Uncrewed Weapons Journal

Edition 2

Uncrewed Surface and Underwater Vehicles

Avante Edge Research

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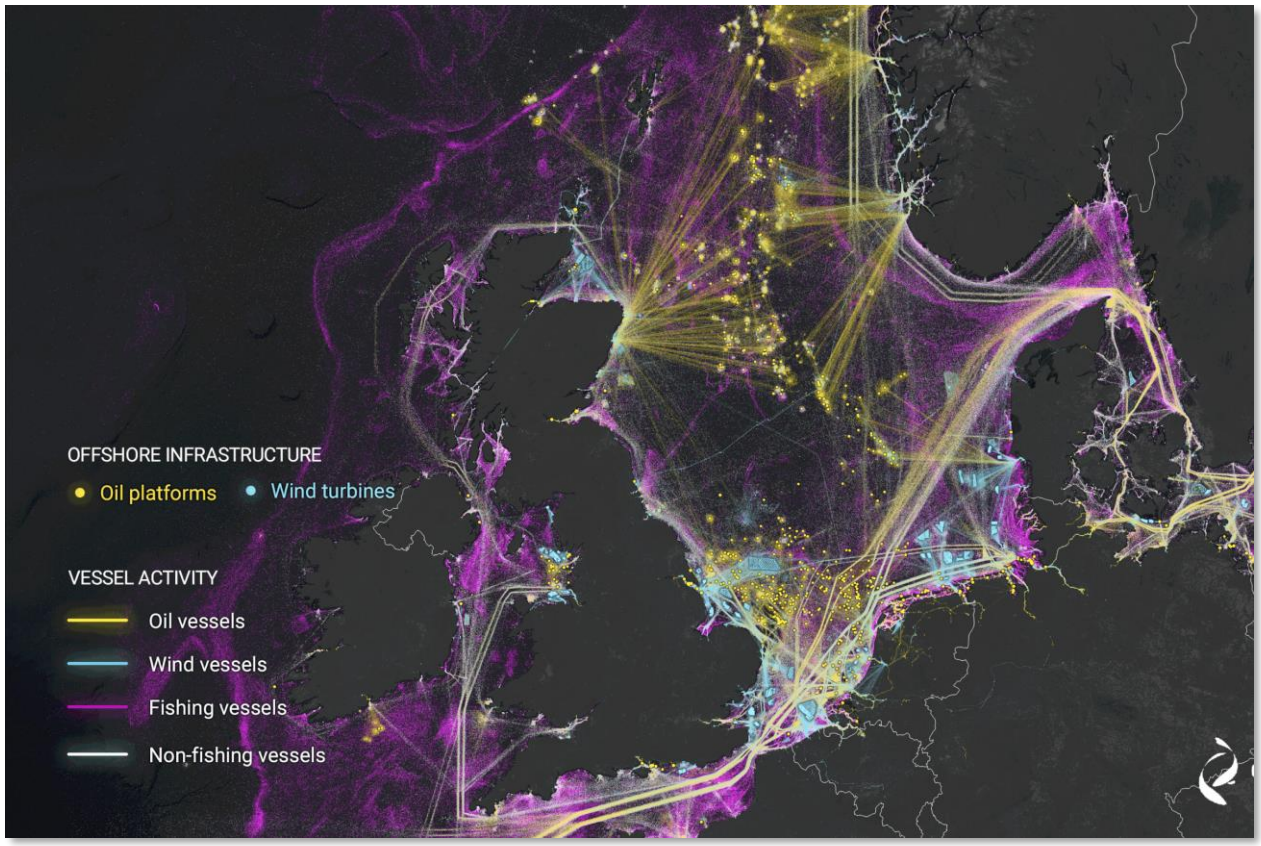
Uncrewed Surface/Underwater Vessels

If one thing can be taken away from the still mysterious bombing of the NordStream 2 Pipeline, is that offshore infrastructure vulnerability is at an all time high. The reality that there is no solid indication or discovery of a means or manner in which it was destroyed is a testament to modern technology's both ability and inability. Remote power stations, undersea cables, and energy platforms were once thought secure due to the location or



Map generated from Space Based Systems analyzing vessels and platforms of the North Sea

depth of the structure, thinking that modern detection abilities would locate enemy vessels before they could destroy the critical assets. Without any defensive capabilities, the modern era of USV and UUVs now threaten nearly all of these assets by their low profile undetectable means of payload delivery.

