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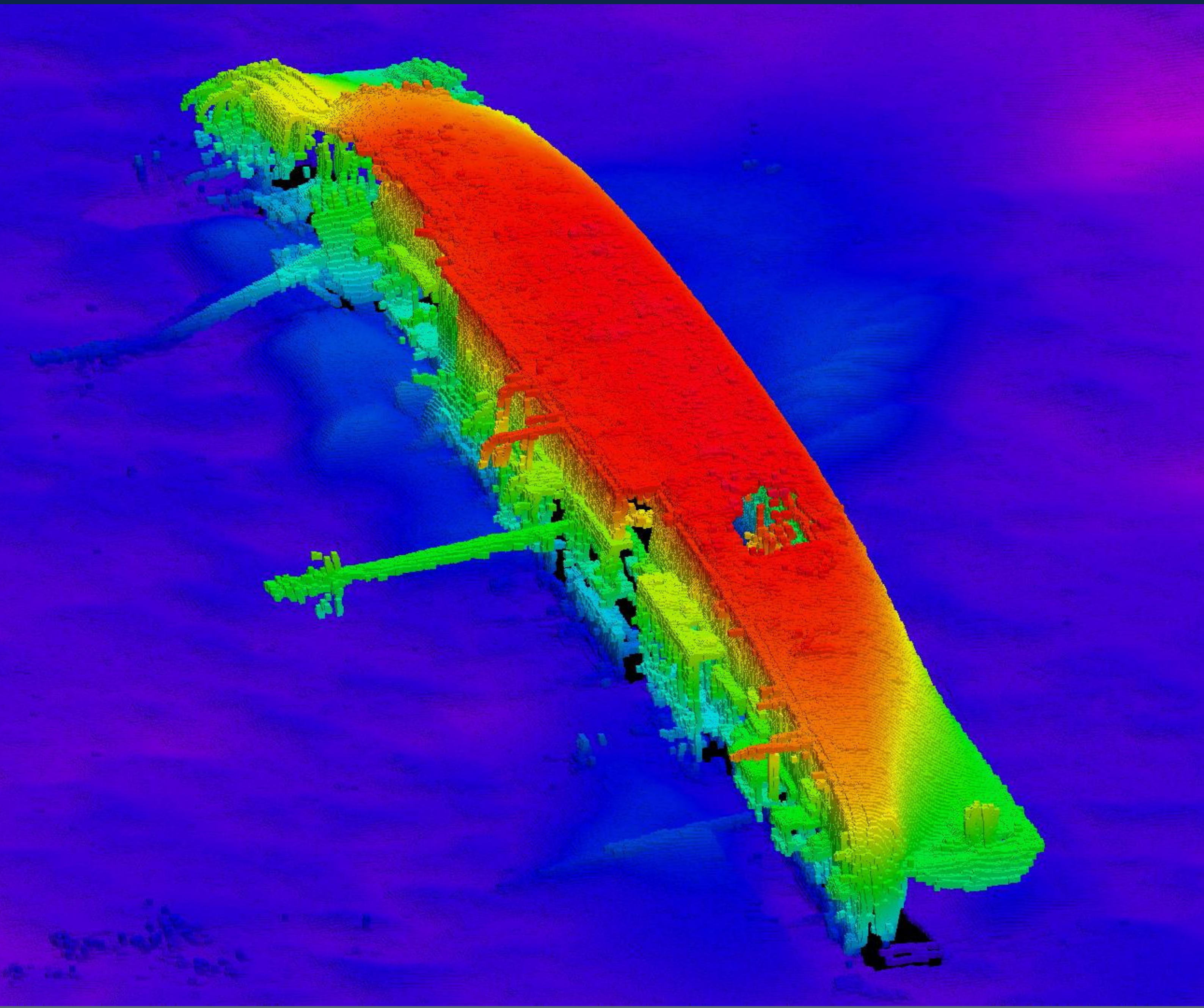
SEA POWER PAPER

Wreck Intelligence:
Why Navies Gather Evidence from the Seafloor

Mick de Ruyter



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Executive Summary

When a ship, submarine or aircraft, or even a missile or drone, is sunk at sea, most of the physical remains end up on the seafloor. Seabed infrastructure itself has long been a target in war. The wreckage that remains has usually lost its operational value but sometimes retains significant intelligence value. Beyond the need to recover sensitive assets, or deny them to or capture them from adversaries, wreckage can reveal the cause of sinking where this is otherwise unknown. Operations to find and investigate wreckage on the seafloor are often complex and can hold the highest national importance. Evidence from seafloor wreckage has been used to attribute attacks and justify military responses. Navies have been at the forefront of efforts to access and exploit wreckage on the seafloor, and the capability to do so is becoming increasingly widespread and accessible. This study uses historical and recent cases to investigate how navies have sought intelligence from the physical remains of things wrecked or lost at sea. It identifies the capabilities, skills, techniques and collaborations these efforts require and considers future scenarios that demonstrate the potential of wreck intelligence.

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- Maritime Warfare Centre (Zentrum Marine Seetaktik) in Bremerhaven
- Maritime Anomaly Recognised Picture, Naval Headquarters (MarKdo MARP) in Glücksburg
- NATO Center of Excellence in Confined and Shallow Water Warfare (COE CSW) in Kiel
- Federal Marine Police (Bundespolizei See) in Neustadt in Holstein
- Central Command for Maritime Emergencies (Havariekommando) in Cuxhaven
- Maritime Safety and Security Centre (MSZ) in Cuxhaven
- Mine Warfare Data Centre, Naval Headquarters (MarKdo), in Rostock
- Federal Maritime and Hydrographic Agency (BSH) in Rostock and Hamburg
- Federal Bureau of Maritime Casualty Investigation (BSU) in Hamburg.

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1. Introduction

After the year 2000 bombing that damaged USS *Cole* in Aden, divers from the US Navy (USN) and the Federal Bureau of Investigation (FBI) recovered evidence from the seabed that helped them identify and trace the attackers (Pastoric, 2021). When the Republic of Korea Ship (ROKS) *Cheonan* was sunk in the Yellow (West) Sea in 2010, a principal piece of evidence used to attribute the attack was the remains of a torpedo recovered from the seabed at the scene of the attack (Yoon et al., 2010). Similarly, from the scene of the Nord Stream 2 pipeline bombing in the Baltic Sea in 2022, investigators recovered traces of explosives from material that enabled a connection to the vessel allegedly used in the attack (Nichols, 2023). The physical remains of craft and infrastructure wrecked at sea may lose their original operational purpose but still provide information about adversary capabilities, intentions, operating methods or identity. The opaque nature of the underwater environment does not render this sunken or destroyed material useless in a military sense. The location and nature of physical remains on the seabed are foundational elements of the maritime domain awareness that allows commanders to plan effects and to counter those of an adversary. Accessing evidence from seabed wreckage often requires special capabilities, is usually beyond immediate public view and has started wars or drawn violent responses. Small and medium navies require some aptitude in this area, usually relying on existing capabilities like mine warfare and hydrography while leveraging national and international collaborations. This study considers how wreckage on the seafloor is used for intelligence purposes, and the sorts of capabilities, skills, techniques and collaborations this effort requires, particularly of naval forces.

Naval forces seek to locate and identify seafloor features as geospatial intelligence tasks to support freedom of manoeuvre and maritime domain awareness, such as for submarine navigation, mine warfare or amphibious access (Houston, 2020). Mine counter-measures, for example, require the investigation and classification of seafloor features, and sometimes the recovery and exploitation of deactivated mines for intelligence purposes. Navies have divers who locate and investigate or recover wreckage from the seafloor, and some navies have dedicated salvage capabilities. Some naval forces have the capability to access the deep seabed for infrastructure surveillance, protection or attack, and to place items on, and recover them from, the seafloor (Ministère des Armées, 2022, pp. 17–20).

This study focusses on the roles of navies and state maritime forces in exploiting intelligence from seabed wreckage. While other agencies are often involved in such efforts, the concern here is to show that wreck intelligence is, and has long been, a role of navies and that navies should maintain the capabilities and expertise to enable it. This does not mean that wreck intelligence must be the primary role of any particular naval unit, capability or asset, but rather that navies need to understand the requirement and have the plans and ability to do it. Although there are examples of long-submerged wreckage being used for intelligence purposes, such as the 1928 Soviet recovery of a British submarine sunk 9 years earlier in the Baltic Sea (Dunn, 2020, pp. 243–244), most wreckage exploitation for intelligence purposes is of recently submerged material. The recent and historical cases reviewed below demonstrate the requirement for wreck intelligence across the full spectrum of competition and conflict. In particular, wreck intelligence expertise is required in hybrid warfare where actors seek to use the opacity of the sea to advantage in the space between detection, attribution and response.

The Nature of the Problem

In 2010, ROKS *Cheonan* was sunk in what appeared to be an attack, later officially attributed to North Korea. The official investigation into the incident reported findings based on the physical evidence of the salvaged ship (Figure 1), as well as elements of what was concluded to be a North Korean torpedo recovered from the seabed (Figure 2). Later intelligence put a North Korean midget submarine at the scene of the attack (Yoon et al., 2010). These findings were disputed at the time and have been questioned since, including by South Korean and Western experts (see, Caprio, 2010; Chung, 2022; Hur, 2016). In 2025, as a hybrid war in the Baltic Sea continued with attacks on seabed infrastructure and attempted sabotage of German warships, Russia accused the UK and Ukraine of planning a false flag attack on a US ship using a Russian torpedo (Tiwari, 2025; EU vs Disinfo, 2025). This attempt to shape the public narrative by foreshadowing another attack like that on *Cheonan* shows both the potentially imminent threat facing allied warships and the value of a wreck intelligence capability.

Technology that enabled early deep-sea expeditions was the preserve of a few maritime powers. Now, many navies are acquiring capabilities for deeper sensing and effects, seemingly lifting the veil of anonymity from the deep seabed and normalising access. Simultaneously, this expanding capability has opened the entire vertical dimension of the ocean, and the seabed everywhere, as a potential battlespace, well beyond the several hundred metres where crewed submarines currently operate. Most of the wreckage and debris of this maritime battlespace will end up on the seafloor. Indeed, most of the debris for recent attacks on seabed cables and pipelines is on the seafloor, as are the remains of submarines and ships lost in accidents or attacks.

