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NETWORK CENTRIC USW – EXPLORING THE REALITIES

In 1900 John Holland, the father of the modern submarine, stated 'as nearly as the human mind can discern now, the submarine is indeed a 'sea devil', against which no means that we possess at present can prevail.'[1] This is a reminder that even the most forward thinking individuals can experience hubris when predicting the future of undersea warfare. When the German submarine *U9* sank the old armoured cruisers HMS *Aboukir*, HMS *Cressy* and HMS *Hogue* in a fateful 75 minutes on 22 September 1914, maritime strategists of the day may well have been persuaded by Holland's view. Yet by contrast, in the month of May 1943, when fortunes changed in the Battle of the Atlantic, the Kriegsmarine lost 41 U-Boats, and never regained ascendancy in the campaign, demonstrating that the undersea threat could be effectively countered.

The history of undersea warfare (USW) in the 20th Century was one of a series of leaps in technology, in which primacy alternated between the hunters and the prey. In the decades following World War II the march of technology caused the pendulum to swing back in favour of the submarine. Some observers have argued that this period represented the zenith of submarine capability, and that the advent of new sensors and networked USW systems heralded the demise of crewed submarines.[2] Yet submarine procurement continues apace across the globe. The question is whether, in the midst of this rapid growth in submarine numbers, there has arrived unheeded a new suite of USW and Network Centric Warfare (NCW) technologies that will make the oceans transparent, and hence render the submarine as obsolete as the battleship.

NCW is a superficially simple concept, involving the linkage of engagement systems to sensors through networks and the sharing of information between force elements. The aim of NCW is to allow a force to make decisions faster than its adversary and apply firepower with greater precision.[3] A review of the literature on NCW reveals two opposing camps. Advocates such as William Owens[4] see NCW as the key to decision superiority, enabling NCW-capable forces to maintain a tempo of operations that will keep the enemy continually off-balance. On the other hand, sceptics predict information overload: 'What is new is the potential for inundating participants with an ever-increasing flow of data masquerading as information because it has been slickly packaged within the common operating picture.'[5] Aldo Borgu, of the Australian Strategic Policy Institute, is even more caustic, stating 'in theory NCW will result in revolutionary change in the way we think about and conduct warfare. Human nature being what it is in reality it's more likely to result in business as usual, namely incremental, evolutionary changes in military capability and doctrine.'[6] NCW then is itself a subject of controversy, even before applying the concept to the undersea battle space.

The past decade has seen the advent of some potent new tools in the undersea battle. Processing power, software engineering and communications have between them facilitated the deployment of a variety of sensors that in the past may have been theoretically feasible, but were technically unachievable. Synthetic aperture radar, virtual sonar arrays, superconducting magnetic anomaly detectors, forward looking infra-red sensors, autonomous air and sub surface vehicles, satellites, geo-location systems, low probability of intercept sonar, low-frequency active/passive sonar, and multi-statics (combining data from multiple sonars) all threaten to upset the balance of power in USW. When combined as a network of above and below water sensors, linked through the information, sensor and engagement grids, they potentially offer a new dimension of USW capability. Yet despite these advances, the oceans remain anything but transparent.

The physical properties of the oceans, and their vastness, continue to favour the submarine. In 1997 the US Panel on Undersea Warfare acknowledged that the submarine threat will increase in the 21st Century. This increase, 'fuelled by the proliferation of advanced submarine quieting, sensors, and processing techniques and technologies, could result in the submarine becoming the dominant threat to the accomplishment of naval missions.'[7] This was echoed in a review of anti-submarine warfare (ASW) sensor effectiveness:

> Submarine quieting degrades this vast array of capability to the point that the ASW force is capable of placing only small diameter detection circles in the water, around sensors (fixed and mobile) that individually have only a very small detection range - perhaps as small as a mile or less, without the overlapping areas of coverage that would be needed for the sensors and subsystems to work cooperatively.[8]

Advocates of NCW extol the virtues of precision and speed of response, value-added decision making, and information superiority. Yet USW is an inherently ponderous business; platforms, weapons and energy travel more slowly, and generally over shorter distances, underwater than they do above it. For this reason, the application of NCW in the underwater environment becomes more an issue of how to fuse data to leverage the contribution of multiple sensors, than of merely faster, more accurate, decisions based on improved situational awareness. But for data fusion to work, communications must be effective. This is one of the biggest inhibitions to making undersea NCW a reality.

