack within several days of an order being given.¹¹ In practice, if a patrolling submarine is not preoccupied, this delay could be shortened to a matter of hours, and possibly less.

Furthermore, it is extremely challenging for an adversary to locate and subsequently disable a nuclear submarine once it is deployed within the vast expanses of the ocean. By maintaining a submarine on patrol at all times, the UK can reassure its allies and convince its adversaries that its nuclear

forces are invulnerable to a first strike, and remove a possible incentive for pre-emptive attacks.

In addition to these operative factors, it has been argued that the broader effort of maintaining continuous patrols reinforces the impression that the UK is actually prepared to carry out its deterrent threats. For instance, the TAR states that by regularly expending the financial and personnel resources required by CASD, the UK can demonstrate a strong and consistent commitment to its nuclear forces, and that it has the resolve to use them if necessary.¹²

While continuous patrols make a contribution to the readiness, survivability and resolve of the UK's nuclear forces, they make little contribution to their reach or destructive power. Aside from the issues associated with firing a Trident missile while surfaced, the operating tempo of UK submarines has no effect on the potency of the warheads it holds. Similarly, the operating tempo of the UK's future nuclear forces will have almost no effect on their range. The next generation of nuclear submarine will be armed with up to forty warheads on eight missiles.¹³ On average, therefore, less than half of the missile's capacity will be used, which increases the range of the missiles up to approximately 11,000 km. This makes far-flung deployments unnecessary by giving the UK's missiles – in effect – a global range.¹⁴

Maintaining an unbroken nuclear capability does not create a credible deterrent by itself. Jeffrey Lewis observes that the Chinese leadership believes that nuclear deterrence is 'relatively insensitive to changes in the size, configuration, and readiness of nuclear forces'.¹⁵ Reflecting this belief, Chinese nuclear warheads are currently held separately from their launching systems on a day-to-day basis, and the two are only mated when intelligence suggests a heightened threat level.¹⁶ As such, China voluntarily places its nuclear forces beyond short-notice use, confident in the knowledge that it can reconstitute them when necessary. One can similarly look to the nuclear arsenals of India and Pakistan; while neither is housed on invulnerable platforms held at a continuous level of readiness, both are often seen to have played a role in the deterrence of major conflict.¹⁷ While these postures may change in the future, this does not imply they were unsuccessful in the past.

Thus while continuous patrolling probably enhances the credibility of the UK's nuclear forces, it does not embody it. It is not immediately apparent if Russia, China or, indeed, any other state would feel any less threatened by the UK's nuclear forces were they occasionally unavailable. While many of the UK's allies would be taken aback by such a change in its nuclear posture, with proper presentation and integration into NATO's nuclear structures it could still make a useful and reassuring contribution to the Alliance's shared

nuclear force. Abandoning CASD is therefore not *a priori* incompatible with a credible nuclear threat.

'A Ladder of Nuclear Capability and Readiness'

According to the TAR, there are a number of non-continuous postures which could 'deliver at short notice a nuclear strike against a range of targets at an appropriate scale and with very high confidence' while submarines are deployed in a crisis.¹⁸ However, these postures vary in both the proposed frequency of deployment and their readiness to deploy in response to changes in the international environment.

At lower readiness, the 'preserved deterrence' posture presented in the TAR and the 'contingency' posture proposed elsewhere by the Liberal Democrat Party would have no nuclear platforms deployed on a day-to-day basis, and would only have the ability to reconstitute a force over a limited period of time (in the case of 'preserved deterrence', a matter of years).¹⁹ At medium levels of readiness, the 'sustained' or 'responsive' postures presented in the TAR would have nuclear-armed submarines patrolling on a day-to-day basis, interrupted by voluntary periods of inactivity of varying length (the former permitting fewer and shorter interruptions than the latter). At higher levels of readiness, the 'focused' posture would maintain back-to-back patrols, interrupted only for periods of technical or personnel recuperation.

The TAR suggests that the UK could move from one posture to another to match the international threat environment, raising or lowering the readiness and vulnerability of its nuclear forces. For instance, the UK could adopt a 'preserved deterrence' while there were no nuclear threats on the horizon, but switch to a higher-readiness posture as such threats emerged; an approach described by Danny Alexander, chief secretary to the Treasury and the minister responsible for overseeing the TAR, as a 'ladder of nuclear capability and readiness'.²⁰ In this sense, the UK could alter the readiness of its submarine forces so that they are only as credible as they need to be given the international situation.

