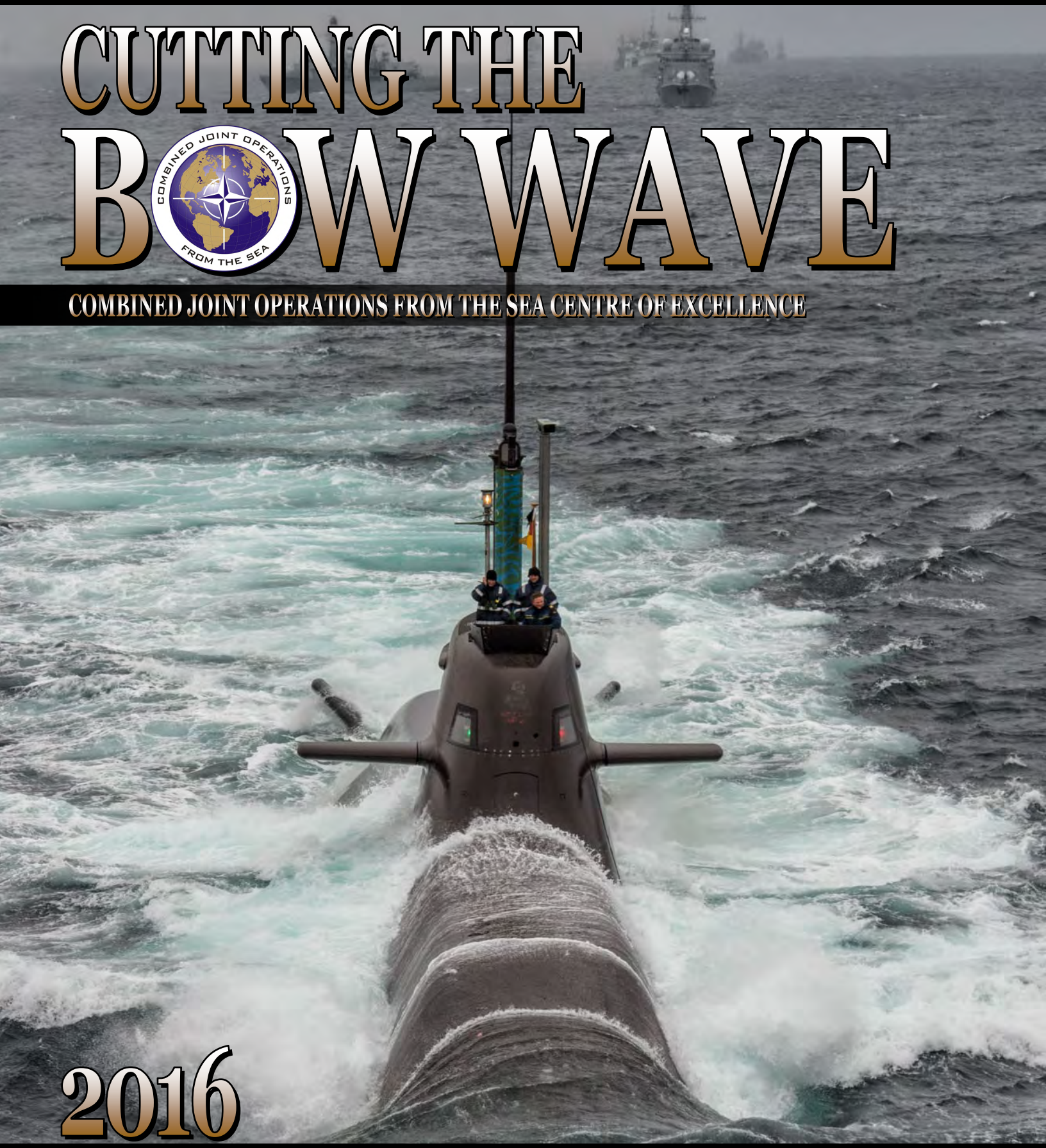
CUTTING THE BOW WAVE

COMBINED JOINT OPERATIONS FROM THE SEA CENTRE OF EXCELLENCE



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United Kingdom HMS Ambush (S120) participating in NATO Exercise JOINT WARRIOR 2015.

LEVERAGING UNDERSEA AUTONOMY FOR NATO: ALLIES MUST WORK TOGETHER TO AVOID FRACTION

Dr. Heiko Borchert
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U.S. Navy

Autonomous maritime vehicle conducting undersea maneuvers.