As we've shown with UAVs, Uncrewed surface vessels (USV) have been around far longer than one may think. In the US Civil War, ships loaded with explosives were then sent into enemy harbors. Before that, ancient naval warfare would light ships on fire and have them drift into enemy fleets. Undersea drone technology is a bit more recent; Uncrewed Underwater Vessels (UUVs) were first used for military purposes to disable mines in the port of Um Qasr, Iraq in 2003. Besides these rare occasions, many of the sea-borne drones were used for exploration and research so it was a resounding wake up call to many in 2023 upon seeing ships of the Russian Black Sea Fleet being repeatedly sent to the bottom of the sea by a multitude of OWA and missile platforms USVs. As a whole, most sea drones are used for intelligence surveillance, and reconnaissance (ISR), mine-hunting, anti-submarine warfare (ASW), communications relay, surveying, and maintenance/sabotage of sea-based infrastructure. Let's discuss the types and employment tactics of modern USVs and UUVs.

US Sail Drone with TF-59 in the Red Sea

Sail drones and other subsurface vessels have made a rapid shift from explorative use to military employment in a short period. Uncrewed ISR surface vessels are predominantly wind-propelled and solar powered capable of operating for periods of three to twelve months at sea. Most range from 20 -70 feet in length and are capable of

carrying a wide variety of sensors to remote areas. Usually used for ISR, Measurement and Signature Intelligence (MASINT), and gathering data from the objects, atmosphere, or subsurface/ocean floor mapping. In recent months the US has employed a great number of these in the Red Sea and in the South China Sea. These greatly improve situational awareness around the important Carrier Fleets and Surface Action Groups for very little cost, around $500K. USVs used for mine laying or ASW are much larger than these ISR sail drones, some reaching +130ft. Most of the successful USVs currently being employed are being designed and built by Ukrainians. These small low profile speed boats are being packed with 1000 – 2000lbs of explosive and driven in swarms at high speeds towards Russian ships patrolling or in harbor. As of March, ’24, 16 Russian vessels have been sunk and 6 damaged from Ukrainian OWA USVs, these 22 ships make up approximately 25% of the Russian Black Sea Fleet. These are impressive results from a country that does not have a navy. Though these have been the most combat effective due to their small radar cross section and speed, China, Russia, and the US are still developing larger craft with either vertical launch systems (VLS) or remotely operated weapon systems (ROWS). These crafts are larger and have a variety of propulsion systems. Many of these larger systems are in the testing phases. Such as the US Sea Hunter, a large surface vessel used for ASW that has been