Reflecting the view expounded in the 2010 National Security Strategy (NSS) and Strategic Defence and Security Review (SDSR) that the UK currently faces no threats to its integrity or independence, the Liberal Democrats have argued that the UK can take a few steps down this 'ladder of capability' and end nuclear-armed patrols on a day-to-day basis.²¹ Their 'contingency posture', outlined separately from the Cabinet Office-led TAR, would disarm the UK's nuclear submarines and keep them in port, whilst 'exercising submarine capability regularly to maintain relevant skills, including weapons handling and nuclear command and control'. If the survival of the state is 'conceivably' at risk, submarines would then be 'surged' to more constant

armed patrols for a limited period of time – effectively climbing back up the ladder of capability to a posture of medium or high readiness.²²

Table 1: Non-Continuous Patrolling Postures.

High Readiness	Focused (TAR)	Unbroken patrols sustained for a set period of time; patrols cancelled only for periods of recuperation
Medium Readiness	Sustained (TAR)	Patrols are sustained by one ‘on-duty’ boat, and are only interrupted by occasional and brief returns to port
	Responsive (TAR)	Patrols are conducted sporadically and in an irregular fashion
Low Readiness	Contingency (Liberal Democrat)	Submarines are typically held unarmed in port, ready to deploy within a specific timeframe to ‘more constant’ patrols
	Preserved (TAR)	Submarines are typically held in port, ready to deploy in a matter of years. One submarine held at ‘medium readiness’ to deploy

The UK considered a similar ‘de-alerted’ posture in 1998, but rejected it on the grounds that ‘ending continuous deterrent patrols would create new risks of crisis escalation if it proved necessary to sail a Trident submarine in a period of rising tension or crisis. The further step of removing warheads from missiles would also add a new vulnerability to our deterrent posture’.²³ Critics of non-continuous postures argue that the same fears that dissuaded the UK from adopting a non-continuous posture in 1998 are still very much relevant today.

As will be discussed below, Members of Parliament have voiced concerns that by introducing the presence (or prospect) of inactivity and vulnerability, a non-continuous posture is ‘simply not credible and very dangerous’.²⁴ Furthermore, the government might also feel pressured into undesirable actions by the fear of sustained patrols being interrupted at unfortunate moments. Finally, it has been argued that while submarines are inactive, the government would have to confront a ‘terrible choice’ as to when to make the ‘tremendously escalatory move [to activate them] that would turn a mere dispute into an acute crisis’.²⁵

Sustaining Patrols

To guarantee unbroken patrols, the current fleet requires four submarines to juggle the competing tasks of patrol, repair, training and sitting in reserve. If one submarine were to be removed from this fleet, the remaining three would have to take up the slack and sacrifice a portion of their time to carry out the tasks of the lost submarine (see Figure 2).

Figure 2: Indicative Continuous Patrolling Cycle with Three Submarines, Showing the Outstanding Tasks of the Lost Submarine.

1	Patrol	Repair	Training	Reserve
2	Reserve	Patrol	Repair	Training
3	Training	Reserve	Patrol	Repair

Note: Periods are illustrative only.

If a successor fleet were to operate unbroken patrols with three or even two boats, it would have to sacrifice a portion of time dedicated to support activities to maintain this posture. Over a protracted period of time, foregoing repairs or training to patrol (or provide back-up to a patrol) would eventually degrade the reliability of a boat to such a point that patrols would have to be interrupted – whether to train crews, repair submarines, fix unexpected faults or because of accidents on a patrolling boat. As such, the likelihood and duration of any period of inactivity depends heavily upon the number of successor submarines in a future fleet and their individual reliability.

Until successor submarines have been fully designed, it is challenging to assess exactly how much time will be needed to carry out repairs and train their crews. However, reports of the design work conducted so far can shed some light on the time needed for repairs, if not for training.

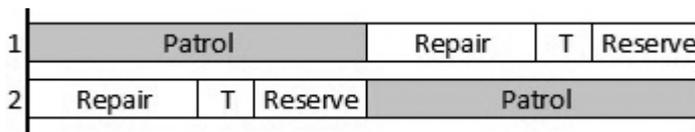
Every generation of submarine so far has required a long period of overhaul to conduct repairs and to refuel the nuclear reactors that power them (known as Long Overhaul Period (Refuel), or LOP(R)). During these periods, major refurbishment work is conducted on the propulsion reactors, drive systems, weapons systems and other elements of submarine infrastructure. While the current *Vanguard*-class submarines require a three-year LOP(R),²⁶ successor submarines will be equipped with a new reactor (the PWR-3) that will fuel each submarine for the entirety of its lifetime, removing the most significant element of current LOP(R) procedures.²⁷