In the 21st century NATO will operate in a different undersea domain. What used to be a rather benign environment will become increasingly crowded and contested. Among others this broad trend results from power projection in a new geostrategic environment, toughening competition for offshore resource exploitation and strategic maritime transport corridors as well as the proliferation of technology, which enables the deployment of different types of sensors that will make the undersea domain more permeable.

"Autonomy describes the degree to which tasks can be delegated between men and machines and among machines."

As a consequence, undersea autonomy is as much a driver for change in the undersea domain as it is a result of the developments changing it. If NATO nations want to benefit from the advent of undersea autonomy they need to understand the respective risks and opportunities. In particular, they will have to come up with a common understanding of how to operate autonomously in the undersea domain in order to avoid friction between the US as the current thought leader on undersea autonomy and the remaining Allies.

Undersea Autonomy is Different

Autonomy describes the degree to which tasks can be delegated between men and machines and among machines. Autonomy is not only about technology, but foremost about concepts, culture, and mindsets. Trust binds all of these elements together. As Armed Forces around the world have been using systems with different levels of autonomy for quite some time, it is tempting to assume that operational experience gained ashore or in the airspace could easily be transferred to another domain. This, however, risks ignoring the essential drivers and characteristics of naval operations in the undersea domain.

At first sight, the undersea domain seems the most challenging environment for the use of autonomous systems. The unstable physical characteristics (e.g., salinity of water, changing water temperature,

water currents, reflections from seabed or surface resulting in multipaths) render certain tasks such as communication and data transmission much more difficult than in other domains. While these specifics might reveal the limitations of today's technology, they should not be construed as fundamental show-stoppers. Rather, the undersea domain might be the place where autonomy could come to fruition faster than elsewhere. Why?

- All human ignorance about the oceans is astonishing. This might explain why the subject of undersea autonomy is attracting scientists in large numbers. The more scientific research is seen to be leveraging undersea autonomy in the advance of mankind's knowledge about the oceans, the more the respective technology is seen as an enabler for human progress. This creates a positive branding for undersea autonomy and paves the way for a better understanding of the benefits offered by autonomous undersea systems.

- Undersea traffic differs from air traffic, as there is – apart from very specific NATO/PfP regulations on water space management – no undersea traffic management regime. As a consequence regime discussion needs to start from scratch and can thereby find innovative ways to take into account the specifics of traditional and autonomous assets as well as the contribution of autonomy and automation for water space management.

- The C2 paradigm of the subsea forces is different from that in other domains. Subsea commands are at ease with delegating tasks to assets that neither need constant monitoring nor control as this might be detrimental to their operational success. Thus, the subsea culture seems more palatable to fully embracing the principle of mission command, which provides an optimal starting point for the use of autonomous systems.

- Opposition against weaponized remotely piloted aerial systems mainly stems from resistance against a certain type of waging war. Despite some countries considering the option, weaponizing autonomous undersea systems to use them in a similar way is not on the table these days. This removes a key stumbling block for public acceptance.

Key Benefits of Undersea Autonomy: Think Beyond the "3Ds"

Today's debate about autonomous systems centers around the "3D" paradigm suggesting that autonomous systems are useful because the can conduct "dull, dirty, and dangerous" missions. Reference to the "3D" paradigm is understandable: By portraying autonomy as life sustaining it might be easier for humans to accept it. However, the problem is that the "3D" paradigm is only focusing on risk avoidance. This is important, but neglects the true potential of autonomous technology. There is thus an urgent need to bring to the forefront the broader spectrum of benefits resulting from undersea autonomy:

- Greater flexibility. Autonomous systems are not just another means of transportation. Rather they should be seen as smart agents that can be tasked to accomplish different missions. Future forces blending manned units with assistive autonomous agents will provide political and military decision-makers with a greater number of options. In addition, greater flexibility provides for improved adaptability as forces will have more options to react to changes in their surrounding operational environment.

Atlas Elektronik

Autonomous Undersea Vehicle, SeaCat, conducting maneuvers in the North Sea.

- Greater scalability. In today's undersea domain, the provision of effects is either "1" (e.g., fire a torpedo) or "0" (e.g., refrain from firing a torpedo). In the future autonomous systems and smart payloads could provide for graded effects such as disabling other undersea platforms, tracking and tracing enemy submarines and thus depriving them of their stealth advantage, or enabling undersea fencing to enforce sea control by electronic countermeasures. In doing so, autonomy supports the subsea forces' adherence to the principle of proportionality.