Figure 1. *The corvette ROKS* Cheonan, *sunk in 2010, recovered along with the remains of a North Korean torpedo from the seabed (Image: Associated Press / Yonhap).*

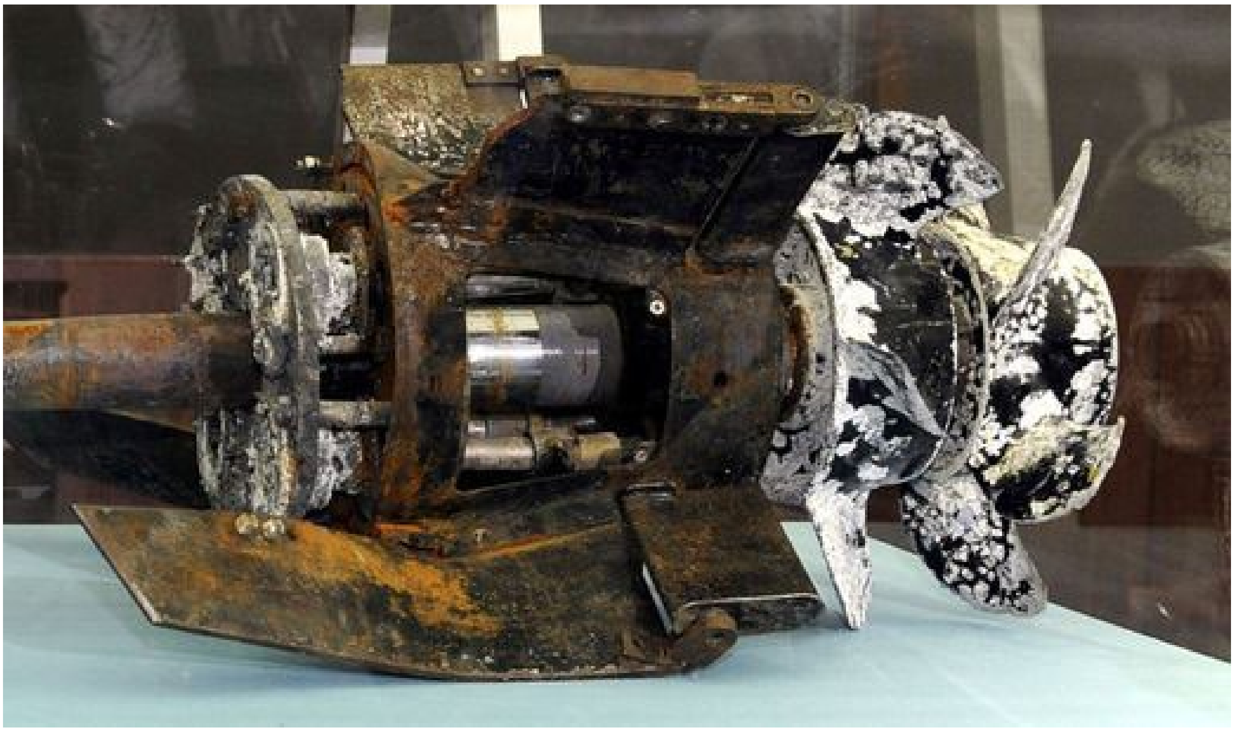

Figure 2. *The afterbody and propellers of the torpedo recovered from the* Cheonan *wreck site (Image: Pool / Getty Images).*

Incidents at sea resulting in physical evidence are often unseen or ambiguous, and potentially the result of hybrid warfare where attribution is difficult (Matisek et al., 2025, pp. 2–4). Military forces have an interest in constraining that liminal space through deterring potential perpetrators and their sponsors by increasing their risk of exposure through credible and timely attribution, and enabling swifter responses to attacks. On the other hand, erroneous or hasty attributions not supported by evidence risk unnecessary escalation and discredit future efforts, making it easier for adversaries to deny or obscure involvement. The military need to investigate the seabed is increasing as hybrid warfare leaves potentially attributable evidence of attacks on warships, submarines and critical undersea infrastructure on the sea floor. As Western states now seem to be in a period of perennial hybrid warfare, both in European and Asian seas, this issue becomes a matter of business as usual rather than an extraordinary event in times of open conflict or a peacetime incident scrutinised at length by a board of inquiry (see Matisek et al., 2025).

Context

As this study was conducted primarily in Germany, the experience and capabilities of the German Navy provide useful context and comparison with the Australian experience more familiar to the author. The issues of hybrid maritime warfare and maritime domain awareness are of immediate and increasing relevance to both Australia and Germany, given recent threats. The Royal Australian Navy (RAN) is building the capabilities and expertise required to counter or deter hybrid undersea attacks (Jackson, 2025). Germany is actively participating in NATO Operation Baltic Sentry 2025 to counter threats of hybrid maritime warfare. Russia appears to be foreshadowing false flag torpedo attacks on allied warships in the Baltic (Tiwari, 2025; EU vs Disinfo, 2025), and China's maritime militias are threatening hybrid actions in Asian seas (Dobius, 2024). The requirement for cooperation and information sharing among allied nations to counter hybrid threats in the maritime domain is pressing and real (Loik, 2024). During the period that this study was conducted, from September to December 2025, it was revealed by NATO intelligence sources that Russia may have illegally planted sensors within the wreck of the ferry Estonia, which sank in the Baltic Sea in 1994 with great loss of life and which remains an emotive site for many (Bews et al., 2025; The Maritime Executive, 2025a). Incidents like this show that seabed warfare is growing in importance and entering the public conscience. It is more than just cables and pipelines, and the public is entitled to ask what the navy is doing about it.

This study builds from historical precedent to future prospects. Section 2 defines and contextualises wreck intelligence, and Section 3 explores the reasons why navies have accessed wreckage on the seabed for intelligence purposes. Section 4 considers the tradecraft of wreck intelligence: the capabilities, methods, techniques, skills and collaborations required for intelligence operations. Section 5 compares German and Australian approaches to the problems of intelligence collection from seafloor wreckage, while Section 6 shows what the future of wreck intelligence might look like in light of recent and historical trends. Conclusions are in Section 7—principally that growing realisation of the value of wreck intelligence is helping to generate the collaborations, expertise and organisation required for effective collection and analysis, and that awareness of the perennial requirement is key.

2. Defining Wreck Intelligence

Wreck intelligence is a collective term for a range of processes already common to many navies. In essence, it is intelligence drawn from the investigation of physical remains of craft or infrastructure on the seafloor. This section defines key terms and capabilities.

Wreck

The International Hydrographic Organization (IHO) defines wreck as 'the ruined remains of a stranded or sunken vessel which has been rendered useless', and wreckage as the 'goods or parts of a wrecked vessel washed ashore or afloat, [the] remains of a wreck' (International Hydrographic Organization, 2023[1]). While the IHO does not define 'vessel' in this case, it is clear from other definitions that it means any platform, including aircraft (International Hydrographic Organization, 2023[2]). In IHO usage, wreck refers to a single site, but it can also be a collective term, as in some legal contexts where it refers to material from a 'ship, aircraft or hovercraft' that is found ashore or in tidal waters (see HM Government, n.d.). Wreck includes the sunken remains of any form of craft, including uncrewed vehicles or drones, and material lost or expended from craft into the sea, such as weapons or expendable sensors. The term also includes the sunken remains of infrastructure no longer in operation or that has been subject to attack, such as damaged seabed pipelines and cables, and even wind turbines and drilling platforms. In this study, wreck is the sunken physical remains of craft or structures that are no longer operational and that constitute evidence. Wreck intelligence seeks to use that apparently useless seabed material as a source of exploitable information.

[1] See 'wreck' (ID 6072) and 'wreckage' (ID 6073).
[2] See 'survey vessel' (ID 6216).

Intelligence

By adapting the NATO definition of intelligence[3], wreck intelligence can be defined as the product derived from 'the directed collection and processing of information' from sunken wreckage about the environment and about actors' capabilities and intentions, 'in order to identify threats and offer opportunities for exploitation'. By this definition, wreck intelligence includes investigating wreckage to attribute cause or responsibility, to understand sunken system workings and capabilities, and survey tasks to locate and identify wrecks or collect information about the surrounding environment. Activities solely for salvage, clearance, personnel recovery or heritage would not qualify as intelligence collection. While wreck intelligence in practice uses the same capabilities, these tasks differ in purpose. Salvage usually refers to the rescue of ships and cargo, while naval salvage also includes first aid to damaged ships, the recovery of lost objects and the clearance of sunken wreckage and obstructions for operational purposes (Bartholomew and Milwee, 2009, p. xxv).

As intelligence is the product resulting from collection and processing of information, accessing wreck sites themselves is directed collection. Collection efforts on wreckage contribute to intelligence that concerns technical, geospatial and forensic knowledge of an adversary's capabilities and intentions and the protection of one' own. These are the primary fields of wreck intelligence, and each is examined below.

Technical Intelligence

Technical intelligence concerns 'foreign technological developments, and the performance and operational capabilities of foreign materiel, which have or may eventually have a practical application for military purposes' (NATO, n.d.b.). This includes the exploitation of wreckage for information about the vehicle or device design, function, capability and contents, including recovering weapons or electronic equipment. The underwater technical intelligence activity most practised by navies is the recovery and exploitation of mines, usually after they have been deactivated or rendered safe, although functioning mines are weapons rather than 'wreck' in the definition above. History offers some spectacular examples of technical intelligence from wrecks, such as the US recovery of part of the sunken Soviet submarine K-59 by *Glomar Explorer* in 1974, which is discussed in Section 3 (Polmar and White, 2010).

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[3] 'The product resulting from the directed collection and processing of information regarding the environment and the capabilities and intentions of actors, in order to identify threats and offer opportunities for exploitation by decision-makers.' See, NATO, n.d.a.

The recovery or destruction of one's own wrecked material to prevent an adversary gaining technical intelligence is a form of counter-intelligence (NATO, n.d.c.). In these instances, available capabilities or operational pressures might limit recovery to those items of the highest intelligence value.

Geospatial Intelligence

Even without wreckage recovery, navies can derive valuable intelligence from wrecks, such as geospatial information about the location and nature of material on the seabed (NATO, n.d.d.). Geospatial intelligence is 'derived from the combination of layered geospatial information with other intelligence data, products and layers' (NATO, n.d.e.). This includes wreck search as a special activity of hydrography or military survey to identify anomalies on the seafloor, such as with mine counter-measures route survey and charting activities to locate and fix the sites of wreckage and obstructions. The object of these activities is usually to locate and characterise wreckage on the seafloor for navigation or to differentiate it from active weapons, vehicles or submarines (Bateman, 2005). In this way, the location and attributes of heritage wrecks can still hold intelligence value.