While this will shrink the overhaul period for new submarines, it will not remove it. Given the decision not to adopt more modern (and therefore less well understood) systems such as electric drive propulsion, successor submarines will probably have to undergo at least one major refurbishment

period – as well as a series of shorter maintenance periods – during their planned twenty-five-year lifespan.²⁸

Opting for a two-boat fleet would involve sacrificing large portions of secondary tasks to maintain unbroken patrol. While one submarine patrolled, a second submarine would have to undergo all of its minor repairs and training exercises whilst simultaneously acting as a back-up to the patrolling submarine (see Figure 3). Performing the bare minimum of necessary repairs and training would leave little (if any) time for a second submarine to act as a reserve, making seamless patrolling very sensitive to unexpected interruptions. Maintaining this arrangement would also become impossible once one submarine entered a long period of overhaul. Even if one assumes this period were to shrink from three to two years (which may be optimistic), a patrolling submarine would have to stay out four times longer than is currently thought possible,²⁹ in which time a combination of food spoilage and morale degradation would likely render patrols untenable.

Figure 3: Potential Patrolling Cycle for a Two-Boat Fleet.



Note: Periods are illustrative only.

A three-boat fleet would be able to sustain unbroken patrols for a far longer period. A third boat could always act as a reserve whilst its sister boats patrolled or performed maintenance and training tasks, covering the risk that materiel or personnel degradation would pull a patrolling submarine off duty (see Figure 4). In this case, the first serious impediment to continuous patrolling would arise when boats entered a long overhaul period. At this point, the fleet would have to operate essentially as a two-boat fleet, with both boats operating a tandem patrol until the conclusion of long overhaul periods returned the fleet to full capacity. As above, tandem patrols during this long overhaul period would have to juggle periods of patrolling, training and minor upkeep to maintain unbroken patrols. Without a third boat to act as a back-up, this would certainly introduce a risk of interruption due to personnel or technical degradation, and the TAR suggests that a three-boat fleet would risk (but not necessarily guarantee) ‘multiple unplanned breaks in continuous covert patrolling as well as regular planned breaks for maintenance and/or training’ over a twenty-year period.³⁰

Figure 4: Potential Patrol Cycle for a Three-Boat Fleet.

1	Patrol	Repair	Train	Reserve
2	Reserve	Patrol	Repair	Train
3	Repair	Train	Reserve	Patrol

Note: Periods are illustrative only.

Breaking Covert Patrols

In today's benign threat environment, a sudden interruption to the UK's continuous covert patrols would not have particularly dramatic consequences for deterrence. However, if an overt interruption were to coincide with the emergence of a tangible existential threat to the UK or its allies, the consequences would be more severe. In a nuclear-tinged crisis, an adversary may see an interrupted patrol as an opportunity to escalate or even strike. The fear of such a break in patrols may even force the UK into otherwise-undesirable mitigation actions.

Exploiting Unreliability

If an adversary were able to anticipate such an interruption, this dynamic could conceivably play a significant role in the outcome of a nuclear crisis. In anticipation of an interruption, an adversary may have little incentive to resolve a crisis quickly (or even prevent one from starting) when the patient application of pressure would eventually force the UK's nuclear forces into inactivity, weakening its bargaining position. More pessimistically, the anticipation of such an interruption may make any overtures towards peaceful reconciliation by the UK seem like desperate attempts to resolve differences before its nuclear strength falters.³¹ If an adversary were confident that the UK could not sustain patrols for long and that a break in patrols could be exploited, it may even increase the chances of a nuclear crisis developing in the first place.

However, this worst-case analysis does not consider the practical factors that determine the likelihood of an interruption in patrols, and the chances that such an interruption would fatefully coincide with a period of heightened nuclear tension. While a two-boat fleet would not be able to sustain patrols much beyond the beginning of a long overhaul period, it must be considered how frequently such overhaul periods might occur. If successor submarines could be overhauled in only two years, rather than three, only 8 per cent of a submarine's twenty-five-year lifespan would be spent undergoing overhaul.³²

In the meantime, another question is how an adversary would quantify the rate at which a fleet's operation capability declined, increasing the risk of an unexpected interruption. Crew and technical degradation does

not necessarily occur in a smooth and predictable manner, and even if an adversary had some 'threshold' of presumed reliability under which it might consider aggression, it would be challenging to gauge when this threshold had been passed. The adversary would find it similarly difficult to quantify the chances of a submarine suffering an unexpected and debilitating fault while there was no reserve submarine to replace it. If such an event could be predicted, it could also be avoided. It is also important to recall here that if the current submarine fleet can conduct minor repairs whilst still on patrol, the same will probably be true of its successor.