- Broaden mission spectrum. Autonomous systems can open up new opportunities to get closer to adversarial targets without being noticed. In addition, autonomous systems can provide advanced loitering and endurance capabilities thereby improving the "coping" power of subsea forces in attrition scenarios.

- Enable new ways to overwhelm adversarial forces. In combination with cheap expendable assets, autonomy will promote swarming as a new warfighting regime. Swarms would leverage all of the above benefits and provide armed forces with disruptive operational advantages in the fields of range and persistence, daring, mass, coordination and intelligence as well as speed and thus operational tempo.

Autonomy à l'americaine Will Be a Tough Race for Allies

As with many other military innovations, the US is currently leading the development of concepts and technologies for autonomous undersea systems. This poses challenges for NATO. For the US technological superiority is key to maintain political leadership. This leads Washington to perceive all challenges through a technological lens that is hard to share even for its most ardent Allies thus fuelling the risk of decoupling from Allies. This is also the case today with regard to undersea autonomy.

Overall, the U.S. drive for autonomous undersea systems is one response to the adversarial anti-access area denial (A2AD) postures that could limit future US power projection. Although Allies might share the need to push back adversarial encroachment upon the freedom of navigation at sea, not all will buy into the specific A2AD requirements. In a sense, the current debate about the need to nullify adversarial A2AD resembles the intra-Alliance discussion about the need to shift from territorial defense to international intervention and crisis management at the beginning of the 1990s. The lesson for the US should be to make the argument in favor of undersea autonomy broad enough for all Allies to have a stake in it.

In addition, US subsea forces face unique challenges resulting from the shrinking of the fleet whereas China's subsea fleet is growing. This opens the risk of capability gaps. The very specific capability requirements resulting from this development give room for ideas like the Large Displacement Unmanned Undersea Vehicle (LDUUV). The LDUUV perfectly fits into the US preference for "multi-capability big size" platforms. The risk is that LDUUV's are likely to

extend today's problems related to technical complexity, maintenance, and costs from manned to autonomous systems thereby deepening existing lock-in effects.

Conclusion: Getting Allies Back In

In the future, NATO will require a greater number of more capable and diversified autonomous undersea assets. For this reason NATO nations should work on a family of autonomous undersea systems that blend with more traditional subsea assets. This approach would leverage the strengths of all Allies and would provide opportunities for each partner to carve out a tailored role that reflects individual levels of ambition, undersea capability requirements as well as undersea industrial ambitions and capacities. For autonomy to boost Allied undersea capabilities, NATO should do the following:

- Re-animate the 2009 concept on "Maritime Unmanned Systems in NATO" since Allied operational experience has matured. This helps recalibrating the mission set to focus on more realistic tasks. Allied partners should welcome this step and bring in their own conceptual ideas on the use of undersea autonomy thereby helping the Alliance to tap into its broad pool of multinational experience.

- With four Centres of Excellence directly engaged in the maritime domain the Alliance has enough intellectual horsepower to develop and align concepts for underwater autonomy. In doing so, it will be important to hook up on conceptual work being done at other places such as SHAPE's a future Anti-Submarine Warfare roadmap, swarming concepts envisioned by the Joint Air Power Competence Center (JAPCC), and the cyber expertise at the Cooperative Cyber Defence Center of Excellence. Reaching out to the Centre for Maritime Research and Experimentation (CMRE) builds a bridge to experiment with different ideas on undersea autonomy.

- Undersea autonomy will depend on the contribution of innovative scientific and commercial players residing outside the traditional defense-industrial complex. The NATO Industry Forum could tap into this community by giving it a voice and bring innovation in from the outside. To this purpose joining forces with the European Defence Agency, that also maintains an Unmanned Maritime Systems program, would be most useful.

- NATO nations would be well advised to consider how autonomy will affect adversarial action in the undersea domain. The Counter-Unmanned Autonomous Systems project, which is part of the 2015-2016 Multinational Capability Development Campaign, provides a good opportunity to do so. In looking at adversarial benefits, NATO's red teaming will need to keep an eye on the cross-domain nature of autonomy and the disruptive impact of innovation stemming from commercial breakthroughs.

1. James Jay Carafano, Autonomous Military Technology: Opportunities and Challenges for Policy and Law (Washington, DC: Heritage Foundation, 2014).
2. For more on this, see: Paul Scharre, Robotics on the Battlefield Part II: The Coming Swarm (Washington, DC: Center for New American Security, 2014).
3. Statement by RADM Richard P. Breckenridge and RADM David C. Johnson, Program Executive Office Submarines, before the House Armed Services Committee, Subcommittee on Seapower, 12 September 2013.

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