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The bandwidth required for effective above-water NCW continues to push the limits of technology. As identified in the US, 'the exchange of information among sensors that is entailed in netting them … will require sturdy communications networks that have enormous capacity, in both bandwidth and data rate.'[9] Satellite communications systems are stretched to capacity by the demands of network information exchange at data rates of hundreds of kilobytes per second, and the adoption of extra high frequency systems operating in the tens of megabaud range is gathering pace. Underwater though, effective low probability of intercept digital communications are in their infancy. Using spread spectrum techniques, ranges of up to 30km may be achieved, but at data rates of only a few hundreds of bits per second. Even the US Space and Naval Warfare Systems Command Communications at Speed and Depth program is targeting data rates well below those currently available on UHF satellite systems. Given such limitations, the exchange of sensor information between multiple underwater systems seems unlikely to generate real network synergy for some years to come.

Tactically speaking, there are significant challenges to the use of bottom sensors and unmanned underwater vehicles (UUVs) in the littoral. Such waters can be dangerous to navigation, prone to strong tidal streams, amenable to effective, low-technology countermeasures. Deploying arrays, using UUVs or submarines, and exposing antennae for above water communications all carry risks. Achieving comprehensive coverage with bottom arrays is also problematic. For example, given a 50 x 10 nautical mile area, and detection ranges of about 1000 metres, at least 1000 bottom sensors will be needed to achieve gap-free cover. The time required to deploy them and the frequency of interrogation are not likely to aid rapid compilation of the Common Operating Picture. Tidal streams can play havoc with sensor disposition, and severely limit the endurance of mobile platforms. If an adversary controls the sea and airspace in the littoral, the choice of our mobile platforms able to cooperate in the network, or deploy and monitor its static and mobile sensor fields, is severely constrained.

UUV technology has yet to overcome some of the problems of accurate navigation, and achieve the optimum balance between payload, speed and endurance. Small, expendable UUVs are relatively cheap and readily available, but at speeds of, typically, three knots for eight hours, with a payload of a few kilograms, their utility is limited, especially when 'swimming against the tide'. Larger UUVs capable of deployment from a mother submarine, autonomous operation and subsequent return for replenishment and reconfiguration are under development. Yet the engineering obstacles are formidable, given the complexity and risk involved in mating a 10 metre UUV with a submerged submarine. Subsequent docking of the UUV and connection to the submarine systems in preparation for the next mission is a challenge, given the difficulties of designing a launch and recovery system for even small, tethered objects such as communications buoys.

No military operation exists in a vacuum and, as Field Marshal Helmuth Von Moltke noted, 'No plan of operation survives the first collision with the main body of the enemy'.[10] The advocates of NCW can thus expect their concepts to be followed with the closest interest by potential adversaries and, even as the debate gathers pace, counters to the technology will be under development. Historically there has been a very small lag between a new military technology or tactic and its counter. Indeed, the technology itself may be employed to attack the concept. If UUVs can be used to interrogate sensor fields, they could also be used to find and defeat them, either physically or by acoustic jamming. Countermeasures to multi-static systems are already under consideration, and the notion of defeating a network by information overload is a real threat to its effectiveness. Attacking the communications infrastructure directly is one option, but the damage could be compounded exponentially by a small fleet of cheap and expendable decoy UUVs released into the sensor field.

In conclusion, a variety of technologies promise to advance the sophistication of USW, offering the hope that increased mission effectiveness will derive from a combination of improved sensors, multiple platforms, and efficient, rapid data exchange and fusion. But there are profound difficulties in the practical application of both the technology and the doctrine. The larger debate about the nature and value of NCW is far from settled, and the debate about how to apply and manage it in the underwater battlespace is even less mature. ADF doctrine acknowledges the as yet unformed nature of NCW and the risks inherent in trying to incorporate it into Australia's future warfighting concepts.[11] What is clear is that we have not yet witnessed the genesis of either a concept or a technology that will make the oceans transparent. It also seems likely that rather than a revolution, NCW operations will ultimately be seen as another step in the leap-frogging process USW has followed since World War I. Certainly, there is nothing to suggest that the next two decades will witness other than a continuation of this process.

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