The reliability of and repair schedules for the next generation of submarines have yet to be determined, and once they are the former would be highly classified and the latter would be flexible. There is little information available to suggest that reserve submarines have been called upon in the past, and even if they had been, such an incident would never be openly reported.³³ By opting for known, operationally understood systems – rather than novel ones (such as electric drive) – it is reasonable to suspect that successor submarines may ultimately be more reliable than their predecessors. Furthermore, once the constraints that CASD imposes on patrolling structures were abandoned, the repair and overhaul schedules of successor submarines could be advanced to coincide with periods of calm, or delayed until a crisis had passed. Even periods of minor repair could be broken up into shorter and more frequent tasks, some of which could be performed whilst deployed.

If all submarines were visibly in port, an adversary would have little doubt that there were no operational patrols. However, once a boat were deployed an adversary would have little information from which to judge the length of its patrol. While an adversary might be able to exploit human intelligence to this end, its most reliable open source of information from which to hypothesise the likelihood of a gap in patrols would ultimately be the previous behaviour of the successor fleet. For instance, if a three-boat fleet had recently completed a major period of repair, an adversary would probably not anticipate an unavoidable breakdown in patrols within a useful timescale. However, if a two-boat fleet had been sustaining unbroken patrols for a long time without undergoing any major refurbishment, an adversary might suspect a long-overdue repair would soon interrupt this patrol.

This reveals a potential benefit of a flexible approach to nuclear readiness. If the UK were to maintain patrols on a near-continuous basis (as in the 'focused' and 'sustained' postures outlined above) irrespective of the international threat environment, it would have little chance to utilise periods of calm to address any developing concerns over reliability or training. On the other hand, if the UK relaxed its patrol tempo in periods of calm (to lower-readiness arrangements such as the 'responsive' or 'contingency' postures outlined above), it could address any emerging reliability issues before an unfolding

crisis made them acute. In this latter case, if submarines had to be deployed this would be done with the lowest possible risk of fault or interruption.³⁴

Sustaining Patrols in a New Cold War Scenario

This flexibility would not guarantee the reliability of a two- or three-boat fleet in the longer term. While few nuclear-tinged crises in the past have stretched much beyond the duration of one or two submarine patrols,³⁵ it is possible that a limited crisis may transform into a drawn-out period of sustained international political and military tension. As suggested by the TAR, if a crisis were to stretch out over twenty years, even a recently overhauled three-boat fleet would 'risk multiple unplanned breaks in continuous covert patrolling'.³⁶ Furthermore, a two-boat fleet deployed over twenty years would almost certainly suffer a number of breaks over this period.

However, over a twenty-year period of tension, the UK could find a number of nuclear or non-nuclear (either military or otherwise) means to mitigate the emerging threat of a break in nuclear submarine patrols. For instance, if a fleet could sustain unbroken patrols for a few years (challenging with two boats, but far more feasible with three) the UK could possibly resurrect former nuclear systems – such as the WE-177 gravity bombs that were abandoned in the 1990s – to cover the risk of an inactive submarine. This weapon closely resembles the US B61 gravity bomb, some of which are still forward-deployed in Europe through NATO mechanisms.

While the TAR suggests that developing alternative nuclear weapons for a cruise missile may take up to twenty-four years,³⁷ this timescale would be significantly reduced by the familiarity of the WE-177 warhead, the retention of some of its non-nuclear components, and by relaxing production, design and safety criteria in line with its emergency stop-gap nature. This solution could even buy enough time to restart inactive production lines and acquire a fourth nuclear-armed submarine to guarantee the maintenance of CASD if deemed necessary. This flexibility would cost a significant amount of time and money: restarting production lines has proven difficult in the past and acquiring a fourth boat long after the first three would certainly be more expensive than if four were procured in quick succession.³⁸

However, the option to return to a more continuous level of nuclear force (either through additional submarines or other platforms) would always be present. If there were only a 20 per cent chance that this option would be required, refraining from procuring a fourth boat could still be considered cost effective. Were it to adopt a three-boat fleet, the UK could still reconstitute its previous nuclear strength if the international environment demanded it. Retaining this option would further reinforce the deterrent value of a three-boat fleet by undermining the chances that an adversary might believe it could enjoy a nuclear advantage in the long term.