Forensic Evidence

Efforts to acquire information from wreckage on the seafloor have attributes in common with both archaeology and forensic investigation. Although wreck intelligence may use the same methods and equipment, its purpose is not usually to study the behaviour of past human societies, and only some wreck investigations are forensic in nature.[4]

Forensic investigation in its basic sense is the gathering of information for a legal purpose and forensic evidence is information used to indicate the truth or validity of a proposition.[5] Physical evidence is tangible material, like pieces of wreckage or ordnance, which is of value in an investigation. While physical evidence can usually be retained and repeatedly examined, trace evidence is physical but fleeting, usually available only in small quantities and often exhausted by the initial examination (Forensic Intelligence Specialist Advisory Group, 2022). Despite common assumptions to the contrary, trace evidence such as fingerprints, DNA and fibres are recoverable from underwater sites in some circumstances (Becker, 2013, pp. 7–8, 156–7).

These definitions construct wreck intelligence as the product of information drawn from the investigation of physical remains of craft or infrastructure on the seafloor that informs understanding of the environment and the capabilities and intentions of adversaries. It is used to identify threats

[4] For discussion relevant to wreck intelligence, see Bass, 2011.
[5] For a comparison of archaeological and forensic methods, see Becker, 2013, pp. 1-6.

and offers opportunities for exploitation. The next section considers the uses of intelligence collected from the seabed.

3. Intelligence Collected from the Seabed

The primary reasons for naval access to wreckage on the seafloor are attribution of attacks, technical intelligence and counter-intelligence. Wreck search is perhaps the most common activity of geospatial intelligence that provides the foundational information for the others. Although this paper is primarily concerned with how navies derive intelligence from wreckage, other non-intelligence related tasks are relevant to how navies build the capabilities and expertise to do so. Examples of such activities include salvage and recovery, clearance of obstructions, personnel recovery, heritage or commemoration tasks, training, and aid to the civil community roles like research support. This section provides an open source thematic review of naval involvement in investigations of evidence derived from material on the seabed and the themes that emerge from these activities.

Attribution

Attribution is one of the primary reasons why naval forces seek to access wreckage on the seafloor for intelligence purposes. Hybrid warfare at sea occurs in the space between detection, attribution and response, where malign actors exploit ambiguity and anonymity to avoid responsibility. While it is often clear who the perpetrator might be in open warfare, in some cases the incident may have been the result of an accident rather than a deliberate attack. Often, the physical evidence of these actions ends up on the seabed, complicating efforts to identify those responsible. Kilcullen's conceptualisation of liminal warfare as the space between detection and response locates attribution, as a military intelligence task, within this space. While his focus is primarily on land, air and cyber domains, the concept is readily adaptable to the maritime domain. Kilcullen's notion of 'attribution time' as 'the time taken by analysts to identify the operations' perpetrators and sponsors' underpins this study's notion of attribution (Kilcullen, 2020, p. 158). Given sufficient time, most navies can access wreckage on the seafloor, even in the deepest seas, although the availability of an operational capability to do so is a fundamental element of attribution time.

Attribution Case Studies

When the British gunboat HMS *Doterel* exploded and sank in the Strait of Magellan in Argentina in 1881, speculation in the press and parliament suggested that Irish terrorists may have been responsible by placing an explosive in the ship's coal supply (Hansard, 1881). Small explosives disguised as 'coal torpedoes' were effective weapons first used against coal-burning ships in the American Civil War. These shells were cast to resemble coal pieces, filled with gunpowder and plugged before being coating in tar or resin. The resulting weapon could be covertly added to coal stocks destined for use in warships, exploding when added to a boiler (Welker, 2022). While there were other, more plausible, explanations offered for the explosion, the Royal Navy (RN) investigated the wreckage to determine the cause (Figure 3). Divers from HMS *Garnet*, surveyed the wreck in around 22 metres of water and found the boilers to be in good condition (Gorman, 1882, pp. 241–244). The RN later determined the explosion to have been an accident. This relatively swift and competent investigation avoided an unnecessary response and quelled public fears of an attack.

In 1898, USS *Maine* exploded and sank in Havana and_the initial USN investigation of the sunken wreck determined that the ship's magazine had detonated following the explosion of a mine. This incident was a catalyst for the Spanish-American War (1898), although later investigations showed that an accidental internal explosion rather than an external attack most probably caused the sinking (Fahey, 2023; Wenzer, 2020). Despite access to the submerged wreckage (Figure 4), initially by divers and later in a dry cofferdam, inquiries in both 1898 and 1911 lacked the technical expertise in naval architecture and engineering to investigate such a site. A re-examination in the 1970s concluded that 'technical problems must be examined by technically qualified people who cast their analysis in terms other citizens can understand. Otherwise, fateful decisions will be made on the basis of emotions' (Wegner, 2001). USS *Maine* is an early example of an apparent wreck intelligence capability that lacked the expertise to fully exploit the source.

In 1939, the RN battleship HMS *Royal Oak* sank in its anchorage in Scapa Flow following explosions in the hull. The cause of the explosions was revealed some days afterwards when divers inspected the damaged hull and found remains of German torpedoes on the seabed (Turton et al., 2021). More recently, after USS *Cole* was bombed in Yemen in 2000, USN and FBI divers recovered evidence from the seafloor that helped to identify the attackers (Pastoric, 2021). Again, after the sinking of the corvette ROKS *Cheonan* in 2010, investigators recovered the remains of a North Korean torpedo from the site of the incident that was associated with the blast-damaged hull by forensic analysis (Yoon et al., 2010). These cases serve as examples of attribution from wreck intelligence and include many issues relevant to this study.

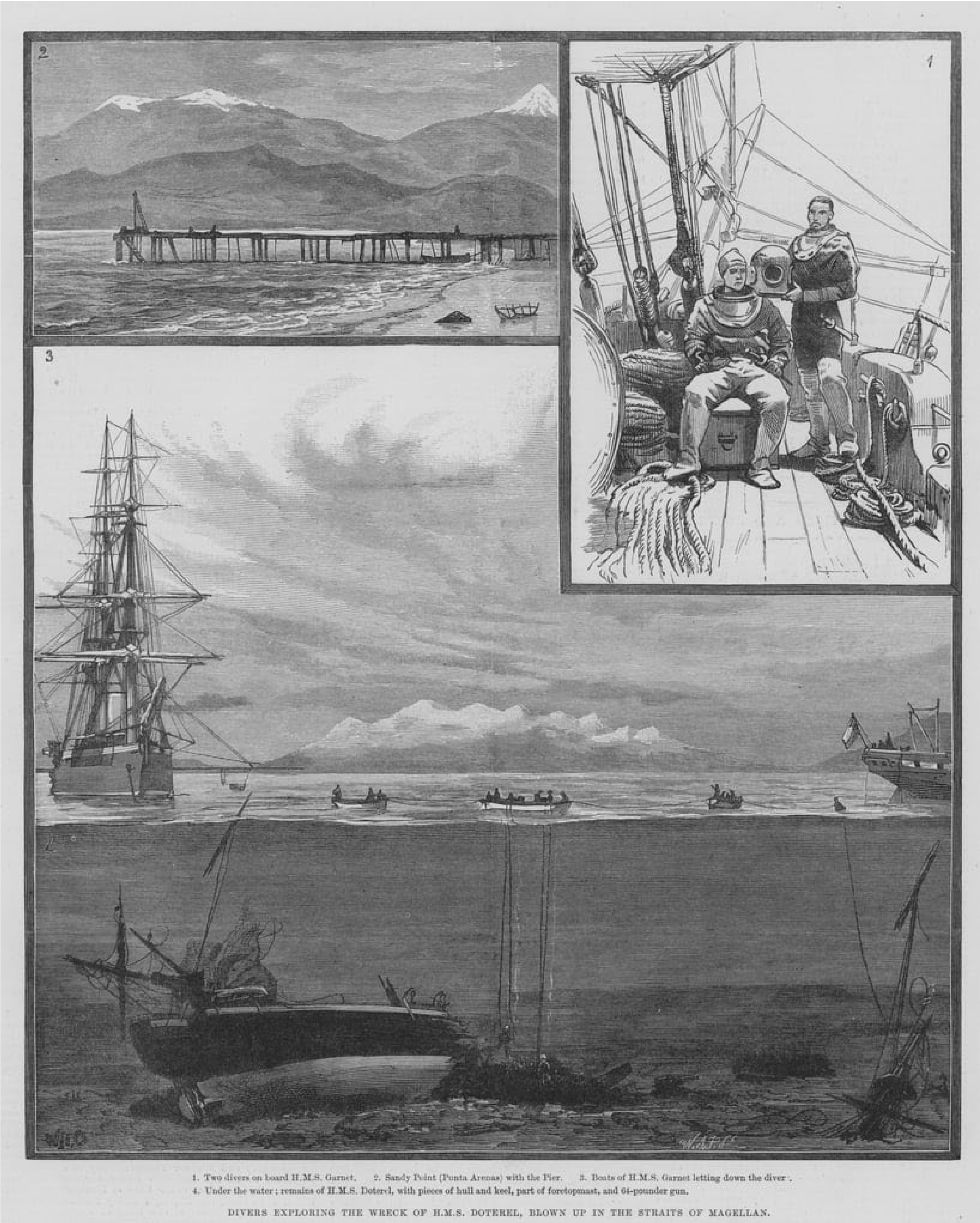

Figure 3. *Artist's impression of diving operations on the wreck of HMS* Doterel, *sunk in initially unknown circumstances in 1881 (Image: The Illustrated London News, 16 July 1881).*