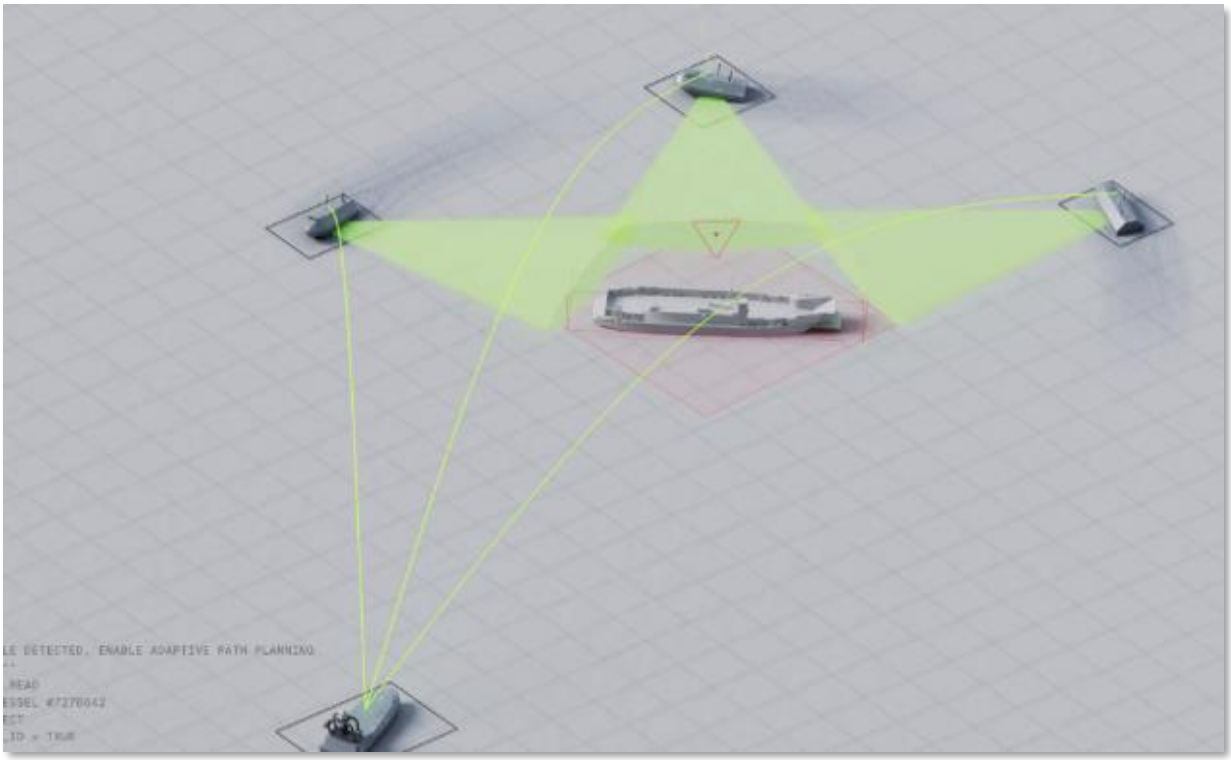
Chinese PLA-N JARi USV launched in 2019.

undergoing trials since 2016. The US defense industry is extremely optimistic of future military contracts as of the recent congressional requests from the US Navy to fund over half a billion dollars into not only USV and UUV technology but LUSV (Large Uncrewed Surface Vessels) and XLUUV (Extra Large Uncrewed Underwater Vessels). The LUSV is defined as a vessel upwards of 300 feet in length and a 2000-ton displacement, making it a large enough option to carry various weapon systems that enable participation in surface warfare actions. XLUUVs are thought to be the size of a "Subway Car" according to congressional documents. The DoD (Department of Defense) is looking for this vessel to deliver multiple payloads, specifics were not mentioned though this could be a variety of sea-floor mines or other weapon systems we may not know of.

The uncrewed systems give an air of ultimate perfection for sea warfare, no crew to feed or uphold morale during long deployments, smaller cross sections decreasing chances of detection, yet still allowing for the use of high-power weapon systems to engage in surface and subsurface combat. Unfortunately, there are some limitations. Power generation and storage are particularly challenging, especially for long-duration UUVs. Most UUV can rarely continue operations over 24 hours which forces the drone to be retrieved by manned vessels and charged. Another UUV and USV challenge is communication, though mainly autonomous, the vessels will need to communicate and that is a challenging task. For example, even the lowest radio waves rarely pass 20 meters in depth beyond that they are distorted, attenuated, or slowed. For surface vessels, accidental, active, and passive jamming can render the drone inoperable. US Sail drones have ended up washing ashore at times seemingly from accidental loss of communication, most likely not intentional. Towed arrays can be employed, but that also increases the signature of the vessel. ISR Surface