Transitioning to and from Patrols

As discussed above, the risk of a two- or three-boat fleet suffering an interruption in covert patrols in a crisis partially depends upon the operational history of the fleet prior to the crisis. If a fleet were normally held in port, rolling repairs would ensure submarines were deployed with the lowest possible risk of mechanical or personnel failure. However, postures in which the UK rarely sends its submarines to sea (such as the 'contingency' and 'preserved' postures) raise two important questions: the circumstances under which the UK would change the status quo and deploy nuclear-armed submarines, and how this action might affect the behaviour of its adversaries. Having deployed its submarines, the UK would also find itself questioning under what circumstances it might withdraw them. While a premature withdrawal might reignite an adversary's enthusiasm for aggression, maintaining unnecessary patrols could exhaust the fleet's ability to meet resurfacing threats.

Both the deployment and withdrawal of nuclear submarines could send powerful signals to the international community. If the UK were to feel threatened, deploying its submarines would remind its adversaries that the UK was prepared for a crisis that might eventually bring it to the nuclear brink. In anticipation of an acute threat, early deployment could also remove an adversary's incentive to initiate hostilities while the UK's submarines were vulnerable. If such a threat were to recede, visibly withdrawing submarines would show the UK's adversaries that it felt no need to sustain a short-notice strike capability, and was comfortable enough to assume that a bolt from the blue was highly improbable.³⁹ The Labour government was keen to outline this 'signalling' dynamic in its 2006 defence White Paper, which argued that it is 'especially important during a crisis' to 'both overtly and covertly' increase or decrease the readiness of its nuclear forces to provide the most flexibility in posture.⁴⁰

It can be argued that in both cases the intended signals can have unintended consequences. Whether or not an adversary intended to threaten the UK, visible efforts to deploy submarines might come across as preparations to launch a nuclear strike, prompting an adversary to escalate by pre-emptively attacking the UK's forces (either by conventional or even nuclear means) before they became operational. The visible cancellation of unbroken patrols could be seen more as an act of technical necessity rather than one of reassurance, presenting an aggressor with an opportunity to escalate without fear of nuclear reprisal.

Further, the security dilemma – in this case, that the defensive deployment of a submarine might trigger an avoidable conflict – could paralyse UK decision-makers. If an adversary came to expect this paralysis, the credibility of the UK's deterrence would be significantly degraded.

In practice, these signalling dilemmas greatly simplify the manner in which the UK's readiness might be calibrated and the responses such actions might prompt.

First, an adversary would not see the deployment or withdrawal of submarines in isolation. Rather, there would be a deluge of other information – such as diplomatic, intelligence and personal sources – as a crisis evolves. According to Keren Yarhi-Milo, 'decision-makers' inclination to rely on their own judgements and subjective readings of signals to infer political intentions is pervasive and universal'.⁴¹ As such, the significance (intended or otherwise) of armed-submarine deployment or withdrawal in a crisis might be emphasised by an adversary's intelligence agencies that are designed to identify military threats, but downplayed by decision-makers in favour of other information. In many previous cases – such as 1971 Indo–Pakistani War and the 1973 Yom Kippur War – the purposefully overt raising of the readiness of US nuclear forces proved to have little impact on, or was superfluous to, the resolution of a crisis.⁴²

If patrolling patterns were frequently changed with little obvious regard to the international environment, even the most carefully calibrated change in the future might be dismissed by adversaries as simply scaremongering or a bluff. On the other hand, as any period of sustained patrol or inactivity lengthened, with few adjustments made in response to changes in the international environment, any subsequent change to patrols would be a stark break in the norm, unavoidably amplifying its significance in an adversary's calculus. This would be most acute in the highest- and lowest-readiness postures (such as a 'focused' deterrent or a 'preserved' deterrent), which maintain either deployment or inactivity as the status quo.⁴³

In the case of lowest-readiness postures, the occasional deployment of submarines for training purposes (as envisioned in the Liberal Democrats' 'contingency posture') must be taken into account. The procedures associated with calibrating the readiness of nuclear submarines (such as reactor activation, warhead loading, or even submarine deployment) would have to be exercised occasionally to ensure they remain safe and efficient, diluting the impact of any single deployment process and offering a less-threatening interpretation to any concerned adversary. While there is no direct corollary for postures which normally maintain boats on patrol, a break from this norm is unlikely to provoke new aggression.

Second, submarines can be held at varying levels of readiness. As a crisis loomed, submarine reactors could be activated within a day or two, crews could be mustered, and provisions loaded without actually launching the submarine. For instance, even if submarines were not deployed, a 'sustained' posture would maintain one submarine 'on deterrent duty' and ready to

deploy swiftly,⁴⁴ perhaps by keeping its reactor online or by a host of other measures. Similarly, cancelling submarine patrols would not necessarily place submarines far beyond re-use; a signal of vulnerability could be sent without reversing all of the deployment steps described above.