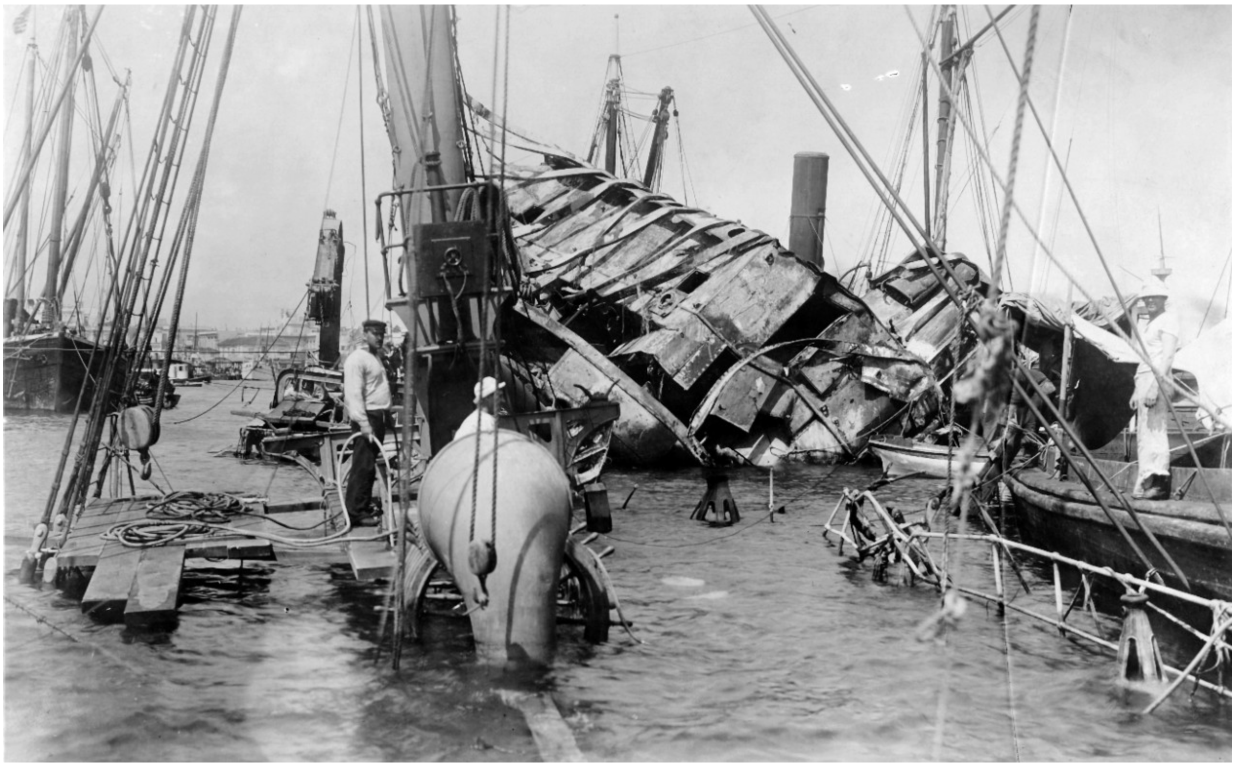

Figure 4. *A US Navy dive team works on the wreck of USS* Maine*, sunk in Havana in 1898 (Image: US Naval History and Heritage Command Photograph NH 46774).*

Technical Intelligence

Technical intelligence includes the exploitation of wreckage for information about function and capability, including recovering weapons or electronic equipment. During the Korean War, both sides recovered the first-of-type fighter jets from shallow water in mirror intelligence coups. In July 1951, British and US forces managed to recover a crashed MiG-15 from shallow water on the North Korean coast (Giannangelli, 2018), and in October that year, North Korean forces, directed by Soviet advisers, recovered a ditched F-86 Sabre submerged in coastal waters (Wetterhahn, 2023). The ROK Navy has since proved adept at recovering debris from North Korean ballistic missiles fired into the sea, providing significant technical intelligence on the development of these weapons. In 2022, a ROKN submarine rescue ship recovered the wreckage of a North Korean ballistic missile from the sea, while North Korea was unable to do so due to the lack of salvage and recovery capabilities (Newdick, 2022). In some earlier cases, a ROKN air warfare destroyer plotted the impact points of missile debris and directed a salvage vessel onto the target to use ROVs and divers to recover the debris (Kim and Yong-Soo, 2016). In 2023, the ROKN recovered parts of North Korea's first spy satellite after it crashed into the sea shortly after launch (Al Jazeera, 2023). South Korea has recovered at least two North Korean midget submarines lost by grounding or scuttling, which have yielded important intelligence information on the North's covert insertion campaign (Roblin, 2017; Roblin, 2020).

Project Azorian, a US attempt to recover covertly the sunken remains of an entire Soviet submarine, offers a spectacular example of technical wreck intelligence. In 1968, the nuclear-armed Soviet submarine *K-129* sank in the Pacific Ocean; in 1974, the CIA used the drill ship *Glomar Explorer* in a secret attempt to recover the remains. The US sought to recover documents and material, including nuclear weapons, from the wreck in over 5,000 metres of water before the Soviets discovered where it was. The US abandoned the operation after leaks to the press the following year (Polmar and White, 2010).

Turning to the present, the RN plans to exercise underwater battle damage assessment (UBDA) on a wreck they intend to sink by coordinated live-fire attacks as part of exercise Atlantic Thunder 26. Exercise planners expect the hulk to sink in over 1,900 metres of water, and they will evaluate the effectiveness of the weapons used in the attack by inspecting high-resolution imagery gathered by uncrewed underwater vehicles (UUVs) (Navy Lookout, 2025). While billed as a relatively new concept, some efforts to investigate wrecks with unknown causes are similar in method to UBDA. By finding out how well the weapons worked, these cases constitute a form of technical intelligence.

Counter-intelligence

Recovering sensitive material lost at sea before an adversary has the opportunity to capture it has been a regular theme of military deep-sea salvage capability. In 1966, the USN recovered a hydrogen bomb lost in Mediterranean Sea that year, and, in 1976, recovered an F-14 Tomcat with long-range air-to-air missiles off the coast of Scotland, to prevent them 'from falling into Soviet hands' (Newdick, 2021). In the latter case, Soviet 'fishing' vessels had already tried to net the wreck in an illicit attempt to recover a missile but had failed to bring it to the surface (Leone, 2024). Similarly, after the Falklands War ended in 1982, the UK conducted Operation Blackleg to recover or destroy classified material and weapons on the wreck of HMS *Coventry*, a destroyer sunk during the war (Hoare and Sinclair, 2022). In 2021, the USN recovered a Seahawk helicopter from nearly 6,000 metres underwater off Okinawa, Japan (Newdick, 2021). Finally, at least three F-35 Joint Strike Fighters have been lost at sea in recent years, with the US, Japan and the UK making significant efforts to recover them lest they become 'an intelligence prize for any foreign power with the means to recover it, either in whole or in part' (Trevithick, 2022; Lagrone, 2022: Newdick, 2021).

In October 2025, a German investigative report claimed that the Russian Navy had recently installed sensors in the wreck of the ferry *Estonia*, which sank in the Baltic Sea with great loss of life in 1994 (Bews et al, 2025). The wreck is considered a gravesite and a treaty between Baltic nations prohibits diving or visits to the wreck. This protection may have attracted Russia's Main Directorate for Deep-

Sea Research (GUGI) to the site, as the shallow Baltic offers few opportunities to mount clandestine seabed sensors. GUGI is known to have conducted 'training' at the site and may have installed sensors inside the wreck with which to monitor NATO surface and submarine traffic (The Maritime Executive, 2025a). While using a wreck like this as a sensor platform is not specifically technical intelligence, a response that aimed to remove or disable the sensors would be a good example of counter-intelligence.

Wreck Intelligence in the Russo-Ukrainian War in the Black Sea

The ongoing Russo-Ukrainian War in the Black Sea has seen numerous incidents of intelligence collection or counter-intelligence directed at wrecks on the seafloor. While it is difficult to verify numbers, it is clear from claims and reports that many airborne and surface drones have sunk in the Black Sea during the conflict, along with several vessels and aircraft, littering the seabed with their wreckage (Mattis, 2025; Harutyunyan et al., 2025, p 15). Russia claimed to have recovered from the sea the wreckage of some aerial drones used to attack ships in Crimea in late 2022, the first year of the war (The Jerusalem Post, 2022). Disabled drones from the conflict have also been found capsized or drifting in the waters of non-combatant states Romania and Türkiye (Sutton, 2024; Kyiv Post, 2025).

In a significant operation involving several ships, Russian forces reportedly recovered bodies and classified equipment, and possibly weapons, from the wreck of the sunken cruiser *Moskva* in 2022 (Axe, 2022; Ukrayinska Pravda, 2022). The main vessel involved in this salvage, the 1913 vintage *Kommuna* that carried the submersibles required to access the wreck (Figure 5), was reportedly later targeted in Sevastopol (Axe, 2024). *Kommuna* is a veteran of wreck intelligence work, having recovered the British submarine HMS *L-55* from the Baltic Sea in 1928, which gave Soviet engineers much insight to Western submarine design. *L-55* was even later commissioned into the Soviet Navy (Polmar, 2024).

In 2023, a US MQ-9 drone crashed in the Black Sea after an apparent collision with a Russian aircraft. Although the US claimed it would be broken up in waters up to 1,500 metres deep, Russia expressed the intention to retrieve it. Russia later claimed to have recovered the UAV and collected technical intelligence from electronic systems it carried (Satam, 2023). Russian forces lost a Mi-24 attack helicopter in unknown circumstances near Sevastopol in 2024 and used divers to find and survey the wreckage in 15 metres of water. Parts of the aircraft were recovered months later to investigate if it was shot down by a Ukrainian USV (Yan, 2025). In 2025, GUGI's underwater intelligence ship (AGI) *Yantar* investigated the wreck of the military cargo vessel *Ursa Major* in the Mediterranean after this ship was sunk by an unexplained series of explosions (Van Lokeren, 2025). *Yantar* had previously been used to sanitise the wrecks of fighter aircraft lost from the Russian carrier in 2017 during operations in Syria. In another attack that may have countered wreck intelligence potential, a Ukrainian aerial drone struck a Russian survey-equipped multifunction salvage vessel in 2025, although it is not clear if the vessel was deliberately or opportunistically targeted (Fornusek, 2025).