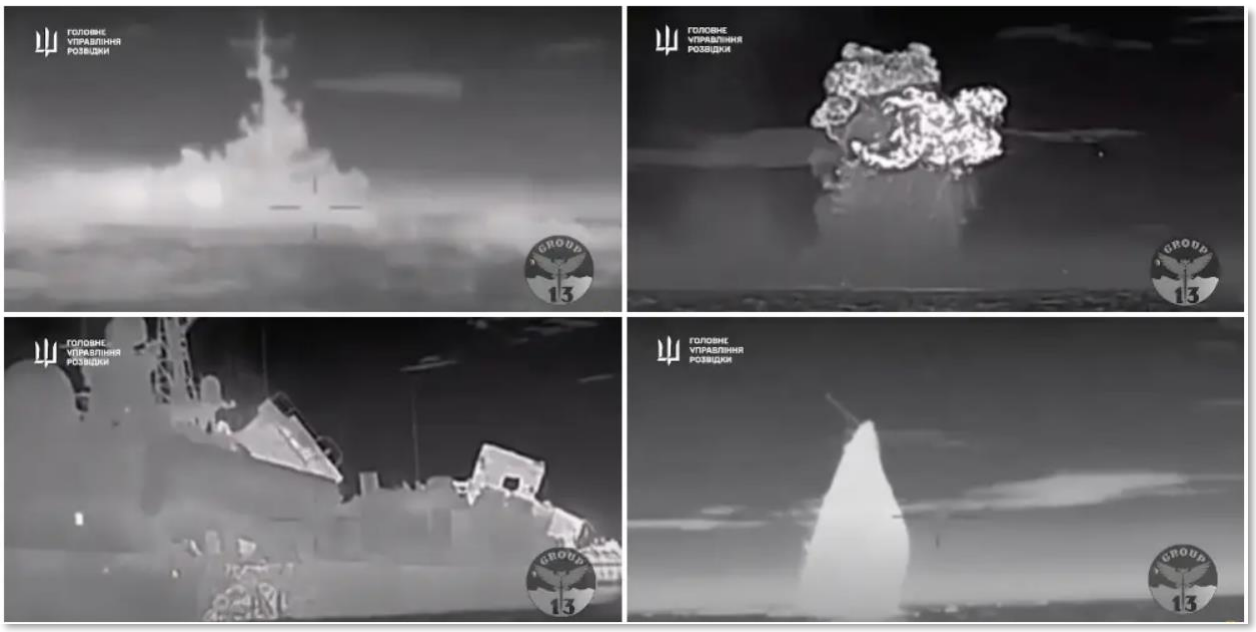
drones, generally unarmed, are completely helpless to some actor attempting to destroy, capture, or exploit the vessel. This instance happened in 2016 when a Chinese PLA-N (Peoples Liberation Army – Navy) vessel seized a US USV and eventually returned it to the US stating it was a "navigation hazard."

The PLA-N is the USs' main competitor in the field of USV and UUV development. They have multiple small to medium size vessels that are also in varying levels of testing. The Chinese, learning from the Ukrainians, are developing advanced sensing techniques and capabilities to detect small OWA USVs. This strategy is an attempt to protect their naval infrastructure and vessels with what they call a multi-domain three-dimensional approach. The three-dimensional perimeter defenses include point defense, floating barriers, and electronic warfare to disable enemy attack boats and drones. China, understanding their threat, also sees the strengths in such vessels. Autonomous swarm vessels able to



Rendering of Autonomous Drone concept using Saronic USV Technologies.

communicate and share information could rapidly overtake multiple vessels. If an operator is merely using an infrared camera searching for ships, it would be fairly inefficient, increase a drone's size and sensor suite and allow it to communicate with not only other OWA aor aerial assets and you have a very formidable swarm. Even with rudimentary swarm capabilities, we have seen success time and again of the Ukrainian USVs attacking both harbors and patrol ships. It is an attack type that navies across the world will have to rapidly develop defenses against.