Rather than being faced with a single ‘terrible choice’, as a crisis emerged or receded the government would be faced with an array of choices with inactivity at one extreme and the rushed deployment of armed submarines at the other. Choosing which (if any) steps to take may not be easy; calibrating the readiness of nuclear forces in such a way would be entirely unfamiliar to those accustomed to the simplicity of CASD.⁴⁵ Rather, these choices would provide decision-makers with more nuanced responses to an evolving international threat environment.

With this in mind, if the UK adopted a non-continuous patrolling posture, not only would it have to consider when it would deploy its submarines, it would also have to consider how to deploy these submarines, and how to integrate this change in readiness into its broader foreign policy. The coordination – or lack thereof – between any adjustment in nuclear readiness and broader signals of intent (such as declaratory posture or rhetoric) would play a greater part in crisis management than the deployment itself.

As such, the stability of any transition to or from patrolling will ultimately be determined by the UK’s ability to consider these questions and implement the answers in a reliable yet flexible manner. No matter how well a deployment is portrayed on the international stage, if such a move were poorly executed by an ill-prepared crew it could still destabilise an emerging crisis or, worse still, cause a nuclear accident. Developing a flexible yet reliable system through which to respond to an emerging crisis would be challenging, given that these two characteristics are not always mutually reinforcing, and communication between those that manage patrols and those that manage diplomacy is often imperfect.

A Bolt from the Blue?

The success of this flexible approach to submarine readiness would depend upon a relatively sophisticated understanding of an adversary’s intentions and fears. While current assessments declare that no state is willing and able to threaten the independence or integrity of the UK, this may not be the case in the future. By monitoring the submarines and training activities at the UK’s naval base in Faslane, one can imagine an unknown adversary covertly developing an impression of how quickly the UK could deploy its submarines in the event of an imminent attack. Such an adversary might feel tempted to exploit this window of vulnerability by striking the UK’s forces out of the blue.

If the UK were unaware of this threat, it would have little chance to prepare a response. Deploying an inactive submarine would not be instantaneous: it would likely be 'fraught with difficulties – both technical and human'.⁴⁶ Without any prior preparation aside from training, current deployment procedures would require a submarine to be activated, loaded with supplies, checked over, carefully armed with up to forty warheads, and then piloted to a safe patrolling zone. In all, these activities take up to two weeks to complete.⁴⁷

In a straight race from a standing start, a determined and suitably equipped adversary with ready forces could certainly strike the UK's nuclear forces before they had a chance to deploy. There is no silver bullet for dealing with this problem. If the UK dramatically altered the current deployment procedures (for example, by relocating submarines to the warhead depot at Coulport and re-designing the arming procedure) it might be able to reduce this 'cold start' time. However, making such readjustments to the existing submarine infrastructure would be very expensive (and potentially unsafe), and such dramatic measures were not considered in the TAR. Furthermore, modern ballistic missiles can strike their target in approximately thirty minutes, leaving little time for even the best-prepared submarine to deploy to a safe distance.

A 'Part-Time' Deterrent?

While the UK could never guarantee the survivability of an inactive submarine fleet, it might never have to do so. Despite criticism that non-continuous postures would create a 'part-time deterrent',⁴⁸ even an inactive fleet of submarines can help to deter actors from seriously threatening the UK. If it were seen to be capable of deploying its nuclear forces in a crisis, the very existence of such a force could have the effect of dissuading a potentially hostile state from threatening or blackmailing the UK and its allies. With this in mind, the visibility of deployment exercises might reinforce this 'recessed' form of deterrence.

Furthermore, a pre-emptive strike against inactive nuclear forces (through conventional or nuclear means) would be an extremely drastic move. A serious threat to the UK would not come out of the blue in this way. It is highly unlikely that an adversary would consider a surprise attack without passing through some prior period of overt tension that could alert the UK to this threat. Indeed, even at the height of the Cold War, the UK's 'transition to war' exercises assumed that a nuclear crisis would emerge over a month, rather than a couple of weeks, and included multiple indications of a potential nuclear threat.⁴⁹

In the unlikely event that this threat emerged without any warning, an aggressor would have to be extremely bold to ignore the probability that such

pre-emptive aggression would be met with stern punishment from sources other than the UK, which is likely to remain a member of NATO. Even in the unlikely scenario that the UK's relationship with the US has seriously and visibly deteriorated (and the credibility of NATO's shared nuclear deterrence is questioned), an aggressor might still fear severe punishment by nuclear-armed states wishing to discourage unprovoked counter-force attacks on nuclear capabilities.⁵⁰ As noted earlier, 'even a modest chance of a huge penalty can have great deterrent effect'.⁵¹

This is not to say that a non-continuous fleet would be immune to a 'bolt-from-the-blue' attack. Rather, such an attack would only become plausible if the international environment soured dramatically. This would not happen overnight, but it is still possible that the UK might miss important indications of tension, or register such indications but avoid responding for fear of contributing to the risk of inadvertent escalation. However, if the UK could successfully gauge the international threat environment, it would have many opportunities to co-ordinate a response and calibrate the readiness of its nuclear forces.