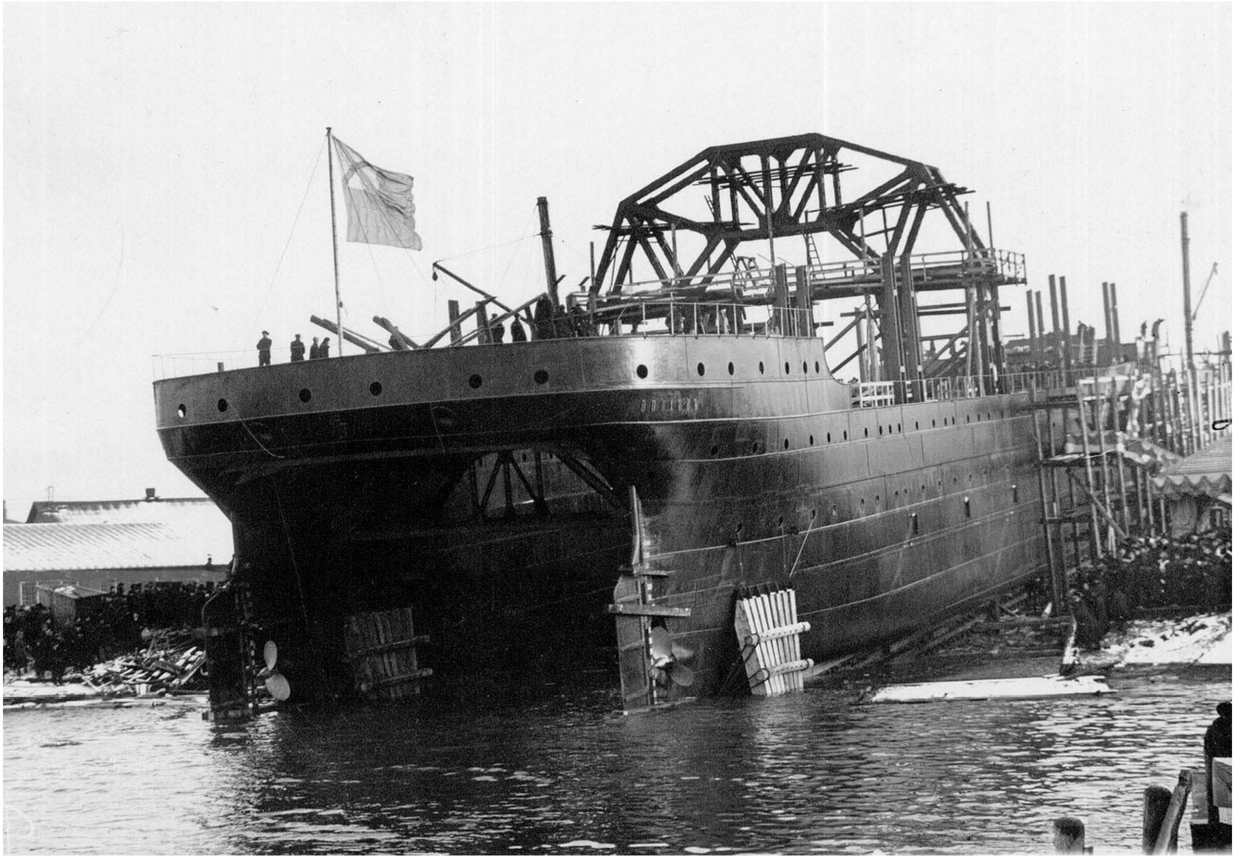

Figure 5. *The launch of the Russian salvage vessel* Kommuna *(ex-*Volkhov) *in 1913, the vessel used to salvage sensitive material from the wreck of the cruiser* Moskva *in 2022 (Image: Wikipedia / Public Domain).*

Other Reasons to Access Seafloor Wreckage

Military forces also access wreckage for reasons not primarily associated with intelligence collection against an adversary. Navies are often involved in personnel recovery when incidents or accidents involve the loss of life, although sometimes this is conducted in parallel with activities directed at wreck intelligence outcomes. This was the case with the South Korean *Cheonan* investigation in 2010 (Yoon et al., 2010), and reportedly with the Russian cruiser *Moskva* in 2022 (Ukrayinska Pravda, 2022). Some states conduct historical personnel recovery from underwater sites, usually from Second World War aircraft crashes. These cases involve excavation and forensic expertise, and are conducted with the permission of the coastal state (Pietruszka, 2015). Some methods are similar to those employed in wreck intelligence, especially when searching for and surveying sites.

Salvage and clearance include efforts to retrieve wreckage from the seafloor by bringing it to the surface, or to clear a path or port of obstructions. Damaged vessels and infrastructure can be returned to service, lost objects relocated and explosive ordnance and hazardous materials removed. Wreck intelligence operations often involve the same methods and units as do salvage and recovery, although much of this effort only indirectly involves intelligence outcomes (Bartholomew and Milwee, 2009). Navies sometimes access wrecks for heritage and commemoration purposes, on their own initiative to replace ensigns or add plaques, or in support of civilian-led heritage research activities. Sunken warships often represent war graves to which modern military forces, with the equipment to access them, retain emotional attachment. Some units use wrecks for training or practice for operating sensors and targeting weapons (de Ruyter, 2014, pp. 15–18). These cases rarely have a direct intelligence outcome, other than contributing to foundational awareness of seabed features. Given the number of relevant dual-use capabilities and activities that include elements of practice useful in collecting intelligence from the seabed, it is worth now considering the methods, skills and capabilities that are used specifically for wreck intelligence.

4. The Tradecraft of Wreck Intelligence

Within the intelligence community, the term tradecraft refers to the methods, techniques, skills and capabilities used in intelligence operations. The tradecraft employed is different for analysis and collection, and even for each collection discipline, and its appropriate application is a matter of professional competence (Weinbaum, 2024). Wreck intelligence, then, should have an applicable form of tradecraft in the methods and capabilities that enable it. While military forces and navies in particular may have a variety of elements of tradecraft that can be applied to wreck intelligence, effectiveness requires the selection of tools and methods appropriate to the purpose. For example, many navies have ROV capable of military tasks such as mine clearance, but industry standard working class ROV may be required for deeper work or to recover more substantial material. Many organisations and individuals seek evidence from wreckage on the seafloor for a variety of reasons. Adjacent fields of research that seek to analyse incidents through evidence on the seabed, such as marine accident investigation (Marine Accident Investigators' International Forum, 2014), marine forensics (Smith et al., 2005), and maritime archaeology (Church, 2014; Søreide, 2011), offer insights into the problems faced by naval forces. What then are the common elements of wreck intelligence tradecraft that might be drawn from recent examples or anticipated for future requirements?

Search and Location of Sites

After an indication that relevant wreck material may have been deposited on the seafloor, through detection, destruction or other report, the ability to locate the wreck underwater becomes a fundamental enabler of wreck intelligence. Refining the search location and selecting the appropriate capability from those available is, therefore, the initial move in seeking wreck intelligence.[6] Wreck search is considered to be a special application of hydrographic surveying, where detecting and mapping the locations of underwater features and finding their least depth is the principal objective (Bundesamt für Seeshifffahrt, n.d.[7]; International Hydrographic Organization, 2011[8]). Similarly, existing military capabilities in mine warfare and anti-submarine warfare can be adapted to this purpose, and maritime patrol aircraft have been employed in successful searches for historic wrecks (see Gesner, 2000, pp, 26–27; Thom, 2009). The nature and precision of the initial location data determine the size of the search area, which is based on a locality description and any associated sources of uncertainty (Chapman and Wieczorek, 2020; Becker, 2013, pp. 85–88). The extent of the search area in turn determines the rate of effort required with the available capabilities to locate the underwater site.

The instruments most commonly used to locate material on the seafloor are active acoustic sensors for the initial search, followed by higher resolution visual sensors; however, geophysical sensors, like magnetometers or sub-bottom profilers, are also useful. These sensors can be deployed on a variety of airborne, surface or subsurface platforms, with the probability of detection related to the 'shape, extent, composition and aspect' of the feature sought, the environmental conditions and nature and depth of the seabed, and the method of employment and resolution of the search sensor package (International Hydrographic Organization, 2011[9]). Basically, the deeper the site and the smaller the pieces, the more specialised becomes the capability requirement.

Site Documentation and Recording

Once a site has been located, its full extent should be understood, as far as this impacts the collection requirement. In some instances, the requirement for recovery may supersede the need for a comprehensive survey, such as through restrictions of time or capability. Yet, it matters where parts of the site occur in relation to each other, and the ability to produce accurate documentation and 'crime scene sketch' type visualisations, a process sometimes called 'profiling', is a critical element of

[6] As for underwater crime scene investigation, see Becker, 2013, pp. 85–88.
[7] See 'Wreck Search'.
[8] See Chapter 2.
[9] See Chapter 2, para 2.2.4.3 and sections 2.2 and 2.3.

intelligence collection underwater (Becker, 2013, pp. 98–105). As with most underwater forensic cases, and unlike incident sites on land, investigators or analysts are unlikely to experience the scene themselves and will rely on documentation and visualisation provided by operators of underwater sensors (Moniz and Magni, 2023).

The debris field created on the seabed by a sunken ship or aircraft is usually much more extensive than the size of the major elements of the craft's structure. For example, the horizontal extent of the debris field of modern ships sunk in deep-water has been calculated at around 20 per cent of the water depth plus the length of the hull, based on observations of ships sunk in the Gulf of Mexico (Church, 2014). Additionally, in cases where the ship did not immediately sink after the fatal torpedo strike, there might be an initial debris field as well as a trail of debris created while the ship lost way (see Church, 2014, pp. 30–33). Depending upon how they break up in the air and enter the water, aircraft debris fields can cover much larger areas (Becker, 2013, pp. 185–88; Eck, 2025). In the case of one of the Nord Stream pipeline attacks, fragments were dispersed at least 250 metres from the site of the explosion (Nord Stream, 2022).

The debris fields created at these sorts of sites dictate the types of sensors and capabilities that might be appropriately used to survey them, although any visual or high-resolution sensor might be used for an initial inspection of the site. For example, after the Nord Stream pipeline attacks in 2022, the Swedish newspaper *Expressen* engaged an ROV operator to access the site using a suitcase-sized vehicle deployed by hand from a small boat, indicating the situational awareness that can be generated by even relatively simple capabilities (Carlsson and Wiman, 2022). Later, Greenpeace used an ROV to conduct a broader survey of the site and collect seabed samples for testing for explosives (Görz y Moratalla and Schader, 2022). These non-military agencies provided some of the most comprehensive open source visual material of the damage. Documenting and recording the entire site to forensically acceptable standards may not always be possible in the prevailing circumstances; however, it is important to note that the site usually extends beyond the main element of wreckage and can involve several dispersed locations.

Evidence Recovery and Analysis

Often, elements of wreckage need to be recovered from the seabed for analysis ashore. Recovery teams must describe the methods and protocols they followed while identifying and recovering evidence (Becker, 2013, p. 105). Inappropriate recovery technique risks losing or contaminating trace evidence, or even physical evidence, and the loss of contextual information required for visualisation and reporting (Becker, 2013, p.6). After the sinking of ROKS *Cheonan* in 2010, a Joint Investigation

Group (JIG) was formed to review the incident and attribute the cause. The JIG included '25 experts from 12 Korean civilian agencies, 22 [Korean] military experts, 3 advisors recommended by the National Assembly, and 24 foreign experts from the United States, Australia, the United Kingdom, and Sweden' (Yoon et al., 2010, p. 28). The two halves of the sunken ship were recovered from the seabed, along with debris, and the crucial evidence of parts of a North Korean torpedo were recovered using 'special nets' (Yoon et al., 2010, p. 30). This was not an ideal method of recovery as the artefacts were not imaged or mapped before being disturbed, so the find place was imprecisely known, introducing a potentially weak link in the chain of custody. As in crime scene investigation, 'if a piece of evidence were located on land, no competent investigator would pick it up; hold it over [their] head and say, "I've found it."' (Becker, 2013, p. 4). The techniques employed will always need to be balanced with the time and resources available, and high-profile wreck investigations like the *Cheonan* case will often be conducted under intense political and public pressure. The evidence collected from the seabed was crucial to the investigation, as the JIG analysis covered the internal and external hull structure and damage; explosive analysis; medical examination of casualties; digital, acoustic and video sources; considerations of seabed and tide conditions; and intelligence of vessel movements (Yoon et al., 2010, pp. 41–46).