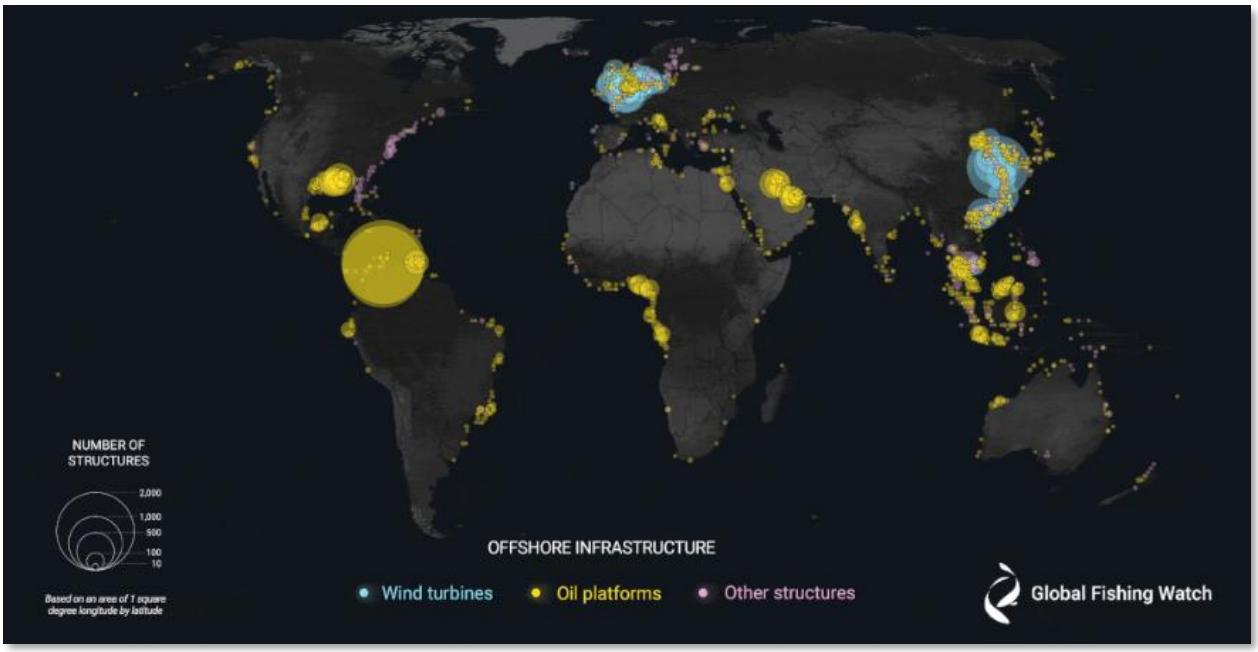


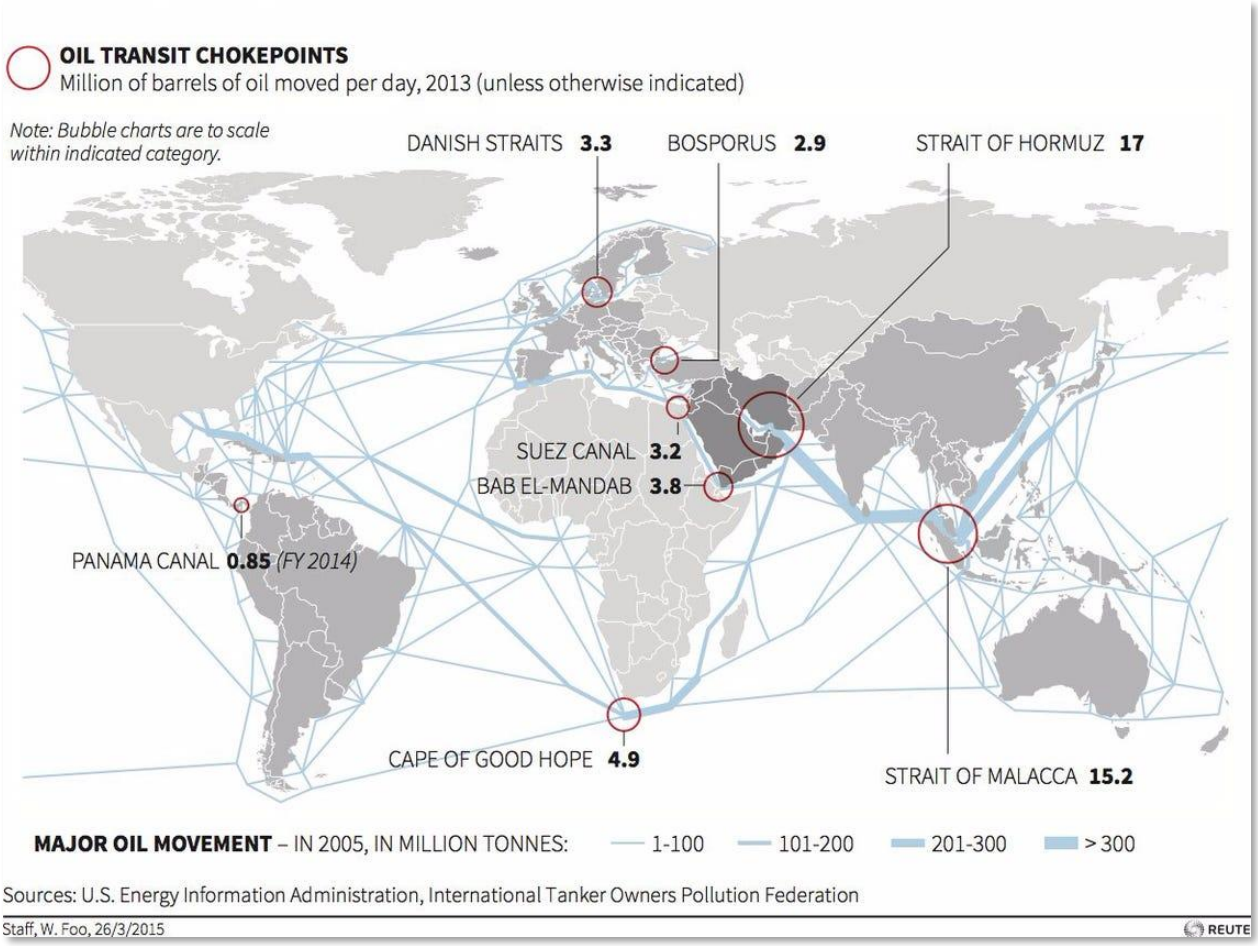
Ukrainian USVs attack against the Russian Corvette Ivanovets.

Most of these vessels, much like aerial drones, are being designed with the thought of long-range, lone, autonomous operations along with supplementing existing manned fleets and capabilities. As technology progresses, we will see innovations that continue to shock the world with both surface and subsurface vessels. The rise of Medium and Large USVs will lead to not only advanced military tactics, but I can foresee law enforcement activities adopting systems as well. Drones of all types are slowly being integrated more

into a law enforcement capacity and I see no reason why USVs or UUVs can bolster detection and interdiction in the national waters of the US or the high seas between the Middle East and the African East Coast where drugs are in constant flow. If war erupts in the future on a larger scale, the use of solo USSVs could also be leveraged to conduct succesfful harrasment of logistics and shipping. We need only look to the successes of the German U-Boat from World War I and World War II to see the capabilities that hard to detect vessels can play in hampering Sea Lines of Communications (SLOCs).

US Navy Sea Hunter MUSV (Medium Uncrewed Surface Vessel


NUMBER OF STRUCTURES
2,000
1,000
500
100
10
Based on an area of 1 square degree longitude by latitude
OFFSHORE INFRASTRUCTURE
Wind turbines
Oil platforms
Other structures
Global Fishing Watch


OIL TRANSIT CHOKEPOINTS
Million of barrels of oil moved per day, 2013 (unless otherwise indicated)
Note: Bubble charts are to scale within indicated category.
DANISH STRAITS 3.3
BOSPORUS 2.9
STRAIT OF HORMUZ 17
SUEZ CANAL 3.2
BAB EL-MANDAB 3.8
PANAMA CANAL 0.85 (FY 2014)
CAPE OF GOOD HOPE 4.9
STRAIT OF MALACCA 15.2
MAJOR OIL MOVEMENT – IN 2005, IN MILLION TONNES:
1-100
101-200
201-300
> 300
Sources: U.S. Energy Information Administration, International Tanker Owners Pollution Federation
Staff, W. Foo, 26/3/2015
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