A Break from the Norm

If the UK were to break a forty-five-year tradition and abandon CASD, its nuclear forces would still present a threat to current and future adversaries. Even if this doctrinal change were accompanied by a reduction in the size of its future submarine fleet from four to three boats, the UK would still be able to sustain seamless, unbroken patrols for an extended period of time. This period would not be indefinite, and the risk of unavoidable interruptions would grow as these patrols dragged on. However, this risk would be very low during the first decade of each submarine's lifetime (in the case of the successor, from 2028 towards 2040). Even after that date, without the ability to quantify its growth over a time, adversaries are unlikely to see this risk as an incentive for aggression. Only the most reckless adversary would embark on a hostile pathway under the assumption that it could control a crisis well enough to prompt and subsequently take advantage of a break in patrols. Even if such a foe did exist by the 2040s, the UK would have a number of mitigating options.

During periods of lower tension, the fleet could cancel sustained patrols and return to port without incurring any substantial risks of automatically prompting an opportunistic strike or sacrificing its ability to deter. An inactive fleet would be vulnerable to a no-notice strike, and could neither protect itself against nor respond to an attack under these circumstances. However, such an attack seems highly unlikely without prior indication or provocation, both of which would provide the UK with an opportunity to calibrate the readiness of its forces. When considering an attack in this way, an adversary would have to calculate that the response from the UK's allies, or even the

wider international community, would not outweigh the benefits of a surprise strike. The international opprobrium that such a strike would create, and the comparatively small gains it might produce while the US remains the world's dominant military power, suggests this bargain would not be easily made.

By visibly training and exercising the deployment of inactive submarines, the UK would be able to reinforce the impression that its nuclear forces continued to present a potent threat at relatively short notice. In much the same way that conventional forces held in reserve present a deterrent threat, so could a three-boat fleet of nuclear submarines held in reserve. In this sense, nuclear forces that are voluntarily kept inactive should not be seen as a part-time deterrent.

If the UK were to abandon CASD and take steps down 'the nuclear ladder of capability and readiness', moving back up this ladder to a period of sustained patrols might not automatically trigger a spiral of escalation. While prominent approaches to international relations suggest that an adversary would judge the UK's intentions primarily on changes to its military capabilities, a recent study of past crises suggests that an adversary is more likely to judge intention not on military capabilities, but on a subjective interpretation of a number of signals, including personal relationships and ideologies.⁵² The decisive nuclear factor in the escalation or de-escalation of a crisis would therefore not be the deployment or withdrawal of nuclear forces alone, but the manner in which such a move is carried out and integrated into broader diplomatic signals.

The risks associated with activating and deactivating nuclear submarines (whether voluntarily or otherwise) must be placed in this broader international context, in which relationships between adversaries are determined by far more than the condition of nuclear forces. Changes in nuclear strength will be only one element of the multifaceted causal relationships that ultimately determine the outcome of hostilities, and co-ordinating diplomatic, military, economic and institutional messages has long been a central issue in international relations.⁵³

Nuclear Novelty

However, the co-ordination of nuclear and non-nuclear signals has not been central to the UK's nuclear strategy for a very long time. By its very nature, continuous at-sea deterrence rules out a number of adjustments the UK might make to signal to its adversaries. Indeed, despite the last Labour government's assertions about the importance of overtly raising and lowering the readiness of its nuclear forces,⁵⁴ the UK has had very little opportunity to send nuclear signals since it abandoned the airborne element of its nuclear forces in the late 1990s.⁵⁵ While airborne forces can be visibly redeployed to threaten specific targets (as the US did during the Berlin Crisis and Korean

War, and as the US often does today to send signals to North Korea), it is hard to make threatening gestures with invisible submarines.

In that sense, the immutability of CASD disengages nuclear forces from the day-to-day management of international relations. While crises may erupt and recede, the UK's nuclear forces continue their patrols unchanged and would only play a part in crisis management in the most extreme circumstances. Decisions over the readiness and potency of the UK's nuclear forces are primarily constrained to periodic posture reviews, which take a strategic (rather than tactical) view of the international threat environment.