Developing Relevant Perceptual and Interpretive Expertise

The involvement of people who understand what they are looking for or at is fundamental to wreck intelligence. Forensic scientists, scenes of crime investigators, nautical architects, marine engineers, hydrographers, divers, fishers, salvors, archaeologists, and operators and spotters of ships, submarines, aircraft and remote and autonomous vehicles will have developed forms of perceptual expertise relevant to the interpretation of wreckage on the seafloor. Nevertheless, generating specialists in areas relevant to seabed warfare is also a conscious endeavour (see Ministère des Armées, 2022, pp. 44–46). Locating and surveying historic wrecks helps develop relevant expertise and provides exposure to underwater sites and the considerations that are important in their interpretation (See Ruane, 2025).

The Russian Navy's Northern Fleet has been using sunken Second World War cargo ships in the Barents Sea to train personnel in seabed warfare and diving, and to test submersibles and UUVs. The training included salvaging tanks, guns and a locomotive from the lend-lease cargo, potentially in violation of international law (Solon, 2023). Similarly, the range areas at sea where weapons are tested, targets shot down and hulks sunk would provide ideal venues at which to develop relevant wreck intelligence expertise. Such ranges could double as exercise areas in which to practice locating and interpreting the wreckage of weapons, test vehicles and craft destroyed or sunk by weapons

(Navy Lookout, 2025). Indeed, the French armed forces were among the first to explicitly define this in their 2022 *Seabed Warfare Strategy*, which showed that seabed warfare covers more than just cables and pipelines. This strategy is one of 'know, monitor and act', where foundational knowledge of the seabed, built up by decades of research, supports surveillance efforts and the ability to take action 'on, from and towards the seabed' down to 6,000 metres (Ministère des Armées, 2022, p. 27). French intelligence services are explicitly included in this strategy for their support in 'the three steps of detecting and identifying potentially hostile actions, understanding and characterising our competitors' and potential enemies' intentions and designating responsibility for these actions' (Ministère des Armées, 2022, p. 40). By taking action, this strategy refers to searches and investigations to characterise threats and for attribution, interventions to 'neutralise, destroy or retrieve devices', to repair or salvage underwater objects, and to search and retrieve sensitive objects (Ministère des Armées, 2022, p. 39). Here, in essence, is wreck intelligence. Making the point even more obvious, in early 2025, the French admiralty expressed a desire to investigate the wreck of *Ursa Major* to 'observe more precisely' what the Russian vessel *Yantar* had been doing (Manaranche and Vavasseur, 2025).

The French *Seabed Warfare Strategy* 2022 identifies some of the capabilities, skills and collaborations required to know, monitor and act on the seabed, as well as the doctrinal path required to enact the strategy. It is clear from this that no single agency is expected to have all the capabilities and skills required, and that collaborations between government agencies, industry and academia are essential. The development of the capability to know, monitor and act on the seabed is also a focussed process involving the investment of time, treasure and intellectual muscle: experiments, exploration and innovation are integral (Ministère des Armées, 2022). Such development takes place as 'hybrid seabed warfare' is already underway in European and Indo-Pacific seas, and openly in the Black Sea, driven by necessity and experience. This provides the context for a comparison of German and Australian approaches to seabed warfare, particularly the use of wreckage for intelligence purposes.

5. German and Australian Approaches to Wreck Intelligence

The German and Australian navies offer examples of small to medium sized forces, supported by other government agencies, which have a strong interest in seabed warfare and have engaged in activities relevant to wreck intelligence. The German area of primary interest in the Baltic and North Seas has directly involved hybrid warfare activities, while Australia's extensive underwater domain involves exposure to the full spectrum of seabed warfare across huge areas. A comparison of the two approaches highlights the common requirements of a wreck intelligence capability, including those adaptable capabilities already in place, as well as areas of shared maritime interests and opportunities for collaboration in seabed warfare.[10]

German Capabilities for Wreck Intelligence

The capabilities and expertise required to collect intelligence from seabed wreckage is rarely contained within a single agency, nor does the responsibility for such investigations usually reside within only one authority. In practice, states require collaborations and networks to achieve the collection requirements (Chief of German Navy, 2023, pp. 5–6). Germany provides an example to illustrate the organisation of agencies that support or contribute to intelligence collection from wrecks in a NATO state with recent experience of hybrid warfare and confrontation. German Navy ships have been subjected to sabotage attempts that damaged a minehunter and very nearly a corvette in 2024, as well as a thwarted attempt in 2025 to contaminate the fresh water tanks of a frigate (The Maritime Executive, 2025b; 2025c). German Navy aircraft have been targeted by Russian flares in the Baltic and Chinese lasers in the Red Sea (Chareptreau, 2024; The Guardian, 2025). As well as damage to undersea infrastructure in the Baltic and North Seas, these incidents indicate a quickening of confrontations at sea that could lead to the deposition of evidence on the seafloor. According to the *German Navy Objectives for 2035 and Beyond* (Chief of German Navy, 2023, p. 5):

> the underwater sub-domain is rapidly gaining in importance. Modern submarines and other submersibles can cause enormous damage, even in peacetime, because it is difficult to attribute underwater attacks on civilian and military targets to a responsible party.

Wrecks are managed within German legislation along four themes: as an environmental concern, as an issue of marine traffic and safety, as property or as cultural heritage. The tasks that agencies perform relate to these themes; therefore, modern wrecks of intelligence interest are usually not covered by cultural heritage legislation, although warships remain state property under German law (Lindgren and Rythönen, 2025, pp. 61–65). The Federal Maritime and Hydrographic Agency (BSH) is responsible for hydrography and nautical charting within the German EEZ, covering 57,000km^2, including the localisation and investigation of seabed obstructions and wrecks (Lindgren and Rythönen, 2025, p. 63). The Federal Waterways and Shipping Administration (WSV) is responsible for the safety of shipping lanes, other agencies are responsible for environmental protection, and two further agencies are responsible for 'former moveable assets of the German Reich' within territorial

[10] For a more extensive comparison of the two navies' approaches, see Schwarzer, 2022.

seas and the EEZ. Authorities from the four coastal states of Germany are responsible for wrecks that pose immediate navigation or environmental hazard, unless these constitute a complex emergency, which are then managed by federal authorities (Lindgren and Rythönen, 2025, p. 63).

The principal federal agency responsible for responding to these complex emergencies is the Central Command for Maritime Emergencies (CCME or Havariekommando) in Cuxhaven. The CCME has limited assets of its own to conduct this task but is a joint organisation of state and federal agencies (Lindgren and Rythönen, 2025, pp. 63–64). Other federal authorities, including the Federal Police, Federal Customs Administration and the German Navy, are important contributors in emergency response through the Maritime Safety and Security Centre (MSSC), which is co-located with the CCME. The MSSC provides constant monitoring of national and international shipping for safety and security in German waters and can call upon responses from federal and state agencies (Maritime Safety and Security Centre, 2019).

The lead agency for investigation of wrecks in Germany is the BSH, which is responsible for hydrography. With several ships dedicated to wreck search using acoustic sensors, ROVs and divers, the BSH investigates an average of 200 seabed obstructions or wrecks each year and monitors over 3,000 obstructions – wrecks, navigation hazards, containers, munitions, rocks – within the German EEZ (Lindgren and Rythönen, 2025, p. 64). The German Navy's Mine Warfare Data Centre contributes to the database and maintains its own records of historical and modern ordnance and mine-like features on the seabed (Jan Warrmke, Mine Warfare Data Centre, personal communication, 2025). The Federal Bureau of Maritime Casualty Investigation (BSU), co-located with the BSH in Hamburg, is responsible for the initial investigation into the cause of marine casualties in German waters, as well as those involving German ships or citizens worldwide. The BSU collaborates with other federal and state authorities during these investigations, including the Federal Police (Bundesstelle für Seeunfalluntersuchung, n.d.). The Federal Police, usually the lead investigator in incidents where criminal or hostile action is suspected, have patrol vessels available to access wreck sites and that assist other agencies during investigations. Importantly, the Federal Police have forensic divers and are acquiring ROVs to enable inspection of submerged sites (see Maritime Safey and Security Centre, n.d.).

While the German Navy contributes to the MSSC and CCME operations, it maintains capabilities that are directly relevant to the collection of intelligence from the seabed. These capabilities are primarily related to mine warfare, explosive ordnance disposal and diving, and surveillance, as hydrography beyond Q-route surveillance and other military data gathering is a civil function in Germany. In a capability response to hybrid warfare actions relevant to collecting wreck intelligence, the German

Navy is increasing the depths at which its divers can operate and testing UUVs, and is seeking more modern sensors and weapons, underwater vehicles and AI-based underwater picture tools (Marine Forum, 2025; Chief of German Navy, 2023, p. 5).

Following the North Sea collision between the cargo ships *Verity* and *Polesie*, in which *Verity* sank with four missing crewmembers in around 30 metres of water, divers and an ROV were used to investigate the wreck. High winds, rain, strong currents and underwater visibility of 1 to 2 metres in the days after the collision all limited the effectiveness of these methods and little useful information was obtained (The Maritime Executive, 2025d). The survey ship *Atair* of the German BSH was used to locate and survey the wreckage (Milton, 2023).

In response to the September 2022 attacks on the Nord Stream gas pipelines, NATO established the Critical Undersea Infrastructure Coordination Cell with the responsibility to oversee international and cross-sector activities. This body is intended to 'improve co-ordination and decision making to strengthen deterrence and defence against CUI threats' (Willett, 2023). The cell, the product of a joint proposal from Germany and Norway, aims to provide better characterisation of hybrid undersea threats to CUI to enable better protection, deterrence and response. The elements that this cell is intended to provide include intelligence sharing and information exchange, threat assessments, engagement with stakeholders, and exchange of good practices and innovative technologies (Willett, 2023). Most of this activity focusses on identifying and deterring suspicious surface vessel behaviour around CUI through enhanced intelligence networks and data sharing, and responding when required.

Australian Capabilities for Wreck Intelligence

Similar to the German case, the approach to seabed warfare in Australia relies on inter-agency co-operation and a degree of industry support. Wreck intelligence is nowhere specifically addressed, but a nascent capability may be inferred from other seabed warfare developments. In contrast to Germany, the national hydrographic role in Australia is a Defence function, and the deployable assets and personnel are predominantly from the RAN, although with considerable industry support for the national charting activities. Under the provisions of the Navigation Act 1912 (Commonwealth), and associated with the national charting task, Defence has long had responsibility for investigating and reporting marine wreck in Australia, which included 'jetsam, flotsam, lagan and derelict' — essentially anything from a wrecked ship (see Navigation Act 1912, §294). The Navy elements assigned this task are made up of hydrographers, meteorologists and oceanographers that together are considered geospatial warfare specialists within the maritime domain (Australian Hydrographic Office, 2025). The RAN is replacing large crewed hydrographic ships with deployable teams that use remote and autonomous systems. This shift is similar to the Navy mine warfare capability, in which crewed minehunters are being replaced with deployable teams that operate crewed, optionally-crewed and uncrewed systems. The clearance diving capability is being maintained (Arthur, 2025, pp. 16–18).