Adopting a flexible approach to non-continuous postures, in which the UK would calibrate its forces from high to low readiness, would require the UK to consider the status of its nuclear forces on a more frequent basis. In the face of an evolving crisis, the UK would need to take a number of decisions over whether and how to initiate, sustain and ultimately terminate extended periods of patrolling – decisions that are currently unfamiliar. Furthermore, these steps would have to be carefully integrated into broader efforts towards crisis resolution.

While the UK maintains continuous deployments, there is little reason to view emerging threats in terms of a required level of nuclear readiness; this has already been set. If the UK adopted a non-continuous posture, however, any emerging threat above a certain threshold would necessarily be seen through a nuclear lens. Should this threshold be crossed on a regular basis, a non-continuous nuclear force would not 'de-couple nuclear weapons from the day-to-day calculus of national security';⁵⁶ instead, it would pollute areas of decision-making where it was previously of little relevance.

In this case, a key challenge to abandoning continuous at-sea deterrence may not be the preservation of credible nuclear threats, but the development and implementation of organisational structures that would allow decision-makers the time, freedom and confidence to calibrate nuclear forces in response to emerging threats. At the political level, overt changes to nuclear readiness may have to be explained not just to the public, but also to the UK's adversaries and allies. At the operational level, the current rigid and well-practised structures for deployment and repairs would have to evolve to accommodate a more flexible approach whilst simultaneously maintaining the safety and security of the UK's nuclear forces. Technical realities may make it challenging to break down large-scale repairs into smaller, more flexible packages, and while adjustments to the current operational infrastructure may mitigate this, these may not come cheap.

To date, the 'threshold' at which the UK's nuclear forces may come into play has been very loosely defined. In its most recent formulation of nuclear-weapons policy, the UK stated that its forces exist to 'prevent, at the extreme, any threat to our national existence, or nuclear blackmail from a nuclear-armed state against the UK homeland or our vital interests'.⁵⁷ If the government has made a conscious decision as to what constitutes its vital interests, it is not immediately clear from this formulation.

If this threshold is set too low, the government may find its ability to transition successfully from periods of low nuclear readiness to high nuclear readiness in a stable manner regularly tested. In this case, abandoning continuous at-sea deterrence for a more flexible approach may prove to be more trouble than it is worth. Conversely, if this threshold is set too high, the government might have difficulty maintaining the personnel and political support to retain a fleet of nuclear submarines that scarcely (if ever) are called upon to deploy. US nuclear ICBM (intercontinental ballistic missile) crews have recently failed a broad swath of assessments in relation to safety, security, and command chains. These failures have been associated with declining morale and a lack of prestige of their mission,⁵⁸ which in practice involves little more than exercising for an attack that is presumed to be highly unlikely. A former submarine officer has voiced concerns that if the UK's nuclear forces are rarely, if ever, called upon to deploy (such as in a 'preserved' posture), then a similar rot might eventually set in. In this case, rather than reinvigorating morale by moving back to continuous at-sea deterrence, the wholesale abandonment of the UK's nuclear forces would be a more suitable alternative.

Continuous patrols are a valuable element of the UK's nuclear mission and while financial and political realities can accommodate CASD, abandoning it may create unnecessary risks. However, with strained defence budgets and limited political and public support for the nuclear status quo,⁵⁹ a cost-benefit analysis must be undertaken.

Abandoning CASD in favour of a more flexible approach to nuclear deterrence would not automatically undermine the UK's ability to deter nuclear threats and blackmail. Rather, the desirability of abandoning continuous at-sea deterrence rests upon a rigorous analysis of how non-continuous postures would actually work in practice, with explicit consideration of when the UK might have to call upon its nuclear forces and how exactly it might calibrate them in response to an emerging threat. If the UK's 'vital interests' face a turbulent and threatening future, abandoning CASD in favour of a more flexible approach to nuclear patrolling may be more trouble than it is worth. However, while the UK remains a member of NATO, can call upon robust conventional forces, and retains the ability to reconstitute its current nuclear strength, threats to these 'vital interests'

will only require a deployed nuclear deterrent on rare occasions. In this case, if the UK can implement a flexible structure in which to operate a non-continuous nuclear force without sacrificing any financial or political gains it hopes to make, a step away from CASD could be one of several legitimate pathways in the UK's nuclear future.

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The author would like to thank his colleagues Andrea Berger and Professor Malcolm Chalmers, whose insights and feedback were instrumental in the production of this paper. Furthermore, thanks are due to both Ashlee Godwin and Adrian Johnson for their patience and keen editorial eyes. Special thanks are also due to the many individuals who took the time to discuss and comment upon earlier drafts of this paper. Finally, RUSI is grateful to the Nuclear Threat Initiative (NTI), whose generous support made this paper possible.

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