The geospatial warfare, mine warfare and clearance diving elements of the RAN are focussing their efforts on seabed warfare tasks that relate to AUKUS Pillar II Undersea Warfare capabilities.[11] These capabilities are being developed in partnership with the US and UK and are aimed at using advanced technology to understand and exploit the undersea environment. While much of the discussion is focussed on seabed infrastructure, Navy is deploying ROVs and UUVs for 'effective identification, monitoring and neutralisation of seabed threats, including defending undersea infrastructure, salvaging equipment and disarming hazardous objects' (Jackson, 2025). Through collaborative exercises and experimentation, the relatively small RAN force is quickly building the expertise that enables deployed operations from a variety of platforms (Jackson, 2025). In 2024, a RAN team supported by contractors located and identified the wreck of the Second World War destroyer USS *Edsall* in nearly 6,000 metres of water off the West Australian coast (Figure 6), demonstrating this developing capability (Ruane, 2025).

The *Australian Government Civil Maritime Security Strategy* of 2022 acknowledges that seabed infrastructure is part of Australia's maritime domain and includes an objective to protect 'Australia's maritime infrastructure' (Australian Government, 2022, p.18). Some civil and paramilitary agencies in Australia have relevant capabilities, such as the research vessels of the Commonwealth Scientific and industrial Research Organisation and the patrol vessels of the Australian Border Force (Moate and Jateff, 2024). The Strategy proposes inter-agency and whole-of-government measures that support decision making, mitigate risks and 'prevent, detect, deter and respond to threats or potential threats' to maritime infrastructure (Australian Government, 2022, pp. 36–37). The Australian Transport Safety Bureau (ATSB) performs a similar role in Australian accident investigation to that performed by BSU in Germany, although with limited organic assets (Australian Transport Safety Bureau, 2025). The Australian Maritime Safety Authority used 'contracted equipment, an emergency towage vessel, and four jet aircraft' for marine search and rescue response (Australian Maritime Safety Authority, 2025a), although this is supported by other federal and state agencies including Defence (Australian Maritime Safety Authority, 2025b). This is a roughly similar capability to the German Havariekommando. The Defence Science and Technology Group supports underwater search efforts,

[11] AUKUS is a collective shorthand term for Australia, the UK and the US specific to a trilateral security agreement announced in 2021.

such as was the case with the ATSB-led search for the missing Malaysia Airlines airliner MH370, with a range of relevant scientific and technological expertise (Davey et al, 2016, p. vii).

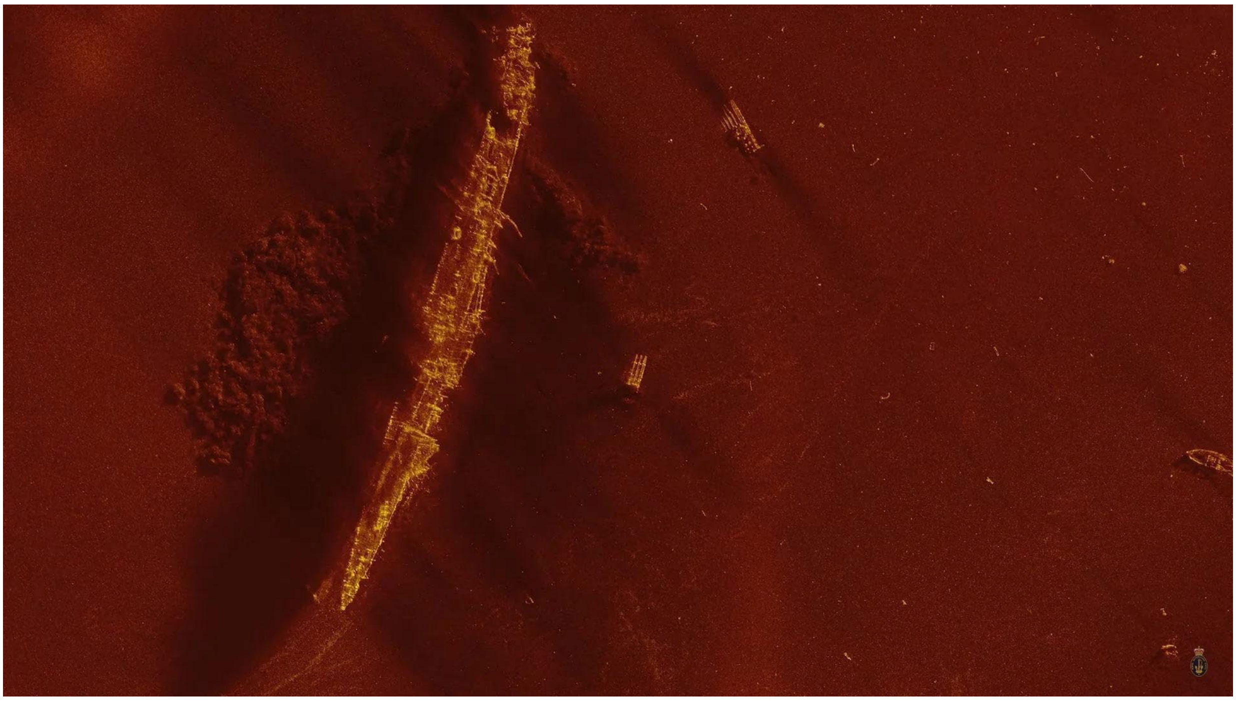

Figure 6. *The wreck of USS* Edsall *discovered in nearly 6,000 metres of water by an uncrewed underwater vehicle operated by the Royal Australian Navy (Image: Royal Australian Navy).*

While scenarios like the mass deployment of weaponised underwater gliders or attacks on seabed cables might be considered in discussion of potential hybrid or grey zone threats to Australia (Arthur, 2025, p. 16; Bashfield, 2025, pp. 11–14), there are fewer recent examples of wreck intelligence from Australia's maritime domain than one finds in the Baltic and North Seas. Navy is regularly involved in wreck searches and finds, and in support to civil agencies for criminal matters or accident investigations (see Lucas, 2009; Broome, 2016). While these actions are not related to intelligence collection, they indicate the development of applicable skills and expertise. In 2023, the Australian Defence Force worked with international military and civil agencies to locate and recover the wreckage of an Australian Army Taipan helicopter that had crashed off the Queensland coast (Defence, 2023), demonstrating the collaborations involved in accessing and recovering wreckage.

German and Australian Approaches Compared

Germany and Australia have roughly similar sized navies that receive support from other government departments and industry for activities that would constitute wreck intelligence collection. Both navies are generating capabilities for seabed warfare that support wreck intelligence, although neither has specified the need or developed in-service salvage capabilities more familiar from the US and Republic of Korean navies, for instance. The future of wreck intelligence for these two navies, like many of similar size, involves building on existing capabilities, maintaining collaborations and partnerships that provide for those capability areas they are missing, and building awareness and expertise in relevant areas.

6. The Future of Wreck Intelligence

The wreck intelligence cases examined in this research show scenarios and recent trends that have made it to prominence, not the entire scope or application of such a capability. Some scenarios may become more prominent in a future of 'unwar', or operations short of outright armed conflict, where adversaries struggle for advantage on the seabed—a 'new playing field of strategic competition' (Ministère des Armées, 2022, p. 3). False flag attacks that shift responsibility to another party, massed uncrewed vehicles that take advantage of opacity and deniability at sea, ships turned into weapons for plausibly deniable attacks on other ships or port infrastructure and covert sabotage will all potentially leave material on the seafloor. Some of this material will be useful to those who seek to understand who was behind the attack, how it was conducted or how the weapon operated, and even to those who seek to keep this information from their adversary. This section considers some of these scenarios and how states can develop the capabilities and expertise of wreck intelligence in response.

False Flag Attacks

The use of false flag attacks—attacks that appear to have been carried out by an actor other than the real assailant—is neither new nor necessarily restricted to hybrid warfare. Yet the opacity of the ocean and the distance from surveillance can make false flag attacks at sea particularly attractive. As part of a recent disinformation narrative of false flag attacks planned by NATO or other Ukrainian allies, Russia accused Ukraine and the UK of planning an attack on a US ship using Russian-made torpedoes. Russia claimed that some weapons would detonate before reaching their target, and that at least one torpedo would sink relatively intact, thereby becoming 'evidence' of Russia's 'malicious activity' (Tiwari, 2025; EU vs Disinfo, 2025). The details in this scenario are similar in many respects to the *Cheonan* incident, where the remains of a North Korean torpedo were recovered from the site of the sinking, which could have resembled a false flag attack. As part of the same narrative, Russia asserted that Soviet-era mines were to be sown in international waters to provoke a response against Russia for not acting in accordance with international law (EU vs Disinfo, 2025). Such claims are premised on the assumption that the remains of the weapons will be recovered and identified as

Russian. Indeed, accusations or suspicions of false flag provocations regularly attend evidence drawn from underwater sites as attempts to discredit such investigations.

Proliferation and Weaponisation of Uncrewed Vehicles

The Russo-Ukrainian War in the Black Sea has seen the requirement to seek intelligence from wreckage on the seafloor grow apace as new types of missiles and drones are deployed, and as novel and experimental capabilities are thrown into combat. Across the six years of the Second World War, the German Kriegsmarine lost 648 submarines at sea worldwide to operational causes (Niestlé, 2014, p. 4). Each submarine carried at least one cryptographic machine, and Allied forces were able to capture several machines from U-boats (Gough, 2011, pp. xiii–xxi). While there are many fewer submarines in operation now, and the likelihood of their capture is probably much lower, an ever-increasing number of UUVs are entering service offering opportunities to capture, or lose, sensitive material. David Strachan (2018) describes these UUVs, as unencumbered by the requirement to avoid confrontation in the same way as crewed platforms:

> with the cover of the opaque undersea environment, as well as plausible deniability to cloak them, fleets of unmanned vehicles will be free to disrupt, degrade, and destroy seabed infrastructure – and one another – at will.

Picture a seafloor littered with the remains of uncrewed aerial, surface and underwater vehicles, each with potentially sensitive technology or weapons, and you have a new frontier of wreck intelligence.

The search for lethal mass in the 'march to autonomy' means that uncrewed vehicles are proliferating, with maritime forces investing in extra-large uncrewed underwater vehicles (XLUUV), like the Australian *Ghost Shark* (Sharpe, 2025). Indeed, many nations are acquiring or testing XLUUV – US, UK, Australia, Germany, Russia, China, South Korea, India and France at least – many of which are designed to carry payloads that include weapons (Suman-Chauhan et al., 2024). These vehicles are a supplement to crewed submarines, but smaller UUVs are already standard kit for mine warfare and geospatial intelligence forces. The use of UUVs as one-way attack drones is also spreading. In early 2024, US forces destroyed a weaponised UUV in Houthi-controlled waters off Yemen, and similar UUVs may already have been used in attacks on tankers of the UAE in 2019 and against Israeli offshore infrastructure in 2021 (Sutton, 2024).

Chinese militia fishermen reportedly recovered a UUV in the coastal waters off Hainan, and in 2016 the Chinese Navy seized a US glider UUV in the South China Sea (Erikson and Kennedy, 2015; Sutton, 2021). The discovery of at least eight underwater gliders in Indonesia between 2016 and 2020 has caused concern in Indonesian defence circles about how to detect and counter such UUVs (Bakar, 2024). These gliders have been linked to Chinese-flagged ships and research institutes, and the Indonesian government has protested their presence (Anom and Citrawan, 2024). Chinese *Sea Wing* gliders have also been found in Vietnam and the Philippines (The Maritime Executive, 2025e). These glider UUVs use ocean currents and buoyancy propulsion for long endurance, occasionally surfacing to transmit data to a control station, and can be launched from any vessel: 'their innocent-looking yellow paint and tendency to drift in the currents is the embodiment of plausible deniability' (Sutton, 2021). That so many gliders have been recovered suggest that there are many more that remain undiscovered, while their potential for weaponisation is a sign of the increasingly complicated underwater space. Commercial UUVs would be relatively easily adapted to military purposes while simultaneously remaining deniable (Piekarski, 2025, p. 9).

Blocking and Ramming Attacks

Sinking ships to block channels is an ancient practice, either as a defensive or offensive move, but in almost all cases the identity and motive of the agent sinking the vessel is known. In the 2014 assault on Crimea, Russian forces deliberately sank a decommissioned missile cruiser and other vessels to block the egress of Ukrainian naval vessels from Lake Donuzlav. The disruptions caused by the grounding of the container vessel *Ever Given* in the Suez Canal in 2021 and by the collision of a ship with a bridge in Baltimore in 2024 illustrate the risks posed by blockships (Savitz et al., 2025). Such blockages take time to reduce or remove, particularly with large ships or when major infrastructure is damaged, while the 'plausible deniability of blockship attacks might make them attractive to prospective attackers' (Savitz et al., 2025, p. 6). Baltic Sea states are alive to this possibility (Piekarski, 2025, p. 6). Evidence of whether the ship itself was sabotaged or if the incident was indeed accidental may lie submerged in the wreck of the blockship. The same might be said of ramming attacks, or of plausibly deniable collisions at sea.

China's maritime militia vessels reportedly rammed and sank three Vietnamese trawlers during a dispute in the South China Sea in 2014 (Erickson and Kennedy, 2015). Some Chinese maritime militia vessels are built with reinforced hulls specifically for ramming (Erickson, 2018; also Loomis and Holz, 2021). Additionally, Chinese Coast Guard vessels appear to be designed to better enable 'shouldering' or deliberate collisions with other vessels; similar tactics were employed in the Cold War between Soviet and US ships (Axe, 2021), and during the 'Cod Wars' between Iceland and the UK (Ingimundarson, 2003). The March 2025 collision between the partly Russian-crewed Portuguese-flagged cargo ship *Solong* and the anchored tanker *Stena Immaculate* that was carrying jet fuel on charter for US forces raised speculation of a deliberate ramming attack (Diver et al., 2025). Cases of intentional harassment and jamming of navigation systems of vessels are a regular feature of hybrid warfare in the Baltic Sea, and Russian border forces even removed buoys marking the international boundary with Estonia (Piekarski, 2025, pp. 4–5). Russian shadow-fleet vessels that sail under flags of convenience, sometimes from nations that do not have a shipping register, and that are typically un- or underinsured and have dubious ownership arrangements. Incidents involving these vessels often require the coastal state to fund the salvage, occupying seagoing resources and causing expense while simultaneously offering plausible deniability to the vessels' operators (Braw, 2024).

Developing Effective Wreck Intelligence Capabilities

The German and Australian cases show that development of capability in this field, for medium sized powers at least, will be a shared civil-military endeavour that relies on collaborations between defence, government, industry and research institutions. The French *Seabed Warfare Strategy* 2022 involves 'creating emulation through chosen partnerships' which will 'stimulate development […] through cross-fertilisation of expertise and know-how in a dual military and civil field' (Ministère des Armées, 2022, p. 9). This is the fourth stream of the French roadmap, which otherwise involves integrating seabed warfare into defence strategy, defining the related governance among stakeholders, and preparing capability. Governance and partnerships are closely related, and rely to a great extent on information sharing, the effectiveness of which in turn impacts attribution time.

Attribution time, the time between detection of an attack and confident attribution that enables response, is a primary driver for organic capabilities in seabed survey, including the ability to observe and record the seabed soon after an incident. Often there is political pressure for information, but also the site could be disturbed deliberately, accidentally or by natural processes. Surveying and recording the site before it is disturbed is a basic principle of forensic investigation that allows investigators to reconstruct the incident and gather evidence (Becker, 2013, pp. 10–11, 99–100). Attribution time is also an element of resilience and deterrence, as a rapid on scene response, survey and investigation complicates the effort required of the attacker to obscure their tracks and makes gathering relevant evidence more likely (Kilcullen, 2020, p. 158). Surveillance is a large part of this effort, but the ability to quickly investigate anomalies is also important.

Responding agencies may be constrained by laws or policies that were drafted for scenarios that were quite different from those now faced. Ensuring agencies have the appropriate authority to inspect suspicious vessels and to access seabed sites in a timely manner will enable more effective attribution and response (Piekarski, 2025, p. 8). Law enforcement agencies other than militaries also require appropriate tools with which to maintain situational awareness, including with underwater sensors (Piekarski, 2025, p. 9). This is part of the governance referred to in the French *Seabed Warfare Strategy*, which aims to coordinate stakeholders within defence, intelligence and other government agencies who contribute to a wreck intelligence capability (Ministère des Armées, 2022, pp. 32–34).

Many navies are developing or incorporating relevant capabilities, or expanding the limits to which current capabilities operate, like diving to deeper depths (see Chief of German Navy, 2025, pp. 5–6; Ministère des Armées, 2022, pp. 35–37). Rather than being reserved for specific mission sets, remotely operated or autonomous underwater vehicles can form an integral element of a ship's sensor suite. This creates a form of distributed underwater sensing to augment and protect crewed vessels, and provide mass and resilience. For example, the Norwegian Coastguard equipped its entire fleet with ROVs to perform a variety of roles from ships and deployed boats, such as hull inspection, underwater searches and as a substitute for divers (Naval News, 2023). While specialised systems will be required for deep or complex scenarios, organic ROV and UUV systems within naval fleet units or other government vessels will enable any vessel to put eyes on the seabed without having to wait for such a capability to arrive on scene. Normalising the operation of such systems by incorporating them into the ship's sensor package also builds experience and expertise, which is recognised as a major requirement of a consolidated approach to seabed warfare (Ministère des Armées, 2022, p. 9).

7. Conclusions

Whenever craft or infrastructure is attacked or destroyed above, on or under the sea, or on the seabed itself, some debris and material remains at least will usually fall to or be spread on the seabed. This material can be exploited for its intelligence value, from which to identify assailants and derive the capabilities or intentions of adversaries, or to protect one's own from exposure. Modern navies have been using wreckage on the seabed for intelligence purposes for well over a century and some have developed specialised capabilities that enable such efforts in even the deepest waters. Hybrid wars in the Baltic and North Seas, and in the South China Sea, and the hot war in the Black Sea demonstrate the prevailing need to access wreckage on the seabed for intelligence purposes. This need is not going away and is probably required more now in an era of constant competition and hybrid war than before. As capabilities to access and recover material from the seabed increase, so too do the threats offered by the same capabilities. To generate the experience and expertise required to exploit the opportunities offered by seabed wreckage, navies must develop coherent plans for capabilities, establish collaborations, conduct training and familiarisation, and exercise scenarios. More competent actors make this part of business as usual, rather than a set of niche capabilities cobbled together when exploitable wreckage inevitably falls to the seabed.

Wreck intelligence does not need to become an area of specialisation, nor does it require units dedicated to its pursuit. Many existing capabilities and specialisations can be adapted to the task, with expertise consciously developed among those already qualified in cognate disciplines. The risks of inexpert investigators were shown in the USS *Maine* investigation, where dubious conclusions led directly to war. Awareness of the intelligence value inherent in seabed wreckage will act as an enabler of the capabilities and expertise required to access it. Perspectives can be adjusted by presenting seabed wreckage as a potential security issue rather than merely hazard or heritage. Relevant capabilities can be multi-purpose and adaptive, and shared among agencies as national power assets rather than entirely military. Capabilities that contribute to intelligence, surveillance and reconnaissance of the seabed and approaches to areas, particularly acoustic sensing and surface traffic, enable data collection and correlation for investigations. The more options available to deploy offboard or autonomous platforms with high-resolution visual and acoustic sensors, the easier it will be to achieve situational awareness and information collection requirements at incident sites. The importance of high-resolution imagery of seabed sites, including the relative position of evidentiary artefacts *before* retrieval or salvage operations, and of scours or modifications on mobile seabeds before erosion, is highlighted by the case of the corvette ROKS *Cheonan*, where torpedo components were trawled rather excavated in place. Units will need guidance and training as seabed incident first responders that should be developed, promulgated and exercised. Investigation lessons, standards and best practices should be shared among allied nations to enable consistency and to bolster the credibility of investigations.

The history of wreck intelligence warns that hybrid actors, at least, will adapt to new methods, become forensically aware, attempt to limit or interfere with access to sites, offer plausible counter explanations by way of denial, and dispute findings using experts of their own. There were many lessons learned from the *Cheonan* case, including by potential hybrid actors, about the capabilities and limitations of wreck intelligence. We need only look at how Russian intelligence services used this knowledge in 2025 to accuse the UK and Ukraine of planning a false flag attack on a US ship in the Baltic Sea by using Russian torpedoes (Tiwari, 2025; EU vs Disinfo, 2025). This could only work if it was expected that the remains of the weapons would be retrieved from the seabed and forensically linked to Russia by a credible wreck intelligence capability. This demonstrates both the deterrence value of such a capability and the dilemmas it creates for an adversary. Herein lies the benefit of nurturing the military capability and expertise required to investigate wreckage on the seabed for its intelligence value.

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